

## SECTION 010120 - INTERPRETATION & PROCEDURE INSTRUCTIONS (RFI)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This section contains the procedures to be followed by Contractor upon discovery of any apparent conflicts in the Contract Documents or upon having any question concerning interpretation.

#### 1.3 PROCEDURES

- A. Notification by Contractor:

1. Submit all Requests for Interpretation (RFI's) together with suggested solutions for changing the Contract Documents in writing to Architect using an approved form.
2. Number RFIs sequentially. All attachments or sketches shall contain a unique number related to the RFI number. A sketch provided with RFI 0001 would be labeled SK-RFI 0001.1.
3. Log: Maintain log showing status of RFIs and responses, and continuously update address status of RFIs regularly at scheduled project management meetings.
4. Limit each RFI to one subject.
5. Submit an RFI if one of the following conditions occur:
  - a. Contractor discovers an unforeseen condition or circumstance that is not described in the Contract Documents.
  - b. Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents.
  - c. Contractor discovers what appears to be an omission from the Contract Documents that cannot be reasonably inferred from the intent of the Contract Documents.
6. Contractor shall not:
  - a. Submit an RFI as a request for substitution.
  - b. Submit an RFI as a submittal.
  - c. Submit an RFI under the pretense of a Contract Document discrepancy or omission without thorough review of the Documents.
  - d. Submit an RFI in a manner that suggests specific portions of the Contract Documents are assumed to be excluded or by taking an isolated portion of the Contract Documents in part rather than whole.

- e. Submit an RFI in an untimely manner without proper coordination and scheduling of work of related trades.
  - 7. If Contractor submits an RFI contrary to the above, Contractor pays the cost of all review, with cost deducted from the Contract Sum.
  - 8. Submit request for information or clarification immediately upon discovery. Submit RFIs within a time frame so as not to delay the Construction Schedule while allowing the full response time described below.
- B. Response Time:
- 1. Architect will resolve such questions and will issue instructions to Contractor within a reasonable time frame. In most cases, RFIs will receive a response within 10 working days. If in the opinion of Architect more than 10 working days is required to prepare a response to an RFI, Contractor will be notified in writing.
  - 2. Should Contractor proceed with the work affected before receipt of a response from Architect, within the response time described above, any portion of work which is not done in accordance with Architect's interpretations, clarifications, instructions, or decisions is subject to removal or replacement and Contractor responsible for all resultant losses.

END OF SECTION 010120

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Project information.
  - 2. Work covered by the Contract Documents.
  - 3. Access to site.
  - 4. Coordination with occupants.
  - 5. Specification and drawing conventions.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Lakers Practice Facility, Los Angeles, California.
  - 1. Project Number: 2014-015.
- B. Architect: Rossetti Associates, Inc., 160 West Fort, Suite 400, Detroit, Michigan 48226.
  - 1. Telephone: (313) 463-5151.
  - 2. Fax: (313) 463-5160.

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. Type of Contract:
  - 1. Project will be constructed under a single prime contract.

#### 1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways, parking garage, loading areas, and entrances serving premises clear and available to building occupants, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
  - a. Schedule deliveries to minimize use of driveways and entrances. Respect normal use by all building occupants.
  - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

#### 1.6 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
  2. Obtain a Certificate of Occupancy from Authorities Having Jurisdiction (AHJ) before Owner occupancy.
  3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
  4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

#### 1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
  1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 012100 - ALLOWANCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.

#### 1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

#### 1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

## 1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

## 1.6 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

## 1.7 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

## PART 2 - PRODUCTS

- 2.1 Refer to Sheet G-003.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 012100

## SECTION 012300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

#### 1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.

### PART 2 - PRODUCTS

- 2.1 Refer to Sheet G-002.

### PART 3 - EXECUTION (Not Used)

END OF SECTION 012300

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

#### 1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, as "Architect's Supplemental Information (ASI)."

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests (PR) issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 016000 "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

#### 1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor.

#### 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive (CCD). Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

- 1. Project meetings.

#### 1.3 COORDINATION

- A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

- 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
- 3. Make adequate provisions to accommodate items scheduled for later installation.
- 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

- 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

- 1. Preparation of Contractor's Construction Schedule.
- 2. Preparation of the Schedule of Values.
- 3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

#### 1.4 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Contractor shall prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, Contractor, and Architect, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Contractor, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
  - a. Tentative construction schedule.
  - b. Phasing.
  - c. Critical work sequencing and long-lead items.
  - d. Designation of key personnel and their duties.
  - e. Procedures for processing field decisions and Change Orders.
  - f. Procedures for requests for information (RFIs).
  - g. Procedures for testing and inspecting.
  - h. Procedures for processing Applications for Payment.
  - i. Distribution of the Contract Documents.
  - j. Submittal procedures.
  - k. Preparation of Record Documents.
  - l. Use of the premises.

- m. Work restrictions.
  - n. Owner's occupancy requirements.
  - o. Responsibility for temporary facilities and controls.
  - p. Construction waste management and recycling.
  - q. Parking availability.
  - r. Office, work, and storage areas.
  - s. Equipment deliveries and priorities.
  - t. First aid.
  - u. Security.
  - v. Progress cleaning.
  - w. Working hours.
3. Minutes: Contractor will record and distribute meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction, as indicated elsewhere in the specifications (Division 2 thru 16).
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related Requests for Information (RFIs).
    - d. Purchases.
    - e. Deliveries.
    - f. Submittals.
    - g. Review of mockups.
    - h. Possible conflicts.
    - i. Compatibility problems.
    - j. Time schedules.
    - k. Weather limitations.
    - l. Manufacturer's written recommendations.
    - m. Warranty requirements.
    - n. Compatibility of materials.
    - o. Acceptability of substrates.
    - p. Temporary facilities and controls.
    - q. Space and access limitations.
    - r. Regulations of Authorities Having Jurisdiction (AHJ).
    - s. Testing and inspecting requirements.
    - t. Installation procedures.
    - u. Coordination with other work.
    - v. Required performance results.
    - w. Protection of adjacent work.
    - x. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Contractor shall conduct progress meetings at a reasonable interval for the project scope. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner, Contractor, and Architect, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Status of correction of deficient items.
      - 14) Field observations.
      - 15) Requests for information (RFIs).
      - 16) Status of proposal requests.
      - 17) Pending changes.
      - 18) Status of Change Orders.
      - 19) Pending claims and disputes.
      - 20) Documentation of information for payment requests.
  3. Minutes: Contractor will record and distribute to Contractor the meeting minutes.
  4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

- a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for submitting Submittals Schedule, Shop Drawings, Product Data, Samples, and other submittals.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

#### 1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit three (3) copies of schedule. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
    - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:
  - a. Scheduled date for first submittal.
  - b. Specification Section number and title.
  - c. Submittal category: Action, informational.
  - d. Name of subcontractor.
  - e. Description of the Work covered.
  - f. Scheduled date for Architect's final release or approval.
  - g. Scheduled dates for purchasing.
  - h. Scheduled dates for installation.
  - i. Activity or event number.

#### 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
  1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project Record Drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Contractor shall execute a data licensing agreement in the form of an Agreement form acceptable to the Owner and Architect.
    - c. The following files will be furnished for each appropriate discipline:
      - 1) CAD floor plans, Grid plans.
      - 2) Reflected ceiling plans.
      - 3) REVIT models.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 10 working days for review of each resubmittal.
- D. Identification and Information for Shop Drawings: Place a permanent label or title block on each paper copy submittal item for identification.
  1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of subcontractor.
    - g. Name of supplier.
    - h. Name of manufacturer.
    - i. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number. Resubmittals shall be identified as such and shall note the previous submittal number on the Transmittal/ Data Sheet.
    - j. Number and title of appropriate Specification Section.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Other necessary identification.
- E. Options: Identify options available, requiring selection by the Architect. If Contractor has not made edits, it shall be assumed that all options are available for Architect to select at no additional cost.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals. All resubmittals shall also bubble specific changes to the previous submittal as well.
- G. Digital Submittals: All submittals including shop drawings and product data shall be submitted as PDF files and posted for review by the Architect.
- H. Additional Paper Copies (PHYSICAL and COLOR SAMPLES ONLY): Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  1. Submit number of samples needed plus one for Architect's record.
  2. Additional samples submitted will be returned upon review for Contractor's Use. Contractor shall maintain Owner's copy as well.
- I. Contractor Review: Contractor to review and sign all submittals prior to transmittal to Architect - See Part 3 - EXECUTION.
- J. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a Transmittal/Data Sheet form.

1. Transmittal/Data Sheet Form: Use template provided by Architect.
  2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- K. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked "Approved" or "Approved as Noted".
  4. Cloud or highlight revisions. All other content will be assumed to be unchanged from the original submittal.
- L. Distribution: Furnish digital PDF copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- M. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved as Noted" by Architect.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Action Submittals (SAMPLES): Submit three paper copies of each submittal, unless otherwise indicated. Architect will return two copies.
  2. Action Submittals (SHOP DRAWINGS, PRODUCT DATA): Submit Digital PDF Files of the requested information. Architect will return PDF with comments only.
  3. Informational Submittals: Submit Digital PDF Files of the requested information. Architect will not return copies unless an issue is noted.
  4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
  5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  6. Test and Inspection Reports Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Mill reports.
    - j. Standard product operation and maintenance manuals.
    - k. Compliance with specified referenced standards.
    - l. Testing by recognized testing agency.
    - m. Application of testing agency labels and seals.
    - n. Notation of coordination requirements.
  4. Submit Product Data before or concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings are otherwise permitted. Shop Drawings that are not based on the specific project (boiler-plate drawings) will be returned to the Contractor as "Not Reviewed".
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Design calculations.
    - j. Compliance with specified standards.
    - k. Notation of coordination requirements (including necessary clearances).
    - l. Notation of dimensions established by field measurement.
    - m. Relationship to adjoining construction clearly indicated.
    - n. Seal and signature of professional engineer if specified.
    - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (216 by 279 mm) but no larger than 30 by 40 inches (762 by 1016 mm). Provide clear space on all associated drawings sheets for review stamps of the Contractor, Architect and related Consultants, failure to provide clear space may result in submittal being returned as "Not Reviewed".

- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
  3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  4. Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  5. Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
  2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.
  4. Location within room or space.
  5. Submit product schedule as a Digital PDF File.
- F. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
  4. Submit subcontract list as a Digital PDF File.
- G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.
- I. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- J. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- K. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- L. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- M. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- N. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- O. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
  2. Date of evaluation.
  3. Time period when report is in effect.

4. Product and manufacturers' names.
  5. Description of product.
  6. Test procedures and results.
  7. Limitations of use.
- P. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- Q. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- R. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- S. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- T. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- V. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
  2. Required substrate tolerances.
  3. Sequence of installation or erection.
  4. Required installation tolerances.
  5. Required adjustments.
  6. Recommendations for cleaning and protection.
- W. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.

6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- X. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

#### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
  1. A= Approved.
  2. AN= Approved as Noted, (Resubmission not Required)
  3. RR= Not Approved. Revise and Resubmit.
  4. NR= Not Reviewed.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

NOTE: THIS IS A BLANK VERSION. A PROJECT-SPECIFIC COPY NEEDS TO BE PROVIDED

# ROSSETTI

160 WEST FORT, SUITE 400  
DETROIT, MICHIGAN 48226  
313.411.5151  
ARTN: 1907

Address  
City, state, zip  
Phone  
Fax

## SUBMITTAL DATA SHEET / TRANSMITTAL

Project \_\_\_\_\_ RA Job No. \_\_\_\_\_

Subcontractor or Vendor \_\_\_\_\_

Project Manual Section No. \_\_\_\_\_ Resubmittal: \_\_\_\_\_

Control No. \_\_\_\_\_

Received from Sub-Contr.  
(date) \_\_\_\_\_

Sent to Architect  
(date) \_\_\_\_\_

Received by RA  
(stamp) \_\_\_\_\_

Sent to Consultant  
(date) \_\_\_\_\_

Received by Consultant  
(stamp) \_\_\_\_\_

Received by RA  
(stamp) \_\_\_\_\_

Returned to Contr/CM  
(date) \_\_\_\_\_

Contr/CM Rec'd from RA  
(stamp) \_\_\_\_\_

Returned to Sub-Contr.  
(date) \_\_\_\_\_

### SUBMIT A SEPARATE FORM FOR EACH PROJECT MANUAL SECTION

Contr/CM Control No.	RA Control No.	Subm'l Type	Qty	Description	Review Code

☐ Interior ☐ Structural ☐ Mechanical ☐ Electrical ☐ Civil ☐ Other: \_\_\_\_\_

Contractor/ CM Comments:  
  
By: \_\_\_\_\_ Date: \_\_\_\_\_  
Contractor certifies by signature that this submittal has been reviewed and approved in accordance with the General Conditions of the Contract. Failure to provide signature will result in submittal being returned to the Contractor / CM marked "Not Reviewed".

Consultant Comments:  
  
By: \_\_\_\_\_ Date: \_\_\_\_\_

ROSSETTI Comments:  
  
By: \_\_\_\_\_ Date: \_\_\_\_\_

Code	Description	Distribution
A	Approved	Owner <input type="checkbox"/>
AN	Approved as noted	Contractor <input type="checkbox"/>
ANR	Approved as noted, Resubmit	Consultant <input type="checkbox"/>
RR	Not Approved / Revise & Resubmit	Consultant <input type="checkbox"/>
NR	Not Reviewed, See comments above	ROSSETTI File <input type="checkbox"/>
Submittal Type		
SD	Shop Drawing	PD Product Data <input type="checkbox"/>
S	Samples	CO Color Samples <input type="checkbox"/>
		RP Record Purposes Only (see section 01300 for other types) <input type="checkbox"/>

## SECTION 013700 – BUILDING INFORMATION MODELING (BIM) PROJECT REQUIREMENTS

### PART 1 - GENERAL (NOT USED)

### PART 2 - BUILDING INFORMATION MODELING / MANAGEMENT

#### 2.1 BUILDING INFORMATION MODELING / MANAGEMENT - DEFINITIONS

- A. Base Structural Model – the structural steel mill order drawing file showing all structural elements. This model is not necessarily fully detailed with all connections.
- B. Base Architectural Model – a combination of the Base Structural Model and key architectural elements. This model is to be used by all coordination participants as the background file in which to develop their work. Information within this model will be updated through RFI responses and the coordination process. This model is for reference only.
- C. Base Composite Model – this model includes all trade model files within the Base Architectural Model as a representation of the completed systems. This model is used to run the intermediate clash reports and is considered a work in progress.
- D. Final Coordination Model – this model shows all trades' systems fully coordinated models within the Base Architectural Model. All clashes have been resolved. No further coordination is required. The work shown within this model represents the upcoming installations of each system.
- E. Completed Coordination/Record Model – this model is the close-out submittal to the Owner and includes the information within the Final Coordination Model as well as any project updates that have taken place during installations such as RFI responses, as-built conditions, etc.
- F. PDF – Portable Document Format – When referred to elsewhere in the specifications a PDF shall refer to a portable document format which meets the following requirements:
  - 1. Bookmarked – All PDF's shall have established bookmarks for ease of navigation
  - 2. Hyperlinked – All PDF's which are large scale drawings shall utilize hyperlinks to reference pages within the document or other PDF's with the file folder which are made reference through one of the following mechanisms: sections, elevations, details etc.
  - 3. Original PDF format – All PDF documents shall be natively printed to PDF from the original document. i.e. faxed documents will not be accepted (with the exception of scanned)
  - 4. Digital Signature – All contractors shall have the ability to digitally sign and certify PDF documents and shall do so where required by the specifications.

## 2.2 BUILDING INFORMATION MODELING / MANAGEMENT – GENERAL REQUIREMENTS

- A. A Coordination model produced using Building Information Modeling software is to be developed by all BIM participants. This model will be utilized to establish field installation sequence, resolve trade coordination issues prior to installation, and to make the most efficient use of installation space without sacrifice to system performance for mechanical, electrical, structural and assigned architectural systems. This method will use multiple BIM design review software platforms as a means of documenting, identifying and resolving inter-relationships and possible interferences between all trades' Work and the architectural features as using the model to schedule, provide quantity takeoffs and serve as the as-built of the facility.
- B. Communication is a critical element to the success of this coordination process. Each Subcontractor, the Design Team Members, the Owner, and General Contractor/CM must be in constant communication to keep the process moving forward in a timely manner and per the sign-off schedule. Constant collaboration is expected of all team participants and each participant should be proactive in identification and resolution of the design engineering and model interferences.
- C. General Contractor/CM will facilitate and lead the BIM Process. General Contractor/CM will be the final authority on model issues. It is the responsibility of all BIM participants to resolve discrepancies pertaining to their own model. Each Subcontractor shall purchase at its own cost licenses of Navisworks 2014 including any maintenance and software updates during the course of the Project.
- D. All BIM participants are required to attend all model review meetings, are expected to be active participants and have the expertise and authority to resolve coordination issues to produce a clash-free, information loaded model. Provide sufficient detailing manpower to meet the BIM milestones for level of development as shown on the attached Exhibit 1 Table. Required coordination participants include:
  - 1. Site Utilities
  - 2. Reinforcing steel
  - 3. Concrete Foundations and SOG including reinforcing steel
  - 4. Masonry
  - 5. Structural Steel and Stairs
  - 6. Miscellaneous Metals – Interior and Exterior (railings)
  - 7. Architectural Millwork/Casework
  - 8. Metal Panels
  - 9. Curtainwall System
  - 10. Metal Studs and Ceilings (ACT and Studs)
  - 11. Kitchen Equipment
  - 12. Grandstand System
  - 13. Elevators
  - 14. Fire Protection and Equipment
  - 15. Mechanical Plumbing & Piping and Equipment
  - 16. HVAC Systems and Controls and Equipment
  - 17. Electrical System and Equipment (primary)
  - 18. Electrical System and Equipment (building)
  - 19. Low Voltage System and Equipment
- E. A Mandatory BIM Kick-Off Meeting for all participants will be set up to review:
  - 1. Team Collaboration
  - 2. The execution process

3. Coordination schedule
  4. Establishing standard zones per system
  5. Use of the model during construction
  6. Project specific information and requirements
  7. Model / Document standards
- F. General Contractor/CM will subdivide the project into coordination areas and establish a model flow for each specific area. It is required that all contractors model around previously developed models and submit only clash-free models. For example, structural steel detailing will fully detail an area. The combined structural model will then be forwarded to the mechanical contractor for duct detailing. It is expected that the mechanical contractor model around the previously developed models to produce a clash-free model.
- G. Weekly BIM Development Meetings will be held with all participants to review the model progress per the schedule and process indicated below:
1. Posting of files to the web-based posting site shall be at least weekly.
  2. Refer to the Exhibit 1 Table following this section to include
    - a. Completion milestones for each area
    - b. Sequence of drawing
- H. Typical utility corridors and above ceiling space zones for each trade will be established by the group at the beginning of the process. These zones will be adjusted through the coordination process to meet actual installation requirements during system development.
- I. All participants are required to identify those submittals required for accurate detailing of the coordination model (such as equipment, light fixtures, etc.) and are to make those submittals a priority in obtaining final approval so the specific information can be incorporated into the modeling process.
- J. All BIM participants are required to produce a BIM with all information typically included on their shop drawings. BIM may not replace the standard submittal process and all contractors will be required to produce 2D shop drawings from their BIM as requested.
- K. At the Weekly BIM Development Meeting:
1. The purpose of the Weekly BIM Development Meeting is the review and resolution of items that are found as models are developed in conjunction with the project schedule. The meetings will focus on clashes that cannot be resolved by internal collaboration, additional information that needs to be placed with model objects to support scheduling and estimating goals, and / or review of design changes to be incorporated. General Contractor/CM will facilitate the meeting and will make final decisions on clash resolution that are the least impact to the project as a whole. WEEKLY BIM DEVELOPMENT MEETINGS WILL NOT BE USED TO RESOLVE INDIVIDUAL SUBCONTRACTOR'S WORK. If a Subcontractor does not post a clash-free system of its own work, that Subcontractor will be considered unprepared for the meeting and will be responsible for any delays to the project schedule and any associated costs due to that delay.
  2. Each BIM participant shall review the Base Composite Model and utilize clash detection BIM software capable of combining and reviewing all sub-models from other participants in order to clean-up any simple clashes that can be made without review by all participants.

3. All BIM participants are expected to be prepared for the meeting with new models of the next area to be coordinated per the project schedule. Issues, including, but not limited to, design and owner requested changes, space issues, and potential conflicts should be identified by each contractor's modeler. Each participant shall have available any shop model, submittals or other materials required to solve identified or potential conflicts.
  4. It is expected the coordination schedule will be maintained and all potential and identified conflicts are addressed and resolved per that schedule.
  5. All agreed upon corrections to issues and potential conflicts determined by the team at the BIM Development Meeting are to be updated and resolved prior to the next meeting.
- L. When an area of the model is fully coordinated, each participant agrees:
1. Through active participation at the Coordination Meetings that each trades' work is fully coordinated and the associated field installation will be solely per the model and not in conflict with any other trade or system.
  2. The Final Coordination Model is to be referred to for resolution of all field installation issues and RFIs. No extra compensation will be paid for relocating material whose installation deviates from the Final Coordination Model. If any deviation is found, that installing Subcontractor is responsible for the full correction of the work including costs incurred by other affected Subcontractors and/or costs borne by the responsible Subcontractor.
  3. The Model is not considered to be the Final Coordination Model until the A/E and Owner has approved all systems and routings.
- M. Should a conflict arise during installation that was not foreseen or solved during the coordination effort, each BIM participant will work together with General Contractor/CM to find a solution that is the least impact to all trades and the project. The cost of this work will be evaluated as the problems arise, however, the party responsible for the conflict will be responsible for the cost of the fix, including the additional detailing time of all parties involved.
- N. The Final Coordination Model shall be kept up to date by all participants during construction to include any project updates including as-built information and documents and be submitted to General Contractor/CM electronically in IFC, WRL, or native file format and PDF form on a rolling basis. In coordination with the Supply Chain Requirements, items to be included in these files includes:
1. User Defined Attributes (UDA's), which are set-up within each respective BIM model for every object, must contain Supply Chain Requirements (submittal approved, material installed etc.), Equipment attributes (name, location etc.), Commissioning phases (pre-commissioning, functional performance test, system start-up, equipment acceptance), Manufacturer Information (name, address, contact etc.), and Warranty/Service Information (warranty, service contact etc.).
  2. RFI responses are required to be incorporated into the base models when design changes are necessary.
  3. Submittal documentation will be uploaded via FTP by all subcontractors.
  4. All documentation submissions must be in PDF form.
  5. The BIM will be used as an as-built for the facility. Each BIM participant is required to provide a fully updated BIM of that participant's system incorporating all as-built conditions and any field changes.

- O. Participants not attending one or multiple BIM Development Meetings, or failing to post their model files per the Schedule, will relinquish the right to request changes to the model in an effort to coordinate their own work, and will execute their Work without impact to the Work coordinated at the meeting. Should this not be possible, the offending participant who has not met the Coordination Schedule will be responsible for any additional meeting time and/or the costs associated with delaying the model development.
- P. A professional code of conduct is assumed of all participants. All participants' documentation will be available on the designated web-based posting site for reference by the other participants. Drawing files shall never be tampered with by non-owners of the file. If a mistake occurs and a drawing is inadvertently changed, the responsible party is required to alert all others immediately.
- Q. Representatives of both the Design Team and Owner may attend the BIM Development Meetings and will be authorized to assist in the resolution of clashes from a design perspective to expedite the process. The General Contractor/CM may request a change be submitted as an RFI and that process will be followed. When submitted, the RFI must clearly state the problem, possible solutions and benefits to the project.

## 2.3 BUILDING INFORMATION MODELING / MANAGEMENT – SCHEDULE

- A. The General Contractor/CM shall develop a BIM schedule as part of the master construction schedule development, major milestones should be included.

## 2.4 BUILDING INFORMATION MODELING / MANAGEMENT - DETAILING REQUIREMENTS OF ALL PARTICIPANTS

- A. A folder system will be established by General Contractor/CM on the FTP site to be used by all coordination participants. The folder use and structure includes:
  - 1. Progress Drawing Folder – As each coordination participant makes progress to his model, the drawing files shall be posted and maintained in this folder. These files are then made available to the other coordination participants for reference during their drawing progress. These files will not be used in the generation of the Base Composite Model and uploaded into the design review software prior to a scheduled coordination meeting.
  - 2. Postings Folder – prior to each Coordination Meeting as per the schedule, post all progress drawing files here. These are the files that will be uploaded into the Base Composite Model for review. There should be one file per trade per coordinate area currently being coordinated. As additional areas of the are modeled and coordinated, the previous areafile shall be over-written and posted here. Refer to the standard file naming conventions listed below.
  - 3. Completion Folder – once an areais fully coordinated and clash free, the final coordinated drawing file shall be posted to this folder. These are the files will be used for the Final Coordination Model. Shop drawings shall be produced with annotations from this model, see article 2.4/E.
  - 4. For ease of use by all coordination participants, a naming convention will be utilized. The naming convention is as follows Year\_Month/Day Name. For example: 2013\_0429 Structural Model Quad 1. All participants will be required to utilize this naming convention.

5. All coordination participants are to maintain a current control copy of their own drawing files outside of the project's cloud based posting site.
- B. Only Naviworks 2014 compatible file types must be used for compatibility of all drawing postings. No other file types will be accepted.
- C. The common coordinate system will be defined by ROSSETTI and distributed to all participants to use as a background to detail their work around. The origin point must not change as it will affect the collation of the files into the Base Composite Model. No drawing work shall take place until this point is agreed upon by the team.
- D. When posting model files for coordination:
  1. Model files must be sent with all necessary layers or items thawed and necessary model elements visible. All model files will be uploaded into the Base Composite Model in the state they were sent.
  2. Provide only individual contractor model space information. Elements from other contractor's model inserted for reference must be deleted.
  3. Posted model files should be of each Subcontractor's system that is clash-free with its own work. The only work that should be shown is elements to be installed in the field.
  4. These files should be void of any text, dimensions or any other notations. All text, annotations and dimensions can be placed on a separate layer from model entities; for general coordination postings, this layer shall be deleted.
- E. Each BIM Development participant is required to submit (1) complete set of shop drawings prior to any work being installed in the field. These complete drawings are to be fully dimensioned and notated. It is required that the subcontractor using a BIM program capable of producing these shop drawings from their model. Items to be noted in the final, fully coordinated drawing paper and electronic file versions of each system include:
  1. Bottom and top elevations of duct, duct insulation, pipe, conduit racks, hangers, cable trays etc. must be indicated (where applicable).
  2. Dimensions shall be shown from the gridlines to the centerline of each element drawn (round duct, pipe, cable tray, etc.) and from finished floor
  3. Height to top of light housing assembly must be indicated.
  4. Labeling of all equipment tags.
- F. During the BIM Development effort, priority will be given to those systems that have the least flexibility. The following list is a descending order of the system priority and shall be used as a general guideline. Throughout the coordination drawing effort, adjustments and deviations to this list can be made with the approval of General Contractor/CM. 0'-6" clear above the ceiling shall be maintained for access and construction of the ceiling. Required maintenance and/or code access spaces and set-backs take precedence over all systems.
  1. Steel framing
  2. Gravity Pipe: plumbing waste, roof drainage, steam condensate return and other systems that rely upon gravity for flow
  3. Ductwork and appurtenances, except bracing which shall be relocated to accommodate local interferences
  4. Cable tray
  5. Fire protection piping and fixtures
  6. Bus duct
  7. Recessed light fixtures

8. Electrical conduit over 2" in diameter
  9. HVAC piping
  10. Plumbing vent, supply and medical gas piping
  11. Electrical conduit smaller than 2" in diameter
  12. Above ceiling miscellaneous metal supports
  13. Access to kitchen equipment hoods
- G. See attached Exhibit 1 for model Level of Development (LOD) requirements for each BIM at each stage of the project.
- H. See attached Exhibit 1 Table for the specific project elements that each BIM participant, or Model Element Author (MEA), is responsible for modeling. This table also provides the required Level of Development at each stage in the project. In situations where multiple BIM participants are shown as responsible for a specific element, the Model Element Author shown at each stage is merely the participant whose model will be considered official for use in the Base Composite Model at that stage. It is required that each Model Element Author begin modeling before their model is the official and that each Model Element Author continuing modeling to an as-built condition.

## PART 3 - SUPPLY CHAIN MANAGEMENT

### 3.1 SUPPLY CHAIN MANAGEMENT - DEFINITIONS

- A. Supply Chain Management: Supply Chain Management (SCM) is the management of a network of interconnected Project Stakeholders (Design Team, Owner, General Contractor, Vendors, and Subcontractors) involved in the provision of products, materials and/or services required to satisfy the Project Requirements ultimately resulting in the completion of the Project.
- B. Information Supply Chain Management: Information Supply Chain Management (ISCM) is the management of the creation, submission, review and approval of information, e.g. submittals, shared between Project Stakeholders.
- C. Physical Supply Chain Management: Physical Supply Chain Management (PSCM) is the management of the manufacturing, fabrication, shipping, installation, inspection and QA/QC of products, materials and/or services required to satisfy the Project Requirements and ultimately the completion of the project.
- D. Comma-Separated Values File: A comma-separated values (CSV) file stores tabular data (numbers and text) in plain-text form. Plain text means that the file is a sequence of characters, with no data that requires interpretation, as binary numbers would require. A CSV file consists of any number of records, separated by line breaks of some kind. Each record consists of fields, separated by commas. For this Project, a CSV file is the minimum acceptable means of communicating Supply Chain Management information digitally.
- E. API Integration / Direct Integration: An API (Application Programming Interface) or Direct Integration are technical implementations used as an interface by software solutions to communicate with each other. For this Project, an API or Direct Integration is the preferred means of communicating Supply Chain Management information digitally if such an interface is available.

- F. Control Number: A Control Number is a unique identification number within a particular project for a particular building system; Control Numbers need not be globally unique. Control numbers should be as short as possible and should be easily understood by simply reading them, e.g. 1, 2, 3, etc. Control Numbers may also have meaning if required, e.g. AHU-6.
- G. Bay Control Number: A Bay Control Number is a unique identification number within a particular project to indicate the location of a 2-dimensional area of risers, aluminum, seat attachments, handrails and seats.
- H. Barcode: A Barcode is an optical machine-readable representation of data relating to the object to which it is attached. Every effort should be made to utilize Barcodes already in use in the Supply Chain or Barcodes that have meaning without being read by a machine.
- I. Assembly Mark: An Assembly Mark is the identification number assigned to sufficiently like Structural Steel objects during the detailing process. These marks are used to aid in the management of detailing, fabrication and erection process. They are only unique to the Structural Steel assemblies to which they are assigned within the Project.
- J. Cast Unit Mark: A Cast Unit Mark is the identification number assigned to sufficiently like Concrete objects during the detailing process. These marks are used to aid in the management of detailing, fabrication and construction of Concrete. They are only unique to the Concrete assemblies to which they are assigned within the Project.
- K. Pile Cap Number: A Pile Cap Number is the identification number used to describe like pile caps within the Project.
- L. Service Area: Service Area is the area served by an elevator.
- M. Section: Section is the section served by an elevator.
- N. Equipment Number: Equipment Number is the unique number assigned to a piece of equipment. Equipment Numbers should be as short as possible and should be easily understood by simply reading them. Equipment Numbers may also have meaning if required, e.g. AHU-6.
- O. System Number: System number is the unique number assigned to a group of infrastructure objects, e.g. pipe, duct, conduit, wire, etc. System Numbers should be as short as possible and should be easily understood by simply reading them. System Numbers may have meaning if required, e.g. MECHDUCT-7.
- P. Grid Location: A Grid Location is the location at which two column grid lines intersect each other. The Grid Location is represented by listing both designations together, e.g. C1. A Grid Location can also be two Grid Locations separated by a dash to represent that a particular object is spanning these two grid intersections.
- Q. Software ID: A Software ID is the identification number arbitrarily assigned to an object by a software application. Software IDs are not globally unique and are only unique to objects within a particular file or database.
- R. BIM ID: A BIM ID is the identification number arbitrarily assigned to an object by a BIM application. BIM IDs are not globally unique and are only unique to objects within a particular Building Information Model.

- S. Tekla ID: A Tekla ID is the identification number arbitrarily assigned to an object by Tekla BIM software. Tekla IDs are not globally unique and are only unique to objects within a particular Building Information Model.
- T. Software GUID: A globally unique identifier (GUID) is a unique reference number used as an identifier in software. GUIDs are created using a randomization algorithm to generate hexadecimal numbers that are so large that the chance of generating the same number twice is negligible.
- U. BIM GUID: A globally unique identifier (GUID) is a unique reference number used as an object identifier in BIM software. GUIDs are created using a randomization algorithm to generate hexadecimal numbers that are so large that the chance of generating the same number twice is negligible.
- V. Tekla GUID: A Tekla globally unique identifier (GUID) is a unique reference number used as an object identifier in Tekla BIM software. GUIDs are created using a randomization algorithm to generate hexadecimal numbers that are so large that the chance of generating the same number twice is negligible.
- W. BMC Schedule Activity ID: The Barton Malow Company (BMC) Schedule Activity Identifier (ID) is the reference number used to uniquely identify each schedule activity for the Project.
- X. Graphical Summary Area: A Graphical Summary Area is a designation of a 2-dimensional space represented either in the Design Documents or the Project schedule. It can also be a collection of Areas.
- Y. Area: An Area is a designation of a 2-dimensional space represented either in the Design Documents or the Project schedule.
- Z. Vertical Level: The Vertical Level is a designation based on elevation as indicated in the Project's design documents and utilized in the Project's schedule.
- AA. Room ID: Room ID is a unique number assigned to a room or space within the project.
- BB. Assembly Name: An Assembly Name is a text description of a Structural Steel assembly, e.g. Column, Beam, Brace, etc.
- CC. Name: A Name is a text description used to describe an object, e.g. Pile Cap.
- DD. System Name: A System Name is a text description used to describe a group of infrastructure objects, e.g. Mechanical Duct, Electrical Conduit, etc.
- EE. Weight: The Weight of an object in pounds that is managed in the Supply Chain.
- FF. Volume: The Volume of a concrete object in cubic yards.
- GG. Height: The Height of an object in decimal feet.
- HH. LF: The Linear Footage (LF) of an object in decimal feet.
- II. SF: The Square Footage (SF) of an object in decimal feet.

- JJ. Fabrication Phase: The Fabrication Phase is the phase designation used by the Fabricator, for its own purposes, to express the current supply chain state.
- KK. Fabrication Sequence: The Fabrication Sequence is the designation used by the Fabricator, for its own purposes, to express which fabrication grouping an object belongs.
- LL. Fabrication Load: The Fabrication Load is the designation used by the Fabricator, for its own purposes, to express which material load grouping an object belongs.
- MM. Fabrication Lot: The Fabrication Lot is the designation used by the Fabricator, for its own purposes, to express which shipping group an object belongs.
- NN. Fabrication Location: The Fabrication Location is the designation used to identify from which manufacturing facility has originated or will originate.
- OO. Coating Location: The Coating Location is the designation used to identify from which coating facility an object has been coated or will be coated.
- PP. Rebar Location: The Rebar Location is the designation used to identify from which rebar fabrication facility rebar will originate or has originated.
- QQ. Stringer Location: The Stringer Location is the designation used to identify from which fabrication facility stringers will originate or have originated.
- RR. Aluminum Location: The Aluminum Location is the designation used to identify from which fabrication facility stringers will originate or have originated.
- SS. Handrail Location: The Handrail Location is the designation used to identify from which fabrication facility handrails will originate or have originated.
- TT. Storage Location: Storage Location is the designation used to identify where equipment is stored after fabrication is complete and before it is deliver to the Project site.
- UU. Origin: The location from which infrastructure objects originate.
- VV. Rig Number: The Rig Number is the unique identifier for each rig used on the Project.
- WW. Crew: A Crew is a group assigned to a particular work task.
- XX. Layout: Layout is the date upon which the necessary positioning information has been physically placed at the project site to complete the installation or construction of an object in the Supply Chain.
- YY. Form: The date upon which concrete formwork for a concrete element has been installed.
- ZZ. Anchor Bolts and Embeds: The date upon which Anchor Bolts and Embeds have been laid out and installed prior to concrete placement.
- AAA. Wreck: The date upon which concrete formwork has been removed after concrete placement.
- BBB. Drill: Drill is the date upon which an auger cast pile or a group of auger cast piles have been drilled.

- CCC. Reinforcement Fabricated: Reinforcement Fabricated is the date upon which Reinforcement for a concrete object has been fabricated.
- DDD. Reinforce: Reinforce is the date upon which a concrete object has been reinforced.
- EEE. Rebar Inspection: Rebar Inspection is the date upon which reinforcement for a concrete object has been inspected.
- FFF. Pour: Pour is the date upon which a concrete object has been poured.
- GGG. Concrete Inspection and Testing: Concrete Inspection and Testing is the date upon which Concrete Inspection and Testing has occurred.
- HHH. Layout Verification: Layout Verification is the date upon which verification of the position of an object on the Project site has occurred.
- III. Fabrication Started: Fabrication Started is the date upon which the Fabricator's fabrication process has begun. When this date has been recorded but the subsequent date has not been recorded, this will indicate that the fabrication process has begun and may be completed but the Fabricator's inspection has not been complete.
- JJJ. Inspected by Fabricator: Inspected by Fabricator is the date upon which the Fabricator's own internal inspection process has been completed. When this date has been recorded but the subsequent date has not been recorded, this will indicate that an object has been fabricated, is ready for shipping by the Fabricator to the Coating facility but has not yet shipped.
- KKK. Shipped to Coating: Shipped to Coating is the date upon which the Fabricator has shipped an object to the Coating facility.
- LLL. Received by Coating: Received by Coating is the date upon which the Coating facility has received an object from the Fabricator.
- MMM. Inspected by Coating: Inspected by Coating is the date upon which the Coating Facility has inspected an object. When this date has been recorded, this will also indicate that an object has been coated.
- NNN. Shipped by Coating: Shipped by Coating is the date upon which the Coating Facility has shipped an object to the Project Site.
- OOO. Received at Staging Area: Received at Staging area is the date upon which the Project has received an object and stored it in the Staging Area.
- PPP. Received Onsite: Received Onsite is the date upon which an object has been moved from the Staging Area to the Project Site.
- QQQ. Ready for Erection: Ready for Erection is the date upon which an object is ready to be erected by the Erector.
- RRR. Erected: Erected is the date upon which an object has been erected.
- SSS. Inspection: Inspection is the date upon which an object has been inspected by the required Inspector.

TTT. Final Sign-Off: Final Sign-Off is the date upon which Final Sign-Off has occurred.

UUU. Assembly: Assembly is the date upon which an elevator or escalator has been preassembled prior to installation.

VVV. Stringers Installed: Stringers Installed is the date upon which Stringers are installed.

WWW. Stadia Installed: Stadia Installed is the date upon which Stadia is installed.

XXX. Steps Installed: Steps Installed is the date upon which steps are installed.

YYY. Handrails Installed: Handrails Installed is the date upon which handrails are installed.

ZZZ. Seating QA/QC: Seating QA/QC is the date upon which all pre-seating installation quality checks have been performed.

AAAA. Ready for Seats: Ready for Seats is the date upon which all actions required prior to seating installation have been completed.

BBBB. Shipped to Warehouse: Shipped to Warehouse indicates the date that equipment is shipped from the Fabricator to the Warehouse for storage prior to delivery to the Project site.

CCCC. Shipped to Jobsite: Shipped to Jobsite indicates the date upon which equipment is shipped from the warehouse to the Project site.

DDDD. Infrastructure Connection: Infrastructure Connection is the date upon which equipment is connected to the infrastructure that is required for equipment to operate.

EEEE. Fabrication/Make-Up Started: Fabrication/Make-Up Started is the date upon which infrastructure elements are fabricated or assembled either in a shop or on the Project Site.

FFFF. As-Built Complete: As-Built Complete is the date upon which as-built documentation for all Site elements are complete.

END OF SECTION 013700

Building Information Model Coordination  
Exhibit 1

## **ARTICLE 1 GENERAL PROVISIONS**

**1.1** This Exhibit establishes along with Section 013700 – Building Information Modeling (BIM) Project Requirements the protocols, expected levels of development, and authorized uses of Building Information Models on this Project and assigns specific responsibility for the development of each Model Element to a defined Level of Development at each Project phase. Where a provision in this Exhibit conflicts with a provision in the Agreement into which this Exhibit is incorporated, the provision in this Exhibit will prevail.

**1.1.1** The parties agree to incorporate this Exhibit by reference into any other agreement for services or construction for the Project.

## **1.2 Definitions**

**1.2.1 Building Information Model.** A Building Information Model(s) is a digital representation of the physical and functional characteristics of the Project and is referred to in this Exhibit as the "Model(s)," which term may be used herein to describe a Model Element, a single Model or multiple Models used in the aggregate. "Building Information Modeling" means the process and technology used to create the Model.

**1.2.2 Level of Development.** The Level(s) of Development (LOD) describes the level of completeness to which a Model Element is developed.

**1.2.3 Model Element.** A Model Element is a portion of the Building Information Model representing a component, system or assembly within a building or building site. For the purposes of this Exhibit, Model Elements are represented by the Construction Specifications Institute (CSI) UniFormat™ classification system in the Model Element Table at Section 3.3.

**1.2.4 Model Element Author.** The Model Element Author is the party responsible for developing the content of a specific Model Element to the LOD required for a particular phase of the Project. Model Element Authors are identified in the Model Element Table at Section 3.3.

**1.2.5 Model User.** The Model User refers to any individual or entity authorized to use the Model on the Project, such as for analysis, estimating or scheduling.

## **ARTICLE 2 LEVEL OF DEVELOPMENT**

**2.1** The following LOD descriptions identify the specific content requirements and associated authorized uses for each Model Element at five progressively detailed levels of completeness. Each subsequent LOD builds on the previous level and includes all the characteristics of previous levels. The parties shall utilize the five LOD described below in completing the Model Element Table at Section 3.3, which establishes the required LOD for each Model Element at each phase of the Project.

### **2.2 LOD 100**

**2.2.1 Model Content Requirements.** Overall building massing indicative of area, height, volume, location, and orientation may be modeled in three dimensions or represented by other data.

#### **2.2.2 Authorized Uses**

**2.2.2.1 Analysis.** The Model may be analyzed based on volume, area and orientation by application of generalized performance criteria assigned to the representative Model Elements.

**2.2.2.2 Cost Estimating.** The Model may be used to develop a cost estimate based on current area, volume or similar conceptual estimating techniques (e.g., square feet of floor area, condominium unit, hospital bed, etc.).

**2.2.2.3 Schedule.** The Model may be used for project phasing and overall duration.

### **2.3 LOD 200**

**2.3.1 Model Content Requirements.** Model Elements are modeled as generalized systems or assemblies with approximate quantities, size, shape, location, and orientation. Non-geometric information such as object name and quantities should be attached to Model Elements.

#### **2.3.2 Authorized Uses**

**2.3.2.1 Analysis.** The Model may be analyzed for performance of selected systems by application of generalized performance criteria assigned to the representative Model Elements.

**2.3.2.2 Cost Estimating.** The Model may be used to develop conceptual cost estimates based on the approximate data provided and conceptual estimating techniques (e.g., volume and quantity of elements or type of system selected).

**2.3.2.3 Schedule.** The Model may be used to show ordered, time-scaled appearance of major elements and systems.

## 2.4 LOD 300

**2.4.1 Model Content Requirements.** Model Elements are modeled as specific assemblies accurate in terms of quantity, size, shape, location, and orientation. Existing building elements are modeled as shown on building record drawings. Non-geometric information such as object description and object tags (door number, equipment number, etc) and quantities should be included with each object. Examples of the details required for systems modeled to LOD 300 include, but are not limited to:

- PART 4 - Site Utilities
- PART 5 - Masonry
- PART 6 - Steel decking
- PART 7 - Correct slopes for gravity piping for sanitary, or storm water systems.
- PART 8 - Piping materials specifically called out on documents included with model element attributes (generic manufacturer for system components are acceptable).
- PART 9 - Insulation around Pipe and Ducting.
- PART 10 - Duct dampers included with the duct system.
- PART 11 - Doors/Frames (hollow metal and storefront)
- PART 12 - Owner Furnished Fixtures, Equipment, etc. generically modeled as space claims by the Model Element Author (MEA).

## 2.4.2 Authorized Uses

**2.4.2.1 Construction.** Suitable for the generation of traditional construction documents. Contractors may utilize this model for coordination purposes and creation of shop drawings.

**2.4.2.2 Analysis.** The Model may be analyzed for performance of selected systems by application of specific performance criteria assigned to the representative Model Elements.

**2.4.2.3 Schedule.** The Model may be used to show ordered, time-scaled appearance of detailed elements and systems.

## 2.5 LOD 400

**2.5.1 Model Content Requirements.** Model Elements are modeled as specific assemblies that are accurate in terms of size, shape, location, quantity, and orientation with complete fabrication, assembly, and detailing information. Non-geometric information such as manufacturer name, model and installation should also be included with each object in addition to the information added in LOD 300. Examples of the details, above any beyond LOD 300 details, required for systems modeled to LOD 400 include, but are not limited to:

- PART 13 - Concrete
- PART 14 - Concrete reinforcing steel
- PART 15 - Anchor bolts
- PART 16 - Structural Steel
- PART 17 - Steel stairs, handrails
- PART 18 - Floor/roof penetration steel
- PART 19 - Significantly sized support hangers and stanchions for all systems.
- PART 20 - Uni-Strut associated with system components if it is located in a tight overhead space (case by case basis).
- PART 21 - Architectural millwork/casework.
- PART 22 - Metal Panels and support steel.
- PART 23 - Curtainwall System.
- PART 24 - Steel Stud Framing including kickers and trusses at floor penetrations.
- PART 25 - Valve locations.
- PART 26 - Access panels (these should be modeled with the system they provide access to).
- PART 27 - Conduit racks or other substantially wide / bundled electrical routing. (these can be generically modeled, i.e. extruded boxes, space claims)
- PART 28 - Single conduit runs associated with any system (lighting, power, controls, etc) if needed to coordinate concrete coring.

PART 29 - Kitchen Equipment  
PART 30 - MEP/FP & Low Voltage Equipment  
PART 31 - MEP/FP & Low Voltage Systems  
PART 32 - Pull box locations and any extra space claims for their access.

## **2.5.2 Authorized Uses**

**2.5.2.1 Construction.** Model Elements are virtual representations of the proposed element and are suitable for construction.

**2.5.2.2 Analysis.** The Model may be analyzed for performance of approved selected systems based on specific Model Elements.

**2.5.2.3 Schedule.** The Model may be used to show ordered, time-scaled appearance of detailed specific elements and systems including construction means and methods.

## **2.6 LOD 500**

**2.6.1 Model Content Requirements.** Model Elements are modeled as constructed assemblies actual and accurate in terms of size, shape, location, quantity, and orientation. Non-geometric information should be updated with actual installed items.

### **2.6.2 Authorized Uses**

**2.6.2.1 General Usage.** The Model may be utilized for maintaining, altering, and adding to the Project, but only to the extent consistent with any licenses granted in the Agreement or in a separate licensing agreement.

**2.6.2.2 Other Authorized Uses.** The Model will be a tool for accessing as-built information for facility management and maintenance purposes.

## **ARTICLE 3 MODEL ELEMENTS**

### **3.1 Reliance on Model Elements**

**3.1.1** The Model Element Table at Section 3.3 identifies (1) the LOD required for each Model Element at the end of each Project phase, and (2) the Model Element Author responsible for developing the Model Element to the LOD identified. Each Model Element Author's content is intended to be shared with subsequent Model Element Authors and Model Users throughout the course of the Project.

**3.1.2** It is understood that while the content of a specific Model Element may include data that exceeds the required LOD identified in Section 3.3 for a particular phase, Model Users and subsequent Model Element Authors may rely on the accuracy and completeness of a Model Element consistent only with the content required for a LOD identified in Section 3.3.

**3.1.3** Any use of, or reliance on, a Model Element inconsistent with the LOD indicated in Section 3.3 by subsequent Model Element Authors or Model Users shall be at their sole risk and without liability to the Model Element Author. To the fullest extent permitted by law, subsequent Model Element Authors and Model Users shall indemnify and defend the Model Element Author from and against all claims arising from or related to the subsequent Model Element Author's or Model User's modification to, or unauthorized use of, the Model Element Author's content.

### **3.2 Table Instructions**

**3.2.1** The table in Section 3.3 indicates the LOD to which each Model Element Author (MEA) is required to develop the content of the Model Element at the conclusion of each phase of the Project.

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
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## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Contractor, or Authorities Having Jurisdiction (AHJ) are not limited by provisions of this Section.

#### 1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Contractor.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to Authorities Having Jurisdiction (AHJ), to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of Authorities Having Jurisdiction (AHJ).

#### 1.4 REFERENCED STANDARDS

- A. Conform to reference standard by date of issue current on date of Contract Documents.
- B. Obtain copies of standards when required by Contract Documents.
- C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

#### 1.5 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

## 1.6 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
  2. Description of test and inspection.
  3. Identification of applicable standards.
  4. Identification of test and inspection methods.
  5. Number of tests and inspections required.
  6. Time schedule or time span for tests and inspections.
  7. Entity responsible for performing tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by Authorities Having Jurisdiction (AHJ), that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.

- b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Contractor, with copy to Architect. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven (7) days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 48.

## 1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by Authorities Having Jurisdiction (AHJ). Perform quality-control services required of Contractor by Authorities Having Jurisdiction (AHJ), whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to Authorities Having Jurisdiction (AHJ), when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within thirty (30) days of date established for commencement of the Work.
1. Distribution: Distribute schedule to Owner, Architect, Contractor, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## 1.9 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by Authorities Having Jurisdiction (AHJ), as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Contractor, with copy to Architect and to Authorities Having Jurisdiction (AHJ).
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Contractor's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

#### 1.3 REFERENCED STANDARDS

- A. ADA - Americans with Disabilities Act.
  - 1. ADAAG - Accessibility Guidelines for Buildings and Facilities. Adopted in 1991; continual revisions.
- B. ANSI - American National Standards Institute.
  - 1. ANSI A117.1: Accessible and Usable Buildings and Facilities.
- C. ASTM - American Society for Testing and Materials International.
  - 1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.
- D. ICC - International Code Council, Inc.
  - 1. ICC/ANSI A117.1: Accessible and Usable Buildings and Facilities.
- E. NECA - National Electrical Contractors Association.
- F. NEMA - National Electrical Manufacturers Association.
- G. NFPA - National Fire Protection Association International.
  - 1. NFPA 70: National Electrical Code.
  - 2. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.
- H. UL - Underwriters Laboratories Inc.

#### 1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
  - 1. Owner's construction forces.
  - 2. Occupants of Project.
  - 3. Architect.
  - 4. Testing agencies.
  - 5. Personnel of authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.
- C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
- D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

#### 1.5 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
  - 1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. Locations of dust-control partitions at each phase of the work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air filtration system discharge.
  - 4. Other dust-control measures.
  - 5. Waste management plan.

## 1.6 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

## 1.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2 inch (51 mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (41 mm) OD top rails.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
- C. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

## 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.

- a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
  3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- C. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service underground, unless otherwise indicated.
  2. Connect temporary service to Owner's existing power source, as directed by Owner.
- D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  2. Install lighting for Project identification sign.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
  2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  3. Maintain and touchup signs so they are legible at all times.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
  - 1. Set fence posts in concrete bases.
  - 2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
  - 3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.
- B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
  - 1. Protect porous materials from water damage.
  - 2. Protect stored and installed material from flowing or standing water.
  - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 4. Remove standing water from decks.
  - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Periodically collect and remove waste containing cellulose or other organic matter.
  - 4. Discard or replace water-damaged material.
  - 5. Do not install material that is wet.
  - 6. Discard, replace or clean stored or installed material that begins to grow mold.
  - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
  - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
  - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
  - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Section 017700 "Closeout Procedures."

END OF SECTION 015000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 015723 – TEMPORARY STORM WATER POLLUTION CONTROL

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Installation of Storm Water Pollution Prevention Plan (SWPPP) measures as per plans, specifications and the project SWPPP document for the purpose of preventing the discharge of pollutants from the construction site.
- B. Compliance with local, state and federal regulations.

#### 1.2 REFERENCES

- A. California Storm Water Best Management Practice Handbook for Construction Activity (BMP Handbook)
- B. Construction General Permit (CGP) Order No. 2009-009-DWQ

#### 1.3 SUBMITTAL REQUIREMENTS

- A. Product Data: Provide product catalog cut sheets of all temporary and permanent equipment and specialty items that will be provided to comply with the SWPPP, including items necessary for storage, disposal and recycling.
- B. Shop Drawings: Provide site plan indicating construction staging, storage, refuse areas and vehicular routing and parking areas.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Use materials of a class, grade and type needed to meet the performance described in the BMP Handbook and project SWPPP document.

### PART 3 - EXECUTION

#### 3.1 QUALIFIED SWPPP DEVELOPER (QSD)

- A. The owner shall designate a Qualified SWPPP Developer (QSD) having registrations, certifications and appropriate experience as defined by the State of California Construction General Permit (CGP) Order No. 2009-009-DWQ to perform the following:

1. Prepare, certify and amend as required the project SWPPP document.
2. Assist the owner in obtaining permit coverage prior to the commencement of construction activity through filing of Permit Registration Document (PRDs) on the Storm Water Multiple Application and Report Tracking System (SMARTS).
3. Assist the owner in filing the Notice of Termination (NOT) when construction is complete and final stabilization has been reached.

### 3.2 QUALIFIED SWPPP PRACTITIONER (QSP)

- A. The owner shall designate a Qualified SWPPP Practitioner (QSP) having registrations, certifications and appropriate experience as defined by the State of California Construction General Permit (CGP) Order No. 2009-009-DWQ to perform the following:

1. Conduct storm water and non-storm water visual inspections of Best Management Practices (BMPs) and prepare documentation as prescribed by the CGP according to the risk level and project type.
2. Identifying BMP failures or shortcomings and provide an action plan to correct the deficiencies.
3. Conduct discharge monitoring as prescribed by the CGP for pH, turbidity, and non-visible pollutant monitoring, according to the project risk level and project type.
4. Develop a Rain Event Action Plan (REAP) for Risk Level 2 and 3 projects for qualifying rain events.
5. Conduct pre-storm event visual inspections for qualifying rain events.
6. Implement a Construction Site Monitoring Program (CSMP).
7. Track weather forecasts from the National Oceanic and Atmospheric Administration (NOAA) in accordance with Permit requirements.
8. Complete applicable monitoring, sampling, and inspection logs, forms and documents for filing to the Storm Water Multiple Application and Report Tracking System (SMARTS).
9. Report Numeric Action Level (NAL) exceedances to SMARTS for Risk Level 2 and 3 projects.
10. Provide assistance to the owner with annual reporting requirements.

### 3.3 PERFORMANCE BY CONTRACTOR

- A. General

1. Keep the original SWPPP document in a readily accessible location at the construction site from the commencement of construction activity until submission of the Notice of Termination (NOT) for storm water discharges associated with construction activity. Contractors with day to day operation control over SWPPP implementation shall have the original SWPPP document available at a central location, on-site, for the use of all operators and those identified as having responsibility under the SWPPP.
2. Review the SWPPP. Ensure that all key personnel understand the requirements of the SWPPP.
3. Provide to the QSD, names of all key subcontractors involved in earthwork/land disturbing activities.

- B. Good Site Management "Housekeeping"

1. For projects designated as Risk Level 1 and above, implement good site management (i.e., "housekeeping") measures for construction materials that could potentially be a threat to water quality if discharged. At a minimum, the contractor shall implement the following good housekeeping measures:
  - a. Conduct an inventory of the products used and/or expected to be used and the end products that are produced and/or expected to be produced. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
  - b. Cover and berm loose stockpiled construction materials that are not actively being used (i.e. soil, spoils, aggregate, fly-ash, stucco, hydrated lime, etc.).
  - c. Store chemicals in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed).
  - d. Minimize exposure of construction materials to precipitation. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
  - e. Implement Best Management Practices to prevent the off-site tracking of loose construction and landscape materials.
2. For projects designated as Risk Level 1 and above, implement good housekeeping measures for waste management, which, at a minimum, shall consist of the following:
  - a. Prevent disposal of any rinse or wash waters or materials on impervious or pervious site surfaces or into the storm drain system.
  - b. Ensure the containment of sanitation facilities (e.g., portable toilets) to prevent discharges of pollutants to the storm water drainage system or receiving water.
  - c. Clean or replace sanitation facilities and inspect them regularly for leaks and spills.
  - d. Cover waste disposal containers at the end of every business day and during a rain event.
  - e. Prevent discharges from waste disposal containers to the storm water drainage system or receiving water.
  - f. Contain and securely protect stockpiled waste material from wind and rain at all times unless actively being used.
  - g. Implement procedures that effectively address hazardous and non-hazardous spills.
    - 1) Equipment and materials for cleanup of spills shall be available on site. Spills and leaks shall be cleaned up immediately and disposed of properly.
    - 2) Appropriate spill response personnel shall be assigned and trained.
    - 3) Ensure the containment of concrete washout areas and other washout areas that may contain additional pollutants so there is no discharge into the underlying soil and onto the surrounding areas.
3. For projects designated as Risk Level 1 and above, implement good housekeeping for vehicle storage and maintenance, which, at a minimum, shall consist of the following:
  - a. Prevent oil, grease, or fuel to leak in to the ground, storm drains or surface waters.
  - b. Place all equipment or vehicles, which are to be fueled, maintained and stored in a designated area fitted with appropriate Best Management Practices.
  - c. Clean leaks immediately and dispose of leaked materials properly.

4. For projects designated as Risk Level 1 and above, implement good housekeeping for landscape materials, which, at a minimum, shall consist of the following:
  - a. Contain stockpiled materials such as mulches and topsoil when they are not actively being used.
  - b. Contain all fertilizers and other landscape materials when they are not actively being used.
  - c. Discontinue the application of any erodible landscape material within two days before a forecasted rain event or during periods of precipitation.
  - d. Apply erodible landscape material at quantities and application rates according to manufacture recommendations or based on written specifications by knowledgeable and experienced field personnel.
  - e. Stack erodible landscape material on pallets and cover or store such materials when not being used or applied.
5. Maintain an inventory of materials in association with the Material Safety Data Sheet (MSDS) per OSHA requirements. Provide to QSP upon request.
6. For projects designated as Risk Level 1 and above, implement good housekeeping measures on the construction site to control the air deposition of site materials and from site operations. Such particulates can include, but are not limited to, sediment, nutrients, trash, metals, bacteria, oil and grease and organics.
7. For projects designated as Risk Level 2 or 3, implement the Rain Event Action Plan (REAP) as directed by the QSP.
8. For projects designated as Risk Level 1 and above, begin implementing repairs or changes to BMPs within 72 hours of identification as directed by the QSP and complete the changes as soon as possible.

C. Non-Storm Water Management

1. For projects designated as Risk Level 1 and above, implement measures to control all non-storm water discharges during construction.
2. For projects designated as Risk Level 1 and above, wash vehicles in such a manner as to prevent non-storm water discharges.
3. For projects designated as Risk Level 1 and above, clean streets in such a manner as to prevent unauthorized non-storm water discharges.

D. Erosion Control

1. For projects designated as Risk Level 1 and above, implement effective wind erosion control.
2. For projects designated as Risk Level 1 and above, provide effective soil cover for inactive areas and all finished slopes, open space, utility backfill, and completed lots.
3. For projects designated as Risk Level 1 and above, limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation.

E. Sediment Controls

1. For projects designated as Risk Level 1 and above, establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from the site.

2. For projects designated as Risk Level 1 and above, on sites where sediment basins are to be used, at minimum, install and maintain sediment basins according to the method provided in CASQA's Construction BMP Guidance Handbook.
3. For projects designated as Risk Level 2 or 3, implement appropriate erosion control Best Management Practices (runoff control and soil stabilization) in conjunction with sediment control Best Management Practices for areas under active construction. Active areas of construction are areas undergoing land surface disturbances.
4. For projects designated as Risk Level 2 or 3, install linear sediment controls along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with sheet flow lengths in accordance with Table 1.

Table 1 – Critical Slope/Sheet Flow Length Combinations

Slope Percentage	Sheet Flow Length Not to Exceed
0 - 25 percent	20 feet
25 - 50 percent	15 feet
Over 50 percent	10 feet

- F. For projects designated as Risk Level 2 or 3, ensure that construction activity traffic to and from the project is limited to entrances and exits that employ effective controls to prevent offsite tracking of sediment.
1. For projects designated as Risk Level 2 or 3, ensure that all storm drain inlets and perimeter controls, runoff control Best Management Practices, and pollutant controls at entrances and exits (e.g. tire washoff locations) are maintained and protected from activities that reduce their effectiveness.
  2. For projects designated as Risk Level 2 or 3, inspect on a daily basis all immediate access roads daily. At a minimum daily (when necessary) and prior to any rain event, remove any sediment or other construction activity related materials that are deposited on the roads (by vacuuming or sweeping).
- G. Run-on and Run-off Controls
1. For projects designated as Risk Level 1 and above, effectively manage all run-on, all runoff within the site and all runoff that discharges off the site. Run-on from offsite shall be directed away from all disturbed areas or shall collectively be in compliance with the effluent limitations in this General Permit.

END OF SECTION 015723

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

#### 1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

#### 1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  2. Completed List: Submit in sufficient time to allow review and timely procurement.
  3. Architect's Action: Architect will respond in writing to Contractor. Architect's response will include a list of unacceptable product selections Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use Architect's Substitution Request Form.
  2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to Authorities Having Jurisdiction (AHJ).
    - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    - j. Cost information, including a proposal of change, if any, in the Contract Sum.
    - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
  3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
    - a. Form of Acceptance: Change Order.

- b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Section 012500 "Submittal Procedures."
    - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 012500 "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  3. Refer to Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
2. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
3. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
4. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
5. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
6. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers. Other named manufacturers listed are approved as sources provided the product proposed conforms to design criteria established by the product identified under the "Basis-of-Design".
7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
8. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

- a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
- b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of Authorities Having Jurisdiction (AHJ).
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.
  - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

## 2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Installation of the Work.
  - 3. Cutting and patching.
  - 4. Progress cleaning.
  - 5. Starting and adjusting.
  - 6. Protection of installed construction.
  - 7. Correction of the Work.

#### 1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Mechanical systems piping and ducts.
    - f. Control systems.
    - g. Communication systems.
    - h. Fire-detection and -alarm systems.
    - i. Conveying systems.
    - j. Electrical wiring systems.
    - k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
  - a. Water, moisture, or vapor barriers.
  - b. Membranes and flashings.
  - c. Exterior curtain-wall construction.
  - d. Sprayed fire-resistive material.
  - e. Equipment supports.
  - f. Piping, ductwork, vessels, and equipment.
  - g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with Authorities Having Jurisdiction (AHJ).
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings before proceeding.

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a Professional Surveyor to lay out the Work using accepted surveying practices.

1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  2. Inform installers of lines and levels to which they must comply.
  3. Check the location, level and plumb, of every major element as the Work progresses.
  4. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  5. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work. Coordinate backing requirements with other trades.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

- a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
  - b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of waste materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 014000 "Quality Requirements."

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.

- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 017419 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Specification Section 018113 "Sustainable Design Requirements".

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for a required Site Waste Management Program This program shall include the following:
  - 1. Salvaging, recycling, and disposing of nonhazardous construction waste.
- B. Performance Goals:
  - 1. General: Develop waste management plan in accordance with ASTM E 1609 and as specified herein that results in end-of-Project rates for salvage/recycling of 50 percent by weight of total waste generated by the Work.
  - 2. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous construction waste as possible including the following materials:
    - a. Construction Waste: Track all waste hauling by weight or by volume.
      - 1) Site-clearing waste.
      - 2) Masonry and CMU.
      - 3) Lumber.
      - 4) Wood sheet materials.
      - 5) Wood trim.
      - 6) Metals.
      - 7) Roofing.
      - 8) Insulation.
      - 9) Carpet and pad.
      - 10) Gypsum board.
      - 11) Piping.
      - 12) Electrical conduit.
      - 13) Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
        - a) Paper.
        - b) Cardboard.
        - c) Boxes.
        - d) Plastic sheet and film.
        - e) Polystyrene packaging.
        - f) Wood crates.

- g) Plastic pails.

### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM E 1609: Development and Implementation of a Pollution Prevention Program.
  - 2. ASTM E 2114: Standard Terminology for Sustainability Relative to the Performance of Buildings.
- B. HFH - Habitat for Humanity International.

### 1.4 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E 2114.

### 1.5 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for construction waste. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Approval of Contractor's plan shall not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- E. Submit final waste report showing facilities and combined diversion rates exceeding 75% diversion from landfills.

### 1.6 QUALITY ASSURANCE

- A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss site waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

#### 1.7 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
- D. Identify waste haulers and/or facilities and include company name and address in waste management plan.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

##### 3.1 SITE WASTE MANAGEMENT

- A. Develop and implement a waste management program in accordance with ASTM E 1609 and as specified herein.

##### 3.2 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect, Owner, and Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  1. Comply with Section 015000 "Temporary Facilities and Controls" for operation, termination, and removal requirements.

- B. Waste Management Coordinator: Appoint a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

### 3.3 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycling/Reuse on project site. Contractor and subcontractors are both required to separate recyclable materials into bins and to arrange for delivery of recyclable materials to recycling depot. Clearly label all recycling containers and list acceptable and unacceptable materials.
- B. Recycle paper and beverage containers used by on-site workers.
- C. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following: Recycling/Reuse off project site. The following is a partial list for Contractor's information only. For more information, contact the State Department of Environmental Quality and the local Integrated Solid Waste Management Office.
  - 1. HFH, a non-profit housing organization that rehabilitates and builds housing for low-income families. Sites requiring donated materials vary. Contact the national hotline at (800) HABITAT.
- D. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

### 3.4 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees.
  - 1. Comply with requirements for use of chipped organic waste as organic mulch.
- C. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
    - a. Comply with requirements for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
  - a. Comply with requirements for use of clean ground gypsum board as inorganic soil amendment.

### 3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
  - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 8. Complete startup testing of systems.
  - 9. Submit test/adjust/balance records.
  - 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  - 11. Advise Owner of changeover in heat and other utilities.
  - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  - 13. Complete final cleaning requirements, including touchup painting.
  - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  - 2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
  - 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  - 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  - 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  - 4. Submit pest-control final inspection report and warranty.
  - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order.
  - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.

## 1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (216 by 279 mm) paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

- a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Remove snow and ice to provide safe access to building.
  - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Replace parts subject to unusual operating conditions.
  - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not dispose of debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 018113 – SUSTAINABLE DESIGN REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes general requirements and procedures for achieving LEED for New Construction (LEED NC) at the GOLD level and for meeting the mandatory requirements of the California Green Building Code (CalGreen).

#### 1.2 OBJECTIVES

- A. To achieve LEED NC GOLD certification and meet the mandatory requirements of CalGreen. During the construction phase of this project, the contractor shall implement the following procedures singly or in combination:
  - 1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce and employ recycled materials. To help purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
    - a. Include environmental considerations as part of the normal purchasing process.
    - b. Emphasize pollution prevention early in the purchasing process.
    - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
    - d. Compare relevant environmental impacts when selecting products and services.
    - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
  - 2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
  - 3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

#### 1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. 01 91 00 General Commissioning Requirements

#### 1.4 DEFINITIONS

- A. Agrifiber Products: Composite panel products derived from agricultural fiber
- B. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program
- C. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder
- D. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 017419.
- E. LEED: The Leadership in Energy & Environmental Design green building rating systems developed and adopted by the U.S. Green Building Council (USGBC). The systems certify levels of environmental achievement based on a point and credit scoring system.
- F. LEED NC: The Leadership in Energy & Environmental Design green building rating system developed and adopted by the USGBC for new construction and major renovations of buildings
- G. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky.
- H. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials
- I. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use
- J. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims": [www.ftc.gov/bcp/gnrule/guides980427](http://www.ftc.gov/bcp/gnrule/guides980427)
- K. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 500 miles (400 km) from the Project site
- L. Sealant: Any material that fills and seals gaps between other materials
- M. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

#### 1.5 SUBMITTALS

- A. General: Additional Sustainable Design submittal requirements are included in other sections of the Specifications.

B. Sustainable Design Submittals:

1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.
2. Heat Island Effect: Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.
3. Exterior Lighting Fixtures: Submittals for non-emergency exterior lighting must include cut sheets with photometric data and Backlight/Uplight/Glare (BUG) Ratings.
4. Irrigation Systems: Provide manufacturer's cut sheets for irrigation system controllers.
5. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.
6. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
7. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
8. On-Site Renewable Energy Systems: Provide cut sheets and manufacturer's product data for all on-site renewable energy generating components and equipment, including documentation of output capacity.
9. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation:
  - a. Cost of each material or product, excluding cost of labor and equipment for installation
  - b. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
  - c. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content and post-consumer recycled content OR combined recycled content value.
10. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:
  - a. Cost of each material or product, excluding cost of labor and equipment for installation
  - b. Location of product manufacture and distance from point of manufacture to the Project Site

- c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
  - d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material
  - e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB
  - f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.
- 11. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
  - a. Provide manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
  - b. The contractor shall create a spreadsheet for the city building inspector showing all adhesives and sealants used on the project, their VOC contents and acceptable limit based on those given in section 2.1G.
- 12. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
- 13. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
- 14. Paints and Coatings: The contractor shall create a spreadsheet for the city building inspector showing all paints and coatings used on the project, their VOC contents and acceptable limit based on those given in section 2.1H.
- 15. Floorcoverings:
  - a. Carpet Systems: Submittals for all carpet must include the following: Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
  - b. Resilient Flooring: Submittals for all resilient floorcovering must include manufacturer's product data verifying certification under either the Greenguard for Children & Schools or FloorScore indoor emissions testing program.
- 16. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.

17. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
  18. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:
    - a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs)
    - b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction
  19. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
  20. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
- C. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:
1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
    - a. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
    - b. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
  2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.
- D. Construction Waste Management: See Section 017419 "Construction Waste Management" for submittal requirements.
- E. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
1. Not more than 30 days after the Preconstruction Meeting, prepare and submit an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:

- a. Construction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling
    - b. Construction procedures for protecting absorptive materials stored on-site or installed from moisture damage
    - c. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
    - d. Construction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
    - e. Construction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit
  2. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
    - a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
    - b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).
  3. Not more than 14 days after Substantial Completion provide the following:
    - a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
    - b. A minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
- F. Commissioning: See Section 019100 "Commissioning Requirements" for submittal requirements.
- G. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 017419 "Construction Waste Management."
  2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

## 1.6 QUALITY ASSURANCE

- A. General: Perform the work of this Section as a supplement and in accordance with applicable requirements of Division 1 "Contractor Quality Control Program."

- B. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project's Sustainable Design Requirements and coordination of the Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.
- C. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

## PART 2 - PRODUCTS

### 2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

- A. Roofing Materials: All roofing systems must comply with the following requirements:
  - 1. Low-Sloped roofing less than or equal to 2:12 slope must have an SRI of at least 78.
  - 2. Steep-Sloped roofing greater than 2:12 slope must have an SRI of at least 29.
- B. Exterior Lighting Fixtures:
  - 1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
  - 2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
  - 3. Exterior lighting fixtures shall meet the Maximum Allowable Backlight, Uplight and Glare Ratings for Lighting Zone 3 in Table 5.106.8 in the 2010 California Green Building Standards Code with July 1, 2012 Supplement.
- C. Water-Conserving Fixtures: Flow and flush rates shall not exceed the following:
  - 1. Hotel Room Toilets: 1.28 gallons per flush and meet the US EPA WaterSense Tank-Type High-Efficiency Toilet Specification
  - 2. First Floor Flushometer Toilets: 1.00 gallons per flush and meet the requirements of ASME A 112.19.2 / CSA B45.1.
  - 3. Urinals: no more than 0.125 gallons per flush or use meet the requirements of ASME A 112.19.2 / CSA B45.1.
  - 4. Lavatory Faucets: 0.5 gpm with automatic faucet controls and meet the requirements of ASME A 112.18.1 / CSA B125.1.
  - 5. Kitchen Sink Lavatories: 1.8 gpm.
  - 6. Showerheads: 2.0 gpm and meet the requirements of ASME A 112.18.1 / CSA B125.1.
- D. Elimination of CFCs AND HCFCs:
  - 1. Ozone Protection: Base building cooling equipment shall contain no refrigerants other than or HFC 410a.
  - 2. Fire suppression systems may not contain ozone-depleting substances.
- E. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 15% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.
  - a. The post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
  - b. The pre-consumer recycled content value of a material shall be determined by dividing the weight of pre-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
  - c. Do not include mechanical and electrical components in the calculations.
  - d. Do not include labor and delivery costs in the calculations.
  - e. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
  - f. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.
  
- F. As a guideline, the contractor should strive to use materials in the following list with the minimum recycled content indicated:

<b>Category</b>	<b>Minimum Recycled Content</b>
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined
Cellulose Insulation	90% combined
Rock Wool Insulation	75% pre-consumer
Fireproofing	20% combined
Steel Doors and Frames	35% combined
Gypsum Wallboard	100% combined
Carpet	40% combined
Ceramic Tile Flooring	60% combined
Rubber Flooring and Base	60% combined
Acoustical Ceiling Tile (ACT)	40% post-consumer
ACT Suspension System	90% post-consumer
Toilet Partitions	60% post-consumer

- G. Regional Materials: Provide a minimum of 10 percent of building materials (by cost) that are manufactured and extracted/harvested within a 500 mile radius of the project site, exclusive of labor and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials within this specified 500 mile radius.

1. The contractor should attempt to procure the following materials from regional sources:

- a. Aggregate
- b. Concrete
- c. Gypsum Board
- d. Steel

- H. Adhesives and Sealants:

1. All adhesives and sealants, regardless of where they are used, must comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24):

- a. Concrete Curing Compound: 60 g/L
- b. Concrete Sealer: 10 g/L
- c. Concrete Form Release Agents: 0g/L
- d. Garage Deck Sealer: 50g/L
- e. Wood Glues: 20 g/L
- f. Millwork and Casework Adhesives: 20g/L
- g. Metal to Metal Adhesives: 30 g/L
- h. Adhesives for Porous Materials (Except Wood): 50 g/L
- i. Subfloor Adhesives: 50 g/L
- j. Plastic Foam Adhesives: 50 g/L
- k. Carpet Adhesives: 50 g/L
- l. Carpet Pad Adhesives: 50 g/L
- m. Carpet Seam Sealer: 50g/L
- n. VCT and Sheet Vinyl Adhesives: 50 g/L
- o. Cove Base Adhesives: 50 g/L
- p. Rubber Floor Adhesives: 60 g/L
- q. Wood Flooring Adhesives: 100 g/L
- r. Ceramic Tile Adhesives: 65 g/L
- s. Gypsum Board and Panel Adhesives: 50 g/L
- t. Gypsum Drywall Joint Compound: 20 g/L
- u. Portland Cement Plaster: 20 g/L
- v. Multipurpose Construction Adhesives: 70 g/L
- w. Cast Resin Countertop Silicone Sealant: 20g/L
- x. Plastic Laminate Adhesives: 20 g/L
- y. General Contact Adhesive: 80 g/L
- z. Structural Glazing Adhesives and Compounds: 100 g/L
- aa. Silicone Sealant: 50 g/L
- bb. Pipe Thread Sealant: 50 g/L
- cc. Duct Sealant: 10 g/L
- dd. Plastic Cement Welding Compounds: 250 g/L
- ee. ABS Welding Compounds: 400 g/L
- ff. CPVC Welding Compounds: 270 g/L
- gg. PVC Welding Compounds: 150 g/L
- hh. Adhesive Primer for Plastic: 250 g/L
- ii. Architectural Sealants: 250 g/L
- jj. Single-Ply Roofing Membrane Adhesives: 250 g/L

2. Interior sealants shall not contain: mercury, butyl rubber, neoprene, SBR (styrene butadiene rubber), or nitrile.
3. Sealants and glazing compounds formulated with aromatic solvents (organic solvent with a benzene ring in its molecular structure) fibrous talc or asbestos, formaldehyde, halo-genated solvents, mercury, lead, cadmium, hexavalent chromium, or their components shall not be used.
4. Adhesives used to apply laminates, whether shop-applied or field-applied, shall contain no urea-formaldehyde.

I. Paints and Coatings:

1. Interior Paints and Coatings: For interior field-applied applications, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the chemical restrictions (Restricted Components listed below) of Green Seal Standard GS-11, Paints, First Edition, May 20, 1993; Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997; and South Coast Air Quality Management District Rule 1113, Architectural Coatings, rules in effect on January 1, 2004, as follows:
  - a. Flat Paints and Coatings: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments
  - b. Non-Flat Paints and Coatings Except High Gloss: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments.
  - c. High Gloss Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments. High Gloss Coatings are coatings that register a gloss of 70 or above on a 60-degree meter according to ASTM Test Method D 523 as specified in paragraph (e)(6).
  - d. Water-Based Polychromatic Finish Coatings: Not more than 150 g/L (150 g/L for primer and flat polychromatic paint)
  - e. Anti-Corrosive Coatings: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
  - f. Sanding Sealers: Not more than 50 grams of VOC per liter of coating less water and exempt compounds
  - g. Waterproofing Sealers: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
  - h. Concrete Slab Sealers: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
  - i. Polyurethanes: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
  - j. Stains: Not more than 250 grams of VOC per liter of coating less water and exempt compounds
2. Interior paints shall not contain antimicrobial additives (such as fungicides and biocides).
3. Exterior Paints and Coatings: For exterior applications, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the chemical restrictions (Restricted Components listed below) of Green Seal's Standard GS-11:
  - a. Flat Paints and Coatings: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments
  - b. Non-Flat Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments

- c. High Gloss Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments. High Gloss Coatings are coatings that register a gloss of 70 or above on a 60-degree meter according to ASTM Test Method D 523 as specified in paragraph (e)(6)
    - d. Anti-Corrosive Coatings: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
    - e. Varnishes and Sanding Sealers: Not more than 275 grams of VOC per liter of coating less water and exempt compounds
    - f. Stains: Not more than 250 grams of VOC per liter of coating less water and exempt compounds
  - 4. Aromatic Compounds: Paints and coatings shall not contain more than 1% (by weight) total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
  - 5. Restricted Components: Paints and coatings shall not contain any of the following:
    - a. Acrolein
    - b. Acrylonitrile
    - c. Aniline dyes
    - d. Antimony
    - e. Benzene
    - f. Butyl benzyl phthalate
    - g. Cadmium
    - h. Di (2-ethylhexyl) phthalate
    - i. Di-n-butyl phthalate
    - j. Di-n-octyl phthalate
    - k. 1,2-dichlorobenzene
    - l. Diethyl phthalate
    - m. Dimethyl phthalate
    - n. Ethylbenzene
    - o. Formaldehyde
    - p. Hexavalent chromium
    - q. Isophorone
    - r. Lead
    - s. Mercury
    - t. Methyl ethyl ketone
    - u. Methyl isobutyl ketone
    - v. Methylene chloride
    - w. Naphthalene
    - x. Toluene (methylbenzene)
    - y. 1,1,1-trichloroethane
    - z. Vinyl chloride
    - aa. Xylene
  - 6. Coordinate with paint manufacturers for implementing a "take-back program" for all unused paint. Set aside scrap and unused paint to be returned to the manufacturer for recycling into new product. Close and seal all partially used containers of paint to maintain quality as necessary for reuse.
- J. Floorcoverings:
- 1. All carpet systems, including adhesives, must meet or exceed the Carpet and Rug Institute Green Label Plus Indoor Air Quality Test Program.
  - 2. Carpet cushion shall not contain brominated flame retardants.

3. Carpet tile applications shall be self-adhering.
  4. All resilient floorcovering must be certified under the Greenguard or FloorScore indoor emissions testing programs.
- K. Composite Wood and Agrifiber Binders: Use composite wood products approved by the California Air Resources Board (ARB) as no-added formaldehyde (NAF) based resins or ultra-low emitting formaldehyde (ULEF) resins.
- L. Entryway Systems: Walk-off systems to capture particulates shall be installed at least six feet long in the direction of entry travel at all entryways directly connected to the outdoors that are used as regular entry points by building users. Acceptable entryway systems include:
1. Permanently installed grates, grilles, or slotted systems that allow for cleaning beneath them
  2. Permanently installed direct glue-down walk-off mats
  3. Non-permanent roll-out mats, but only if a service organization is contracted for maintenance on a weekly basis
- M. Air Filtration: Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better in all air handling units for processing both return and outside air that is delivered to the air supply system. Replace all filtration media after the completion of construction and prior to occupancy.
- N. Lighting Controls: Install and calibrate controls as specified by Division 26 – Electrical in order to comply with LEED IAQ lighting controllability requirements.
- O. Thermal Comfort: Install and calibrate controls as specified in Division 23 – Heating, Ventilation, and Air-Conditioning.
- P. Fiberglass Insulation: Fiberglass batt insulation shall contain no formaldehyde-based binders or shall be third-party certified for conformance with Greenguard Children & Schools or Indoor Advantage Gold.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION WASTE MANAGEMENT

- A. Develop and implement a Construction Waste Management Plan (CWMP) quantifying material diversion by weight in order to recycle, reuse, and/or salvage at least 80% (by weight) of construction, demolition and land-clearing waste.
- B. 100% of non-contaminated trees, stumps, rocks and associated vegetation and soils resulting primarily from land-clearing shall be reused or recycled.
- C. Clean materials which are contaminated prior to placing in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination and other substances deleterious to the recycling process.
- D. Utilize any on-site existing paving materials that are scheduled for demolition as granulated fill or subbase material, and include the weight of this material in the calculations for material diverted from landfill disposal.

- E. Arrange for materials collection by or materials delivery to the appropriate recycling or reuse facility.
- F. Tax credits and other savings obtained or revenue generated for recycled or reused materials accrue to the Contractor.
- G. Discuss CWMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, and record progress in meeting minutes.
- H. Submit monthly progress reports with Applications for Payment in accordance with Section 017419, documenting the status of the CWMP and current diversion percentage rates.

### 3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- A. Develop and implement a Construction IAQ Management Plan (CIAQMP) to prevent indoor air quality problems resulting from construction activities, including, at minimum, the following:
  - 1. Construction activities must meet or exceed the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995.
  - 2. During construction, protect all absorptive materials stored on-site or installed from moisture damage as described in the Construction IAQ Management Plan (CIAQMP) defined above. Specifically:
    - a. Exercise special care at all times in the storage of materials to prevent exposure to moisture.
    - b. Avoid installation of gypsum wallboard and other porous materials until the building is weather-tight.
    - c. All standing water which accumulates on interior floors shall be removed on the day that it is observed.
    - d. Any drywall that has retained more than 20% moisture after 48 hours following exposure to moisture, or that has evidence of mold, must be disposed of in accordance with Specification Section 017419 "Construction Waste Management."
    - e. The contractor shall identify and remove all porous building materials that become wet or damaged by moisture within 7 calendar days of such exposure.
  - 3. During construction and HVAC system installation, provide the Architect with photographs of IAQ management measures (such as protection of ducts and on-site or installed absorptive materials), including six photographs on three different occasions depicting implemented SMACNA approaches.
- B. Air Filtration:
  - 1. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better in all air handling units for processing both return and outside air that is delivered to the air supply system; replace all filtration media after the completion of construction and prior to occupancy.
  - 2. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. Inspect weekly and replace as required.

- C. Discuss CIAQMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, and record progress in meeting minutes.

### 3.3 COMMISSIONING

- A. Commissioning: All building energy-related systems and building envelope components shall be commissioned in accordance with the requirements of Specification Section 019100 "Commissioning Requirements" and related commissioning sections in other divisions in order to verify and ensure that fundamental building elements and systems are installed, constructed, calibrated to operate, and perform according to the Owner's Project Requirements, Basis of Design, and Construction Documents.

END OF SECTION 018113

## SECTION 019100 - COMMISSIONING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Commissioning is a systematic process of ensuring that the building systems perform according to the design intent.
- B. Commissioning during the construction phase is intended to achieve the following specific objectives:
  - 1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted standards and that they receive adequate operational checkout by installing contractors.
  - 2. Verify and document that equipment and systems perform according to the Owner's design intent and the Contract Documents.
  - 3. Verify that Operations & Maintenance documentation left on site is complete.
  - 4. Verify that the Owner's operating personnel are trained.
- C. Deferred or seasonal commissioning may be required if commissioning during the construction phase does not fulfill the objectives listed above.
- D. Commissioning augments but does not replace close-out procedures or other testing requirements contained in the Contract Documents.

#### 1.2 RELATED DOCUMENTATION

- A. Contract drawings, Division 0, Conditions of the Contract, and Division 1, General Requirements, apply to the Work of this Section.

#### 1.3 RELATED SECTIONS

- A. Form - Product Substitution.
- B. Section 013300 Submittal Procedures.
- C. Division 22 Plumbing Requirements.
- D. Section 220800 Plumbing Commissioning Requirements.
- E. Division 23 Mechanical Requirements.
- F. Section 230800 Mechanical Commissioning Requirements.
- G. Division 26 Electrical Requirements.
- H. Section 260800 Electrical Commissioning Requirements.

- I. Section 320800 Commissioning for Exterior Improvements (Irrigation).

#### 1.4 COORDINATION AND RESPONSIBILITIES

##### A. The Commissioning Team includes:

1. The Owner, including an independent Construction Manager or Project Manager, if applicable (Owner's Representative)
2. Commissioning Authority (CA)
3. Architect and design engineers (Design Team)
4. General Contractor (Contractor)
5. Building or plant operator (Operator)

##### B. Responsibilities:

###### 1. Owner's Representative Responsibilities

- a. Provide Design Team with a Design Intent Document.
- b. Review the pre-functional checklists and functional test procedures prior to testing.
- c. When necessary, observe and witness pre-functional checklists, startup and functional testing of selected equipment.
- d. Review commissioning progress.
- e. Coordinate the resolution of non-compliance and deficiencies identified during commissioning.
- f. Sign-off on individual commissioning tests as completed and passing
- g. Assist the Contractor in coordinating the training of Owner's personnel.

###### 2. CA Responsibilities

- a. Direct and coordinate the commissioning activities and report to the Owner's Representative.
- b. Provide an initial schedule of commissioning activities to the Contractor.
- c. Coordinate with the Contractor to establish the schedule of commissioning activities.
- d. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
- e. Perform site visits, as necessary, to observe component and system installations.
- f. Attend selected planning and job-site meetings to obtain information on construction progress.
- g. Request and review additional information required to perform commissioning tasks, including control sequences, submittals, O&M materials, contractor start-up and checkout procedures and training agendas.
- h. Develop and distribute pre-functional checklists, as necessary.
- i. Develop and distribute functional test procedures, as necessary.
- j. Coordinate, witness and approve functional tests performed by installing contractors.
- k. Coordinate re-testing as necessary.
- l. Participate in resolution of system deficiencies identified during commissioning.
- m. Keep the Owner's Representative apprised of the status of commissioning related activities.
- n. Coordinate and supervise seasonal or deferred testing and deficiency corrections.
- o. Review and approve the content of the Operation & Maintenance (O&M) manuals.

- p. Oversee and approve the training of the Owner's operating personnel.
- q. Provide a final commissioning report (as described in this section).

3. Design Team Responsibilities

- a. Attend the commissioning scoping meeting and selected commissioning team meetings.
- b. Develop Basis of Design Document.
- c. Perform normal submittal review, construction observation, record drawing preparation, etc. as contracted.
- d. Review pre-functional checklists and functional test procedures prior to testing.
- e. Participate in resolution of system deficiencies identified during commissioning.

4. Contractor Responsibilities

- a. Include the cost of commissioning in the total contract price.
- b. Integrate commissioning activities into the master schedule.
- c. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
- d. Review pre-functional checklists and functional test procedures prior to testing.
- e. Complete pre-functional checklists as defined by the CA.
- f. Execute functional performance testing as defined by the CA.
- g. Participate in resolution of system deficiencies identified during commissioning.
- h. Coordinate the training of Owner's personnel.
- i. Prepare O&M manuals including clarifying and updating the original sequences of operation to as-built conditions.
- j. As-built drawing preparation
- k. Participate in deferred and seasonal testing, if necessary and as required.

1.5 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

- 1. CA: Commissioning Authority
- 2. Cx: Commissioning
- 3. O&M: Operations & Maintenance
- 4. TAB: Testing, Adjusting and Balancing

B. Definitions:

- 1. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
- 2. Basis of Design: Describes the systems, components, conditions and methods chosen to meet the design intent.
- 3. Data logging: Monitoring equipment using stand-alone data loggers separate from the building control system.
- 4. Deferred Testing: Testing performed after substantial completion due to partial occupancy, equipment, seasonal requirements, design or other site conditions that prevent testing from being performed during initial testing.
- 5. Deficiency: A condition in the installation or function of a component or system that is not in compliance with the Contract Documents and the Design Intent.

6. Design Intent: A document that provides an explanation of the ideas, concepts and criteria that are important to the Owner and therefore the intention of the design.
7. Factory Testing: Testing of equipment on-site or at the factory, by factory personnel with an Owner's Representative present.
8. Functional Testing: Test of the function and operation of equipment and systems using direct observation or monitoring methods. Functional Testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes of operation and are run through the control system's sequences of operation. Traditional TAB is not Functional Testing.
9. Initial Startup and Check-out: The initial starting of dynamic equipment, including executing pre-functional Checklists.
10. Non-Compliance: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or is not complying with the design intent.
11. 1Pre-functional Checklist: A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Contractor.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS

#### A. Test Equipment:

1. The Contractor shall provide testing equipment required to perform startup, initial checkout, and functional test procedures.
2. The Contractor shall provide two-way radios to assist in the commissioning process.
3. System specific test equipment, tools and instruments (e.g. test equipment specific to a piece of equipment) required for commissioning shall be included in the base bid price by the Contractor and retained by the Owner.
4. Data logging equipment and software required to test equipment provided by the CA, will not become the property of the Owner.
  - a. Testing equipment shall be of sufficient quality and accuracy measure system performance with the tolerances listed in the Specifications
5. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
6. Control System Instrument Calibration:
  - a. Field-installed sensors, gauges, and actuators shall be calibrated per the manufacturer's recommendations.
  - b. Alternate calibration methods may be used, if approved by the Owner's Representative.
  - c. Test instruments shall have had a certified calibration within the last 12 months.
  - d. Sensors installed at the factory with provided calibration certification need not be field calibrated.
7. Measurement Tolerances, Standard Applications (Sensor and Required Tolerance (+/-))
  - a. Outside air, space air, duct air temperature: 1.0 deg F.

- b. Watt-hour, Voltage & Amperage: 1% of range.
- c. Pressures, air, water and gas: 3% of design.
- d. Flow rates, air: 10% of design.
- e. Flow rates, water: 4% of design.
- f. Relative humidity: 5%.
- g. CO2 monitor: 0.1 %.
- h. CO2 monitor: 75 ppm.

### PART 3 - EXECUTION

#### A. Commissioning Plan:

- 1. The Commissioning Plan is an independent document issued by the CA to the Owner's Representative, Contractor, and Design Team near the start of construction. The plan is not a Contract document and if there is a conflict, the Specifications and Contract documents take precedence.

#### B. Commissioning Meetings:

##### 1. Scoping Meeting:

- a. The CA will schedule, plan and conduct a commissioning scoping meeting with the commissioning team.
- b. Information gathered from this meeting will allow the CA to revise and reissue the Commissioning Plan.

##### 2. Commissioning Meetings:

- a. At the discretion of the CA, meetings will be planned and conducted as construction progresses. Typically the frequency increases as construction completion nears,
- b. Commissioning meetings will be held as frequently as one per week.
- c. These meetings will cover commissioning coordination and deficiency resolution.
- d. There shall be a maximum of 6 separately scheduled commissioning meetings.

#### C. Reporting:

##### 1. General Commissioning-Related Reporting:

- a. The CA will keep the Owner's Representative apprised on the progress of commissioning.
- b. The CA will communicate with members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes.
- c. Testing or review approvals and non-conformance and deficiency reports are made with the review and testing as described in later sections.

##### 2. Commissioning Work Products

- a. The commissioning process generates a number of written work products. In summary, the written products are:

Product

Developed By

Owner's Project Requirements (OPR)	Owner's Representative
Basis of Design Documents (BOD)	Design Team
Commissioning Plan (Cx Plan)	CA
Equipment Submittals	Contractor
Start-up and Initial Checkout Plan and Forms	Contractor
Prefunctional Checklists	CA
Final Testing and Balance report (TAB)	Contractor
Functional Test Procedures	CA
Operations & Maintenance (O&M) Manuals	Contractor
Overall Training Plan	Contractor
Deficiency Reports	CA
Final Commissioning Report	CA

3. Final Commissioning Report:

- a. The final commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, a general description of testing and verification methods, and a brief description of commissioning results.
- b. Outstanding non-compliance items will be specifically listed. Future actions, commissioning process changes, etc. will also be listed.

D. Commissioning Submittals:

1. The CA will request specific equipment submittals be copied or routed to the CA for review and comments.
2. Commissioning submittal requests will be integrated into the normal submittal process and protocol of the construction team.
3. CA will review and comment on submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures.

E. Initial Start-Up And Checkout:

1. Parties responsible for Initial Start-up and Checkout for each system to be commissioned shall be identified by the Contractor.
2. The Contractor develops the Initial Start-up and Checkout plan using manufacturer's start-up and checkout procedures and other standard field checkout sheets.
3. The Contractor shall submit the Initial Start-up and Checkout plan to the CA for review and approval.
4. As necessary, the CA will further assist the commissioning team members in developing a more detailed Initial Start-up and Checkout plan.
5. The Initial Start-up and Checkout forms used for the Project shall include specific boxes or lines for recording and documenting specific inspections along with a summary statement and a signature block.

F. Pre-Functional Checklists:

1. The CA will develop, as necessary, Pre-functional Checklists above and beyond the Contractor's Initial Start-up and Checkout plan. The CA will issue sample Prefunctional Checklists.

2. The Initial Start-up and Checkout plans and Pre-functional Checklists are executed by the Contractor, who may assign this task to a Sub-contractor, vendor, or other party responsible for equipment installation.
3. The CA will observe Initial Start-up and Checkout of selected equipment.
4. Within two days after completion of the start-up and initial checkout plans and Pre-functional Checklists, the Contractor shall provide the CA with a signed and dated copy of the completed Prefunctional Checklists.
5. Only individuals that have direct knowledge of an item on the Prefunctional Checklists shall initial that item.
6. The Contractor shall clearly list outstanding items that were not successfully completed, at the bottom of the relevant checklist.
7. The Contractor shall clearly list items not in conformance with the Pre-functional Checklists.
8. The responsible party shall correct areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction
9. The Pre-functional Checklists shall be repeated, as necessary, for deficient items, after the deficiencies have been corrected.
10. Items left incomplete, which later cause deficiencies or delays during Functional Testing shall result in back charges to the responsible party.
  - a. The CA will accept or reject each Prefunctional Checklist submittal.

G. Functional Performance Testing:

1. Objectives and Scope:
  - a. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents.
  - b. Functional Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation.
  - c. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
  - d. Each system to be commissioned will be operated through all modes of operation (e.g. seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load). Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
2. Development of Test Procedures:
  - a. Before test procedures are written, the CA will obtain requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters.
  - b. The CA will develop specific test procedures to verify and document proper operation of each piece of equipment and system.
  - c. Prior to the execution of the test procedures, the Contractor and Design Team will review and comment on the test procedures.
  - d. The CA will review Owner's contracted, factory testing or required Owner's acceptance tests which the CA is not responsible to oversee, including documentation format, and will determine what further testing or format changes are required to comply with the Specifications. Redundancy of testing will be minimized.

- e. The purpose of specific tests is to verify and document compliance with the stated criteria of acceptance.
- f. The test procedure forms developed by the CA will include (but not be limited to) the following information:
  - 1) System and equipment or component name(s).
  - 2) Equipment location and ID number.
  - 3) Unique test ID number.
  - 4) A copy of the specific sequence of operations or other specified parameters being verified.
  - 5) Required pre-test field measurements.
  - 6) Instructions for setting up the test.
  - 7) Specific step-by-step procedures, in a clear, sequential and repeatable format.
  - 8) Acceptance criteria of proper performance with a specific area for clearly marking whether or not proper performance of each part of the test was achieved.
  - 9) A section for comments.
  - 10) Signature blocks for the participating parties.

3. General Functional Testing Methods

- a. Functional Testing will be achieved by manual testing and by monitoring the system performance and analyzing the results using the control system's trend log capabilities or by stand-alone data logging equipment.
- b. Functional Testing Sequence:
  - 1) Functional Testing is conducted after Prefunctional Checklists and Initial Startup and Checkout have been accepted by the CA.
  - 2) The air and water balancing is completed, reported to the CA and debugged before Functional Testing of air-related or water-related equipment or systems.
  - 3) Functional Testing proceeds from components to subsystems to systems. When proper performance of interacting systems has been achieved, the interface or coordinated responses between systems is checked.
- c. Functional Testing Setup:
  - 1) Each functional test shall be performed under conditions that simulate actual conditions as close as is practically possible.
  - 2) The Contractor executing the test shall provide necessary materials and system modifications to produce operating conditions necessary to execute the test.
  - 3) At completion of the test, the Contractor shall return affected building equipment and systems to their pre-test condition.
- d. Functional Testing Sampling:
  - 1) At the discretion of the CA, multiple identical pieces of equipment may be functionally tested using a sampling strategy.
  - 2) No sampling shall be used in Prefunctional Checklist execution.

4. Coordination and Scheduling:

- a. The Contractor shall incorporate commissioning items into the construction schedule.
  - b. The Contractor shall provide sufficient notice to the CA regarding their completion schedule for the Prefunctional Checklists and startup of equipment and systems.
  - c. The CA will schedule functional tests through the Contractor.
  - d. The CA shall direct, witness and document the Functional Testing of equipment and systems.
  - e. The Contractor shall execute the tests.
5. Control Signal Manipulation:
- a. Actual Conditions: Testing system and equipment to experience actual operating conditions and legitimate control signals is preferred, although it will not be feasible that the system to be commissioned will experience the full range of operating conditions within the scheduled testing period.
  - b. Simulated Conditions - Simulating conditions shall be used as necessary in order to test the systems in all operating conditions:
  - c. Overwritten Values - Overwriting sensor values to simulate a condition shall be employed sparingly. The Contractor will overwrite values and alter setpoints at the discretion of the CA.
  - d. Simulated Signals - Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants will be generally preferred over using the sensor to act as the signal generator via simulated conditions or overwritten values.
  - e. Altering Setpoints - Altering system setpoints to test a sequence is acceptable and will be employed as necessary in the Functional Testing.
6. The CA may recommend solutions to problems; however the burden of responsibility to solve, correct and retest problems is with the Contractor and Architect.

H. Operations & Maintenance Documentation:

1. The Contractor shall provide the Owner's Representative with complete Operations and Maintenance (O&M) information.
2. Prior to substantial completion, the CA will review the O&M submittals, manuals and documentation for systems that were commissioned.
  - a. General:
    - 1) Bound in labeled binder liberally divided with tabs, or provided electronically, to provide efficient access.
    - 2) Name, address and telephone number of the manufacturer or vendor and installing Contractor.
    - 3) Submittal data.
    - 4) O&M instructions with the model and features for this site clearly marked.
  - b. Data Requirements Include:
    - 1) Instructions for installation, maintenance, replacement, startup, special maintenance and replacement sources, a parts list, a list of special tools, performance data, and warranty information.
  - c. Additional Documentation:

- 1) Documentation package on as-built controls that includes a narrative for normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls setup and programming, troubleshooting, alarms, control drawings and schematics and final sequences of operation.
3. The CA will return the submittals to the Owner's Representative or Contractor, in compliance with the Project submittals procedure. The CA will review and comment on O&M manual submittals for commissioned systems. This review does not supersede the Architect's review of the O&M manuals according to the Architect's contract.
- I. Operations & Maintenance Training:
1. The Contractor shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed for commissioned systems. The following should be addressed during training:
    - a. General purpose of the system (design intent).
    - b. Use of O&M manuals.
    - c. Review of control drawings and schematics.
    - d. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
    - e. Interactions with other systems, adjustments and optimizing methods for energy conservation, relevant health and safety issues.
    - f. Adjustments and optimizing methods for energy conservation.
    - g. Relevant health and safety issues.
    - h. Special maintenance and replacement sources.
    - i. Tenant interaction issues.
    - j. Discussion of how the feature or system is environmentally responsive.
  2. The CA will be responsible for overseeing and approving the content and adequacy of the training of Owner's personnel for commissioned equipment.
  3. The CA develops criteria for determining that the training was satisfactorily completed.
  4. At the Owner's Representative's discretion, the Owner's Representative may provide videotaping of the training sessions and have the tapes added to the O&M manuals.
- J. Non-Compliance:
1. The CA will record the results of the Functional Testing on the procedure or test form. Deficiencies or non-compliance issues will be noted and reported to the Contractor.
  2. Corrections of minor deficiencies identified shall be executed by the Contractor during the tests. In such cases the deficiency and resolution will be documented on the procedure form.
  3. As tests progress and deficiencies are identified, the CA will inform the Contractor and the Owner's Representative.
  4. When there is no dispute on the non-compliance issue and the Contractor accepts responsibility to correct it:
    - a. The CA documents the deficiency and the Contractor's response and intentions and proceeds with another test or sequence.
    - b. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. If there is a dispute about a non-compliance issue, regarding whether it is a deficiency or who is responsible:
    - a. The deficiency will be documented by the CA.
    - b. The Contractor shall provide a written response to the deficiency.
    - c. The Architect will provide a written response to the deficiency.
    - d. The Owner's Representative will determine the responsible entity and the appropriate resolution.
    - e. The CA will document the resolution process.
    - f. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency (if necessary). The CA reschedules the test.
  6. The cost for a Contractor to repeat a Prefunctional Checklist or Functional Test, if they are responsible for the deficiency, shall be theirs. If the Contractor is not responsible, cost recovery for repeating will be negotiated with the Contractor.
  7. For a deficiency identified, not related to a Prefunctional Checklist or start-up fault, the following shall apply:
    - a. The CA will direct the retesting of the equipment once at no charge to the Owner.
    - b. The CA's time for additional tests will be charged to the Owner, who may choose to recover costs from the responsible party.
  8. The time for the CA to direct retesting required because a specific Prefunctional Checklist item, reported to have been successfully completed, but determined during Functional Testing to be faulty, will be charged to the Owner, who may choose to recover costs from the party responsible for executing the faulty Prefunctional Checklist.
  9. Retesting will not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- K. Project close-out:
1. The commissioning process will be completed when the systems operate according to the Owner's design intent and the Contract Documents, as determined by the CA.
  2. The commissioning process may continue past substantial completion of the Project, until non-compliance issues have been resolved.

END OF SECTION 019100

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 031000 - CONCRETE FORMWORK

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

##### A. Principal Work in this Section

1. Forms for cast-in-place concrete.
2. Shoring, bracing, accessories and form coating.

##### B. Work installed but furnished in other Sections

1. Inserts, bolts, anchors and other items furnished by other trades for installation in formed concrete.

##### C. Related Work

1. Section 033000 – Cast-in-place Concrete

#### 1.2 SUBMITTALS

##### A. General: Submit in accordance with Section 013300.

##### B. Records: Keep an accurate record of the dates of all form removal and furnish copies to the Construction Manager.

##### C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

##### D. LEED Submittals

##### 1. Recycled Content (MRc4):

- a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
- b. Include information on Material Tracking Worksheets.

##### 2. Material Source (MRc5):

- a. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).
- E. Include information on Material Tracking Worksheets.

### 1.3 QUALITY ASSURANCE

- A. Lumber and plywood shall be grade-marked by a grading agency acceptable to the Building Department.

### 1.4 HANDLING

- A. Procedure: In compliance with Section 016000.
- B. Storage: Store form facing materials above ground on framework or blocking. Protect from moisture and damage. Handle form facing materials to prevent damages which could be transferred to the concrete.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Forms for Exposed Concrete Surfaces
  - 1. General: Plywood, metal, metal-framed/plywood-faced, or FRP which will provide continuous, flat, exposed concrete surface with the appropriate texture and appearance as specified on the architectural drawings. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings, where indicated.
  - 2. Type:
    - a. For concrete surfaces to be sacked and rubbed: US Product Standard PS-1 'B-B (Concrete Form) Plyform", Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
    - b. Elsewhere where concrete will remain exposed, with or without a mechanical finish: Overlaid plywood complying with US Product Standard PS-1 'A-C or B-B High Density Overlaid Concrete Form,' Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for concealed concrete surfaces: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Ties and Spreaders

1. Provide cone or snap type ties designed to be completely removed from wall, or to break off and provide minimum 1-1/2 in. coverage over ends of the portion of snap tie remaining in the concrete.
  2. Do not use wire ties, wood spreaders, or embedded types in which embedded portion is less than 1-1/2 in. from exterior face of concrete.
- D. Chamfer strips: Extruded PVC, with 3/4 in. diagonal faces unless otherwise indicated, by The Burke Co., Greenstreak Plastic Products Co., or Sonneborn-Rexnord, Inc., or oiled softwood shapes with the same profile.
- E. Form coatings: Commercial formulation form-coating compounds that will, not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- F. Prefabricated construction joint keyways: Key-Loc by Form-A-Key Products Div., or Keyed Kold Joint by The Burke Co., complete with all accessories.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrate surfaces to receive concrete formwork and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as installer's acceptance of surface conditions.

#### 3.2 FORM TYPES

- A. General: Comply with the applicable provisions of ACI 347, Guide to Formwork for Concrete, and APA Design/Construction Guide, Concrete Forming.
1. The design and construction of forms and shoring is the Contractor's responsibility but shall comply with specified requirements.
  2. Form contact surfaces shall be clean, free from dents, holes and other imperfections.
  3. Establish and maintain benchmarks, lines and controls necessary to achieve specified tolerances. Take an accurate survey of the form location just prior to concrete pour.
- B. Earth Bank
1. Except for exterior face of wall footings and grade beams which must be formed, earth banks may be used to form footings and grade beams if the soil is firm, neatly trimmed, and will retain concrete in the required size and shape.
  2. The concrete coverage shall be increased as noted on the Drawings when concrete is cast against earth.
- C. Wood Forms

1. Construct with plywood panels as large as practicable. Where because of their height walls or columns have a horizontal form joints, the horizontal joint shall be aligned throughout the same floor, or area, unless otherwise acceptable to the Construction Manager.
2. Concrete surfaces which will remain exposed in the Work:
  - a. Fill voids, fastener heads, and other imperfections in form contact surfaces with body putty sanded smooth.
  - b. Seal joints between plywood panels flush with compound specifically designed to seal forms, or other approved material to prevent concrete paste leakage.
  - c. Provide sharp, clean comers at form intersecting planes, without visible edges and offsets. Back joints with additional studs or girts.
  - d. Form recesses and projections with smooth finish materials, and install in forms with sealed joints to prevent displacement.
  - e. Drill holes accurately in forms to fit ties used. Prevent leakage of concrete around tie holes. Do not drive ties through undersized or improperly prepared holes.
3. Kerf backside of wood inserts used for forming keyways, regrets, recesses and similar treatments, to allow wood to swell without spalling concrete, and to assure easy removal.

D. Metal Forms

1. Fasten sections of forms tightly and interlock securely.
2. Provide precisely cut openings required by other trades.
3. Cut or drill forms for attaching sleeves or other items to be embedded in concrete.

E. Re-use of Forms

1. Form materials may be re-used if they produce finished surfaces equal to finished surfaces where new form materials are used.
2. Before re-use, thoroughly clean, recondition in every respect, suitable for their reuse purpose.

- F. Tolerances: To obtain cast-in-place concrete not exceeding the tolerances specified in Section 033000, except support form facing material to limit deflection to L/360 between supports for concrete.

### 3.3 FORM CONSTRUCTION

A. Construction

1. Rigidly support and construct forms to the lines, surfaces and profiles necessary to produce concrete of the design indicated.
2. Construct forms to be removable without prying against concrete.
3. Make forms tight, without cracks or holes, to prevent leakage of mortar or loss of fine particles from concrete.
4. Cover or fill holes that are not used and cracks that have opened-up flush with adjacent surfaces.

- B. Wales and studs: Of adequate size and spacing to prevent form failure and to obtain concrete within the tolerances specified.

- C. All formwork shall be cambered as specified on drawings.
- D. Ties and spreaders: Place ties symmetrically, equally spaced, in plumb and level rows; tie placement in exposed concrete is subject to the Construction Manager's approval. Do not permit wood, other than built-in treated bucks or nailing blocks, to remain permanently in the forms.
- E. Form contact surfaces
  - 1. As specified above and as best suited to prevailing conditions; may be constructed of plywood, FRP, plastic, or steel.
  - 2. Block plywood edges which do not occur at bearing points to eliminate joint offsets.
- F. Special features
  - 1. Corners
    - a. Form exposed corners between beams and columns to produce a square, smooth, solid joint without paste leakage.
    - b. Install chamfer strips in corners of all other forms, unless otherwise indicated. Miter chamfer strip at changes in direction.
    - c. Corners which will be concealed in the Work may be formed either square or chamfered.
  - 2. Reglets, rebates, seats and pockets: Form as indicated or as necessary to receive or engage work of other trades.
  - 3. Openings, chases and recesses:
    - a. Form as indicated or necessary to receive, pass and clear other work.
    - b. Verify sizes and locations with other trades before forming.
    - c. Closely cooperate in locating boxes, cans and sleeves furnished by other trades.
- G. Form release agent: Thoroughly clean forms and coat with release agent prior to initial use (except when mill-oiled) and before each reuse.
  - 1. Apply form coating in compliance with its manufacturer's printed instructions and coverage rates.
  - 2. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.
  - 3. Provide a coating of uniform thickness. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete against which fresh concrete will be placed.
  - 4. Apply form coating before reinforcement is placed.

### 3.4 FORM REMOVAL

- A. Remove forms only after concrete has developed sufficient strength to not be damaged by form removal operation, and to safely sustain its own weight and superimposed loads, as determined by testing field cured concrete cylinders and as scheduled below, but not sooner than specified in ACI 347.
  - 1. Shoring and Reshoring:

- a. Be solely responsible for the safety of all construction including the periods during and after the preparation and erection of formwork, placement of concrete, formwork removal, reshoring and removal of reshoring. No act of others shall relieve the Contractor of the sole responsibility for safety.
- b. General: Formwork, shoring and reshoring shall relate to the structural systems on each floor. Shoring and reshoring must be aligned over and under beams and girders and spreader beams provided where necessary to transfer loads. Shoring for flat slab systems must be aligned over reshores with spreader beams where necessary to transfer loads to reshores.
- c. General: Do not remove forms or shoring until members have acquired sufficient strength to support their weight and subsequent construction load without deflection exceeding  $L/360$ . Remove forms in a manner to maintain the strength and stability of the structure at all times. Determine time of removal per specified minimum removal times in the following table and lengthen as necessary by job conditions, weather, etc. No stripping allowed before concrete has cured sufficiently to prevent spalling, chipping, or other damage due to form removal.

Area	Time with Supplementing Control Cylinders	Time without Supplementing Control Cylinders	Min. percent of Specified 28 day Cylinder Strength
Beam and column side forms	1 day	2 days	35 percent
Wall forms	1 day	2 days	35 percent
P-T slab soffit forms	3 days	7 days	70 percent
Beam, girder and flat slab soffit forms	14 days	28 days	100 percent

- B. Take care when removing forms that concrete surfaces are not marred or gouged, that corners are true, sharp and unbroken. Do not pry against concrete when removing forms.
- C. Cut-off nails flush in concealed concrete surfaces. Cut back tie wires and nails in exposed concrete surfaces at least 1-1/2 in. Remove rod and cone ties and separators or similar devices and pull inward away from finished surfaces.

END OF SECTION 031000

## SECTION 032000 - CONCRETE REINFORCEMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Principal work in this Section:
  - 1. Reinforcing steel (rods and mesh) for cast-in-place concrete.
  - 2. Accessories such as chairs and tie wires.
- B. Related work in other Sections:
  - 1. Section 033000 - Cast-In-Place Concrete.
  - 2. Section 053000 - Steel Decking.
  - 3. Section 042220 - Concrete Masonry Units.

#### 1.2 SUBMITTALS

- A. Procedure: In compliance with Division 1.
- B. Shop drawings: Submit for reinforcement deviating from that shown on the Drawings.
  - 1. Submit bar drawings and schedules with the corresponding placing diagrams. Drawings shall be complete for any specific area of Project when submitted.
  - 2. Reinforcing shop fabrication and field placement drawings shall be submitted in an acceptable form, be checked and complete. Reuse of the Contract Documents is not permitted. Each submittal shall be provided at least five weeks in advance of reinforcing delivery to site.
  - 3. Reinforcement shall be detailed based on construction joint locations that have been shown on shop drawings, as reviewed. Construction joints shall be indicated on reinforcing shop drawings. Submit proposed construction joints for review prior to submittal of reinforcing shop drawings.
  - 4. The drawings shall be in such detail as to assure that there will be a minimum, if any, of difficulties in execution of the work in the field. Show layout of reinforcing by mark for each member on plan. For each member or collinear series of members, show side elevation of the member with top, bottom and tie reinforcing and spacings shown. Show cross section of each pertinent location. Show all bar lengths and dimensioned bar bending details for each bar type. The detailed bar listing shall be shown on a member-by-member basis indicating the number of bars of each type etc. Clearly show splicing and placing conditions at each splice area. Detail pilaster verticals with respect to beam, and anchor bolts. Placement diagrams shall clearly indicate locations of beam reinforcing passing through verticals and anchor bolts. Placement diagrams shall clearly show layering of beam reinforcement and slab reinforcement locations relative to beams. Walls shall be shown in side elevations of each wall face indicating vertical, horizontal and beam reinforcing with sections showing placement.

5. The drawings shall consist of sections, plans and details clearly showing locations, sizes and spacing of all reinforcing steel, supporting bars and accessories. Include particular details at foundation-column intersections showing locations of vertical and horizontal reinforcing. Include detailed schedules and diagrams to indicate bends, sizes and lengths of all reinforcing steel items and clear cover for reinforcing.
  6. Floor openings, wall openings, wall recesses and sleeves for all mechanical, plumbing and electrical work shall be coordinated with the respective trades and reinforcing shown on these drawings in accordance with the criteria indicated on the drawings.
  7. After review, furnish all copies needed for fabrication and erection, and for the coordination and use of other trades.
  8. Be fully responsible for furnishing and installing all materials called for or required by the Contract Documents even though these materials may have been omitted from the reviewed shop drawings or incorrectly indicated thereon.
- C. Mill reports: Submit copies of mill reports and test data for reinforcing steel sampled and tested, prior to starting this work.
- D. Proprietary splicing details.
- E. Mill Certificates: Submit to Architect, three (3) copies of manufacturer's certificates of reinforcing steel mill tests.
- F. Provide alignment templates at top of pilaster cage to maintain position of vertical bars such that the proper location of beam bars passing through the pilaster and anchor bolts is assured.

### 1.3 QUALITY ASSURANCE

- A. Source quality control: Obtain mill reports for all types and sizes of reinforcing steel.
1. Mill reports shall contain the steel source, description, heat number, yield point, ultimate tensile strength, elongation percentage, bend test and chemical analysis.
    - a. If the reports show that material is satisfactory, no tests will be required.
    - b. For foreign steel, testing as specified below will be required by a testing laboratory acceptable to the Architect.
    - c. For foreign steel, testing as specified below will be required by a testing laboratory acceptable to the Architect.
  2. Ensure that the material delivered for use is that represented by the mill reports and obtain copies of mill reports, examine them, certify whether the material represented complies with Specifications requirements, and make distribution of reports as required. Report chemical composition of each heat, as determined by ladle analysis.
  3. Where materials proposed for use cannot be identified, pay for an approved testing laboratory to make one series of tests (tensile and bend) from each 2.5 tons, or fraction thereof, of each size and kind of reinforcing steel. Include 2 samples, minimum, of sufficient length to allow tests to be made on the as-rolled bar.

### 1.4 HANDLING

- A. Procedure: In compliance with Section 016000.

- B. Electrode storage: Comply with the combined recommendations of AWS and the electrode manufacturer for storage of electrodes. Do not use electrodes that have been wetted.
- C. Delivery: Deliver reinforcement to the site bundled, tagged and marked; handle to prevent damage to material. Use metal tags indicating size, length and other markings shown on placement drawings. Maintain tags after bundles are broken.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Reinforcing steel: Use ASTM A 615, Grade 60 for gravity elements. For welding, conform to specified carbon equivalent or use bars conforming to ASTM A 706.
- B. Reinforcing mesh: ASTM A 185. Provide welded wire fabric in flat sheets, not rolls.
- C. Welding electrodes for Reinforcing Bars: AWS A5.1 E80XX Series, low hydrogen, having a minimum yield point of 80,000 psi.
- D. Tie wire: ASTM A 82, 16 gage (minimum) annealed steel wire.
- E. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.
  - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or pre-cast concrete block chairs with embedded wire ties.
  - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
  - 3. Over waterproof membranes and vapor barriers, use pre-cast concrete chairs to prevent puncturing of membrane.

### 2.2 FABRICATION

- A. General: Except as modified by the Drawings and the Specifications, comply with Chapter 7 of CRSI Manual of Standard Practice for fabrication of reinforcing steel. Exposed Sealing Materials: All sealing materials exposed at entrance and storefront perimeter joints in contact with adjacent cladding materials: 2 component silicone, refer to Division 7 Section "Joint Sealants".
- B. Bending and forming:
  - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or pre-cast concrete block chairs with embedded wire ties.
  - 2. Heating reinforcement for bending is prohibited. Do not install bars with unscheduled kinks or bends.
  - 3. Bars larger than #4 shall not be bent once cast in concrete or masonry.

- C. Tolerances: Comply with ACI 117.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrate surfaces to receive concrete reinforcement and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as Installer's acceptance of surface conditions.

### 3.2 PLACING

- A. Placement inspection: Place reinforcement under the continuous inspection of the Owner's Testing Agency.
- B. Cleaning: Clean reinforcement of loose mill scale, excessive rust, oil, and other coating that might destroy or reduce its bond before placing it.
- C. Placing: Comply with the listed reference standards as applicable.
1. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
  2. CRSI, Manual of Standard Practice.
  3. AWS D1.4, Structural Welding Code - Reinforcing Steel.
- D. Spacing of reinforcement: Space reinforcement to maintain the proper distance and clearance between parallel bars and between bars and forms.

### 3.3 WELDING

- A. Welding: Comply with the requirements of AWS D1.4. Before welding, determine the weldability of reinforcing bars by laboratory chemical analysis of the steel. Only steel conforming to the chemical requirements specified in AWS D1.4 may be welded.
- B. Welded splices: Use full penetration butt welds made by the electric-arc method unless indicated otherwise.
1. Use only welders who have passed the AWS standard qualification tests within the previous year.
  2. Weld splices shall develop 125% of the specified yield strength of the reinforcing bars, or of the smaller bar in transition splices.
  3. Clean bars of oil, grease, dirt and other foreign substances, and flame-dry before welding.
  4. Prepare ends of bars in compliance with AWS D1.4. Preheat bars before welding.

END OF SECTION 032000

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Principal work in this Section:
  - 1. Cast-in-place concrete.
  - 2. Concrete floors, walls, curbs, and slabs on grade and over metal decking.
- B. Work installed but furnished in other Sections:
  - 1. Items to be embedded in concrete.
- C. Related work in other Sections:
  - 1. Section 032000 - Concrete Reinforcement.
  - 2. Section 036000 - Grout.
  - 3. Section 053000 - Steel Decking.

#### 1.2 SUBMITTALS

- A. Procedure: In compliance with Division 1.
- B. Data: Manufacturers' brochures and technical data for all manufactured products.
- C. Certificates:
  - 1. Cement certification.
  - 2. Admixture certification: Include chloride ion content.
  - 3. Batch plant tickets.
- D. Concrete mix designs for approval: Certified concrete mix designs for initial and any subsequent changes in mix designs.

#### 1.3 QUALITY ASSURANCE

- A. Mock-up: Before beginning work, cast a sample panel of each type of finish at a location on the site agreed-upon with the Architect.
  - 1. Protect panel until its removal is authorized by the Architect. Make such modifications as necessary to achieve a panel satisfactory to the Architect.
  - 2. Approved panel shall serve as the standard for all remaining work. Remove panel only after completion and acceptance of work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Portland cement: ASTM C 150, Type II low alkali, typical, Type V for all elements in contact with earth. Do not change source, brand or type of cement without Architect's written approval.
- B. Fly ash: ASTM C 618, Type C or F. Do not change source, brand or type of fly ash without Architect's written approval.
- C. Aggregates: Submit pit source and characteristics of each type aggregate to Architect prior to designing mixes.
  - 1. Hardrock aggregates: ASTM C 33 graded so that coarse aggregate nominal size is not larger than 1/5 of the narrowest dimension between form faces; nor 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars, whichever is less, but never greater than 3/4 inch in any dimension for slabs 4 inches thick or less; 1-1/2 inches at all other locations.
  - 2. Lightweight structural concrete: Mixed of Portland cement, sand, coarse lightweight aggregates, an air-entraining admixture and water. Testing laboratory shall design lightweight structural concrete in accordance with ACI 211.2 for 28-day compressive strengths required by Drawings or specified herein, with weight not exceeding 110 lbs. per cubic foot air dry. Trial batch strengths shall be as specified above. Lightweight structural concrete shall meet the drying shrinkage requirements specified.
- D. Admixtures:
  - 1. May be used only with the Architect and the Building Department approval.
  - 2. Submit manufacturer's data for products proposed for use to the Architect in compliance with the requirements of Section 013340.
- E. Water: Fresh, clean, potable, and free of oil and other materials injurious to concrete.
- F. Structural adhesive: ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
  - 1. Rezi-Weld 1000 by WR Meadows.
  - 2. Thiopoxy by WR Grace.
  - 3. Sikadur Hi-Mod by Sika Chemical Corp.
  - 4. Patch and Bond Epoxy by The Burke Co.
- G. Sealer: One of the following.
  - 1. Cure-Hard by WR Meadows (sodium silicate).
  - 2. Ashford Formula by Curecrete Chemical Co. (sodium silicate).
  - 3. Lapidolith by Sonneborn (magnesium or zinc fluosilicate).
  - 4. Chem Hard (magnesium fluosilicate), Fluohard (magnesium fluosilicate) or Seal Hard (siliconate/sodium silicate) by L&M Construction Chemicals, Inc.
  - 5. Saniseal 50 by Master Builders Co. (magnesium or zinc fluosilicate).
- H. Curing compound:

1. Liquid membrane-forming compound complying with ASTM C 309, Type I (1D), Class B, guaranteed not to affect the appearance of the concrete surfaces, and the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.
  2. Curing compound used on exposed concrete surfaces shall be non-discoloring, fast drying and shall be conclusively demonstrated not to darken or yellow with age.
  3. Curing compound for use on concrete floors to receive adhered covering shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of flooring adhesives.
- I. Dry-pack and grout: One of the following with minimum of 5,000 psi compressive strength at 28 days: See Section 036000.
1. Masterflow 713 by Master Builders.
  2. Five Star Grout by US Grout Corp.
- J. Expansion joint materials:
1. Joint filler: Use in combination with plastic joint cap made by Greenstreak, Quaker Plastic Corp., WR Meadows, or equal.
    - a. Homex Expansion Joint by Homasote Co., or equal non-bituminous product compatible with sealant specified in Section 07920.
    - b. Sealtight self-expanding cork by WR Meadows, or equal compatible with sealant specified in Section 07920.
  2. Joint sealant and back-up rod: As specified in Section 079200.
- K. Curing paper: Orange Label Sisalkraft by Fortifiber Corp., or equal.
- L. Water stop: One of the following.
1. Waterstop-Rx by Cetco.
  2. Waterstop-Plus by Intercontinental Chemical and Equipment, Inc. (Waterstop-Plus is extruded from a cartridge sealant.)
  3. Bluestop by Vinyltex Corp.

## 2.2 SOURCE QUALITY CONTROL

- A. Employ a testing laboratory, acceptable to the Owner and Architect, to test the materials for conformance with these Specifications before concrete mixes are established and when source is changed, unless recent test results of materials to be used on the Project, performed by an acceptable testing laboratory, are accepted by the Architect.
- B. Testing coarse aggregates:
1. Test aggregates before and after concrete mix is established and whenever the character source of material is changed, but not less than one test for each 500 cubic yards.
  2. Perform a sieve analysis to determine conformity with limits of gradation. Perform sampling and testing according to ASTM C 33, and as follows:

- a. Sampling of aggregates: ASTM D 75. Take samples of aggregates at source of supply, or if source of supply has been approved, from storage bunkers at ready-mixed concrete plant.
  - b. Testing of aggregates shall include:
    - 1) Sieve analysis: ASTM C 136.
    - 2) Organic impurities: ASTM C 40. Fine aggregate shall develop a color not darker than the referenced standard color.
    - 3) Soundness: ASTM C 88. Loss after 5 cycles not over 8% for coarse aggregate, nor 10% for fine aggregate.
    - 4) Abrasion: ASTM C 131. Weight loss not over 10-1/2% after 100 revolutions, nor 42% after 500 revolutions.
    - 5) Deleterious materials: ASTM C 33.
    - 6) Materials passing No. 200 sieve: ASTM C 117, not over 1% for gravel, 1.5% for crushed aggregate per ASTM C 33.
    - 7) Reactive materials: ASTM C 289. Aggregates shall indicate no potential deleterious reactivity.
    - 8) Definitions: ASTM C 125.
3. Cement test:
- a. The cement mill laboratory will be acceptable as testing laboratory for this purpose when approved by the Building Department. Submit evidence to show that the cement mill laboratory is qualified to perform tests. The laboratory shall make tests for every 500 barrels or fraction thereof of cement used, in compliance with ASTM C 150.
  - b. Make tensile strength test at 7 days. Tag the cement for identification at the location of sampling. A representative of the Testing Agency shall certify that materials being used are taken from the lots sampled and tested for this report.

## 2.3 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
  - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
  - 2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
  - 1. Requirements of Mix designer:
    - a. List design mixes required, stating where each applies, and identified as follows:
      - 1) "(3-57 AR Col)" which interpreted means 3000 psi, Size 57 agg., air-entrained retarder used for columns.
    - b. Design concrete mixes subject to controls specified under Paragraph, "Proportioning", including adjustments for seasonality.
    - c. Verify adequacy of design mix for compressive strength in accordance with ACI 301, Method 1 or Method 2 as hereinafter modified.

- 1) Method 1: Make and test compressive test cylinders in accordance with appropriate ASTM procedures to substantiate an average compressive strength as specified in Paragraph, "Proportioning".
  - 2) Method 2: Appropriate field test data for concrete made with the same ingredients may be used. Thirty (30) or more consecutive strength test results of mixes with same materials and proportions used in similar construction and climatic conditions within past year shall be used to indicate performance in accordance with specification. Required average compressive strength shall be specified in Paragraph, "Proportioning".
- d. Adjust mix designs that prove unsatisfactory in use, subject to Architects review. Concrete that does not consistently exhibit specified control characteristics shall be considered unsatisfactory. All work constructed with such concrete shall be removed and replaced by Contractor.
2. Submit for Architects Review.
- a. List of mixes.
  - b. Mix Proportions.
  - c. Proposed adjustments for seasonality.
  - d. Test results and/or mill certificates showing that mix proportions and materials comply with performance characteristics specified.
  - e. A concrete mix design submittal shall include the proposed mix components and quantities, material sources, aggregate gradations, manufacturer's data sheets for admixtures, etc. As well as actual strength and slump data for trial mix or historical data statistically summarized. Relative to semi-lightweight concrete also include splitting strength, modulus, shrinkage unit weight and other information as well as identify if the materials are vacuum saturated or not and the supplier's description of their product. The mix sheet shall clearly indicate location of use, a pumped or place mix, and other conditions of proposed usage.

C. Proportioning:

1. Structural Concrete:
  - a. Water reducing (plasticizing) admixture required.
  - b. Trial Mix: Determine average compression strength by ACI 301, Method 1 with minimum of 15% greater than specified  $f'_c$  or by Method 2 where average strength exceeds specified strength  $f'_c$  by at least:
    - c. 400 psi if standard deviation is less than 300 psi.
    - d. 530 psi if standard deviation is 300 psi to 400 psi.
    - e. 690 psi if standard deviation is less than 400 psi to 500 psi.
    - f. 898 psi if standard deviation is less than 500 psi to 600 psi.
    - g. 1131 psi if standard deviation is less than 600 psi to 700 psi.
2. Minimum Cement Content: (94 pounds per bag)
  - a. 3000 psi concrete: 5 bags per cubic yard. Maximum water 6.3 gallons per bag.
  - b. 4000 psi concrete: 5-3/4 bags per cubic yard. Maximum water 5.5 gallons per bag.
  - c. Pumped concrete: Increase minimum cement content as required to maintain equivalent water/cement ratios to those required for strengths of non-pumped concrete.

- d. Maximum Water/Cementitious material ratio is 0.50 unless noted otherwise in project plans.
- 3. Exterior Exposed Concrete:
  - a. Air entrainment and water reducing admixtures as required. Do not add air entrainment agents to concrete to be abrasive blasted.
  - b. Minimum Cement: 5-1/2 bags per cubic yard.
  - c. Maximum Water: 5-1/2 gallons per bag.
- 4. Semi Lightweight Structural Concrete:
  - a. Dry Weight: 110 pounds per cubic foot
  - b. Splitting Tensile Strength: When tested in accordance with ASTM C496, minimum as follows for given compressive strength.
  - c. Modulus of Elasticity: Minimum 2,400,000 pounds per square inch (secant modulus at 0.3 f'c).
  - d. Cement Factor and Water-Cement Ratio: Base on degree of saturation and absorption characteristics of lightweight aggregates stockpiled for use.
  - e. Shrinkage Compensated Cement: May be used to control drying shrinkage if acceptable to Architect.
  - f. Natural Sand: ASTM C33 Substitute for lightweight fines.
- 5. Pumped Concrete:
  - a. Aggregates:
    - 1) Maximum Size: One-third maximum opening in either pump or pipeline, whichever is smaller.
    - 2) Grading: As close as possible to middle of ASTM C33; for normal weight concrete and ASTM C330 for semi lightweight concrete grading range.
    - 3) Fine Aggregate Fineness Modulus (FM): 2.4 to 3.0 with 15 to 30 percent passing number 50 sieve and 5 to 10 percent passing number 100 sieve.
    - 4) Daily Variation in Fineness Modulus (FM): 0.20 from value used in selecting proportion.
    - 5) Lightweight Aggregate Moisture Content: At least equal to 24-hour absorption percentage when tested in accordance with ASTM C127.
  - b. Admixtures:
    - 1) Pumping Aids: As required to produce pumpable mix with sufficient strength.
    - 2) Accelerators: Do not use with pumped concrete.
- D. Concrete shrinkage test:
  - 1. Before placing any concrete slabs or exposed concrete above grade, prepare a trial batch of the mix design, using the same aggregates, cement and admixtures (if any) proposed for use on the Project. Prepare at least 3 specimens for determining the "drying shrinkage" of each mix design including structural semi-lightweight concrete.

2. The "drying shrinkage" specimens shall be 4" x 4" x 11" prisms, made, cured, dried and measured as specified in ASTM C 157. Measure and report separately for 7, 14, 21 and 28 days of drying, after 7 days of moist curing. The effective gauge length of the specimens shall be 10".
  3. The average "drying shrinkage" of the test specimens after 28 days of drying shall not exceed 0.0045%.
- E. Submit reports showing results of sieve analysis, mix design and results of compression tests.
1. Make test specimens from not less than 3 batches of each design mix.
  2. The trial batch strength for each mix shall exceed indicated  $f'_c$  by 25% or a lesser amount based on standard deviations of strength test records according to ACI 318.
  3. Do not start concrete production until mixes have been reviewed and are acceptable to the Architect.
- F. Concrete mixing:
1. Mixing and delivery shall comply with ASTM C 94, these Specifications, and Building Code requirements.
  2. The Owner's Testing Agency will perform check sieve analysis of the aggregates being used, check compliance with mix design and the cement being used against mix design; check that water has been removed from the drum before adding mix ingredients for the following load and shall witness the loading of mixing trucks. The Owner's Testing Agency will send a written report of each inspection to Architect indicating compliance with these Specifications.
  3. In addition to the requirements of ASTM C 94 section 16.1, provide the following information on delivery tickets signed by an authorized representative of the batching plant with each mixer truck of concrete delivered to the site.
    - a. Type and brand of cement.
    - b. Cement content per cu. yd. of concrete.
    - c. Maximum size of aggregate.
    - d. Total water content expressed as water/cement ratio.
    - e. Time batched.
  4. Deliver batch tickets to Inspector at the site when concrete is delivered.
  5. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.
  6. Remove all materials, including water remaining in the ready-mix truck drum, completely before ingredients for the following loads are introduced in the drum.
  7. Do not use concrete that has not been placed 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

## 2.4 VAPOR BARRIER

- A. Per Division 3 Section "Vapor Barriers".

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrate surfaces to receive cast in place concrete and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as Installer's acceptance of surface conditions.

### 3.2 GENERAL

- A. Applicable provisions of the following American Concrete Institute publications govern the work of this Section.
  - 1. ACI 301, Specifications for Structural Concrete for Buildings.
  - 2. ACI 302, Guide for Concrete Floor and Slab Construction.
  - 3. ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
  - 4. ACI 304.2, Placing Concrete by Pumping Methods.
  - 5. ACI 305, Hot Weather Concreting.
  - 6. ACI 306, Cold Weather Concreting.
  - 7. ACI 308, Standard Practice for Curing Concrete.
  - 8. ACI 117, Concrete Tolerances

### 3.3 PHASING

- A. Allow sufficient time in the construction schedule for appropriate slab drying, in accordance with the finish manufacturer's recommendations, for slabs to receive a deferred finish that is moisture sensitive.

### 3.4 PREPARATION

- A. Inspect excavations, subgrades and formwork, as applicable for each placing operation, for accuracy of lines, levels, elevations and dimensions.
- B. Inspect placement of reinforcement and accessories for proper position, sizes, clearances, fastenings, laps and splices.
- C. Moisten, do not saturate, earth subgrade and bearing surfaces. Do not place concrete on muddy subgrade.
- D. Wet wood forms thoroughly when they are not treated with form release agent. Wet other materials sufficiently to reduce suction and maintain concrete workability.
- E. Grade sand covering the vapor barrier to provide a layer of uniform thickness. Wet so that concrete is placed on damp sand.
- F. Verify that steel decking joints are sealed and that there are no openings or voids that will permit concrete leakage.

- G. Place items to be embedded in concrete, including but not limited to, conduits, sleeves, nailers, anchors and rough hardware, built into concrete as indicated or required.
1. Do not embed piping and conduits unless approved by the Architect, and as indicated on the Drawings.
  2. Embed bolts, inserts and other items in the concrete. Secure accurately so that they are not displaced during concrete placing, compacting and finishing operations. Wire tie, nail or bolt embeds securely to forms.
  3. Set embedded bolts for materials and equipment attached to concrete to template, layouts and shop drawings. Verify size, length and location of electrical conduits with respect to equipment supports.
  4. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete in the voids.
  5. Install expansion joint fillers where indicated, and as required to isolate concrete slabs-on-grade from other building elements such as walls and equipment pads. Cover filler with plastic joint cap and leave in place until ready to receive sealant.
  6. Install the water stop in all construction joints below grade, and elsewhere as indicated.
    - a. Place water stop in a continuous ribbon on the exterior face of the outermost dowel line. Keep a concrete cover of 2 inches, minimum.
    - b. When using Waterstop-Rx, butt ends of water stop and nail to concrete to avoid displacement during concrete placing and consolidation.
- H. Do not proceed with placement of concrete until all conditions are satisfactory.
- I. Install vapor barrier where called for on the drawings under interior slabs on grade. Lap joints minimum 6 inches and seal. Do not disturb or damage vapor barrier while placing concrete. Repair damaged vapor barrier.

### 3.5 CONVEYING

- A. Rapid handling: Transport concrete from the mixer to location of placing as rapidly as practical to avoid separation or loss of ingredients.
- B. Transporting methods: Use pipes, cranes, carts, buggies or other approved means to deliver concrete to final locations. Do not use delivery systems (pipe, chutes, etc.) formed of aluminum for transporting concrete.
- C. Free fall:
1. As dictated by job conditions at each location, but not more than 4 ft. where concrete will be exposed in the work and 6 ft. at all other locations.
  2. Avoid large concentration of concrete in one location that would produce unacceptable deflection in supporting formwork or steel decking.
- D. Concrete flow:
1. Keep surface of concrete level during placing with a minimum of concrete allowed to flow from one position to another.
  2. Carry concrete up uniformly for the length of walls being placed to reduce lateral flow of concrete to 5 feet, maximum.

- E. Runways: Construct substantial runways and scaffolding to avoid movement and vibration in the forms and reinforcing steel as a result of transporting and placing concrete.

### 3.6 PLACING

- A. General: Comply with ACI 304. Do not place concrete in or under water.
- B. Consolidation: Thoroughly consolidate concrete and work it around reinforcement and embedded items and into corners and angles of forms, by spading, rodding and tamping to exclude rock pockets, air bubbles and "honeycombs" and to obtain required density and strength.
- C. Internal vibration:
  - 1. Use mechanical vibrators to consolidate each layer with that previously placed, to completely embed reinforcement and fixtures, and to bring fine materials to the faces and top surfaces to produce the proper finish.
  - 2. Assign at least one workman at each location where concrete is being placed to vibrate and consolidate the concrete in forms. Take care to avoid over-vibration causing separation of ingredients. Keep extra standby vibrator at the site.
  - 3. Do not use vibrator to move concrete.
- D. Flow of concrete:
  - 1. Keep surface of concrete level during placing, with a minimum of concrete allowed to flow from one position to another.
  - 2. Place concrete in a continuous operation until each section or panel has been completed.
- E. Record: Keep records showing location, date and time of placement and quantity of all concrete placed on the Project.
- F. Floor slabs: Shape slabs to the levels, slopes and elevations indicated and accurately pitch or grade to drainage fittings and fixtures installed in them. Where indicated, depress slabs to receive other finishes.
- G. Wall supported elements:
  - 1. Under normal weather conditions, wait at least 2 hours after depositing concrete in walls and columns before placing concrete in supported floors.
  - 2. Consider beams, girders, capitals and brackets as part of the floor systems.
- H. Temperature: Do not place concrete when the temperatures of the materials in contact with the concrete, the concrete temperature, and the ambient temperature exceed the ranges recommended in ACI 305 and 306, or if it is likely to exceed these temperature before the concrete has taken its initial set, unless special precautions recommended by ACI 305 and 306 are provided.
- I. Construction joints:

1. Location: Locate joints to least impair the strength and appearance of the structure. Obtain the Architect's approval of all construction joint locations before casting concrete. In general construction joints shall be located as follows, unless otherwise indicated on the Drawings:
    - a. In walls locate at the underside of floors or slabs, and at the top of footings or floor slabs.
    - b. In slabs-on-grade locate joints where shown on the Drawings; offset not less than 5 feet, with a minimum of 2 offsets. Allow proper time lapse in placing of floor sections adjoining prior placings.
    - c. In all cases make construction joints perpendicular to the main reinforcement. Continue reinforcement across joints, unless otherwise indicated.
  2. Provide keyways at least 1-1/2 inches deep in construction joints in slabs, and between walls and footings etc. without exception; use prefabricated bulkheads for slabs.
  3. Keep exposed face of construction joints continuously moist from time of initial set until subsequent placing of concrete against them, but not to exceed the curing period. When not damp, wet (do not saturate) the contact surface of joints for a minimum of 24 hours before placing adjoining concrete.
    - a. Before placing adjoining concrete, clean contact surfaces to remove all laitance, loosened particles of aggregate or damaged concrete, and expose sound, coarse aggregates solidly embedded in the matrix.
    - b. To achieve the above, the contact surface may be washed with clean water under pressure (jet blast), may be sandblasted, or in areas which will be concealed from view when the building is completed an approved structural adhesive may be used on clean, structurally sound concrete. Remove wash water entirely from surface.
    - c. If a contact surface becomes coated with foreign materials of any nature after being cleaned, clean again to suitable condition.
- J. Tolerances: In compliance with ACI 117 with the following clarifications and as specified by the Architect for exposed concrete surfaces.
1. Paragraph 4.5.4, Class A (1/8 in.) for offset in formwork.
  2. Paragraph 4.5.7, "Flat" 3/16 in. in 10 ft. for slabs.
  3. Unless more stringent requirements are specified for architecturally exposed surfaces provide concrete placement and finish as required to achieve tolerances as follows:
    - a. Slab on grade: FF=35, FL=25, with minimum local values FF=20, FL=15
    - b. Slab on metal deck: 3/16in. in 10ft.

### 3.7 FINISHING

#### A. Formed concrete surfaces:

1. General:
  - a. Remove fins, laitance and loose materials from concrete surfaces when forms are removed.

- b. Repair honeycombs, rock pockets, sand runs, spalls and other damaged surfaces by removing the damaged or unsatisfactory area to sound concrete, with slightly undercut edges, and filling-in with the same mix as the adjacent concrete minus the coarse aggregate. All proposed repair procedures shall be mocked up and approved by the Architect prior to field application.
      - c. Fill-in tie holes with the same mix as the adjacent concrete minus the coarse aggregate.
      - d. Tamp and float, or trowel patches flush with adjacent surface and to match adjacent concrete texture.
  2. Exposed walls: Patch as specified above, rub with carborundum stones, fill imperfections with a cement paste, then sack and rub to produce uniformly smooth surfaces.
  3. Related unformed surfaces: Strike top of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, after concrete is placed, and float to a texture reasonably consistent with that of adjacent formed surfaces. Continue final treatment on formed surfaces uniformly across unformed surfaces.
- B. Top of grade beams, footings and pile caps: Screed to elevations indicated.
- C. Slabs:
  1. Protection:
    - a. Protect work of other trades from damage by covering it with heavy kraft paper securely taped in place. Leave protection in place as long as its need exists.
    - b. Control the use of water and other contaminants within the building so that no damage to previously installed work or existing structure and finish occurs.
  2. Compacting and floating:
    - a. Bring slabs to proper elevations and strike off with a straightedge. Remove excess water and laitance.
    - b. Compact and consolidate to embed coarse aggregates.
    - c. Float and test surfaces with a 10 ft. straightedge and eliminate high and low spots to comply with tolerances specified.
    - d. From this point, use the methods and tools necessary to produce surface tolerances and finishes specified.
    - e. Use screeds of type and spacing required to produce specified slab tolerances.
- D. Screeding: At concrete for floors to be placed over steel deck.
  1. The steel angle closure at metal deck edges is not intended to serve as a screed.
  2. Use adjustable screeds at all screeded points and adjust to compensate for existing deflection and for deflection of deck and beams occurring during concreting operations.
  3. Continuously monitor screeds and floors during concrete placement and finishing and adjust concrete floor thickness as required to obtain level floors.
- E. Moisture control: In addition to other finishing requirements, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and/or high temperature exist.

1. Immediately after concrete has been brought to a flat surface and the shiny film of moisture disappears, restore it and maintain until final troweling by applying a light film of moisture with an atomizing type fog sprayer.
2. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and frequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.

F. General requirements:

1. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.
2. Where concrete finishing occurs adjacent to finished metal and similar surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing concrete to harden.

G. Schedule of finishes:

1. Scratch (or raked) finish:
  - a. Apply to monolithic slabs to receive adhered and bonded concrete floor topping, mortar setting beds for tile and stone paving, and other cementitious finish flooring material.
  - b. After placing slabs, plane the surface to a tolerance not exceeding 1/4 in. in 2 ft. when tested with a 2 ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen the surface before the final set with stiff brushes, brooms or rakes.
2. Float all other monolithic slab surfaces unless otherwise specified.
  - a. After placing concrete slabs, do not work the surface further until ready for floating.
  - b. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of power-driven float, or both.
  - c. Consolidate the surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.
  - d. Float surfaces to receive roofing and bituminous waterproofing to produce a uniform texture and finish throughout acceptable to the roofing and waterproofing subcontractors.
3. Steel trowel surfaces to receive elastomeric coating, ceramic tile, carpeting, resilient flooring, other thin floor coverings, and concrete slabs which have no other specified finish, to a hard, dense, burnished surface.
  - a. Consolidate the concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance specified. Grind smooth surface defects that would telegraph through applied floor covering system.
  - b. After steel troweling, texture surfaces to be tiled and slabs to receive elastomeric coating with a fiber broom to provide a mechanical bond with the mortar, or omit the burnishing. These slabs must be approved by the subcontractors installing the tiles and the elastomeric coatings as satisfactory to receive their work.

4. Finish walk slabs with a medium broom finish, with tooled edges, as approved by the Architect on a 4 ft. square sample panel to be provided by the Contractor where directed at the site. Draw broom against a straightedge at right angle to the direction of traffic.

H. Markings:

1. At expansion joints and elsewhere as indicated, mark slabs with a 1/4 in. radiused edging or marking tool. In textured work edge and mark slabs, after texturing, with a combination edging/smoothing tool approximately 1-1/2 in. wide.
2. Where saw cutting is indicated, time this operation so that it is performed as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by the saw, but before shrinkage stresses have developed sufficiently to produce cracking.
3. Make marking lines straight, or curved as indicated, equally spaced and parallel to adjacent lines and/or walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed.

- I. Curbs: Immediately after removing forms, finish faces and top with a steel trowel.

### 3.8 CURING

A. Formed concrete:

1. Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
2. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound as specified for flatwork below.

B. Concrete flatwork:

1. After finishing, spray the specified curing compound uniformly in a minimum of 2 coats at 90 degrees to each other at 3 times the minimum coverage rates recommended by the manufacturer.
  - a. Inspect treated surfaces daily for 14 days for evidence of drying.
  - b. Re-wet the surfaces and apply a new application of curing compound, if premature drying occurs, as soon as can be done after finishing without marring the surfaces.
2. All interior floors not scheduled to receive a deferred finish shall receive the sealer applied in compliance with its manufacturer's printed instructions. Remove sealer residue after curing period is completed.
3. Concrete for the fountain and waterfall structure should be only water cured.

### 3.9 MISCELLANEOUS CONCRETE WORK

- A. Provide all other concrete work indicated or required to complete the Work, even though not specifically specified, including the following.
- B. Grouting and dry-packing: Comply with the grout manufacturer printed instructions and the following.

1. Mix material with sufficient water so it flows under its own weight for grout, and to just moisten and bind the material together for dry-pack.
2. Place dry-pack by forcing and rodding to fill all voids and provide complete bearing under plates. Place fluid grout from one side only and puddle to completely fill voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth and damp cure at least 3 days.

C. Equipment bases and foundations:

1. Provide machine, and equipment bases and foundations where indicated on Drawings.
2. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of the manufacturer furnishing the machines and equipment.

D. Pits, trenches, curbs, integrally-cast equipment pads and other miscellaneous concrete work: Construct to the profiles and dimensions indicated.

E. Waterproof membranes:

1. Perform work over waterproof membranes to prevent damage to the membranes.
2. Schedule this work to reduce to a practical minimum the period when the installed membrane is left without protection.
3. Prior to placing concrete, inspect the membrane and repair damage that may have occurred.

### 3.10 PROTECTING/CLEANING

- A. Take suitable precautions in compliance with applicable ACI requirements to secure satisfactory concrete in either hot or cold weather.
- B. Restrict construction vehicular traffic on slabs-on-grade to prevent damage and staining.
- C. Protect concrete to prevent damage and staining.
- D. Protect work of other trades from damage by work of this Section with heavy kraft paper securely taped in place.
- E. Upon completion, wash and clean exposed concrete and leave free of oil, paint, plaster and foreign substances, ready to receive applied finishes or to be left exposed.

### 3.11 DEFECTIVE CONCRETE

- A. Concrete which does not meet the requirements of the Contract Documents will be deemed defective.
- B. Remove defective concrete as directed by Architect and replace with concrete meeting the requirements of the Contract Documents, at no additional cost to the Owner.

### 3.12 FIELD QUALITY CONTROL

- A. Concrete quality control: The following will be performed by the Owner's Testing Agency.
1. Samples will be taken during progress of the work to determine slump, compression strength, aggregate sieve analysis, and grout-mix tests, with assistance furnished by the Contractor.
  2. 4 cylinders will be made for each day's pour or for each 100 cu. yds. or once for each 4,000 sq. ft. of surface area, whichever is less, for each type of concrete being cast.
  3. 1 cylinder will be tested at 7 days, and 2 cylinders at 28 days. The remaining cylinder will be kept in reserve in case tests are unsatisfactory.
  4. Samples will be made in compliance with ASTM C 172.
  5. Specimens will be made and laboratory cured in compliance with ASTM C 31.
  6. The 28-day values will be the criteria for acceptance of concrete regarding strength only.
    - a. 7-day tests may be regarded as indicative of compliance or non-compliance with the 28-day strength requirements, and the Contractor should be guided accordingly in matter of adjusting proportions, if necessary, and notify the Architect.
    - b. 7-day tests shall also be a guide to the Contractor regarding time for form removal.
  7. Slump tests will be made for each set of tests cylinders in compliance with ASTM C 143.
- B. Tests evaluation:
1. Concrete cylinder test will be evaluated in compliance with ACI 214 and 318.
  2. If 28-day test results indicate that concrete strength is not as specified, core concrete as directed by the Architect in compliance with ASTM C 42.
  3. In the event that additional core tests do not show strength required, or as determined by load tests made in compliance with ACI 318, the defective concrete shall be removed and replaced, or shall be reinforced as directed by the Architect, at the Contractor's expense.
  4. If core tests results fall below design strength specified, adjust the concrete mix or water content for future batches, at no additional cost to the Owner.
- C. Concrete floors shall be tested for flatness & levelness per ACI 117 in the allotted time, by the contractor. Test results are to be sent to the architect & engineer. Floors are to be "Very Flat", U.N.O.

END OF SECTION 033000

## SECTION 033543 - POLISHED CONCRETE FINISHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes polished concrete finishing.
  - 1. CONC-02, Concrete for dyed polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."
- B. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

#### 1.2 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Cast-in-place concrete subcontractor.
    - e. Polished concrete finishing Subcontractor.
  - 2. Review curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

- C. Samples for Initial Selection: For each type of product requiring color selection.
- D. Samples for Verification: For each type of exposed color. Provide samples with sealer and samples without sealer.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Repair materials.
  - 2. Liquid floor treatments.

#### 1.6 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
  - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
  - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Demolish and remove field sample panels when directed.
- B. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build a minimum of two mockups in the location and of the size as directed by Architect, each of 50 sf. Minimum area.
  - 2. Demonstrate curing, finishing, and protecting of polished concrete.
  - 3. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  - 5. Polished concrete mockups that are not accepted may remain in place if concealed under permanent floor finish covering.

#### 1.7 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

## PART 2 - PRODUCTS

### 2.1 DYE MATERIALS

- A. Penetrating Dye: Solvent based color liquid dye concentrate.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield, L. M. Company; Formula One Liquid Dye Concentrate or comparable product acceptable to the Architect.
- B. Chemical Hardener/Densifier: Water-borne acrylic penetrating material.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield, L. M. Company; Formula One Guard-W or comparable product acceptable to the Architect.

### 2.2 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advanced Floor Products.
    - b. ARDEX GmbH.
    - c. Euclid Chemical Company (The); an RPM company.
    - d. L&M Construction Chemicals, Inc.
    - e. QuestMark.
    - f. Scofield, L. M. Company.
    - g. Vexcon Chemicals Inc.

## PART 3 - EXECUTION

### 3.1 POLISHING

- A. Polish: Level 2: Low sheen, 400 grit.
- B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
  - 1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal light exposure of aggregate to match approved mockup.
    - a. Grind floor to within 2-3 inches of any installed walls with multiple passes of finer-grit pads to indicated level of grit finish, removing construction debris, floor slab imperfections and until there is a uniform scratch pattern and desired concrete aggregate exposure.

2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

### 3.2 DYING

- A. Newly placed concrete shall be at least 14 days old before staining.
- B. Prepare surfaces according to manufacturer's written instructions and as follows:
  1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
  2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding or sanding. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
  3. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.
- C. Allow concrete surface to dry before applying dye. Verify readiness of concrete to receive dye according to ASTM D 4263 by tightly taping 18-by-18-inch, 4-mil- thick polyethylene sheet to a representative area of concrete surface. Apply dye only if no evidence of moisture has accumulated under sheet after 16 hours.
- D. Penetrating Dye: Apply penetrating dye and densifier to concrete surfaces according to manufacturer's written instructions.

END OF SECTION

## SECTION 033713 - SHOTCRETE

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

A. Work includes:

1. Shotcrete at indicated locations. Shotcrete shall be as specified herein, and as needed for a complete and proper installation.

B. Related work includes:

1. Concrete formwork including any required formwork for shotcrete: Section 031000.
2. Concrete reinforcement, including reinforcement for shotcrete: Section 032000.
3. Cast-in-place concrete: Section 033000.

C. Related work provided by Owner:

1. Registered Deputy Inspector to inspect the placement of all shotcrete in accordance with Building Code requirements.

#### 1.2 TESTS AND INSPECTIONS

A. General:

1. The Owner will employ a Testing Agency to test and inspect this work as specified here after, and to submit reports to all concerned parties.
2. The Testing Agency will be responsible for conducting and interpreting the tests and inspections, will state in their reports whether the results comply with the Contract Documents and requirements of Governing Authorities, will specifically note deviations there from, and will indicate corrective measures required and taken.
3. The Contractor shall make corrective measures, including additional and more complete testing if initial testing indicates non-compliance with the Contract Documents and requirements of Governing Authorities, at no additional cost to the Owner.
4. Cooperate with the Testing Agency's personnel and permit their unrestricted access to the site as required for the performance of their duties.
5. Refer to Section 014000 - "Quality Control" for additional information pertaining to tests and inspections.

B. The Testing Agency employed by the Owner will:

1. Test the proposed materials for compliance with these specifications.
2. Review and check proposed mix proportions.
3. Test preconstruction test specimens.
4. Secure production samples of materials at stockpiles during construction and test for compliance with specifications.
5. Test the strength of the shotcrete as the work progresses by one or more of the following methods:

- a. Cut cores from the structure and test in accordance with ASTM C42. A set of 3 cores will be taken not less than once each shift nor less than once for each 50 cu/yd of shotcrete placed through the nozzle. Cores will be soaked in water for a minimum of 40 hours before testing.
    - b. Make one test panel as indicated on the Drawings, gunned in the same position as the work represented. Panels shall be gunned during the course of the work by the Contractor's regular nozzle operator. Field cure panels in the same manner as the work, except that the test specimens shall be soaked in water for a minimum of 40 hours before testing. The designated testing agency will cut cores as indicated on the Drawings.
    - c. When the length of a sample is less than twice the diameter, apply the correction factors given in ASTM C42 to obtain the compressive strength of individual cores.
  6. The average compressive strength of three samples taken from the structure or test panel, representing a shift or 50 cu/yd of shotcrete, must equal or exceed 0.85 fc with no individual core less than 0.75 fc. The average of three cubes taken from a panel representing a shift or 50 cu/yd of shotcrete must equal or exceed fc with no individual cube less than 0.88 fc.
  7. Final acceptance of the shotcrete will be based on results obtained from samples or sawed cubes. Use of data obtained from impact hammers, ultrasonic equipment, or other nondestructive testing devices will not be permitted for final acceptance of the shotcrete. However, these data may be useful for determining uniformity of the shotcrete.
- C. Preconstruction testing to be performed by the Contractor: The Contractor shall prepare specimens for examination and testing prior to construction.
1. Contractor shall have test specimens made by each application crew using the equipment, materials, and mix proportions proposed for the Project.
  2. Contractor shall make a test panel at least 30" x 30" for each mix being considered, and for each shooting position to be encountered in the job. Provide the same reinforcement as the structure in at least half of the panel to test for proper embedment of reinforcing steel. Fabricate test panels to the same thickness as the structure, but not less than 3". Take at least 5 cubes or cores from the panels for testing. All cut or broken surfaces shall be dense and free from laminations and sand pockets. Finish test panel with smooth sponge float finish texture as directed by Architect.
    - a. If first texture test panel is unacceptable, construct additional one(s) until Architect's acceptance is gained.
  3. Alternate to preconstruction testing: When accepted by the Architect, preconstruction testing may be eliminated if it has been shown that mix, materials, equipment, and personnel have given satisfactory results on similar work. In such case, make test panels concurrently with the first shotcrete placed on the site.

### 1.3 QUALITY ASSURANCE

- A. Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

- B. In addition to complying with pertinent regulations of governmental agencies having jurisdiction, comply with pertinent provisions of ACI 506. "Recommended Practice for Shotcreting", and ACI 506.2. "Specifications for Materials, Proportioning, and Application of Shotcrete", except as may be modified herein.
- C. Do not commence placement of shotcrete until required mix designs joint layout, curing method, pumping Operations sequences and procedures have been reviewed and approved by the Deputy Inspector and all governmental agencies having jurisdiction.
- D. Refer to the Structural General Notes on the Drawings for additional requirements pertaining to this work. Applicable parts of Structural General Notes shall apply to the work of this Section as though repeated verbatim herein.

#### 1.4 SUBMITTALS

- A. Make submittals in accordance with the requirements of Section 013300.
- B. Data: Submit shotcrete mix design, curing method, joint layout, pumping operation sequence and procedures.
- C. Phasing of shotcrete Work: Submit proposed plan for phasing the shotcrete work.

#### 1.5 HANDLING

- A. Comply with requirements of Section 016500.

#### 1.6 PROTECTION

- A. Finished shotcrete concrete surfaces shall be protected from stains, abrasions and other damage, as necessary.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Cement: Use the type of Portland cement upon which the approved mix design is based.
- B. Cement Tests. Required prior to use for all cement needed for shotcrete applied concrete.
  - 1. Tensile strength required at 7 days only by ASTM C183, C184, C187, C190 and C191 methods.
  - 2. Resample and retest any cement showing evidence of damage or deterioration prior to testing, prior to use.
  - 3. Certificate required, acceptable evidence and information required on the Certificate Test verifications as prescribed by the Los Angeles County Building Code.

4. Alternate: Perform sampling and testing after delivery to the jobsite. Do not use cement until results of tests are known.
- C. Aggregates: Provide normal weight aggregate complying with ASTM C33, with the combined gradation of fine and coarse aggregate conforming to Table 2.2.1 of ACI 506.2 and as recommended in the approved mix design where mix designs are required to be submitted.
- D. Water: Clean, fresh, and potable.
- E. Admixtures: Use only those admixtures recommended in the approved mix design and approved by the governmental agencies having jurisdiction.

## 2.2 SHOTCRETE MIX DESIGNS

- A. Owner's Testing Agency using a Registered Engineer shall provide a mix design and curing method, based on strength of the specified materials, and meeting the requirements stated in the Contract Documents.
  1. Owner's Testing Agency shall submit each mix design to the Architect, including new mix designs required to be prepared should there occur a change in materials being used.
  2. Comply with provisions of Paragraph 2.5 of ACI 506.2.
- B. Produce the compressive strengths called for on the Drawings.
- C. Mix cement and aggregates dry in a suitable mixer for not less than one minute but not until all ingredients are thoroughly mixed. Discharge mixer completely before recharging.

## 2.3 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected.
- B. Inspect forms and reinforcement after placement of reinforcing and prior to placing shotcrete.

### 3.2 BATCHING AND MIXING

- A. Control mix proportions by weight batching, or by volume batching complying with ASTM C685.

1. If permitted, other volume batching procedures may be used, provided a minimum of one weight batching check is made every four hours for control purposes.
  2. Assure that the specified mix design is achieved.
- B. Use batching and mixing equipment capable of proportioning and mixing all ingredients (except water in the case of dry-mix equipment) at a rate that will provide adequate production and with an accuracy that will assure uniformity of batches.
1. Use weighing equipment capable of batching with the accuracy specified in ASTM C94.
  2. For volumetric equipment, be capable of batching with the accuracy specified in ASTM C685.
- C. Ready-Mixed Concrete (if used):
1. Comply with ASTM C94; except the materials may be delivered to the shotcrete equipment in the dry state if that equipment is capable of adding the water and mixing it satisfactorily with the dry ingredients: or
  2. Comply with ASTM C685 in which case deliver the ingredients dry and proportioned, and mix at the jobsite.

### 3.3 PREPARATION OF SURFACES

- A. Steel Surfaces:
1. Remove rust, oil, scale, and previously applied paint from surfaces receiving shotcrete.
  2. Comply with Specification SSPC-SP6 of the Steel Structures Painting Council.
- B. Forms
1. Use form-coating material on removable forms to prevent absorption of moisture and to prevent bond with the shotcrete.
  2. Use a non-stain material for surfaces exposed to view when construction is completed.
  3. Do not use form-coating material that will interfere with subsequent bonding to the shotcrete when such bonding is required.

### 3.4 PLACEMENT OF SHOTCRETE

- A. Place shotcrete using suitable delivery equipment and procedures that will result meeting the specified requirements. Keep a copy of ACI 506 on hand at the site for easy reference while this work is being done. Substitute the word "shall" whenever the word "should" occurs in ACI 506.
- B. Placement Thicknesses:
1. Control thickness, method of support, air pressure, and/or water content of shotcrete to preclude sagging and sloughing off.
  2. Discontinue shotcreting, or provide suitable means to screen the nozzle stream, if wind or air currents cause separation of the nozzle stream during placement.

3. Dampen absorptive substrate surfaces prior to placement of shotcrete to facilitate bond and to reduce the possibility of shrinkage cracking developing from premature loss of water.
4. Broom or scarify the surface of freshly placed shotcrete to which, after hardening, additional layers of shotcrete are to be bonded. Dampen surface just prior to application of succeeding layers.
5. First, fill with sound material all corners and areas where rebound cannot escape or be blown free. Complete the corners between the web and flanges of structural steel before application to the flat areas.
6. Provide a supply of clean, dry air adequate for maintaining sufficient nozzle velocity for all parts of the work and, if required, for simultaneous operation of a suitable blow pipe for clearing away rebound.
7. Provide a capable nozzle operator's helper equipped with an air blowpipe to assist the nozzle operator in keeping all rebound build-up out of the finished work. Additional workers may be required to take the rebound from the work if rebound cannot be removed by the air blow pipe.
8. The height of a layer shall be limited to a maximum of 3', and a succeeding layer shall be placed in less than 3 hours, unless preconstruction test panel indicates these values may be exceeded. No sloughing or sagging will be permitted.

C. Placement Around Reinforcement:

1. Hold the nozzle at such distance and angle to place material behind reinforcement Before any material is allowed to accumulate on its face.
2. In the dry-mix process, additional water may be added to the mix when encasing reinforcement, to facilitate a smooth flow of material behind the bars.
3. Do not place shotcrete through more than one layer of reinforcing steel rods or mesh in one application, unless demonstrated by preconstruction tests that steel becomes encased properly.
4. Test to ascertain if any voids or sand pockets have developed around or behind reinforcement by probing with an awl or other pointed tool after the shotcrete has achieved its initial set; by removal of randomly selected bars; or by coring or other suitable means. Cost of test cores shall be paid for by the Contractor.

D. Cover of Reinforcement: Place shotcrete to provide the following minimum cover over reinforcement.

1. For Reinforcement in Slabs and Walls: 3/4" for fine aggregate shotcrete and 1-1/2" for coarse aggregate shotcrete, 2" for surfaces exposed to earth or weather.
2. Do not decrease the above minimums except as specifically approved in writing by Architect.

E. Line and thickness Control:

1. Use adequate ground wires or other accepted means to establish the thickness, surface planes, and finish lines of the shotcrete.
2. Maintain specified tolerances by keeping ground wires secure and taut.

F. Placement Precautions:

1. Do not place shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle.

2. Do not use rebound or previously expended material in the shotcrete mix.
3. Remove all overspray and rebound prior to final set and before placement of shotcrete material on such adjacent surfaces.

### 3.5 REPAIR OF SURFACE DEFECTS

- A. Remove shotcrete which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which contains any dry patches, slugs, voids, or sand pockets.
- B. Repair defective areas by preparing as specified above for existing concrete and masonry surfaces, and by applying new shotcrete meeting the specified requirements.
  1. Repair core holes in accordance with Chapter 9 of ACI 301.
  2. Do not fill core holes with shotcrete.

### 3.6 FINISHING

- A. Where exposed in the finished work: Apply a smooth sponge float finish, as required to match the approved sample to exposed shotcrete surfaces.
- B. Where concealed in the finished work: Apply a smooth wood float finish.
- C. In other finishing operations, avoid troweling of thin sections of shotcrete unless both troweling and commencement of moisture curing take place within a relatively short period after placement of shotcrete.
- D. Do not, in any case, scrape or cut to remove high spots until the shotcrete has become stiff enough to withstand pull of the cutting devices.

### 3.7 JOINTS

- A. Make joints in accordance with Paragraph 3.6 of ACI 506.2, as approved by the Architect, and in compliance with pertinent requirements of governmental agencies having jurisdiction.

### 3.8 CURING AND PROTECTION

- A. Cure and protect the in-place shotcrete with approved chemical curing compound in accordance with pertinent provisions of Paragraph 3.7 of ACI 506.2, except as may be directed otherwise by the Architect.
- B. If forms are removed during the curing period, proceed as specified previously. If forms remain in place, keep them continuously wet for the period of time specified above.
- C. Prevent rapid drying at the end of the drying period.

### 3.9 CLEANING AND CLEAN-UP

- A. Remove all rebound materials, other excess, forms, reinforcing, sand and cement materials, tools and equipment from the jobsite and leave all work areas in a clean and safe condition.
- B. Contractor to clean adjacent surfaces of building of splashed-on shotcrete placed concrete materials by approved methods.

END OF SECTION 033713

## SECTION 035300 - CONCRETE TOPPING

### 1.1 QUALITY ASSURANCE

- A. Mockups for concrete floor toppings.

### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Low-emitting flooring.

### 1.3 MATERIALS

- A. Topping: A concrete resurfacing compound modified with high-performance polymers for exceptional bond strength, suitable for polishing.
  - 1. Compressive Strength (28 Days): 6,500 psi.
- B. Divider Strips: 1/4 inch wide metal divider strips and transitions.

### 1.4 INSTALLATION

- A. Concrete Floor Topping Application: Epoxy-bonding adhesive applied to existing concrete; hard trowel finish.

### 1.5 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.

END OF SECTION 035300

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For coatings, indicating VOC content.
- B. Qualification Data: For Installer.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
  - 1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

### PART 2 - PRODUCTS

#### 2.1 HYDRAULIC CEMENT UNDERLAYMENTS

- A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.

1. **Products:** Subject to compliance with requirements, provide one of the following:
    - a. Ardex; K-15 Self-Leveling Underlayment Concrete.
    - b. BASF Construction Chemicals, Inc.; Chemrex Self-Leveling Underlayment.
    - c. Bonsal American, an Oldcastle company; ProSpec Level Set 300.
    - d. Dayton Superior Corporation; Levelayer.
    - e. MAPEI Corporation; Novoplan 2.
  2. Cement Binder: ASTM C 150/C 150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
  3. Compressive Strength: Not less than 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
  4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
1. VOC Content: Provide coating with VOC content of 200 g/L or less.
- E. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
  1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
  2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

### 3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
  1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
  2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
  3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
  1. Apply a final layer without aggregate to product surface.
  2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.
- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

### 3.4 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 036300 - CONCRETE EPOXY ADHESIVE INJECTION

### PART 1 - GENERAL

#### 1.1 SCOPE

##### A. For Cracks up to 1/4".

1. Requirements of the general conditions, supplementary general conditions and division 1 apply to work of this section.
2. Furnish all labor, materials, services equipment and appliance required to perform all work to complete the contract, including but not limited to, these major items:
3. Injection of concrete members with liquid epoxy adhesive in walls and architectural concrete members. Cracks that are at least .030 inches wide are to be epoxied.
4. All work shall conform to current standards for historical restoration.

##### B. RELATED WORK

1. Tests and inspections.
2. Repair of concrete and concrete finishes.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer qualifications: Provide epoxy injection system, which is the product of a manufacturer whose complete system has been approved by the architect. The manufacturer shall have a system that has been used for epoxy injection projects similar in nature for a minimum of fifteen (15) years. Pay all fees and obtain approval for material prior to commencing work.
- B. Sub-contractor qualifications: The epoxy injection sub-contractor will have successfully performed previous installations similar in nature to the one involved in this contract. The epoxy injection sub-contractor shall have a minimum of the (5) years experience with epoxy injection work and shall be a trained and recommended applicator of the epoxy injection material manufacturer.
- C. Qualifications of epoxy injection field superintendent: All work in the field shall be performed under the immediate control of a foreman or superintendent experienced in this type of work. This person shall exercise close check and rigid control of all operations as necessary for full compliance with all requirements.
- D. Worker's qualifications: Contractors/Subcontractors workers in the epoxy injection process shall have completed a program of instruction in the methods of restoring concrete structures, utilizing the specific epoxy injection process indicated. The curriculum shall include theory in the nature and causes of cracking in concrete, methods of permanently repairing damaged concrete structures, the technical aspects of correct material selection and use, and the operation, maintenance and trouble shooting of equipment.

### 1.3 TESTING AND INSPECTION

- A. Material Tests: Owner's testing laboratory will provide all material tests as required by architect and as specified herein. Owner will pay for any costs of testing.
- B. Inspections: If necessary, owner will arrange and pay for the services of registered deputy building inspector for continuous inspections of all epoxy injection work. Inspector will be continuously present during the epoxy injection operations, and will make written reports to engineer, and certifications to architect as to compliance with building code requirements and contract drawings and specifications.
- C. Field Quality Control:
  - 1. Core Testing to verify penetration and strength. (Note: It is imperative that no rebar or tendons be cut. It may be necessary to use a pachometer to locate existing reinforcing).
  - 2. Initial Cores: The contractors/subcontractor shall obtain one (1) 2" diameter initial core sample for each 100 lineal foot of crack repaired or as directed by the architect.
  - 3. The cores shall be adequate in diameter to intersect the crack to the full depth of core and taken from locations as directed by the architect.
- D. Methods of Testing Initial Cores:
  - 1. Penetration: Visual Examination.
  - 2. Bond Strength Compression Test: ASTM C 39.
- E. Test Requirements:
  - 1. Penetration: A minimum of 90 percent of the crack shall be full of epoxy adhesive.
  - 2. Bond Strength/Compression Test: concrete failure before adhesive failure, or 5,000 PSI with no failure either concrete or adhesive.
  - 3. Evaluation and Acceptance of Tests: If the initial cores conform to the requirements of C.2 "Penetration" and "Bond Strength", epoxy adhesive injection work at the area represented by the cores shall be accepted.
  - 4. If the initial cores do not conform to the requirements of C.2 "Penetration" above, the work shall not proceed further until the area represented by the cores is re-injected and retested for acceptance.
  - 5. After rework of areas represented by failed initial cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the engineer. Verifying cores shall be tested in accordance with paragraph C.2 and C.3 for compliance.
  - 6. If cores do not conform to the requirements for C.2 "Bond Strength" above, the work shall be re-injected.
  - 7. After rework of areas represented by failed cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the engineer. Verifying cores shall be tested in accordance with paragraph C.2 and C.3 for compliance.
- F. Payment for core testing:
  - 1. Testing of initial core samples which have been taken by the contractor will be performed by the owner's representative at the owner's expense.
  - 2. Additional cores, called verification cores, required as indicated in paragraph C.4 (rework) herein, will be tested by the owner at the contractor's expense in accordance with the established fee schedule.

G. Pressure Test of Injection Equipment:

1. Method: The mixing head of the injection equipment shall be disconnected and two adhesive component delivery lines shall be attached to the pressure check device. The pressure check device shall consist of two independent valved nozzles capable of controlling back pressure by opening or closing valve. There shall be a pressure gauge capable of sensing the pressure build up behind each valve. The valves in the pressure check device shall be closed and the equipment operated until the gauge pressure on each line reads 160. The pumps shall be stopped and the gauge pressure shall not drop below 150 PSI within 2 minutes.
2. Frequency of Pressure Test: The pressure test shall be run for each injection unit at the beginning of the shift and every four hours of use for all shifts the unit is used on the work of delaminations/crack repair.

H. Ratio Test of Injection Equipment:

1. Method: The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously through the ratio check device. The ratio check device shall consist of two independent valved nozzles capable of sensing the back pressure behind each valve. The discharge pressure shall be adjusted to 160 PSI for both components. Both adhesive components shall be simultaneously discharged into separate calibrated containers. The amounts discharged into the calibrated containers during the same time period shall be compared to determine that the volumes discharged deviate no more than 5% from the correct ratio as specified in the manufacturer's product data sheet.
  2. Proof of Ratio and Pressure Testing.
- I. At all Times during the course of the work the contractor shall keep complete an accurate record of the pressure and ratio tests specified above. These records shall be available to the architect. In addition, the architect/engineer, at any time without prior notification of the contractor, may request the contractor to conduct the tests specified above in the presence of the architect/engineer.

## PART 2 - PRODUCTS

### 2.1 HIGH STRENGTH EPOXY RESIN ADHESIVE FOR INJECTION

- A. Provide LARR reports for all products used for approval by architect/engineer.
- B. Epoxy injection adhesive shall be Sikadur 53 as manufactured by Sika Corporation, tel (800) 933-7452, or ETI manufactured by Simpson Strong Tie, tel (562) 699-0543, or approved equal.
- C. Surface Sealant: SikaTop 123 as manufactured by Sika Corporation, or ETR Epoxy Paste as manufactured by Simpson Strong Tie, or approved equal, and shall be sufficiently strong to resist injection pressures to prevent leakage during injection.
- D. Provide other materials as required and recommended by manufacturers subject to approval by architect/engineer.

- E. Equipment for injection type: The equipment used to meter and mix the two injection adhesive components, and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in line metering and mixing.
- F. Discharge pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to + 1-5 PSI and shall be equipped with a manual pressure control override.
- G. Ratio tolerance: The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of + 1-5% by volume at any discharge pressure up to 160 PSI.
- H. Automatic Shut-Off Control: The injection equipment shall be equipped with sensors on both the component A and the component B reservoirs that will automatically stop the machine when either reservoir becomes dry.

### PART 3 - EXECUTION OF WORK

#### 3.1 PREPARATION

- A. Surfaces adjacent to cracks or other areas of application shall be cleaned of loose paint, dirt, loose concrete, dust, grease, oil, efflorescence or other foreign matter detrimental to bond of epoxy injection surface seal. Acids and corrosives shall not be permitted for cleaning.
- B. Entry ports shall be provided along the crack at intervals to allow for maximum penetration of the epoxy adhesive. Spacing of the entry ports shall be approved by the architect.
- C. Surface seal material shall be applied to the face of the crack or other areas of application between entry ports as needed. For through cracks a surface seal shall be applied to both faces.
- D. Enough time for the surface seal material to gain adequate strength shall pass before proceeding with the injection.

#### 3.2 EPOXY INJECTION

- A. Injection of the epoxy adhesive shall begin at an entry port at one end of the crack or at the lowest port for a vertical crack. The injection shall continue until there is an appearance of epoxy adhesive at the next port adjacent to the entry port being pumped.
- B. When epoxy adhesive travel is indicated by appearance at the next adjacent port, injection shall be discontinued on the entry port being pumped, and epoxy injection shall be transferred to next adjacent port where epoxy adhesive has appeared. At the contractor's option, the injection can continue in the original port if epoxy is appearing at multiple ports adjacent to the port being pumped.
- C. Epoxy adhesive injection shall continue until the cracks are completely filled.

- D. If port to port travel of epoxy adhesive is not indicated, the work shall be immediately stopped and the architect notified.

### 3.3 FINISHING

- A. When cracks are completely filed, epoxy adhesive shall be cured for sufficient time to allow removal of surface seal and ports without any draining or run-back of epoxy material from cracks.
- B. Surface seal material and injection adhesive runs or spills shall be removed from concrete surfaces.
- C. The surface area shall be finished flush with the adjacent concrete, showing no indications or protrusions caused by the placement of entry ports. Grind smooth as required.
- D. After the work has been accepted by the owner engineer, cored holes shall be repaired using a two component bonding agent and suitable grout or patching mortar mix as acceptable to the engineer (Master Builders Construction grout or equal). The bonding agent shall be applied to the surfaces of the cored holes followed by application of the grout mix placed by hand trowel, thoroughly rodded and tamped in place, and finished to be similar in color, finish, and texture of existing concrete to the satisfaction of the owner, and ready for painting, material and procedure for filling testing core holes shall be submitted to and approved by the owner/engineer before proceeding with this work.
- E. Surfaces shall be left in a "ready to paint" condition.

### 3.4 CLEAN UP

- A. At conclusion of work remove all equipment, debris, and excess material and leave area broom clean.

END OF SECTION 036300

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Los Angeles, CA  
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## SECTION 042000 - UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Control and expansion joints.
7. Embedded flashing.

#### 1.3 REFERENCED STANDARDS

- A. ACI - American Concrete Institute International/ASCE - American Society of Civil Engineers/TMS - The Masonry Society.

1. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures.

- B. ASTM - American Society for Testing and Materials International.

1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM A 641: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
4. ASTM A 951: Specification for Masonry Joint Reinforcement.
5. ASTM B 117: Practice for Operating Salt Spray (Fog) Apparatus.
6. ASTM B 370: Specification for Copper Sheet and Strip for Building Construction.
7. ASTM C 90: Specification for Loadbearing Concrete Masonry Units.
8. ASTM C 140: Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
9. ASTM C 143: Test Method for Slump of Hydraulic Cement Concrete.
10. ASTM C 144: Specification for Aggregate for Masonry Mortar.
11. ASTM C 150: Specification for Portland Cement.
12. ASTM C 207: Specification for Hydrated Lime for Masonry Purposes.
13. ASTM C 270: Specification for Mortar for Unit Masonry.
14. ASTM C 404: Specification for Aggregates for Masonry Grout.
15. ASTM C 476: Specification for Grout for Masonry.

16. ASTM C 780: Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
17. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
18. ASTM C 1019: Test Method for Sampling and Testing Grout.
19. ASTM C 1093: Practice for Accreditation of Testing Agencies for Unit Masonry.
20. ASTM C 1142: Standard Specification for Extended Life Mortar for Unit Masonry.
21. ASTM C 1314: Test Method for Compressive Strength of Masonry Prisms.
22. ASTM D 1056: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

C. NCMA - National Concrete Masonry Association.

1. NCMA TEK 8-2A: Removal of Stains from Concrete Masonry Walls.

D. SMACNA - Sheet Metal and Air Conditioning Contractors.

#### 1.4 SUBMITTALS

- A. Descriptive Data: Submit descriptive data for all specified products.
- B. Shop Drawings: Submit shop drawings of concrete masonry walls, including block shapes, lintel requirements, reinforcing steel, flashing, location of control and expansion joints, and sample masonry walls erected on site. Refer to Structural Drawings for additional requirements for reinforcing steel Shop Drawings. Show elevations of reinforced walls.
- C. Samples: Submit three (3) samples to Architect for approval prior to fabrication. Samples to be 4 by 8 by 1 inches (102 by 203 by 25 mm).

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.
- B. Standards: Comply with ACI 530.1/ASCE 6/TMS602 (ref. 1) "Specifications for Masonry Structures":
  1. "TEK" Information Series, published by NCMA.
  2. Follow manufacturer's instructions for installation of each type of masonry product, unless otherwise indicated or specified.

#### 1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Meeting: Before any masonry and associated work is done, Contractor to schedule pre-installation meeting at the site, attended by Owner, Architect, Contractor, Installers of Related Work, Test Agencies, Governing Authorities, and Masonry Installer. Agenda to cover field quality control program, acceptance criteria for sample wall, block pattern and jointing, flashing details, expansion joints, and cavity wall construction.

- B. Record Minutes: Record discussions and agreements, and furnish copy to each participant. Provide at least 72 hours advance notice to participants prior to conference.

#### 1.7 PROTECTION OF MATERIALS AND WORK

- A. Protect all materials from weather and soil when stored and during construction.
- B. Protect exposed masonry walls from moisture and keep dry at all times until wall is completed and capped.
- C. Keep top of all masonry walls dry at all times when work is not in progress by covering with approved moisture resistant and fire retardant tarpaulins.
- D. After erection, protect finished masonry walls from damage due to subsequent building operations. Remove damaged units and replace.
- E. Brace all masonry during construction period until final supports are in place.

#### 1.8 DELIVERY AND STORAGE

- A. Deliver masonry units and carefully stack on pallets to avoid chipping.
- B. Store masonry materials above ground at a height sufficient to prevent soiling. Keep masonry materials dry until placed by storing in a weathertight structure or, if stored in the open, by means of approved moisture resistant tarpaulins, completely enclosing the material.
- C. Furnish cement materials in bags displaying manufacturer's trademark and type. Provide material dry and free of lumps when delivered. Upon delivery, store material in dry, weathertight, and properly ventilated structures. Store different brands or types of mortar separately and do not intermix.
- D. Store masonry reinforcement above ground and protect from contact with the soil. Store anchors and ties in containers in a weathertight structure.

### PART 2 - PRODUCTS

#### 2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

#### 2.2 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes as required for corners, control joints, jambs, heads, lintels, and headers, for use where indicated.
  2. Provide bullnose corners at all outside corners.
- B. Concrete Masonry Units: Load-bearing hollow and solid concrete masonry units, medium weight, unless otherwise indicated, moisture-controlled, conforming to the following unless more stringent requirements specified:
1. Hollow and Solid Units: ASTM C 90, Type 1.
  2. Unit Compressive Strength: Minimum average net area compressive strength of f'm 2000 psi (13.8 MPa).
  3. Linear Shrinkage: Not to exceed .065 percent.
  4. Size (Width): Manufactured to dimensions 3/8 inch (9.5 mm) less than nominal dimensions.
- C. Provide two-core concrete masonry units for all reinforced masonry walls, unless indicated otherwise.
- D. No overall dimensions, width, height, length to differ by more than 1/8 inch (3.2 mm) from the specified standard dimensions. Units uniform as to dimension. Provide planar face surface with no variations greater than 1/32 inch (0.8 mm).
- E. Provide concrete masonry units with a face shell thickness conforming to ASTM C 90, sufficient to adequately embed masonry reinforcement.

## 2.3 CURING CONCRETE MASONRY

- A. Cure concrete masonry units by either high pressure steam autoclave, saturated steam at atmospheric pressure, or air mist curing.
- B. Concrete masonry units that have been cured at a saturated steam pressure of at least 120 psi (0.8 MPa) at a temperature of 350 deg F (177 deg C) for 5 hours or more may be used no sooner than three days after removal from the autoclave.
- C. Yard cure concrete masonry units which have been cured by saturated steam or air mist at atmospheric pressure for at least 28 days before use.

## 2.4 MORTAR AND GROUT

- A. Materials and Proportions: Conform to ASTM C 270; proportion specifications with the following amendments:
  1. ASTM Section 3.1: Cement to be portland cement, Type 1, natural or white as required to match mortar color, of a manufacture selected to achieve the required color. Hydrated lime to conform to ASTM C 207, Type S, (Special Hydrated Lime).
  2. Portland Cement Lime Mix: Packaged blend of portland cement meeting ASTM C 150, Type I and hydrated lime meeting ASTM C 207. For pigmented mortars, use premixed, colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments not to exceed 5 percent of masonry cement by weight for mineral oxides, nor 1 percent for carbon black.

- B. Aggregate for Mortar: Re-screened, clean, sharp, washed and free from loam or clay or other deleterious materials, conforming to ASTM C 144, selected to achieve the required mortar color. Uniformly grade sand from coarse to fine with 100 percent passing a number 4 sieve (4.75 mm), 95 percent passing a number 8 sieve (2.36 mm) and not more than 5 percent passing a number 100 sieve (0.15 mm).
- C. Aggregate for Grout: ASTM C 404.
- D. Mortar for Unit Masonry: Comply with BIA Technical Notes 8A, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
  - 1. For masonry below grade or in contact with earth, use Type M.
  - 2. For reinforced masonry, use Type S.
  - 3. For mortar parge coats, use Type N.
  - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
  - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- E. Grout: Comply with ASTM C 476, and have a minimum 28 day compressive strength of 3000 psi (20.7 MPa).
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
  - 2. Provide grout with a slump of 8 to 11 inches (203 to 280 mm) as measured according to ASTM C 143/C 143M.
- F. Do not use calcium chloride admixtures, anti-freeze liquids, salts, or other substances in the mortar or grout.
- G. Water: Potable, clean, and free from injurious amounts of oil, alkali, acids, organic materials, or other deleterious materials.

## 2.5 TIES AND ANCHORS

- A. Masonry Anchors: Hot-dipped galvanized steel, unless shown otherwise, rolled shapes, bars, and dowels, size and thickness as indicated. Anchors slotted as required for anchor adjustment. Install anchors at spacing indicated and weld or bolt fasten to steel framing. Touch-up welds with paint or other protection:
  - 1. Hot-Dipped Galvanized after Fabrication: ASTM A 153, Class 2 (1.5 ounce zinc coating per sq. ft.).
- B. Hot-Dip Galvanized Steel Wire: ASTM A 153, Class B-2 (1.50 oz. per sq. ft. of wire surface) for zinc coating applied after prefabrication into unit.
- C. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch (6 mm) diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- D. Partition Top anchors: 0.097-inch (2.5 mm) thick metal plate with 3/8-inch (9.5 mm) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6 mm) thick by 24 inches (609 mm) long, with ends turned up 2 inches (50 mm) or with cross pins, unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

## 2.6 STEEL REINFORCEMENT

- A. Reinforcing Bars: Deformed billet-steel bars for concrete reinforcement conforming to ASTM A 615, Grade 60, hot dipped galvanized, unless noted otherwise.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
  1. Interior Walls: Mill galvanized, carbon steel.
  2. Exterior Walls: Hot-dip galvanized, carbon steel.
  3. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
  4. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
  5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.
  6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
  1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch (16 mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

## 2.7 MASONRY WALL REINFORCEMENT

- A. Refer to Structural Drawings and Notes.

## 2.8 CONTROL & EXPANSION JOINT MATERIALS

- A. Bond Breaker Strips: For use in end webs of concrete masonry units at indicated control joints, 15 pound asphalt or coal-tar roofing felt. Externally applied joint fillers, sealant and backer material is specified in Division 07 Section.

- B. Flexible Joint Filler Strips: Built-in between concrete masonry where indicated; molded from natural or synthetic rubbers, alone or in combination, conforming to ASTM D 2000, and neoprene conforming to ASTM D 1056, Grade SCE-41, as manufactured by Williams Products, Inc., Hohmann & Barnard, Inc., or Dur-O-Wal.
- C. Control and Expansion Joint Material: For use in masonry walls where indicated; preformed 4-tube, closed cell sponge neoprene, approximate 3-1/4 inches (79 mm) width, "Type NN Joint Filler" as manufactured by Williams Products, or an approved equal product.

## 2.9 FLASHING MATERIALS

- A. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between 2 layers of glass-fiber cloth.
- B. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.76 mm).
  - 1. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Edge Drip: Stainless-steel, 0.015 inch (0.38 mm) thick.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry:
  - 1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of masonry.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION - GENERAL

- A. Comply with referenced unit masonry standards and other requirements indicated applicable to each type of installation included in project.

- B. Thickness: Build cavity walls and other masonry construction to the full thickness shown.
- C. Cut masonry with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

### 3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of walls, and arises, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (9.5 mm in 6.1 m), nor 1/2 inch in 40 feet (13 mm in 12.2 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6.1 m), nor 1/2 inch in 40 feet (13 mm in 12.2 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (13 mm) maximum.
- B. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm). Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch (3.2 mm). Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch (3.2 mm). Do not vary from collar-joint thickness indicated by more than minus 1/4 inch (6 mm) or plus 3/8 inch (9.5 mm).

### 3.4 LAYING MASONRY WALLS

- A. Carefully layout masonry work before installation to insure proper location of openings, joints, building returns and offsets. Adjust dimensions only when approved, and when required by variations in the masonry unit dimensions.
- B. Provide plumb, true to line work, with courses level and accurately spaced to the vertical dimensions indicated.
- C. In unexposed masonry, deviations from running bond in all vertical joints not to be less than 2 inches (50 mm).
- D. Provide size of any two adjacent masonry units within permitted tolerances so that the difference between the vertical faces not to exceed 1/16 inch (1.5 mm) when used in exposed-to-view walls.
- E. Provide units in exposed-to-view locations free from chipped edges or other imperfections detracting from the appearance of the finished work.
- F. Remove any masonry that is moved or disturbed after laying; clean thoroughly and relay in fresh mortar.
- G. Rake or step back unfinished masonry work; toothing will not be permitted without prior approval.

### 3.5 MORTAR

- A. Mix mortar in accordance with ASTM C 270 for job-mixed mortar or ASTM C 1142 for ready-mixed mortar. Proportion portland cement lime mortar and mix for types of mortar indicated.
- B. Perform hand mixing when permitted, in a tight mortar mixing box. Mixing time not less than required to reproduce results obtained by machine mixing after the required amount of water has been added.
- C. Place mortar in final position within 1-1/2 hours after mixing. Discard mortar not used within the specified time limit.

### 3.6 JOINTS

- A. Tool joints evenly to a dense concave profile, unless noted otherwise, with surface and edges thoroughly compacted and sealed.
- B. Provide average 3/8 inch (9.5 mm) joint thickness, except where indicated elsewhere. Provide a minimum increase or decrease joint thickness to meet indicated wall dimensions, and to avoid cutting, squeezing or opening of joints at ends of runs or lifts.

### 3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.
  - 4. Where new masonry walls abut existing concrete members provide #3 dowels at 16" c.c. Dowels shall be drilled and epoxy set into the existing concrete and extend 8" into the new wall.

### 3.8 CONTROL & EXPANSION JOINTS

- A. Control and Expansion Joints: Locate, space, and construct as indicated, or as recommended by NCMA.
- B. Control Joints in Concrete Masonry: Construct control joints meeting ACI 530.1 requirements, unless otherwise indicated or specified. Use standard stretcher units to provide a continuous unbroken vertical joint, 3/8 inch (9.5 mm) wide, through the entire thickness of the wall. Line one side of the joint with roofing felt. Completely fill core space with mortar; rake joint clean to a minimum depth of 1 inch (25 mm); leave ready for rod backer and sealant. Joint spacing not to exceed 24 feet (7.3 m) on center.

- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

- 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.9 FLASHING

- A. Provide fabric flashing at wall openings, beams, head and sills, grade, building expansion joints, and in all locations where fabric flashing is built into the masonry.
- B. Flashing of Wall Openings and Through-Wall Flashings: Conform, in general, to SMACNA Plates 46 and 47. Extend flashing 4 inches (101 mm) or more beyond edge of lintels and turn up edge on sides and back to form pan and to direct moisture to exterior; lap joints not less than 2 inches (50 mm); embed lap joints in bituminous mastic cement; extend flashing to face of wall. Install metal drip edges beneath fabric flashing at exterior face of wall; stop flashing 1/2 inch (13 mm) back from outside face of wall and adhere flashing to top of metal drip edge.
- C. Build-in flashing in walls, below copings, in expansion joints, and where indicated. Refer to Section 076200 "Sheet Metal Flashing and Trim."
- D. Build-in vertical expansion joint.
- E. Make joints in concealed metal flashing by lock seams or laps, which are mechanically fastened and sealed watertight with bituminous mastic cement. Seal spaces around dowels and all openings in flashings with mastic before covering the flashing with mortar.

### 3.10 LINTELS & BOND BEAMS

- A. Provide lintels at required masonry openings.
- B. Refer to Architectural, Mechanical and Electrical Drawings for openings; provide lintels for all openings.
- C. Unless otherwise noted, provide steel angles and beam lintels for masonry openings, as scheduled on Drawings. Provide hot-dipped galvanized for exterior openings.
- D. Provide block lintels where indicated, made up of 16 inches (406 mm) nominal length bond beam blocks and reinforced as indicated. Match texture of block with adjacent masonry units.
- E. Concrete masonry and precast lintels as shown on Drawings.
- F. Provide minimum of 8 inches (203 mm) bearing, unless noted otherwise, for all lintels at each side of opening.

### 3.11 INSTALLATION OF REINFORCEMENT

- A. Masonry Reinforcement: Install in all bed joints at 16 inches (406 mm) vertical spacing, starting at 16 inches (406 mm) above the first course. Also install reinforcement in the first and second bed joints, 8 inches (203 mm) apart, immediately above lintels of all openings. Extend reinforcement in the second bed joint above all openings two feet beyond jambs. Provide all other reinforcement continuous, except do not pass through vertical masonry control or expansion joints. Lap side rods 6 inches (152 mm) at splices. Place reinforcement to assure a minimum of 5/8 inch (16 mm) mortar cover on the exterior face of the wall and 1/2 inch (13 mm) mortar cover on interior faces.

### 3.12 BUILT-IN WORK

- A. Built-in materials occurring in any type of masonry construction shown and/or specified to be furnished by other Trades. Accurately place all built-in work, securely hold in position, and locate as directed.

### 3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and special inspections indicated below and on Structural Drawings; prepare test reports:
  - 1. Payment for these services will be made by Owner.
  - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- C. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- D. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.
- E. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
- F. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

### 3.14 CUTTING, FITTING AND PATCHING

- A. Cutting and fitting of masonry as required in existing masonry and to meet building dimensions performed by masonry mechanics using masonry saws.
- B. Skillfully perform work with unbroken edges cut plumb and true.
- C. Carefully patch and match original adjacent surfaces in materials and workmanship.

3.15 PROTECTION

- A. Take precautions to protect the finished work from damage by other trades.

3.16 POINTING AND CLEANING

- A. Dry brush masonry walls at the end of each day's work.
- B. Upon completion of the work, rake all holes and defects in exposed mortar joints as required, and then fill with fresh mortar and tool as specified.
- C. After mortar is thoroughly set and cured, dry clean by removing mortar particles with wood paddles, brush and scrapers before wetting the wall.
- D. Clean masonry with stiff brushes, cleaning tools, and clear water. Do not use acid in the cleaning process. Rub joints with a carborundum stone to remove burrs and rough edges.
- E. Abrasive blasting techniques for cleaning will be permitted only when approved in writing by Architect.

END OF SECTION 042000

## SECTION 050300 - HOT DIP GALVANIZING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Hot dip galvanize all permanently exposed structural steel including but not limited to structural steel, columns, beams and metal fabrications.

#### 1.2 QUALITY ASSURANCE

- A. Comply with requirements of Section 014000.
- B. Coating applicator: Company specializing in hot dip galvanizing after fabrication and following the procedures of the Quality Assurance Manual of the American Galvanizers Association.

#### 1.3 SUBMITTALS

- A. Comply with requirements of Section 013300.
- B. Coating applicator's notarized Certificate of Compliance that the hot dip galvanized coating meets or exceeds the specified requirements of ASTM A 123 or A 153.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 016100.
- B. Load and store galvanized articles in accordance with accepted industry standards.

### PART 2 - PRODUCTS

#### 2.1 STEEL MATERIALS

- A. Material for galvanizing to be geometrically suitable for galvanizing as described in ASTM A 384 and A 385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, sheet, fabrications and assemblies.
- B. Material shall be chemically suitable for galvanizing.

#### 2.2 FABRICATION REQUIREMENTS

- A. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's Recommended Details for Galvanized Structures.

- B. Fabrication practices for products shall be in accordance with the applicable portions of ASTM A 143, A 384 and A 385, except as specified herein. Avoid fabrication techniques which could cause distortion or embrittlement of the steel.
- C. The fabricator shall consult with the Architect and hot dip galvanizer regarding potential problems or potential handling problems during the galvanizing process, which may require modification of design before fabrication proceeds.
- D. Remove all welding slag, splatter, anti-splatter compounds, and burrs prior to delivery to the galvanizer.
- E. Provide holes and/or lifting lugs to facilitate handling during the galvanizing.
- F. Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil pint and other deleterious material prior to fabrication.
- G. Remove by blast cleaning or other methods, surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation.
- H. Wherever possible, use slip joints to minimize field welding of material.

### PART 3 - EXECUTION

#### 3.1 SURFACE PREPARATION

- A. Pre-clean steelwork in accordance with accepted methods to produce an acceptable surface for quality hot dip galvanizing.

#### 3.2 COATING APPLICATION

- A. Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with ASTM A 123.
- B. Galvanize bolts, nuts and washer and iron and steel hardware components in accordance with ASTM A 153.
- C. Safeguard products against steel embrittlement in conformance with ASTM A 143.
- D. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

#### 3.3 COATING REQUIREMENTS

- A. Coating weight: Conform to paragraph 5.1 of ASTM A 123 or Table 1 of ASTM A 153 or requirements indicated in individual sections of this Project Manual, as appropriate. Special thickness requirements shall refer to ASTM A 123 3.1.7 and be specified to the minimum average mils of thickness.

- B. Surface finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

#### 3.4 TESTS

- A. Inspection and testing of hot dip galvanized coatings shall be done under the guidelines provided in the AGA publication Inspection of Products Hot Dip Galvanized after Fabrication.
- B. Include visual examination and tests in accordance with ASTM A 123 or A 153 as applicable to determine the thickness of the zinc coating on the metal surface.

#### 3.5 REPAIR OF DAMAGE COATING

- A. The maximum area to be repaired is defined in accordance with ASTM A 123 Section 4.6.
- B. Repair areas damaged by welding, flame cutting or during handling, transport or erection, by one of the approved methods in accordance with ASTM A 780 whenever damage exceeds 3/16" in width. Minimum width thickness requirement for the repair are those described in ASTM A 123 Section 4.6.

END OF SECTION 050300

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Principal work in this Section:

1. Requirements: Provide structural steel, complete, in accordance with Contract Documents.

B. Related work in other Sections:

1. Section 033000 – Cast-In-Place Concrete. Placing embedded items and other anchor bolts.
2. Section 036000 – Grout.
3. Section 053000 – Steel Decking.
4. Section 055000 – Metal Fabrication.
5. Section 050300 – Hot Dip Galvanizing.
6. Section 051213 – Arch. Exposed Structural Steel Framing.

#### 1.2 QUALITY ASSURANCE

- A. Quality Assurance: Prepare and execute full and complete program of Quality Assurance including evaluation, material reports, sampling, appropriate types and quantities of testing, and detailed fabrication and erection drawings which provide no opportunity to complete unsatisfactory steel work. Perform retesting or evaluations by Quality Control Personnel due to deficient work and similar work at no additional cost to Owner.

- B. Quality Control: Steel work is subject to evaluation and tests in shop and field by others. Evaluations and testing undertaken by others is strictly for random evaluation. Extent, duration and amount of testing and evaluation are entirely at discretion of others. Use of testing services, execution of testing or evaluation services by others shall in no way relieve sole responsibility to furnish materials and construction in full compliance with Contract Documents.

- C. Testing Agency: Owner will engage, at his expense, certified Testing Agency to inspect materials, fabrication, high strength bolted connections and welds, to perform test specified, and to submit reports to Architect and Local Building Authority.

1. Testing Agency will be responsible for conducting and interpreting tests, will state in reports whether test results comply with Contract Documents, will specifically note deviations there from, and will indicate corrective measures required and taken.
2. Testing Agency inspectors shall keep daily records of work inspected and its disposition in accordance with form prescribed in "Structural Welding Code."
3. Provide Testing Agency with the following:
  - a. Shop and erection drawings.
  - b. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
  - c. Information as to time and place of rollings and shipment of material to shop.

- d. Access to places where material is being fabricated or produced.
    - e. Representative sample pieces requested for testing.
    - f. Full and ample means and assistance for testing.
    - g. Proper facilities, including scaffolding, temporary work platforms and hoisting facilities for inspection of Work in field.
  - 4. Contractor shall provide and pay for corrective measures, including additional and more complete testing.
  - 5. Architect and Testing Agency may observe structural steel at plant before shipment; however, Architect reserves the right to reject material, at any time before final acceptance which does not conform to requirements of Contract Documents.
  - 6. Unless more stringent requirements are stated elsewhere, be responsible for extra cost due to:
    - a. Inspections and testing required off-site greater than 75 miles from the job site.
    - b. Inspections and testing required at more than one off-site location.
    - c. Overtime inspections and testing incurred without Owner's Approval or for acceleration of work for Contractor's convenience.
- D. Source Quality Control:
- 1. General: Material delivered with certificates classified as identifiable; without certificates classified as unidentifiable. High strength steels shall be suitably identified on each piece and reviewed by the testing Agency in comparison to mill test certificates.
  - 2. Testing of Unidentifiable Material: By testing agency; paid for by Contractor.
  - 3. General: Test material not identifiable by heat number and mill test or other acceptable manufacturer's identification per ASTM A370 as follows:
    - a. Structural shapes and plates: From coupons taken from material; one tensile test and one bend test per five tons of each shape.
    - b. High Strength Bolts: Each lot of 100 bolts; tensile tests on two bolts in full size and one tensile test on half-inch diameter machined specimen.
- E. Bolted connections shall be inspected by Testing Agency in accordance with AISC Specification for "Structural Joints using ASTM A325 and A490 Bolts."
- 1. All bolts shall be inspected as "fully-tensioned" unless specifically identified on the drawings that the bolt may be only tightened to "snug-tight" condition.
- F. Welding shall be inspected and tested by Testing Agency during fabrication (unless the shop is approved by the engineer and building official per section 1701.7 of the code) and erection of structural steel in accordance with AWS as follows:
- 1. Certify welders and make inspections and tests as required. Record types and locations of defects found in Work, and measures required and performed to correct such defects.
  - 2. In addition to visual inspection of welds, magnetic particle and ultrasonic inspection shall be made. Magnetic particle inspection shall be made on root pass and finish weld.
  - 3. Method of magnetic particle inspection shall be in accordance with ASTM E109. Cracks or zones of incomplete fusion or penetration not acceptable. Equipment shall be capable of locating cracking below surface of welds. Check a minimum of 15% of all fillet welds distributed throughout the work and 25% of all fillet welds of built-up sections. 100% of fillet welds for moment resisting frames and braced frames shall be magnetic particle tested.

4. Perform ultrasonic inspection in accordance with AWS D1.1. 100% of all partial and complete penetration shop and field welds shall be ultrasonically tested.
  5. All welding inspection and testing of moment resisting frame welds shall be performed by an experienced deputy welding inspector qualified at NDT Level II for ultrasonic and magnetic particle testing. In addition, inspectors shall have supplemental qualifications as defined in FEMA 353 Appendices E and F.
- G. Testing Agency shall inspect structural steel for laminations or other discontinuities by ultrasonic methods.
1. Ultrasonic testing shall be performed on all sections in ASTM A6 Groups 4 and 5 and in Group 3 where flange or web thickness exceeds 1-1/2". In addition, all plates exceeding 2" in thickness shall be tested.
  2. Testing shall be performed in accordance with ASTM A435 for plates and ASTM A898 for rolled sections.
  3. The test area shall consist of a column flange zone extending at least 3" above and below each beam flange CPJ connection. Column webs shall be similarly tested for weak axis connections. Similar zones for plates in built-up sections and base plates shall also be tested. Tests shall be performed prior to fabrication and after final welding.
  4. For plates any discontinuity causing total loss of back reflection that cannot be contained within a circle 3" in diameter or 1/2 the plate thickness, whichever is greater, shall be rejected.
  5. For rolled shapes ASTM A898 Level I criteria are applicable.
- H. Each bolting crew and welder shall be assigned identifying symbol or mark. Shop and field connections shall be identified so that inspector can refer back to crew or person making connection.
1. Testing Agency shall confirm qualification of welders, AWS procedures are followed, Welding equipment is used per manufacturer's recommendations, preheating is properly used, proper use of runout plates, jigs, and fit-up, and structural steel complies with specific dimensional standards.
- I. Where inspections reveal defects, extent of inspection will be increased as necessary to assure that full extent of defects in joint has been found and to assure that same defects are not present in welds made on similar parts or under similar circumstances.

### 1.3 REFERENCES

- A. Except as modified by governing codes and by Contract Documents, comply with applicable provisions and recommendations of the following:
1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
  2. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
  3. AWS "Structural Steel Welding Code."
  4. Industrial Fastener Institute "Handbook on Bolt, Nut and Rivet Standards."
  5. SSPC "Steel Structures Painting Manual, Volume 2 Systems and Specifications."
  6. "Specifications for Structural Joints Using ASTM A325 or A490 Bolts," approved by research council on Riveted and Bolted Structural Joints of the Engineering Foundation
  7. ASTM A6 "General Requirements for delivery of Braced Steel Plates, Steel Piling and bars for Structural Use."

#### 1.4 SUBMITTALS

- A. Product Data: Include laboratory test reports and such other data required to show compliance with Contract Documents. Indicate by transmittal form that copy of each applicable instruction has been distributed to each Installer or Fabricator.
1. Structural Steel: (each type) including certified copies of mill reports covering chemical and physical properties, country and rolling mill of origin, and including statement indicating that steel is new billet steel and that testing has been performed in accordance with ASTM standards. Correlate individual heat numbers with each specified section and location. Retest steel if test results are unsatisfactory.
  2. High Strength Bolts: (each type) including nuts and washers. Provide test reports for each production lot indicating proof load, tensile strength (wedge test), and hardness. Provide certified copies of mill reports covering chemical and physical properties, country and rolling mill of origin, and including statement indicating that steel is new billet steel and that testing has been performed in accordance with ASTM Standards. Retest bolts if test are unsatisfactory.
  3. Welding Electrodes: (each type).
  4. Shop Coat Primer paint: Field touch-up paint; manufacturer's specifications, performance data, and application instructions.
  5. Shop applied shear stud connectors.
  6. Anchor Bolts.
- B. Shop Drawings: Submit Shop Drawings for the following items in accordance with Division 1 prepared under supervision of a Registered Professional Engineer with current registration in State of California, including complete details and schedules, all shop and erection details for fabrication and assembly, all connections and holes, bolts and welds. All welds, both shop and field shall be indicated by the AWS Standard Welding Symbols.
1. Provide shop fabrication drawings, which show details, schedules and other information necessary for fabrication of each member and for shop assembly of members of structure.
  2. Indicate type, size, location and extent of welds and bolts. Clearly distinguish between shop and field bolts and welds. Indicate member splices and plate splices on shop drawings, for both shop and field. Indicate AISC pre-qualified welds by designation that indicates root and bevel angles for partial and full penetration welds as well as the specific weld process and the fabricator's specific identification for the welding procedure specification, which includes preheating and other requirements.
  3. Provide field assembly and erection drawings which show field assembly prior to erection and after erection. Indicate details, schedules and diagrams showing field assembly. Procedures shall indicate intermediate surveys, cambers, member over length, and allowances for temperature. Include setting drawings and templates for column base plates.
  4. Provide written procedure of each item and welding sequence including preheating and cool down at each joint to minimize effect of weld shrinkage residual stress, and to maintain erection tolerances.
  5. Identify each type and class of welding electrodes.
  6. Non-domestic fabrication shall be in accordance with shop drawings prepared domestically by structural steel detailers commonly providing services to domestic fabricators. Form and character of shop drawings shall be to Architect's satisfaction, be checked and complete. Reuse of the Contract Documents is not permitted.

- C. Calculations: Submit calculations for connections proposed as substitutions for indicated connections, and for connections where design criteria and loads are indicated. Submit calculations bearing seal of Professional Engineer registered in state where project is located.
- D. Surveys: Submit certified surveys by Contractor's registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and showing elevations and locations for major members, with particular notation of discrepancies between actual installation and Contract Documents, signed by Contractor, Erector and Surveyor.
- E. Testing and Inspection Reports.
- F. Welders Certifications, Welding Procedure Specifications, etc.
- G. Prior to fabrication, prepare and submit to Testing Agency and Architect written Quality Assurance Program including material identification, welder certifications/ re-certifications, welding procedure specifications, etc. as well as all procedures for shop fabrication and field connections for steel work. These procedures shall indicate Fabricator's quality control measures, monitoring and repair procedures. Weld details and procedures shall be in accordance with AISC and AWS pre-qualified details, procedures and standards, as well as, particularly pre-qualified welding procedures and particularly pre-qualified welder certifications for each complete penetration shop and field welding process and detail.

#### 1.5 STORAGE AND HANDLING

- A. Comply with the requirements of Division 1.
- B. Plan method and sequence to avoid delay or damage to steel work or work of other trades.
- C. Be responsible for steel shipment to site and storage of fabricated steel at job site. Material stored at job site shall not exceed design loads on structures so that members will not be distorted or otherwise damaged; and shall be protected against corrosion or deterioration.
- D. Stack materials out of mud and dirt and provide for proper drainage. Protect from damage or soiling by adjacent construction operations.
- E. Provide temporary shoring, bracing the guy lines to adequately protect all persons and property and to ensure proper alignment.

#### 1.6 ALTERNATIVES

- A. Substitutions for member sizes, type(s) of steel, connection details or other modifications proposed by Contractor will be considered by Architect only under following conditions:
  - 1. That request has been made and accepted prior to first submission of any shop drawings. The initial submittal of erection plans shall record the substitution of any members or material grades.
  - 2. That there is substantial cost advantage and time advantage to Owner; and that proposed revision is necessary to obtain required materials at proper time to accomplish work in time scheduled. Substitutions proposed due to lack of timely ordering of material are not acceptable.

3. That sufficient sketches, engineering calculations and other data have been submitted to facilitate Architect checking, including the dimensions and weight of both the original and substitute members, connections, and the relationship of the substitute member, or modification of details to adjacent work.
  4. The cost reduction and savings in time to complete work shall also be submitted. The substitutions shall not affect the architectural design and be equal or greater than the original member in structural characteristics, and at no additional cost to the owner.
- B. Substitution of higher yield strength steels is not acceptable for moment frame and braced frame brace members in the lateral load resisting system.
- C. Substitution of higher yield strength steels or Dual Certified steels may be acceptable for other members if found acceptable under the provisions of paragraph A, and the member size is not changed.
- D. Alternative column splice locations or alternatives to provide a single size column where a spliced column is shown, will probably not be acceptable substitutions, particularly for columns in the lateral loading resisting system.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Structural Steel:
1. Structural steel for rolled wide flange shapes shall comply with provision of ASTM Specifications appropriate for grades indicated. Provide ASTM A992 steel, unless noted otherwise.
  2. Structural steel plates and bars shall be ASTM A572-50 as indicated on the drawings.
  3. Structural steel angles and channels shall be ASTM A36 or ASTM A572-50 as indicated on the drawings.
  4. Structural steel tubes shall be ASTM A500, grade B (46 ksi) as indicated on the drawings.
  5. Structural steel pipes shall be ASTM A53 type E or S, grade B. as indicated on the drawings. (U.N.O. on the drawings)
  6. Dimensional Standards: ASTM A6; welded shapes per dimensional standards of mill rolled sections.
  7. Quality: Sound, free from loose mill scale, cracks, laminations and slag inclusions.
  8. Column sections and plates thicker than 1-1/2" inches shall be fine grained killed steel.
- B. Welding Electrodes: Comply with provisions of AWS "Structural Welding Code" and Specification A5.1, A5.5, A5.17, A5.18, A5.20 and A5.29.
- C. High strength bolts and high strength bearing bolts, nuts and washers: Comply with provisions of:
1. ASTM A325 or A490, as noted.
  2. AISC Specification for "Assembly of Structural Joints Using High Strength Bolts."
  3. All bolts in slip critical frame connections shall be hex head without beak-off splines, etc. unless direct tension indicating washers are provided at all slip critical connections. Use of break-off spline bolts in non-frame, gravity connections is acceptable.

- D. Welded Studs: By Tru-Weld, Nelson Stud Welding Div. of Gregory Industries, and Stud Welding and Rebar Splicing Division of Erico Products, Inc. complying with the following.
1. Standard steel studs for welding by automatically timed stud-welding equipment, furnished complete with an arc shield (ferrule) of heat-resistant ceramic for all studs and, for studs 5/16 in. diameter or larger, a deoxidizing and arc stabilizing flux; not painted, galvanized, or cadmium-plated prior to welding and all finished by cold-heading, cold-rolling or machining.
  2. Provide studs of uniform quality and condition, free of injurious laps, fins, seams, cracks, twists, bends not indicated, rust, rust pits, scale, oil and other injurious defects or substances.
  3. Steel shall be Grade C-1015, C-1017 or C-1020, cold-drawn, conforming to ASTM A 108 and having minimum 60,000 psi tensile strength with 20% elongation in 2 in. and 50% area reduction.
- E. Paint:
1. Paint shall be confirmed to meet all Code requirements.
  2. Prime Paint: Tnemec's V10 Red Primer.
  3. Hot dip galvanize all steel work permanently exposed to the exterior including bolts, nuts, washers, etc.
- F. Miscellaneous Materials:
1. Provide miscellaneous materials or accessories as indicated or required for good construction practice.
  2. Provide supplemental structural steel support framing for metal deck where normal deck bearing is precluded by column flange plates or other framing members and around minor floor openings where indicated.
  3. High Strength Anchor Bolts – ASTM A354 Gr BD or ASTM A449 as indicated on the drawings.

## 2.2 FABRICATION

- A. General: Fabricate per AISC Specifications. Properly mark materials where field assembly requires. Sequence material shipments to expedite erection and minimize field handling.
- B. Planning and milling:
1. Mill bearing surfaces to true planes. Mill ends of columns perpendicular to centerline axis connected mid depth points at ends of member. Milled surfaces shall be completely assembled or welded before milling. Cut and fit column and bearing stiffeners to give full bearing over cross section.
  2. Column Base Plates:
    - a. From 2 inches through 4 inches thickness: Straighten by pressing.
    - b. Over 4 inches thickness: Plane top for column bearing; Plane bottom when bearing on steel.
- C. Holes, Cutout and Filling: Provide where indicated for other trades. No additional holes, cutouts, or fittings permitted without written permission.

- D. Camber: Fabricate beams, girders and assemblies with natural camber upward, unless otherwise indicated.
- E. Connections shall be as indicated. Alternate connections may be required due to erection or other conditions. Connections for shop or field connections or splicing shall be shown on shop fabrication drawings for review prior to fabrication.
- F. Detail connections by fabricator based on information indicated and considerations of shipment and erection. Detailing shall be performed using rational engineering design and standard practice in accordance with AISC. Details indicated on Drawings may be subjected to minor changes during detailing.
- G. No combination of bolts and welds shall be used for stress transmission in same faying face of connections.
- H. Automatic or semi-automatic welding may be used per AWS procedure.
- I. Welding, filler metal, welding techniques, qualified welders, and procedures shall be in accordance with AISC Specification for "Design, Fabrication and Erection of Structural Steel for Buildings," and AWS "Structural Welding Code" and "Filler Metal Specifications."
- J. Clean steel in areas where paintings, welding, bolting, stud welding, metal deck welding will be performed.
- K. Welding processes other than shielded metal arc and submerged arc may be used provided procedure qualification tests in accordance with American Welding Society are made for intended application of such process. Testing and Submittal for test reports shall be submitted with proposed locations of use for review prior to Shop Drawings Submittal and shall have been identified during bidding and reviewed.
- L. Built-up sections assembled by welding shall be free of warping and axes shall have alignment within specified tolerances.
- M. Welds not specified shall be continuous fillet weld, using not less than minimum size and specified by AWS.
- N. Welding sequences shall be such to reduce residual stresses due to welding to minimum value.
- O. Toughness and notch sensitivity of steel shall be considered in formation of welding procedures to prevent brittle and premature fracture.
  - 1. Welding procedures for complete penetration welds shall include sequences for placing each weld bead as well as pre-heat and post-heating, electrode selection, etc.
  - 2. Welding procedures shall be written and shall be prepared by a qualified welding engineer.
  - 3. Welding procedures shall account for all fabrication orientations and welding conditions, material grades, mill certifications, member sizes, etc.
- P. Detail and design welded connections to minimize accumulation and concentration of through-thickness strains due to weld shrinkage.
- Q. Detailing of copes/access holes at full penetration welds shall follow FEMA 350 Fig. 3-5.

1. The web cope details shall be compatible with the weld process. The bottom flange web cope shall permit as much welding as possible under the cope and beyond the web.
  2. The cope details shall be developed with the consultation of the qualified welding engineer who developed with the consultation of the qualified welding engineer who develops the written welding procedure specification for the welds.
- R. Repairs: Remove defects, re-weld, and grind welds flush; method of repairs shall be acceptable to Testing Laboratory. In lieu of repairs, materials with defects may be replaced with new at Contractor's option and expense.

## 2.3 SHOP PAINTING

- A. General: Do not paint when ambient temperature is below 40 degrees Fahrenheit. Paint in dry weather or under cover. Apply paint by brush or spray over dust free surface per manufacturer's directions. Do not thin paint in excess of manufacturer's recommendations. Allow paint to dry before handling the shipment of structural steel.
- B. Shop-coat structural steel except the following:
1. Members to be incased in concrete.
  2. Contact surfaces of welded connections and areas within 2 inches of field welds.
  3. Contact surfaces of high-strength bolted connections.
  4. Surface receiving sprayed-on fireproofing or galvanizing.
- C. Prime Paint:
1. Surface Preparation: Clean surfaces of loose mill scale, dirt, rust and other foreign matter by use of suitable tools; hand tool cleaner per SSPC-3, commercial blast cleaning per SSPC SP-6 for steel exposed to the elements. Remove oil and grease with cleaners per SSPC SP-1.
  2. Application: Apply one coat to dry film thickness not less than 4.0 mils.
  3. Zinc Rich Primer Application: Apply one coat to dry film thickness not less than 4.0mils.
- D. Machine Finished Surfaces: Carefully protect against corrosion with coat of white lead and tallow or similar protection; apply per AISC requirements prior to shipments.
- E. Concealed Surfaces: Paint parts inaccessible after assembly or erection with two coats of primer paint, or different colors.
- F. Field Painting:
1. Field paint bolt heads and nuts, welds, abrasions, and unpainted steel work.
  2. Field paint with primer paint.
  3. Clean completed steel work of foreign materials.
- G. Unpainted Surfaces: Remove oil and grease with solvent cleaners; remove dirt and other foreign material by sweeping with wire brushes.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examination: Examine substrates, adjoining construction, and conditions under which Work is to be installed. Do not proceed with Work until satisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Field Measurements: Establish permanent benchmarks and verify elevations of concrete on which structural steel is to be placed and anchor bolt locations and projections using licensed Professional Engineer registered in State where Project is located. Report discrepancies to Architect before proceeding with Work. Perform remedial work in the shop prior to shipment to the field.

### 3.3 ERECTION

- A. Be responsible for accurate setting and leveling of bearing plates. Furnish templates for accurate setting of anchor bolts. Bearing plates shall be leveled on steel wedges or shims or as otherwise detailed. Grout bearing plates as specified in Section 03600-Grout.
- B. Notify grout manufacturer at least twenty-four hours prior to grouting. Do no grouting without grout manufacturer's representative present at site, for initial test plate and initial production work. Train workmen in preparation, placing curing, etc. to the satisfaction of inspector.
- C. Erect building frame true and level. Erect columns in manner to allow for shrinkage of girders after welding. Check plumbness after erection of each tier. Maintain structural stability of frame during erection; provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

### 3.4 ERECTION TOLERANCES

- A. Be responsible for correct fitting of structural members and for elevation and alignment of finished structure per AISC Code of Standard Practice (minimum). Be responsible for adjustments to steel work because of discrepancies in elevations and alignments. Furnish shim plates or developed fills where required to obtain fit and alignment.
- B. Unless noted otherwise, plumb structure to accuracy of 1 to 1000, but not to exceed ¼ inch per two-story tier. Overall vertical plumbness to be better than 1 to 500, but not to exceed ½ inch maximum. Level horizontal members to accuracy of 1 to 1000 not to exceed +/- 1/4 inch at columns.
- C. Measurements relating to above shall be on theoretical centerline of members.

### 3.5 CONNECTIONS

- A. Do no welding or bolting until as much of structure as will be stiffened by welding or bolting has been properly aligned.

- B. Do not use drift pins to enlarge unfair holes in main material. Ream holes that must be enlarged to admit bolts. Use of burned holes for bolted connections not permitted and main structural members with burned holes will be rejected. Drifting may be used to align unfair holes in secondary bracing members only, when acceptable to Architect. Maintain minimum edge distances at enlarged holes.
- C. When high strength bolts or high strength bearing bolts are used, AISC Specifications shall apply including values as noted therein, and installation shall be to full torques (not snug –tight) be either "turn of the nut tightening" or with torque wrenches. In using manual torque wrenches, required torque can be read from wrench dial. Care should be taken that wrench is properly calibrated. Nuts shall be in motion when torque is measured. In using power wrenches, follow recommendations of manufacturer. Calibrate manual and power torque wrenches at least once daily and for each lot of bolts.
- D. Alternative bolting may be accomplished by utilizing Coronet Load Indicator washers as "direct tension indicators" in accordance with current specifications as indicated in AISC, UBC-ICBO Report No. 2885, and manufacturer's recommendations whichever are more stringent. Proposers shall indicate their cost with and without use of indicators for bolting and for use on friction bolted connections only.
- E. Pre-qualified welders using pre-qualified welding procedures shall perform all field welding. All field welding of moment resisting frame complete penetration welds of beam flanges to columns and complete penetration column splices shall be performed by particularly pre-qualified welders and pre-qualified welding procedures. Pre-qualification of frame welders shall be by procedures and criteria as described in FEMA 353 Appendix B. Equipment, electrodes and procedures shall be identical to those used in the field production welds. Weld deposition rates of field production welds shall not exceed those of the successfully performed test. The test coupon shall be placed at an elevation and orientation such that the welder works in a position that replicates field conditions. Each shall frame welder shall successfully complete one beam-column coupon and one column splice coupon prior to being permitted to perform field production welds.
  - 1. Welding shall proceed only based on written procedure specifications prepared by a qualified welding engineer.
  - 2. The written procedure specifications shall account for field conditions, material grades, ember sizes, etc.
  - 3. The written procedure specifications shall include specific diagrams of different job conditions showing the sequence of placements of weld beads, extension/ backup/ runoff material, locations of tack welds, start/ stop locations, etc. as well as cleaning, grinding etc. between passes.
  - 4. The procedure shall indicate the sequence for progression of welding within the building as a whole, within frame lines and within individual connections. Sequences shall minimize locked in tensile stresses due to weld shrinkage to the greatest extent possible.
  - 5. The written procedure specification shall indicate pre-heat and post-heat requirements based on the full chemical composition of the abutting steels, field conditions, electrode and weld process, etc. The procedure shall indicate the locations of measurement of temperatures and frequency of measurements.
  - 6. The written procedure specification shall indicate that the bottom flange welds be built up to full size by welding alternately in a uniform manner on both sides of the web. Stops and starts shall be avoided below the web and weld shall proceed under the web cope and beyond as much as possible.

7. The written procedure specification shall indicate removal of extension/ backup/ runoff materials attendant with the top and bottom flange connections as well as gouging the weld to remove any incomplete penetration, slag, etc. of the root passes and reinforcing the bottom of the weld.
8. The written procedure shall indicate the field fit up requirements and tolerances of the root opening.

### 3.6 SURVEY

- A. Make accurate survey of actual locations and cambers of steel members immediately upon completion of erection of steel of entire structure and promptly submit same to Architect. Should locations vary beyond allowable tolerances, take necessary corrective measures and modify details and/ or procedures as required.
- B. Survey information shall have sufficient actual elevations of steel and cambers to allow other trades to correlate with expected deflections in setting screeds and verifying metal deck gauge.

END OF SECTION 051200

## SECTION 052000 - METAL JOISTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Open web steel joists.
2. Bracing and bridging.
3. Supplementary parts and components, such as clips, fasteners, supplementary framing, and other miscellaneous accessories required for a complete installation.

B. Related work:

1. Division 3 for grouting bearing plates.
2. Division 5 for structural steel.

#### 1.2 SYSTEM DESCRIPTION

A. Open web steel joist assemblies are not fully detailed on the Drawings, which are diagrammatic and show basic dimensions, alignment and profiles of members and their relationship to other building components.

B. Layout and joist sizes indicated are based on manufacturer's published span tables.

C. Design requirements:

1. Engineer, fabricate, assemble and install joists to meet or exceed the criteria indicated and specified, to conform to the profiles indicated and to other requirements of the Contract Documents and to satisfy the requirements of the authorities having jurisdiction.
2. If required by the authorities having jurisdiction, prepare and submit reviewed shop drawings, specifications, calculations and any other supporting data required for review and approval, and pay fees incurred, prior to beginning installation.
3. Engineering calculations for these assemblies shall bear the signature and seal of a California-licensed professional engineer.

D. Performance requirements:

1. Dead and live loads:

- a. Provide assemblies, including anchorage, that accommodate the supporting structure deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
- b. Limit deflection to  $L/360$  under dead and live loads.

2. Seismic loads: Provide assemblies, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction.

### 1.3 SUBMITTALS

#### A. Data:

1. Product data: Submit manufacturer's product data, specifications, typical installation details and other data as necessary to demonstrate compliance with the specified requirements.
2. Design data: Submit engineering calculations demonstrating compliance with the requirements of the authorities having jurisdiction for manufacturer-engineered assemblies.
  - a. Calculations shall be legible and shall incorporate sufficient cross-references to shop drawings to make calculations readily understandable and reviewable.
  - b. Test reports are not an acceptable substitute for calculations.
  - c. Calculations shall include:
    - 1) Yield Strength of material and loads for which joists were designed.
    - 2) Web, chord, end panel, bearing seat, bridging and weld design, including splices.
    - 3) Joist camber
    - 4) Seal and signature of design engineer.

#### B. Shop drawings

1. Submit large scale, dimensioned drawings showing, member profiles, materials, member sizes, dimensions and hardware.
2. Include complete joist plan layout with each joist cross-referenced to the structural calculations.
  - a. Show location and spacing of joists by identification marks.
  - b. Indicate design loading of joists and allowable stress increases, camber and permanent bracing/bridging
3. Identify welds by AWS welding symbols.
4. Show connections to adjacent construction, including details of the following:
  - a. End anchorages, including minimum bearing requirements.
  - b. Bottom chord anchorage, including locations of connections.
  - c. Shop splices.
  - d. Spacing and number of bridging rows.
  - e. Bridging-to-joist connections and connections of bridging lines terminating at walls or beams.
  - f. Accessories required for uplift and their locations.
5. Furnish isometric drawings for conditions too difficult to illustrate in 2 dimensions.
6. Coordinate the shop drawings with the work of other trades that are part of, or will be incorporated into, the work of this section. Indicate work to be performed by other trades, including adjacent and abutting materials to which this work is to be secured.

#### C. Certifications: Submit letter from joist manufacturer stating that joist design, materials, and workmanship meet or exceed the specified requirements.

- D. Test reports: Testing agency shall submit inspection reports to the Architect, stating in each report whether or not fabrication is in conformity with requirements of shop drawings, Contract Drawings and Specifications.
1. Deviations from shop drawings, Contract Drawings and Specifications, if any, shall be expressly noted.
  2. Results of the performance load test called for hereinbefore shall be included with the appropriate inspection report.

#### 1.4 QUALITY ASSURANCE

- A. Uniformity: Obtain joists used for the Project from the same manufacturer.
- B. Fabricator/installer's qualifications:
1. Firm and individuals with a minimum of 5 consecutive years experience in the design, fabrication and installation of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
  2. Obtain joists only from a manufacturer who will send a qualified technical representative to the Project site before covering the work of this section to review installation.
- C. Welder's qualifications: Qualify welding operators and welding procedures in compliance with AWS "Qualification" requirements of AWS D1.1 for steel.
1. Verify welders to be employed in this work have satisfactorily passed AWS qualification tests and are current in their certification.
  2. If re-certification is required, retesting will be Contractor's responsibility.
- D. Testing agency qualifications:
1. Employ an independent testing agency acceptable to authorities having jurisdiction, qualified to conduct the testing indicated.
  2. Personnel conducting tests shall be qualified as required by the authorities having jurisdiction.

#### 1.5 HANDLING

- A. Delivery: Deliver materials to project site in original protective wrappings, clearly labeled with manufacturer's identification labels intact and legible, indicating manufacturer's name, type, source of product and date of manufacture.
- B. Storage: Store joists as shipped, in original wrappers, upright and off the ground on support blocks as recommended by the manufacturer.
- C. Handling:
1. Procedure: In accordance with "Handling and Erection of Steel Joists and Joist Girders" by the Steel Joist Institute (SJI).
  2. Handle products to avoid bending, deformation or damage. Do not dump, drop, or throw.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Joists:

1. Steel plates, shapes, and bars: ASTM A 36.
2. Provide joist series indicated with ceiling extensions on all joists, unless otherwise indicated.

#### B. Miscellaneous items:

1. Provide bridging of size(s) and shape(s) required by design conditions, and space accordingly. Use diagonal bridging for all floor construction.
2. Provide headers, bearing plates, anchors, clips, and other accessories required for a complete installation.

#### C. Paint: For steel joists scheduled to receive a high-performance coating: As specified in Section 09905.

### 2.2 FABRICATION

#### A. Comply with AISC for dimensional tolerances.

#### B. Reinforce joists for concentrated loads occurring between panel points, as detailed.

#### C. Welding: Qualify joint welding procedures by tests as specified in AWS D1.1, Part B, for welded connections.

1. Pre-qualified welding procedures conforming to AWS D1.1, Sections 2, 3, 4, and 8, shall be deemed pre-qualified and exempt from qualification tests.
2. Joint welding procedures and qualification tests shall be prepared by the joist manufacturer written welding procedures shall be made available to testing agency for use or examination.

#### D. Continuously weld shop and field connections in compliance with AWS D1.1, Structural Welding Code – Steel, unless bolted connections are specifically shown.

#### E. Visually inspect welds prior to priming joists. Welds shall be deemed acceptable if, by testing agency's visual inspection, welds meet or exceed the following standards for quality:

1. Acceptance standards for quality of welds on joists welded in compliance with SJI standards:
  - a. Weld has no cracks.
  - b. Through fusion exists between adjacent layers of weld metal and between weld metal and base metal.
  - c. Unfilled weld craters may occur at end of welds, but shall not be included in design length of welds.
  - d. Undercuts shall not exceed 1/16-inch, provided they are oriented parallel to the lines of principal stress.

- e. Sum of surface (piping) porosity diameters shall not exceed 1/16-inch in any 1 inch of design weld length for fillet welds and partial penetration groove welds. Complete joint penetration groove joints transverse to the direction of computed tensile strength shall show no signs of visible piping porosity.
  - f. Weld profiles for fillet welds may be slightly convex or concave and free from excessive overlap.
  - g. Flare-bevel groove welds shall be filled flush to solid section of bar and free from excessive overlap.
2. Acceptance standards for quality of welds on joists welded in compliance with AWS D1.1:
- a. Welds shall meet weld quality standards specified in AWS D1.1, Section 8.15.
  - b. Provide size, length, and type of welds as specified on shop drawings.
- F. Repair unacceptable welds in compliance with repair procedures of AWS D1.1, Section 3.

## 2.3 FINISHES

- A. Shop priming: Do not prime joists until they have been inspected, including all welds, by the testing agency.
- B. Clean surfaces of loose mill scale, rust, welding slag, and other foreign materials prior to painting.
- C. Apply paint in minimum one-mil DFT coats by spraying or dipping to produce a finish coat free from excessive drips, sags, or runs.
- D. Do not stack or bundle joists until paint is dry.

## 2.4 SOURCE QUALITY CONTROL

- A. Performance testing: Performance load tests are required of joist fabricator where any applicable design feature is not specifically covered by SJI specifications, including joists designed with sloped end bearing (slope exceeding 1/2-inch in 12 inches) and joists with non-parallel chords. Joists shall be considered as passing the load test if permanent deflection does not exceed 20 percent of total deflection as described below.
  - 1. Testing laboratory shall select 2 joists at random, during fabrication, for load testing.
  - 2. Joists shall be mocked-up in test assembly as they are to be erected in structure, except joists that are sloped in structure may be tested in a horizontal plane with test supports sloped the same as joist and bearing seats.
  - 3. Joist shall have bridging and top decking applied. Bridging shall terminate at fixed supports as used in structure.
  - 4. End bearing seats shall be connected to seat supports as detailed in structure.
  - 5. Total test load shall consist of dead load plus 1.65 times design live load.
  - 6. Test load shall be applied uniformly distributed in 2 increments:
    - a. A dead load equal to specified dead load shall be applied (weight of test panel, including joist, is included in dead load). Additional load shall be applied to equal specified design dead load. Zero reference measurements, for deflection, are to be made after dead load is in place.

- b. Additional load shall be applied as required to equal 1.65 times the live load of each joist. Design live load shall be live load indicated on structural drawings.
  - 7. Total test load shall remain in place for 1 hour. Deflection measurement at midspan, for both joists, shall then be recorded. Measured deflection is total deflection.
    - a. Test live load shall then be removed, but dead load shall remain in place.
    - b. Deflection measurement at midspan of each joist shall be recorded. This measured deflection will be the permanent deflection referred to above.
- B. Fabricator's inspection: The fabricator shall inspect joists to ensure fabrication is in compliance with Contract Drawings and Specifications, the shop drawings and the following.
  - 1. Maintain a quality control manual containing fabrication tolerances (sweep, camber, depth, length, locations of components, tolerances, etc.). Manual shall be made available to testing agency for its review and use.
  - 2. At suitable intervals, observe joint preparation assembly practices, welding techniques, and performance of welding to determine that welding work is being performed in compliance with written welding procedures.
    - a. Visually inspect welds to determine that size, length, and location are in compliance with shop drawings and details of welded connections.
    - b. Visually inspect welds to determine that weld quality is in compliance with specified requirements.
  - 3. Randomly check joists for overall length, depth, camber, sweep, size of components, locations, and materials, etc. to determine that dimensions conform to tolerances specified herein and with fabricator's quality control manual.
  - 4. Visually inspect shop-priming operations to determine if appearance is in compliance with finish requirements.
  - 5. Randomly test paint thickness to determine shop primer meets required dry film thickness.
- C. Testing agency inspection: During steel joist fabrication, testing agency shall perform the following inspections to ensure work is in compliance with Contract Drawings and Specifications, the shop drawings and the following.
  - 1. Review of mill test reports to determine compliance with the Specifications.
  - 2. Review of welder's qualifications to determine compliance with the Specifications.
  - 3. At suitable intervals, observation of joint preparation, workmanship, technique, and welder's performance to verify that welding work is in conformance with welding procedures and is being performed in compliance with the Specifications.
  - 4. Visual inspection of weld quality, and size and length of weld.
  - 5. Visual inspection of painting operation.
  - 6. Verification that those inspections required of fabricator have been performed and the results thereof have been reported.
- D. The fabricator shall notify Contractor and testing agency at least 3 days prior to beginning shop fabrication, and shall issue reports of inspections to testing agency prior to shipping or delivery of joists.
- E. The fabricator shall promptly comply with requests from the testing agency to correct deficiencies in materials and welding work.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine adjacent construction and supports.
- B. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

### 3.2 PREPARATION

- A. Before erection, clean joists to remove foreign materials.

### 3.3 INSTALLATION

- A. Install in accordance with the Contract Drawings, the joist manufacturer's recommendations, "Handling and Erection of Steel Joists and Joist Girders" published by SJI, the requirements of the authorities having jurisdiction and the following.
  - 1. Install plumb, true, securely anchored, accurately aligned, with all required fastenings, accessories, etc., spaced as indicated on the Drawings.
  - 2. During installation, exercise care to keep horizontal bending of the joists to a minimum.
  - 3. Install joists camber up with lateral bracing as indicated.
    - a. Provide erection bracing to hold joists true, plumb and in safe condition until permanent bracing and bridging is in place to form a structurally sound framing system.
    - b. Erection and permanent bracing shall be installed, and components permanently and securely fastened, before the application of any loads to the joists.
- B. Lifting: Hoist members into position with proper bracing and secured at designated lift points. Keep out-of-plane bending to a minimum.
- C. Permanently fasten joists to supports with all bridging properly spaced and connected and anchors completely installed before placing construction loads on joists.
- D. Cutting: Do not field-cut joists, or remove joist members, except as indicated or directed by the Architect.
- E. Site tolerances:
  - 1. Joists shall be installed within 1/4-inch of true position.
  - 2. Align joists to receive finished surfaces so the difference in plane between adjacent members is 1/8-inch or less at any point.

### 3.4 FIELD QUALITY CONTROL

- A. Temporary construction loads that cause member deflections or stresses beyond design limits are not permitted.

- B. Manufacturer shall conduct periodic on-site inspections of installation operations to verify the joist manufacturer's recommended procedures are being followed.

### 3.5 PROTECTION

- A. Protect joists in place during the construction period protection when no longer needed.
- B. Paint touchup: After installation is complete, touchup damaged shop-primer with the same paint used for shop painting.
  - 1. Wire brush surfaces to bright metal and clean with solvent before painting.
  - 2. Treat field welds, bolts and nuts, and rust spots as specified above.
- C. Remove and replace materials that are damaged, loose, corroded, or that do not match adjacent materials or cannot be satisfactorily repaired, as determined and directed by the Architect, at no cost to the Owner.

END OF SECTION 052000

## SECTION 053000 - METAL DECKING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Principal work in this Section:
  - 1. Steel decking.
  - 2. Accessories, filler pieces and metal closure pieces.
- B. Related work in other Sections:
  - 1. Section 051200 – Structural Steel
  - 2. Section 055000 – Metal Fabrications
  - 3. Section 050300 – Hot Dip Galvanizing
  - 4. Section 033000 – Cast-in-place Concrete

#### 1.2 SUBMITTALS

- A. Procedure: In accordance with Division 1.
- B. Dimensioned shop drawings showing section profiles, trim, detailed layout showing type and gage of steel decking, openings, sump pans (when applicable), supports, connections, welds and erection instructions. Identify welds by the AWS welding symbols. Indicate temporary shoring of decking where required.
- C. Manufacturer's calculations and supporting data demonstrating that each metal deck proposed for use conforms to the Drawings, these Specifications and the Building Code.
- D. Manufacturer's Installation instructions indicating specific installation sequence and special instructions.

#### 1.3 QUALITY ASSURANCE

- A. Welders' qualifications:
  - 1. Welding shall be done only by welders currently certified for welding of light gage metal.
  - 2. Qualification of welders and duration of qualification period in compliance with applicable requirements of AWS D1.3. Recertify and replace, with qualified welders, welders producing unsatisfactory welds, even though they have passed qualification tests.
  - 3. Testing for recertification is Contractor's responsibility.
- B. Design criteria:
  - 1. Fire rating: Be responsible for obtaining UL and Building Department approval of the decking, when used as a part of the assembly indicated on the Drawings in which fire resistive construction ratings are required.

2. Design: In compliance with the following reference standards.

- a. SDI, Design Manual for Composite Decks, Form Decks and Roof Decks.
- b. AISI, Specification for the Design of Cold-Formed Steel Structural Members, and AISI, Manual of Steel Construction.

- C. Shoring: Unless noted otherwise on the Drawings, the decking doesn't require shoring, except that when the weight of the wet concrete fill is expected to exceed the deck manufacturer's published data for safe capacity and allowable deflection. The Contractor shall determine these locations and provide temporary shoring until concrete fill has attained its 28-day strength.

1.4 HANDLING

- A. Procedure: In accordance with Section 016000.
- B. Labeling: Label each unit or bundle of metal decking, which is UL classified, to show manufacture, testing and inspection.
- C. Protection: Work showing dents, creases, burrs in cells, deformations, weathering or other defects affecting its use will not be accepted.
- D. Storage: Store units off the ground with one end elevated to permit drainage. In wet or damp weather, cover with waterproof tarpaulins to avoid rusting.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel for decking and closure strips: ASTM A 653, with minimum yield strength of 33,000 psi, with a G 60 zinc coating.
- B. Miscellaneous steel shapes: ASTM A 36.
- C. Galvanizing repair paint: Tneme-Zinc 90-97 by Tnemec Co., Amercoat 68HS by Ameron Protective Coating Division, or MZ-4 by Valspar Corp.
- D. Welding rods:
  - 1. Complying with the printed recommendations of the metal deck manufacturer and AWS D1.1.
  - 2. Submit the manufacturer's recommendations to the Architect prior to starting the installation.

2.2 FABRICATION

- A. Decking:

1. Of the types and profiles indicated on the Drawings formed in lengths to span 3 or more supports, unless otherwise indicated, with flush, telescoping, or nested ends, end laps and nesting side laps.
  2. Composite decking shall have either mechanically fixed shear devices such as embossments, holes or welded buttons, or inverted triangular shaped ribs.
  3. Fabricate decking supporting waterproofing membrane, roofing and elastomeric coating with vent tabs protruding and staggered in the low flutes, 12 in. maximum o.c., or other joint deformation, to provide a minimum 1.5% openings (uniformly distributed) of the total deck area for relief of vapor pressure; do not use vent tabs to support mechanical equipment.
- B. Form end closures, column flashing, access hole covers and cover plates of sheet metal.
- C. Hangers for suspended ceilings:
1. Lip tabs or integral tabs. Nothing shall be hung from metal decking itself or from tabs punched directly in metal decking.
  2. Provide slots or holes punched in decking for installation of pigtail wires.
- D. Form roof sump pans from a single piece of galvanized sheet steel of same quality as deck units.
1. Thickness shall be a minimum of 14 gage before galvanizing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrate surfaces to receive steel decking and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as installer's acceptance of surface conditions.

### 3.2 INSPECTION

- A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

### 3.3 INSTALLATION

- A. Install decking and accessories in compliance with their manufacturer's recommendations and the approved shop drawings.
- B. Coordinate and cooperate with other trades in locating decking bundles to prevent overloading of structural framework.

- C. Place decking on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting steel supports not less than 2in. before fastening permanently.
- D. Do not stretch or contract side lap interlocks. Place decking in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting deck units,
- E. Cut and fit decking and accessories around other work projecting through or adjacent to the decking as shown on the Drawings. Provide neat, square and trim cuts.
- F. Place roof sump pans over openings in steel deck and weld to top decking surface.
  - 1. Space welds at 12" o.c. maximum with a minimum of one weld at each corner.
  - 2. Cut opening in bottom of pan for roof drain accurately.
- G. Do not use decking for storage or working platforms until permanently secured.
  - 1. Coordinate protection and bracing of metal decking used as runway for transporting concrete.
  - 2. Verify that decking manufacturer's directions for protection are followed.

### 3.4 FASTENING

- A. Side joints: Fasten interlocking side closures as noted on the Drawings.

### 3.5 OPENINGS

- A. Provide openings required for work of other trades and which are not indicated on Drawings only upon approval of the Architect as to size, location and reinforcement. The cost of such openings and reinforcement for same shall be home by the Contractor.
- B. Provide additional steel reinforcement and closure pieces as required for strength, Continuity of decking and support of other work as shown.
- C. Reinforce openings as Indicated on the Drawings.
- D. Fabricate metal closure strips, for openings between decking and other construction, of sheet steel of same quality as deck units. Form to configuration required to provide tight-fitting closures at open ends of cells of flutes and sides of decking.
  - 1. Adjusting plates: Provide in locations too narrow to accommodate full-size deck units and install as recommended by the deck manufacturer and approved on the shop drawings.
  - 2. End closures: Provide metal cover plates or joint tape at joints between decking sheets to be filled with concrete to prevent concrete leakage.
  - 3. Column flashing: Provide between floor decking and columns which penetrate the deck. Field cut flashing to fit, and tack weld to decking and columns.
  - 4. Access hole covers: Provide to seal holes cut in decking to facilitate welding of decking to structural supports.

### 3.6 ATTACHMENTS

- A. Coordinate location, spacing and type of connections required to attach wood nailers, suspended ceilings and similar items to decking.
- B. Drill decking as shown and as required by approved shop drawings.

### 3.7 CLEANING AND TOUCHING-UP

- A. Remove slag from welds, clean to bright metal and touch-up with zinc-rich paint; also clean and touch-up with zinc-rich paint raw edges of deck cut for openings.
- B. Welds over which concrete fill will be placed need not be slagged and painted.

### 3.8 FIELD QUALITY CONTROL

- A. The Testing Agency employed by the Owner will inspect, and test where applicable, all field welding.
  - 1. Testing Agency will furnish qualified inspectors.
  - 2. Tests and inspections shall comply with Code requirements, as amended by Building Department regulations.
  - 3. Testing Agency will inspect welds visually when operators are making welds at commencement of this work and after this work is completed, for penetration of weld metal, fusion, and general ability of operator. Defective welds shall be corrected in compliance with applicable provisions of AWS D1.1.
  - 4. Testing Agency will be required to confirm welder's qualifications and to certify in writing upon completion of this work that the welding has been performed in compliance with Drawings and Specification requirements, Including the use of AWS qualified procedures, the manufacturer's recommended use of automatic equipment, and the use of preheat, if required, and with all applicable requirements of regulatory agencies having jurisdiction.
- B. The Testing Agency will report on the results of the inspection.
- C. In addition to the survey required of the structural steel frame In Section 05120, the Contractor's surveyor shall also provide a survey of the steel decking, to verify dimensions, elevations and tolerances. Deck edge closure strips shall be within 1/4 in. of the theoretical location shown on the Drawings.

END OF SECTION 053000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 054000 - COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

A. Work Includes:

1. Contractor engineered, fabricated, and installed cold-formed steel stud framing systems for support of decorative elements, Portland cement plaster walls, doors, etc., installed therein, complete with all required accessories.
2. Backing plates not provided by other trades for support of items attached to conformed metal framing.
3. Provide all supplementary parts and components, such as inserts, clips, bracing and other miscellaneous supports required for a complete installation.

B. Work furnished but installed in other Sections includes:

1. Inserts and other structural anchorage provisions, exterior walls, etc.

#### 1.2 QUALITY ASSURANCE

- A. Fabricator/Installer qualifications: Fabricator/Installer shall have completed cold-formed steel stud framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Fabricator/installer shall assume responsibility for engineering cold-formed metal framing by employing a State of California licensed Structural Engineer to prepare and seal design calculations, shop drawings, and data.
- B. Testing agency qualifications: Conforming to requirements of ASTM E 699, and that it has experience and capacity to conduct required testing without delaying Work.
- C. Welding Standards: AWS D1.1 "Structural Welding Code--Steel" and AWS D1.
- D. "Structural Welding Code--Sheet Steel."
1. Welder's certification: Each welder shall have passed AWS qualification tests for type of welding processes required for this Project within last 12 months, and if required has undergone recertification. Welders shall be certified by the local Building Official for light gage welding
- E. Fire-rated construction: Provide cold-formed steel stud framing identical to that tested as part of an assembly for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to governing authorities having jurisdiction, and as indicated by design designation listed in UL "Fire Resistance Directory," or by equivalent Warnock Hersey or another testing and inspecting agency acceptable to governing authorities having jurisdiction.
- F. Professional engineer qualifications: Professional Structural Engineer legally authorized to practice in the State of California, and with successful experienced in providing engineering services for work of similar scope and complexity.

G. Reference standards:

1. AISI Specifications - "Specification for the Design of Cold-Formed Steel Structural Members", latest edition.
2. Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections."
3. ASTM Standard C955 – "Standard Specification for Load Bearing (Transverse and Axial) Steel Studs, and Bracing or Bridging for Screw Application of Gypsum Board or Metal Plaster Bases".
4. ASTM Standard C1007 – "Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories".

H. Structural Performance: Design, engineer, fabricate, and erect cold-formed steel stud framing to withstand design loads within limits and under conditions required by the Building Code, but in no case less than 30 psf.

I. Deflection: Lateral deflection of  $L/360$  under full design load.

J. Movement: Make all necessary provisions for movement of framing members without damage to finishes and substrates attached to them, failure of connections, undue strain on fasteners, or other detrimental effects when subjected to a maximum ambient temperature range of 120 deg. F.

K. Deflection of primary building structure: Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

L. Structural General Notes: The applicable Structural General Notes shall apply to the work of this Section as though repeated verbatim herein.

M. Mock-ups: Provide full size mock-ups of special areas and/or shapes of cold-formed metal framing, as directed by Architect.

### 1.3 SUSTAINABLE PROJECT REQUIREMENTS

A. Comply with the requirements of Section 01351, Sustainable Project Requirements, and the LEED V 2.0 Registered Project Checklist.

### 1.4 SUBMITTALS

A. Make submittals in accordance with the requirements of Section 013300.

B. Product data: Submit product data for each type of cold-formed steel stud framing, accessory, and product specified.

C. Shop drawings: Submit shop drawings showing layout, spacing, sizes, gages, and types of cold-formed steel stud framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachments adjacent work.

1. Include setting drawings, templates, and directions for the installation of anchor bolts and other anchorages installed as a unit of work under other sections.
  2. Indicate any proposed deviations from Architect's intent.
  3. Shop drawings shall be signed and sealed by a Structural Engineer registered in the State of California, along with a written statement that the wall system conforms to project requirements, applicable codes, and specified conditions.
    - a. In addition provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, and sealed by a State of California registered Structural Engineer.
- D. Test reports: Submit test reports from qualified independent testing agency evidencing compliance with requirements.
- E. Welder certificates: Submit welder certificates signed by Contractor certifying that welders comply with requirements specified in Article 1.2.
- F. Qualifications: Submit qualification data for installer as specified in Article 1.2. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Building Code compliance: Submit evidence, including research or evaluation reports showing that proposed cold-formed metal framing is in compliance with applicable Building Code requirements.
- H. Recycled content submittals: As specified in Article 1.3 above.

#### 1.5 PRE-INSTALLATION MEETING

- A. Representatives of the following parties shall hold a jobsite conference before this work is started:
1. Architect.
  2. Contractor.
  3. Hollow metal doors and frames installer.
  4. Glazed aluminum framing installer.
  5. Portland cement plaster applicator.
  6. Gypsum sheathing installer.
- B. Attendees shall review all pertinent drawings and specifications, noting any potential problems and making any changes, deletions or additions deemed necessary, and determine the availability of specified materials, submittal requirements, scheduling, and additional items pertaining to this work.
- C. Attendees shall view surfaces receiving cold-formed metal framing and determine their suitability to receive the specified materials.
- D. Discussion shall be recorded, including agreement or disagreement on matters of significance. If the meeting ends with substantial disagreements, it shall be determined how disagreements will be resolved, and a date set for another meeting if required.

## 1.6 SYSTEM DESCRIPTION

- A. The cold-formed steel stud framing fabricator shall be responsible for structural design and engineering required to meet specified performance requirements within physical and aesthetic requirements established.
- B. Requirements specified or indicated on the Drawings are intended to establish aesthetic design requirements and performance of exterior and interior finish materials.
- C. Drawings do not necessarily indicate or describe total work required for completion of Work. Provide all work required for complete installation.
- D. Dimension and profile adjustments may be made in proposed structural design in the interest of fabrication or erection methods or techniques, weatherability factors or ability of system to satisfy design and performance requirements, provided that aesthetic design intent and intent are maintained. Include modifications or additions required to meet specified requirements and maintain the visual design concept.

## 1.7 HANDLING

- A. Store materials undercover, off the ground or floor, in a dry, ventilated space.

## PART 2 - PRODUCTS

### 2.1 FINISHES

- A. General: Cold-formed metal framing shall be galvanized.
- B. Fabricate galvanized studs and furring from galvanized sheet steel complying with ASTM A653, with minimum protective coating equal to G-60 galvanized finish. Hot-dip galvanize inserts and channels in accordance with ASTM A123.
- C. Materials specified hereafter by weight do not include the weight of protective finishes.

### 2.2 MATERIALS

- A. Studs:
  - 1. Of the sizes indicated on the Drawings by Western Metal Lath, Co., Cemco, Angeles Metal Systems, or equal, however the minimum stud gage acceptable is as called for on the Drawings.
  - 2. Studs shall comply with the following, as applicable:
    - a. ASTM C955 - Specifications for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases, for Load Bearing studs.
    - b. ASTM C645 - Specifications for Non-Load (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board, where applicable for non-load bearing interior gypsum board studs.

- c. Studs supporting metal lath shall have a minimum flange width of 1/2". Studs supporting gypsum sheathing shall have a minimum flange width of 1-3/8".
  - d. Where the wall finish does not adequately brace both flanges of studs, bracing shall be added or allowable stresses shall be reduced in computing stud heights in accordance with UBC and AISI requirements.
- 3. Provide all necessary shoes, clips, ties, stiffeners, fasteners, door jamb reinforcements, and other accessories recommended by the manufacturer for the conditions of use.
- B. Top and bottom runner tracks and bridging: As indicated on shop drawings.
- C. All structural framing accessories shall be formed from structural quality steel with minimum yield strength of 33 KSI and have minimum protective coating equal to G-60 galvanized finish.
- D. Fasteners:
  - 1. Screws: As indicated on shop drawings, and complying with applicable requirements of the building code for each condition of use.
  - 2. Welding electrodes: ASTM A233, as recommended by AWS for the conditions of use and the metals to be welded.

## 2.3 FABRICATION

- A. Cold-formed metal framing may be shop or field fabricated into assemblies, prior to erection, or stick built in the field.
- B. Structural members shall be sized, spaced and erected in accordance with the shop drawings and calculations signed and sealed by the fabricator's Structural Engineer.
- C. Structural framing shall have ends squarely cut by shearing or sawing, and shall be installed plumb, square, true to line, and securely fastened in accordance with the shop drawings.
- D. Fabrication, handling, and erection of the structural framing and assemblies shall be done in a manner to prevent any damage or distortion of the framing.
- E. Cold-formed tracks when set to adjacent structures, shall have web contact with a uniform and level bearing surface, and shall be securely anchored with fasteners of size and spacing indicated on shop drawings.
- F. No cutouts or splices permitted in the flanges of axial loaded studs.
- G. Framing for wall openings shall include jack studs, headers, cripples, sill plates, and jamb studs as indicated on the Drawings and shop drawings.
- H. Where structural framing at thermally insulated walls forms box sections at headers, jambs, etc., the voids shall be filled with suitable insulation prior to assembly. Coordinate with work of Section 072100.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

### 3.2 PREPARATION/COORDINATION

- A. Installation of cold-formed metal framing shall be coordinated with structural steel and concrete work to ensure that inserts and other structural anchorage provisions are installed at correct locations.

### 3.3 INSTALLATION

- A. General: Erect cold-formed metal framing in accordance with its manufacturer's printed recommendations, the reference standards, the Drawings and these Specifications.
  - 1. Do not attach metal framing nor suspension wires to ducts, conduits or pipes.
  - 2. Cut framing components squarely for a tight fit against abutting members. Erect framing plumb and level to provide solid backing for finish materials. Install all steel studs so that their flanges point in the same direction.
  - 3. Do not exceed 1/8" in 10 ft. tolerance from true lines and levels nor 1/4" from true position. Perform remedial work on framing as necessary to achieve specified tolerances.
  - 4. Provide additional framing where required to ensure that framing members fall behind exterior Portland cement plaster reveals and control joints. Provide double studs behind control joints.
- B. Wall framing:
  - 1. Align and securely anchor ceiling and floor tracks to building construction.
  - 2. Anchor runners as indicated on the Drawings.
  - 3. Provide metal shims as required by substrate conditions. No wood shims permitted.
  - 4. Provide double studs, closer spacing, and additional reinforcement as detailed or required at door and window frames on other openings.
  - 5. Install studs in single length, without joints, extending from floor to underside of floor or roof structure above. Splicing studs is not permitted.
  - 6. Attaching studs to runner track:
    - a. Except where indicated to be welded, attach studs to runner tracks with screws in accordance with the stud and top slip track manufacturer's printed instructions.
    - b. Attach corner studs, studs on each side of door or window jambs and other openings in walls as indicated on the shop drawings.
    - c. Weld studs where indicated on the shop drawings. Comply with AWS standards specified.
    - d. Provide horizontal stiffeners where indicated on the shop drawings.
    - e. Double cold formed metal framing members (face to face to form a tube adjacent to doors, windows and other openings, and attach securely to top and bottom track as specified in subparagraph 5.b. above, and to door head track with clip angles.

- 1) Locate additional studs not more than 2" from door and window frames, abutting partitions, partition corners, and other construction.
  - 2) Install a section of track over door and window frames with a clip angle at each end and attach securely to the adjacent vertical studs.
  - 3) Install cut-to-length studs at the location of vertical joints and at standard spacing over the door frame header extending to the ceiling track.
  - 4) Provide additional framing, as required, for attachment of reveals, control joints, and similar items in stud walls.
- C. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment, services, heavy trim, and similar work as indicated on the Drawings, the reference specifications, and in accordance with applicable requirements of the building code.
1. Backing plates: Plates not provided with fixtures and equipment shall be at least 11 gage X 4" wide and long enough to span across 3 studs. Notch studs for the thickness of the backing plate and weld plates continuously along all contact surfaces at each stud crossing.
- D. Welding: Perform welding in accordance with AWS recommendations. Welders shall be qualified to weld cold-formed metal framing. Stitch plates may only be used where studs are burned through with written approval of the Contractor's Structural Engineer.
- E. Damaged zinc coating: Repair damaged areas by wire-brushing to bright metal and applying a zinc-rich paint applied in multiple coats to dry film thickness of 4 mils.

END OF SECTION 054000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

A. Work included:

1. Metal fabrications whether or not specifically mentioned herein or in other sections of these specifications, but which are required to complete the work, 12 gage or heavier.
2. Bolts, washers, brackets, sleeves, angles, clips, etc., required in assembly, erection and securing the work of this Section.
3. Elevator hoistway dividers.

B. Products furnished but not installed under this Section: Metal fabrications installed in concrete and masonry.

C. Related work:

1. Security gates and fences.
2. Structural steel.
3. Metal stairs.
4. Aluminum railings.
5. Painting, except shop prime coats.
6. Hot-dip Galvanizing

#### 1.2 QUALITY ASSURANCE

A. Comply with requirements of Section 014000.

B. Railings:

1. Structural performance of handrails and railing systems: Engineer, fabricate and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
  - a. Top rail of guardrail systems: Capable of withstanding a uniform load of 20 pounds per lineal foot (at private balconies) and 50 pounds per lineal foot (at public areas) per lineal foot applied horizontally at right angles to the top rail and concentrated load of 250 pounds applied in any direction at any point on the rail.
  - b. Infill area of guardrail systems: Capable of withstanding the following loads applied as indicated:
    - 1) Concentrated load of 25 pounds per square foot applied horizontally at right angles over the entire tributary area, including openings and spaces between rails.

- 2) Reactions due to the above load need not be combined with those loads on the toprail of guardrail system.
- 3) Wind loads as required by Building Code.
- c. Handrails: The mounting of handrails shall be such that the completed handrail and supporting structure are capable of withstanding the following loads:
  - 1) Concentrated load of 250 pounds applied in any direction at any point on the handrail.
  - 2) These loads shall not be assumed to act cumulatively with those loads on the infill area of the guardrail system.
2. Thermal movement: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating and installing of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculations on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. Temperature change (range): 120 deg. F ambient; 180 deg. F material surfaces.
3. Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
4. Railings shall be free of rattles.
- C. Standards:
  1. American Institute of Steel Construction, Inc. (AISC):
    - a. "Manual of Steel Construction", Third Edition.
    - b. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
    - c. "Code of Standard Practice for Steel Buildings and Bridges".
    - d. "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
  2. American Welding Society (AWS): "Structural Welding Code", D1.1.

### 1.3 SUBMITTALS

- A. Comply with requirements of Section 013300.
- B. Product data: Complete materials list showing items proposed to be provided under this Section.
- C. Shop drawings: Submit layout drawings and details showing required material, gauges, accessories, openings, finishes, welding notes and all other conditions affecting the material and installation.

### 1.4 FIELD MEASUREMENTS

- A. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

## 1.5 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Recycled content.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Steel sections: ASTM A 36.
- B. Steel tubing:
  - 1. Cold-formed: ASTM A 500, Grade B.
  - 2. Hot-formed: ASTM A 501.
- C. Plates: ASTM A 283.
- D. Pipe: ASTM A 53, Grade B, Schedule 40.
- E. Bars and bar-size shapes: ASTM A 663, Grade 65 and ASTM A 675.
- F. Carbon steel sheets and strips:
  - 1. Hot rolled: ASTM A 568 and ASTM A 569.
  - 2. Cold rolled: ASTM A 366.
- G. Bolts, nuts, and washers: ASTM A 307.
- H. Welding materials: AWS D1.1; type required for materials being welded.
- I. Shop paint:
  - 1. Primer: Manufacturer's standard.
  - 2. For repair of galvanizing, use a high zinc dust content paint complying with DOD-P-21035 or SSPC-Paint 20.

### 2.2 MISCELLANEOUS FRAMING AND SUPPORT

- A. Provide miscellaneous steel framing and supports as necessary to complete the work.
- B. Fabricate units to the sizes, shapes and profiles indicated, or if not indicated, of the necessary dimensions to receive adjacent work to be retained by the framing.
- C. Except as otherwise indicated, fabricate using mitered corners, welded brackets and splice plates and a minimum number of joints for field connections.
- D. Equip units with integrally welded anchor straps for casting into cast-in-place concrete wherever possible.

- E. Steel framing and supports for operable partitions, overhead doors, countertops, mechanical and electrical equipment applications where framing and supports are not specified in other Sections.
- F. Miscellaneous items may include elevator safety beams, metal ladders, sump pit covers, loose bearing and leveling plates, etc.

## 2.3 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured, true to line and level.
- C. Weld corners and seams continuously. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed mechanical fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Allow for thermal movement resulting from the maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss for a temperature range of 120 deg. F.

## 2.4 GALVANIZING

- A. Comply with requirements of Section 050300.
- B. Galvanize exterior steel members, bolts, nuts, washers, hardware, fabrications and assemblies after fabrication by the hot dip process.
- C. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.
- D. Galvanize miscellaneous framing where indicated, including hydrotherapy pool pit ladders.

## 2.5 FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- C. Prime and finish paint items where indicated and in compliance with requirements of Section 099000.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Clean and strip primed steel items to bare metal where site welding is required.
- C. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

### 3.2 INSTALLATION

- A. Erect items plumb, square and level, accurately fitted and free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on reviewed shop drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

### 3.3 DISSIMILAR METALS

- A. When dissimilar metals come into contact or when aluminum components come into contact with cement or lime mortar, paint exposed aluminum surfaces with heavy bodied bituminous paint.

### 3.4 CLEAN AND PROTECT

- A. Upon completion of installation, clean all work for inspection and approval. Clean aluminum with plain water containing a mild soap or detergent, or white gasoline kerosene or distillate. Do not use abrasive agents.
- B. Protect all work from damage during the balance of construction.

### 3.5 SCHEDULE

- A. Furnish and install metal fabrications listed herein for the locations shown, complete with anchorage and attachments necessary for installation.
- B. The Schedule is a list of principal items only. Refer to Drawings for items not scheduled.

C. Steel pipe railings:

1. Standard weight black steel pipe, 1-1/2" outside diameter.
2. Standard wall brackets spaced not more than 5'-0" o.c.
3. Clear space between rail and wall shall be exactly 1-1/2".
4. Provide wall backing as necessary to support loads of 250 lbf in bending, shear and tension. Comply with requirements of Paragraph 1.02 B.
5. Extend rails, parallel to floor, 12" minimum beyond top riser nosing and one tread plus 12" beyond bottom riser nosing.
6. Return ends smoothly to wall.
7. Accurately form, cut, miter or cope joints and shape to fit various locations. Weld joints and grind smooth.
8. Shop finish:
  - a. Exterior: Galvanize.
  - b. Interior: Prime paint.

D. Steel guards:

1. Protect walls, ducts, pipes, conduits and equipment that could be damaged by vehicles. Verify required locations with Architect.
2. Shop finish:
  - a. Exterior: Galvanize.
  - b. Interior: Prime paint.

E. Manhole cover and frame:

1. Manufacturer: Alhambra Foundry Co., Ltd., (626) 289-4294.
2. Type: No. A-1254, 24" diameter clear opening, solid cover.

F. Steel backing plates: Provide steel backing plates necessary for engaging and fastening work of other trades, in locations indicated or necessary, except for backing plates specified to be provided under other Sections. Carefully coordinate precise locations with related trades. Securely weld to supporting members in precise location. Paint bare surfaces of plates and welds with metal primer after installation.

G. Steel strip ladders:

1. Fit rungs of strip ladders in centerline of side rails, plug weld and grind smooth on outer rail faces.
2. Support each ladder at top and bottom and at intermediate points spaced not more than 60" o.c. with welded or bolted steel brackets.
3. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, by using a type of manufactured rung that is filled with aluminum-oxide grout or by coating with abrasive material metallically bonded to the rung by a proprietary process.
4. Shop finish:
  - a. Exterior: Galvanize.
  - b. Interior: Prime paint.
  - c. In water-holding tanks: Organic coating complying with requirements of Section 05902.

H. Ledge and shelf angles:

1. Exterior and angles supporting cut stone veneer: Stainless steel.
2. Interior (except angles supporting cut stone veneer): Prime paint finish.

I. Custom fabricated frames, gratings and plate covers for hatches, catch basins, sumps or pits:

1. Shop finish:
  - a. Exterior: Galvanize.
  - b. Interior: Prime paint.

J. Miscellaneous steel shapes:

1. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
2. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6" from each end, 6" from corners, and 24" o.c., unless otherwise indicated.
3. Shop finish:
  - a. Exterior: Galvanize.
  - b. Interior: Prime paint.

END OF SECTION 055000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 055013 – INTERIOR METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Elevator machine beams, hoist beams.
7. Steel shapes for supporting elevator door sills.
8. Metal ladders.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 055000 "Metal Fabrications" for exterior metal fabrications.

#### 1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for operable partitions.

2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Elevator machine beams, hoist beams.
7. Steel shapes for supporting elevator door sills.
8. Metal ladders.

- B. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

- B. Qualification Data: For professional engineer.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Structural Performance of Aluminum Ladders: Aluminum ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

#### 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; unfinished.

## 2.3 FASTENERS

- A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- D. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
- F. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

## 2.7 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3, except for elevator pit ladders.
  - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
  - 1. Space siderails 18 inches apart unless otherwise indicated.
  - 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
  - 3. Rungs: 3/4-inch- diameter steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
  - 6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

## 2.8 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.9 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer.

- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

#### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 055113 - METAL PAN STAIRS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with plywood-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

#### 1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- B. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  1. Uniform Load: 100 lbf/sq. ft.
  2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
  3. Uniform and concentrated loads need not be assumed to act concurrently.
  4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  5. Limit deflection of treads, platforms, and framing members to  $L/360$  or  $1/4$  inch, whichever is less.
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  1. Component Importance Factor: 1.5.

### 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- D. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

## 2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

## 2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

## 2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

## 2.6 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
  - 1. Fabricate stringers of steel plates or channels.
    - a. Provide closures for exposed ends of channel stringers.
  - 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
  - 3. Weld stringers to headers; weld framing members to stringers and headers.
  - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
  - 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
  - 1. Steel Sheet: Uncoated cold-rolled steel sheet.
  - 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they are concealed by concrete fill. Do not weld risers to stringers.
  - 3. Shape metal pans to include nosing integral with riser.
  - 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
    - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

## 2.7 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
  - 1. Rails and Posts: 1-5/8-inch- diameter top and bottom rails and posts.
  - 2. Picket Infill: 1/2-inch- round pickets spaced less than 4 inches clear.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.
- C. Form changes in direction of railings as follows:
  - 1. As detailed.
  - 2. By bending or by inserting prefabricated elbow fittings.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
  - 1. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
  - 2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

## 2.8 FINISHES

- A. Finish metal stairs after assembly.

- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms.

### 3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
  - 1. Anchor posts to steel by welding to steel supporting members.
  - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

END OF SECTION

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 057000 - DECORATIVE METAL FINIS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following ornamental metal fabrications:

- 1. Exterior signage - "integral" fins.

#### 1.3 REFERENCED STANDARDS

- A. AAMA - American Architectural Manufacturers Association.

- 1. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

- B. ASTM - American Society for Testing and Materials International.

- 1. ASTM B 26: Specification for Aluminum-Alloy Sand Castings.
- 2. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- 3. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded.
- 4. ASTM B 247: Specification for Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
- 5. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- 6. ASTM E 488: Test Method for Strength of Anchors in Concrete and Masonry Elements.

- C. AWS - American Welding Society.

- 1. AWS D1.2: Structural Welding Code - Aluminum.

- D. CFR - Code of Federal Regulations.

- 1. 40 CFR 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.

- E. NAAMM - National Association of Architectural Metal Manufacturers.

- 1. Metal Finishes Manual for Architectural and Metal Products.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including finishing materials.
- B. Shop Drawings: For ornamental metal. Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each ornamental metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
  - 1. Provide templates for anchors and bolts specified for installation under other Sections.
  - 2. Provide load calculations by licensed engineer for State of California requirements.
- C. Samples: For products involving selection of color, texture, or design including mechanical finishes.
  - 1. Mock-Up: Provide 5'-0" x 5'-0" mock-up as directed by Architect

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Arrange for installation of ornamental metal specified in this Section by the same firm that fabricated it.
- B. Fabricator Qualifications: A firm experienced in producing ornamental metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2, "Structural Welding Code--Aluminum."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store ornamental metal inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with ornamental metal by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.8 COORDINATION

- A. Coordinate installation of anchorages for ornamental metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 ORNAMENTAL METAL FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide ornamental metal work by the following:
  - 1. Local Fabricators as approved by Architect.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

### 2.3 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Aluminum Tubes:
  - 1. Profile - As indicated on Drawings.
    - a. Provide caps at all open extrusions.
    - b. Metal spacers to be 'Black', unless otherwise indicated.
  - 2. Thickness: 0.125 inch (3 mm) minimum.
- C. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.
- D. Plate and Sheet: ASTM B 209, Alloy 3003-H14.
- E. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- F. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

### 2.4 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Items: Aluminum fasteners.
  - 2. Dissimilar Metals: Type 304 stainless-steel fasteners.

- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching ornamental metal items to other work, unless otherwise indicated.
- D. Anchors: Provide cast-in-place chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
  - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.6 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
- C. Form ornamental metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.8 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- H. Provide weep holes where water may accumulate.
- I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items, unless otherwise indicated.
- J. Comply with AWS for recommended practices in shop welding and brazing. Weld and braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
- K. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

## 2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## 2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure ornamental metal to in-place construction.
- B. Perform cutting, drilling, and fitting required to install ornamental metal. Set products accurately in location, alignment, and elevation; measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of ornamental metal, restore finishes to eliminate evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
  - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.
- H. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.3 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at time of Substantial Completion.
- C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057000

## SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Glass- supported railings.
2. Post-supported railings.

#### 1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

#### 1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.

## 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Architectural Metal Works.
  - 2. Architectural Railings & Grilles, Inc.
  - 3. ATR Technologies, Inc.
  - 4. Julius Blum & Co., Inc.
  - 5. CraneVeyor Corp.
  - 6. C. R. Laurence Co., Inc.
  - 7. Livers Bronze Co.
  - 8. Newman Brothers, Inc.
  - 9. P & P Artec.
  - 10. TACO Metals Inc.
  - 11. Tri Tech, Inc.
  - 12. Wylie Systems.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
  - 2. Stainless Steel: 60 percent of minimum yield strength.

3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

## 2.4 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.
- C. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

## 2.5 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A 312/A 312M, Grade TP 304.
- C. Sheet, Strip, Plate, and Flat Bar: ASTM A 666 or ASTM A 240/A 240M, Type 304.

- D. Bars and Shapes: ASTM A 276, Type 304.

## 2.6 GLASS AND GLAZING MATERIALS

- A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.
- B. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
  - 1. Glass Color: Clear.
  - 2. Thickness for Structural Glass Balusters: As required by structural loads, but not less than 12.0 mm.
- C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacture]. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
  - 1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

## 2.7 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Components: Type 304 stainless-steel fasteners.
  - 2. Stainless-Steel Components: Type 304 stainless-steel fasteners.
  - 3. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

## 2.8 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.9 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- H. Form changes in direction as follows:
  - 1. As detailed.
- I. Close exposed ends of hollow railing members with prefabricated end fittings.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

## 2.10 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
  - 1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
  - 2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.

## 2.11 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.12 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## 2.13 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

### 3.3 ANCHORING POSTS

- A. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

### 3.4 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
  - 1. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top-rail channels in factory.

- a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

### 3.5 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

### 3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

## SECTION 057399 - GLAZED DECORATIVE METAL RAILINGS (EXTERIOR)

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Exterior glass-supported railings.
2. Exterior post-supported railings.

#### 1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

#### 1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.

## 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Architectural Metal Works.
  - 2. Architectural Railings & Grilles, Inc.
  - 3. ATR Technologies, Inc.
  - 4. Julius Blum & Co., Inc.
  - 5. CraneVeyor Corp.
  - 6. C. R. Laurence Co., Inc.
  - 7. Livers Bronze Co.
  - 8. Newman Brothers, Inc.
  - 9. P & P Artec.
  - 10. TACO Metals Inc.
  - 11. Tri Tech, Inc.
  - 12. Wylie Systems.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
  - 2. Stainless Steel: 60 percent of minimum yield strength.

3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

## 2.4 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.
- C. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

## 2.5 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A 312/A 312M, Grade TP 304.
- C. Sheet, Strip, Plate, and Flat Bar: ASTM A 666 or ASTM A 240/A 240M, Type 304.

- D. Bars and Shapes: ASTM A 276, Type 304.

## 2.6 GLASS AND GLAZING MATERIALS

- A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.
- B. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
  - 1. Glass Color: Clear.
  - 2. Thickness for Structural Glass Balusters: As required by structural loads, but not less than 12.0 mm.
- C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacture]. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
  - 1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

## 2.7 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Components: Type 304 stainless-steel fasteners.
  - 2. Stainless-Steel Components: Type 304 stainless-steel fasteners.
  - 3. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
  - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

## 2.8 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.

## 2.9 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- H. Form changes in direction as follows:
  - 1. As detailed.
- I. Close exposed ends of hollow railing members with prefabricated end fittings.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

## 2.10 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
  - 1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
  - 2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.

## 2.11 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.12 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## 2.13 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

### 3.3 ANCHORING POSTS

- A. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

### 3.4 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
  - 1. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top-rail channels in factory.

- a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

### 3.5 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

### 3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057399

## SECTION 057500 - DECORATIVE FORMED METAL

### 1.1 SUSTAINABILITY REQUIREMENTS

#### A. LEED 2009 NC:

1. Recycled content.

### 1.2 PERFORMANCE REQUIREMENTS

- #### A. Engineering design of exterior items by Contractor.

### 1.3 MATERIALS

#### A. Decorative-Metal-Clad Doors and Frames: Titanium finished textured Stainless-steel.

1. Basis of Design Manufacturer/Product: Forms & Surfaces; fused white gold, texture selected from Manufacturer's standard textures.

#### B. Decorative-Metal-Ceiling Elements: Titanium finished textured Stainless-steel.

1. Basis of Design Manufacturer/Product: Forms & Surfaces; fused white gold, texture selected from Manufacturer's standard textures.

#### C. Decorative-Metal-Casework Elements: Titanium finished textured Stainless-steel.

1. Basis of Design Manufacturer/Product: Forms & Surfaces; fused white gold, texture selected from Manufacturer's standard textures.

### 1.4 FINISHES

- #### A. Stainless Steel: Custom, as indicated.

END OF SECTION 057500

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 057513 - DECORATIVE METAL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Facade screen panel.
  - 2. Sponsorship Sign - Coordinate with Owner.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 2. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 3. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 4. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - 5. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 6. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  - 7. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 8. ASTM D 1056: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
  - 9. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
  - 10. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.
  - 11. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements.
- B. NAAMM - National Association of Architectural Metal Manufacturers.
  - 1. Metal Finishes Manual for Architectural and Metal Products.
- C. SSPC - SSPC: The Society for Protective Coatings.
  - 1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.
  - 2. SSPC-Paint 20: Paint Specification No. 20: Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

3. SSPC-SP 3: Surface Preparation Specification No. 3: Power Tool Cleaning.
4. SSPC-SP 6/NACE No. 3: Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Loads: Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved, including anchors and connections, and without exhibiting permanent deformation in any components:
  1. Wind Loads on Exterior Items: 20 lbf/sq. ft. (957 Pa).
- B. Thermal Movements: Provide exterior ornamental formed-metal assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated, including finishes.
- B. Shop Drawings: Detail fabrication and installation of ornamental formed metal. Include plans, elevations, sections, and details of components and their connections. Show anchorage and accessory items.
  1. Calculations: Provide load calculations by licensed engineer for State of California requirements.
- C. Samples: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, including mechanical finishes, and patterns available for each type of ornamental formed-metal product indicated.
  1. Mock-Up: Provide 5'-0" x 5'-0" mock-up as directed by Architect.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing ornamental formed metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ornamental formed-metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with ornamental formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.9 COORDINATION

- A. Coordinate installation of anchorages for ornamental formed-metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of ornamental formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

## PART 2 - PRODUCTS

### 2.1 METAL PANEL AT "SCREEN PANEL - SPONSOR SIGN"

- A. Metal Grill (Painted PNT-01):
  - 1. Basis-of-Design Product: Orsogril; Britosterope, 5-3/16 inches (131 mm) height by 2-7/16 inches (62 mm) or equal as approved by Architect.
    - a. Refer to Drawings: A-312's.
- B. Expanded Metal (Painted PNT-01):
  - 1. Basis-of-Design Product: McNichols; Expanded Metal, 1-1/2 inches (38 mm).
    - a. Refer to Drawings: A-312's.
- C. Metal Grill (Sand Pit):
  - 1. Basis-of-Design Product: McNichols; Galvanized Steel Bar Grating, 3/4 by 3/16 inch (19 by 5 mm) at 1-3/16 inches (30 mm) center to center spacing.
    - a. Refer to Drawings: A-313's.

## 2.2 SHEET METAL

- A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

## 2.3 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in ornamental formed metal and remain weathertight; and as recommended in writing by ornamental formed-metal manufacturer.
  - 1. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
  - 2. Closed cell polyurethane foam, adhesive on two sides, release paper protected.
- B. Sealants, Exterior: ASTM C 920; elastomeric silicone, polyurethane, or polysulfide sealant; of type, grade, class, and use classifications required to seal joints in ornamental formed metal and remain weathertight; and as recommended in writing by ornamental formed-metal manufacturer.
- C. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
  - 1. Provide concealed fasteners for interconnecting ornamental formed-metal items and for attaching them to other work, unless otherwise indicated.
  - 2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Structural Anchors: Provide chemical or torque-controlled expansion anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- E. Nonstructural Anchors: Provide powder-actuated fasteners, metal expansion sleeve anchors or metal impact expansion anchors of type, size, and material necessary for type of load and installation indicated, as recommended by manufacturer, unless otherwise indicated. Use nonferrous-metal or hot-dip galvanized anchors for exterior installations for corrosion resistance.
- F. Backing Materials: Provided or recommended by ornamental formed-metal manufacturer.
- G. Laminating Adhesive: Compatible with substrate; noncombustible after curing.
- H. Isolation Coating: Manufacturer's standard epoxy coating.

## 2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble ornamental formed-metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- B. Coordinate dimensions and attachment methods of ornamental formed-metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch (12 mm) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
  - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce ornamental formed-metal items as needed to attach and support other construction.
- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install ornamental formed-metal items.

## 2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.6 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental formed metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Locate and place ornamental formed-metal items level and plumb and in alignment with adjacent construction.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior ornamental formed-metal items weatherproof.
- E. Corrosion Protection: Apply nonmelting/nonmigrating-type bituminous coating or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

#### 3.3 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

### 3.4 PROTECTION

- A. Protect finishes of ornamental formed-metal items from damage during construction period.  
Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 057513

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preservative treatment of wood.
  - 2. Fire retardant treatment of wood.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Wood blocking, cants, and nailers.
  - 5. Sustainable wood, recycled content, and low-emitting materials.

#### 1.3 REFERENCED STANDARDS

- A. ALSC - American Lumber Standard Committee, Inc.
- B. APA - The Engineered Wood Association.
- C. AWPA - American Wood-Preservers Association.
  - 1. AWPA U1: Use Category System: User Specification For Treated Wood.
- D. ASME - American Society for Mechanical Engineers International.
  - 1. ASME B18.2.1: Square and Hex Bolts and Screws (Inch Series).
  - 2. ASME B18.6.1: Wood Screws (Inch Series).
- E. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 153: Specification for Zinc-Coating (Hot-Dip) of Iron and Steel Hardware.
  - 2. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - 3. ASTM A 563: Specification for Carbon and Alloy Steel Nuts.
  - 4. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  - 5. ASTM D 2898: Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
  - 6. ASTM D 3201: Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products.
  - 7. ASTM D 5664: Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber.

8. ASTM D 6841: Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber.
9. ASTM D 6007: Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber.
10. ASTM D 6330: Standard Practice for Determination of Volatile Organic Compounds (Excluding Formaldehyde) Emissions from Wood-Based Panels Using Small Environmental Chambers Under Defined Test Conditions.
11. ASTM E 84: Test Method for Surface-Burning Characteristics of Building Materials.
12. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements.
13. ASTM E 1333: Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
14. ASTM F 1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.

F. DOC - U.S. Department of Commerce, National Institute of Standards and Technology.

1. DOC PS 1: U.S. Product Standard for Construction and Industrial Plywood.
2. DOC PS 20: American Softwood Lumber Standard.

G. FSC - Forest Stewardship Council.

H. ICC - International Code Council, Inc.

1. International Building Code.
2. ICC Evaluation Service, Inc.; NES NER-272: Pneumatic or Mechanically Driven Staples, Nails, P-Nails and Allied Fasteners for Use in All Types of Building Construction.

I. SPIB - The Southern Pine Inspection Bureau.

1. Standard Grading Rules for Southern Pine Lumber.

#### 1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
5. Recycled Content Materials:
  - a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
  - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

- c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
    - d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
  - 6. Local/Regional Materials:
    - a. Sourcing Location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
    - b. Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
    - c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
    - d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
  - B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
  - C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
    - 1. Wood-preservative-treated wood.
    - 2. Fire-retardant-treated wood.
  - D. Letter of Certification(s) for Sustainable Forestry:
    - 1. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC "Principles for Natural Forest Management" and identify certifying organization.
      - a. Submit FSC certification numbers; identify each certified product on a line-item basis.
      - b. Submit copies of invoices bearing the FSC certification numbers.
- 1.5 QUALITY ASSURANCE
- A. Lumber: Comply with DOC PS 20 and approved grading rules and inspection agencies.
    - 1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
  - B. Sustainably Harvested Wood: Certification Organizations shall be accredited by the Forest Stewardship Council.
  - C. Recycled Content Materials: Where recycled lumber materials are used for structural applications, include lumber certification and quality grading.

D. Engineered Wood Products:

1. Determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D 6007 or ASTM E 1333.
2. Determine Volatile Organic Compounds (VOC), excluding formaldehyde, emitted from manufactured wood-based panels in accordance with ASTM D 6330.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark each treated item with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Application: Treat items indicated on Drawings, and the following:
  - 1. Concealed blocking.
  - 2. Plywood panels.

## 2.4 DIMENSION LUMBER

- A. Grading Agency: Southern Pine Inspection Bureau (SPIB).
- B. Sizes: Nominal sizes, S4S/rough (unsurfaced).
- C. Moisture Content: Kiln-dry or MC15.
- D. Miscellaneous Blocking and Nailers:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

## 2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

### 3.2 ROOFTOP CURB INSTALLATION

- A. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- B. Coordinate curb installation with installation of decking and support of deck openings.

### 3.3 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

### 3.4 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

### 3.5 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (0.7 mm/m) maximum.

END OF SECTION 061000

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 061500 - WOOD DECKING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Framing System.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wood deck panels.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.

#### 1.4 SUBMITTALS

- A. Product Data: Submit product data, including guide specifications, for specified products.
- B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including accessories.
- C. Samples: Submit 12"x12" size samples for selection and verification of materials.
- D. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- E. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
  - 2. Manufacturer's Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

- B. Meets Class A requirements for flame spread and smoke developed per ASTM E 84 testing.
- C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer's instructions and manufacturer's warranty requirements. Comply with Section 013100 "Project Management and Coordination."

#### 1.6 DELIVERY, STORAGE & HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful conditions.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the following:
  - 1. Prodema; ProdEX composite wood panels (Basis-of-Design) or equal as approved by Architect.
    - a. Refer to Event Entrance Details: A-330's.
    - b. Refer to Visitor Staff Entry Details: A-340's.
    - c. Refer to Gallery Entry Details: A-350's.
    - d. Refer to Courtyard Details: A-360's.

#### 2.2 MATERIALS

- A. Wood Deck Panels: Composite bakelite core panels faced with natural wood veneer with manufacturer's synthetic resins and PVDF coating.
  - 1. Face Veneer Grade and Cut: Grade A rotary cut hardwood veneer.
  - 2. Core: Bakelite.
  - 3. Panel Dimensions: As indicated on Drawings.
  - 4. Overall Thickness: 11/16 inch (18 mm).
  - 5. Finish Texture: Smooth.
    - a. Face Veneer Species and Color: "Ayous Veneer" 'Dark Brown' or equal as approved by Architect.

- B. Mounting: Manufacturer's recommended concealed fixing panels with hanging profiles as approved by Architect.
- C. Sub Structure: Manufacturer's recommended aluminum back-up channel system or equal as approved by Architect.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

#### 3.2 INSTALLATION

- A. Comply with Manufacturer's Technical Manual for procedures and techniques for wood decking installation.

#### 3.3 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

#### 3.4 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 061500

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Los Angeles, CA  
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## SECTION 061600 - SHEATHING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Glass-mat gypsum sheathing.
  - 2. Building wrap.
  - 3. Sheathing joint-and-penetration treatment.
  - 4. Flexible flashing at openings in sheathing.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM B 117: Practice for Operating Salt Spray (Fog) Apparatus.
  - 2. ASTM C 9544: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  - 3. ASTM C 1177: Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - 4. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 5. ASTM E 96: Test Methods for Water Vapor Transmission of Materials.
  - 6. ASTM E 119: Test Methods for Fire Tests of Building Construction and Materials
  - 7. ASTM F 1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.
- B. GA - Gypsum Association.
  - 1. GA -253: Application of Gypsum Sheathing.
- C. ICC - International Code Council Evaluation Service, Inc.
  - 1. NES NER-272: Pneumatic or Mechanically Driven Staples, Nails, P-Nails and Allied Fasteners for Use in All Types of Building Construction.
- D. UL - Underwriters Laboratories Inc.
  - 1. Fire Resistance Directory, Published annually.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.
- B. Research/Evaluation Reports: For building wrap, showing compliance with building code in effect for Project.

#### 1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. G-P Gypsum Corporation; Dens-Glass Gold.
    - b. National Gypsum Company; Gold Bond e(2)XP.
    - c. CertainTeed Corporation; GlasRoc.
  - 2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

#### 2.2 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.

- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
  - 1. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

## 2.3 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fortifiber Building Systems Group (Basis-of-Design).
    - b. DuPont (E. I. du Pont de Nemours and Company).
    - c. Dow Chemical Company (The).
    - d. Pactiv, Inc.
    - e. Raven Industries Inc.
    - f. Reemay, Inc.
  - 2. Basis-of-Design Product: Fortifiber Building Systems Group; Super Jumbo Tex 60 Minute or approved equal.
    - a. Composition: Asphalt-saturated kraft Grade "D" breather type sheathing paper.
  - 3. Water Vapor Transmission: 75 grams/11 perms (MVT) per test method ASTM E-96(A).
  - 4. Water Resistance: > 60 minutes per test method ASTM D-779.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## 2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

## 2.5 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing.
    - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.
    - c. MFM Building Products Corp.
    - d. Polyguard Products, Inc.
    - e. Protecto Wrap Company.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
- D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
  1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
  1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

### 3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover sheathing with weather-resistant sheathing paper as follows:
  1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
  2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.
- B. Building Wrap: Comply with manufacturer's written instructions.
  1. Seal seams, edges, fasteners, and penetrations with tape.
  2. Extend into jambs of openings and seal corners with tape.

### 3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
  1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

### 3.5 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
  1. Prime substrates as recommended by flashing manufacturer.

2. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 061600

## SECTION 062023 - INTERIOR FINISH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior stairs stringers and treads.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
- B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
5. Product Data: For installation adhesives, indicating VOC content.

- B. Sample Warranty: For manufacturer's warranty.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Regional Materials: The following wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
  - 1. Interior stairs.
- B. Certified Wood: The following wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
  - 1. Interior stairs.
- C. Composite Wood Products: Products shall be made without urea formaldehyde.
- D. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's Board of Review. Grade lumber by an agency certified by the American Lumber Standard Committee's Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber, mark grade stamp on end or back of each piece.

## 2.2 INTERIOR TRIM

### A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: WD as shown.

## 2.3 STAIRS AND RAILINGS

- A. WD, Treads: 1-1/16-inch, clear, kiln-dried, edge-glued, stepping with half-round nosing.
- B. WD, Risers: 13/16-inch, clear, kiln-dried, edge-glued stock.
- C. WD, Finished Stringers: 3/4-inch finish boards as specified above for interior lumber trim for opaque finish.

## 2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
  - 1. Adhesives shall have a VOC content of 30 g/L or less.
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
  - 1. Adhesives shall have a VOC content of 70 g/L or less.

## 2.5 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
  - 1. Interior trim.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
  - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### 3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
  - 1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
  - 2. Install trim after gypsum-board joint finishing operations are completed.
  - 3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

### 3.5 STAIR AND RAILING INSTALLATION

- A. Treads and Risers at Interior Stairs: Secure treads and risers by gluing and nailing to substrates.

### 3.6 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### 3.7 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes if any.

### 3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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Los Angeles, CA  
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## SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Architectural wood cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
3. Shop finishing of architectural wood cabinets.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in architectural wood cabinets.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. PVC edge material.

D. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.

3. Exposed cabinet hardware and accessories, one unit for each type and finish.

### 1.3 INFORMATIONAL SUBMITTALS

#### A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

#### B. Qualification Data: For Installer.

#### C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

### 1.4 QUALITY ASSURANCE

#### A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

#### B. Installer Qualifications: Fabricator of products.

### 1.5 DELIVERY, STORAGE, AND HANDLING

#### A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

### 1.6 FIELD CONDITIONS

#### A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

#### B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide labels from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
  - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

### 2.2 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Type of Construction: Frameless.
- E. Cabinet and Door and Drawer Front Interface Style: Flush overlay.
- F. Wood for Exposed Surfaces: As scheduled.
- G. Semiexposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
    - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
  - 2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber, same species indicated for exposed surfaces.
  - 3. Drawer Bottoms: Hardwood plywood.
- H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

## 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
  2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Composite Wood Products: Products shall be made without urea formaldehyde.
  1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
  2. Particleboard: ANSI A208.1, Grade M-2.
  3. Softwood Plywood: DOC PS 1.
  4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

## 2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
  1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
  2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
  2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.

3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
  4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Flakeboard Company Limited; Duraflake FR.
    - b. SierraPine; Encore FR.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Panel Source International, Inc.; Pyroblock Platinum.
    - b. SierraPine; Medite FR.

## 2.5 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
1. Grass America; G393.
  2. Salice; Series 200.
  3. Blum; Clip Top Press-In 71T6580
- C. Wire Pulls: Back mounted, solid stainless steel, 4 inches long, 5/16 inch in diameter.
- D. Adjustable Shelf Standards and Supports:
1. Knappe and Vogt (standards and support clips) BHMA A156.9, B04071; with shelf rests, B04081:
    - a. Standards: 255E, zinc coated steel standards.

- b. Shelf supports: 256R ZC, zinc coated steel standards with rubber cushion.
  - 2. Knappe and Vogt (standards and brackets) BHMA A156.9, B04102; with shelf brackets, B04112:
    - a. Standards: 87 ANO, satin finish extra heavy duty.
    - b. Brackets: 187 LL ANO 16" long for 18" shelves. 186 LL ANO 10" long for 12" shelves.
  - 3. Knappe and Vogt (drilled side supports) BHMA A156.9, B04013; metal:
    - a. Shelf Rests: 333 or 346 supports.
- E. Drawer Slides: BHMA A156.9.
  - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type.
  - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
  - 3. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
    - a. Accuride 7432.
  - 4. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches high or 24 inches wide.
    - a. Accuride 4034.
  - 5. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
    - a. Sidewall mount 100 lb./45 kg.: Accuride 3832.
    - b. Top mount 45 lb./20 kg.: Accuride 2006.
- F. Door Locks: BHMA A156.11, E07121.
  - 1. Corbin: 0737 lock with 12-S and 2540 strikes.
  - 2. Yale: 9780 lock with related strikes.
  - 3. Timberline Lock, Ltd.: CB-290.
- G. Drawer Locks: BHMA A156.11, E07041.
  - 1. Knappe and Vogt: 986 lock.
  - 2. Timberline Lock, Ltd.: CB-280.
- H. Door and Drawer Silencers: BHMA A156.16, L03011.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Stainless Steel: BHMA 630.

- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.

## 2.7 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Cabinets: 1/16 inch unless otherwise indicated.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## 2.8 SHOP FINISHING

- A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- C. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: System - 11, catalyzed polyurethane.
  - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
  - 4. Staining: Match approved sample for color.
  - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
  - 6. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
  - 7. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  - 1. For shop finished items use filler matching finish of items being installed.

- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c.
- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
  - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
2. Section 123623.13 "Plastic-Laminate-Clad Countertops."
3. Section 123640 "Stone Countertops."
4. Section 123661 "Simulated Stone Countertops."

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in architectural plastic-laminate cabinets.
4. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish.
2. Exposed cabinet hardware and accessories, one unit for each type.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

B. Qualification Data: For Installer.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Fabricator of products.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide labels from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
  - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- E. Type of Construction: Frameless.
- F. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- G. PLAM, High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
  - 1. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated or comparable products by one of the following:
    - a. Abet Laminati, Inc.
    - b. Formica Corporation.
    - c. Lamin-Art, Inc.
    - d. Pionite: a Panolam Industries International, Inc. brand.
    - e. Wilsonart International Holdings, Inc.
- H. Laminate Cladding for Exposed Surfaces:
  - 1. Vertical Surfaces: Grade VGS.
  - 2. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
  - 3. Pattern Direction: As indicated.
- I. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

- a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
  - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
- 2. Drawer Sides and Backs: Solid-hardwood lumber.
- 3. Drawer Bottoms: Hardwood plywood.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Composite Wood Products: Products shall be made without urea formaldehyde.
  - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
  - 2. Particleboard: ANSI A208.1, Grade M-2.
  - 3. Softwood Plywood: DOC PS 1.
  - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

## 2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

1. Grass America; G393.
  2. Salice; Series 200.
  3. Blum; Clip Top Press-In 71T6580
- C. Wire Pulls: Back mounted, solid s, 4 inches long, 5/16 inch in diameter.
- D. Adjustable Shelf Standards and Supports:
1. Knappe and Vogt (standards and support clips) BHMA A156.9, B04071; with shelf rests, B04081:
    - a. Standards: 255E, zinc coated steel standards.
    - b. Shelf supports: 256R ZC, zinc coated steel standards with rubber cushion.
  2. Knappe and Vogt (standards and brackets) BHMA A156.9, B04102; with shelf brackets, B04112:
    - a. Standards: 87 ANO, satin finish extra heavy duty.
    - b. Brackets: 187 LL ANO 16" long for 18" shelves. 186 LL ANO 10" long for 12" shelves.
  3. Knappe and Vogt (drilled side supports) BHMA A156.9, B04013; metal:
    - a. Shelf Rests: 333 or 346 supports.
- E. Drawer Slides: BHMA A156.9.
1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type.
  2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
  3. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
    - a. Accuride 7432.
  4. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches high or 24 inches wide.
    - a. Accuride 4034.
  5. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
    - a. Sidewall mount 100 lb./45 kg.: Accuride 3832.
    - b. Top mount 45 lb./20 kg.: Accuride 2006.
- F. Door Locks: BHMA A156.11, E07121.
1. Corbin: 0737 lock with 12-S and 2540 strikes.
  2. Yale: 9780 lock with related strikes.
  3. Timberline Lock, Ltd.: CB-290.

- G. Drawer Locks: BHMA A156.11, E07041.
  - 1. Knape and Vogt: 986 lock.
  - 2. Timberline Lock, Ltd.: CB-280.
- H. Door and Drawer Silencers: BHMA A156.16, L03011.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Stainless Steel: BHMA 630.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- E. Plastic Seam Filler: Plastic seam and repair filler in color to match plastic laminate.
  - 1. Product: Seamfil, Kampel Enterprises, Inc.
- F. Colored Caulk: Acrylic latex caulk in color to match plastic laminate.
  - 1. Product: Colorflex, Kampel Enterprises, Inc.

## 2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

#### 3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c..

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

## SECTION 064400 - ORNAMENTAL WOODWORK

### 1.1 SUMMARY

- A. Wood paneling of Type indicated on the Drawings.

### 1.2 QUALITY ASSURANCE

- A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

### 1.3 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Recycled content.
  - 2. Regional materials.
  - 3. Certified wood.
  - 4. Low-emitting composite wood products.

### 1.4 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: As indicated on the Drawings.

### 1.5 MATERIALS

- A. Wood materials are fire-retardant-treated.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. FSC certified, with chain of custody certificate, or 100% post-consumer wood waste, with Manufacturer's certificate.
  - 2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
    - a. Agrifiber particleboard is not acceptable.
  - 3. Softwood Plywood: DOC PS 1, medium-density overlay.

1.6 SHOP FINISHING

- A. Grade: Premium for transparent finish.
- B. Extent: All ornamental woodwork shop finished.

END OF SECTION 064400

## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Glass-fiber or mineral-wool batt insulation.
  - 2. Vapor retarders.
  - 3. Accessories.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM C 665: Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 2. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 3. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
  - 4. ASTM E 119: Methods for Fire Tests of Building Construction and Materials.
  - 5. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.
- B. NFPA - National Fire Protection Association International.
  - 1. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. UL - Underwriters Laboratories Inc.
  - 1. UL 723: Test for Surface Burning Characteristics of Building Materials.

#### 1.4 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- B. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ). Identify materials with appropriate markings of applicable testing and inspecting agency
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

## 1.8 SEQUENCING

- A. Sequence work to ensure fireproofing, firestop, vapor retarder, and air barrier materials are in place before beginning work of this section.

# PART 2 - PRODUCTS

## 2.1 BATT INSULATION (EXTERIOR WALLS AND SOFFITS)

- A. Glass-Fiber or Mineral-Wool Batt Insulation: ASTM C 665; preformed glass-fiber or mineral-wool roll; friction fit, conforming to the following:
  - 1. Facing: Unfaced.
  - 2. Flame/Smoke Properties: 75/150 in accordance with ASTM E 84, UL 723, and NFPA 255.
  - 3. R-Value: 21 minimum, unless indicated otherwise.
  - 4. Thickness: 5 1/2 inches (139 mm), unless indicated otherwise.
  - 5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Guardian Fiberglass, Inc.
    - c. Johns Manville.

- d. Owens Corning.

## 2.2 VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively.
  - 1. Product: Subject to compliance with requirements, provide Reef Industries, Inc.; Griffolyn T-55 FR or equal as approved by Architect.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
- E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

## 2.3 ACCESSORIES

- A. Wire Mesh: Galvanized steel, hexagonal wire mesh.
- B. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer for application.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### 3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically.
  - 5. Retain insulation batts in place with wire mesh secured to framing members.

### 3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of partitions.

### 3.5 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
  - 1. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
  - 2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

### 3.6 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 072129 - SPRAY-APPLIED ACOUSTICAL INSULATION

### 1.1 SUSTAINABILITY REQUIREMENTS

#### A. LEED 2009 NC:

1. Recycled content.
2. Low-emitting adhesives and coatings.
3. Low-emitting walls and ceilings.
4. Low-emitting insulation.

### 1.2 MATERIALS

#### A. Insulation:

1. Spray-Applied Cellulose: Type I (applied with liquid adhesive).
  - a. Thickness: 1.5 inch, unless otherwise indicated.
  - b. NRC: 1.0 minimum.

#### B. Auxiliary Insulating Materials:

1. Adhesive primer.

END OF SECTION 072129

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 072400 - CEMENT PLASTERING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Exterior portland cement plasterwork.
  - 2. Trim accessories and miscellaneous materials.
  - 3. Recycled content and low emitting materials.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 2. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 3. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 4. ASTM C 150: Specification for Portland Cement.
  - 5. ASTM C 206: Specification for Finishing Hydrated Lime.
  - 6. ASTM C 897: Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.
  - 7. ASTM C 926: Specification for Application of Portland Cement-Based Plaster.
  - 8. ASTM C 932: Specification for Surface-Applied Bonding Agents for Exterior Plastering.
  - 9. ASTM C 1063: Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
  - 10. ASTM C 1328: Specification for Plastic (Stucco) Cement.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
  - 2. For sealants, including printed statement of VOC content.
- B. Samples: For each type of factory-prepared finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

## 1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

## 1.7 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Exterior Plasterwork:
  - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
  - 2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
  - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
- C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

## PART 2 - PRODUCTS

### 2.1 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Plastic Cement: ASTM C 1328.
- C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- D. Sand Aggregate: ASTM C 897.
- E. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Omega Products International, Inc. (Basis-of-Design).
    - b. Sto Corp.
    - c. California Stucco Products Corp.
    - d. Dryvit Systems, Inc.
    - e. BASF Wall Systems, Inc.

- f. Stuc-O-Flex International, Inc.
- 2. Finish: AkroFlex Semi-Smooth finish.
  - a. Color: 9541"Smooth Coat" or approved equal to match Architects sample.
  - b. Texture: Steel trowel.
  - c. Match To: OMEGA 414.
  - d. Product: FINE.

## 2.2 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. MarinoWARE.
    - c. Phillips Manufacturing Co.
  - 2. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
  - 3. Diamond-Mesh Lath: Self-furring, 2.5 lb/sq. yd. (1.4 kg/sq. m).

## 2.3 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Moldings: Extruded accessories of profiles and dimensions as indicated on Drawings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. Pittcon Industries.
  - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

## 2.4 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

- C. Bonding Compound: ASTM C 932.
- D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
- F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.

## 2.5 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
  - 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
- B. Plaster Mixes:
  - 1. Scratch and brown coats for three-coat plasterwork at vertical walls as follows:
    - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
    - b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
  - 2. Single-coat plasterwork at soffits.
  - 3. Factory-Prepared Finish-Coat Mixes: Comply with manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

### 3.3 INSTALLING METAL LATH (Add Alternate #1 - See Drawing # 002)

- A. Expanded-Metal Lath: Install according to ASTM C 1063.

### 3.4 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
  - 1. Install lath-type, external-corner reinforcement at exterior locations.
- C. Control Joints: Install control joints at locations indicated on Drawings.

### 3.5 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
  - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
  - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
  - 3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Plaster Finish Coats: Apply finish to match Architect's sample.
- C. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.

### 3.6 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

### 3.7 PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 072400

Back-Check No. 2 - ASI 009  
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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Vapor-permeable, fluid-applied air barriers.

#### 1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
  - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.

2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  3. Include details of interfaces with other materials that form part of air barrier.
- C. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- D. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- E. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- F. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
  2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field mockups.
- B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186.
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
3. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D 4541.
4. Notify Architect seven days in advance of the dates and times when mockups will be tested.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
  1. Protect substrates from environmental conditions that affect air-barrier performance.
  2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 100 g/L or less.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.

## 2.3 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. High-Build, Vapor-Permeable Air Barrier: Membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.
1. Synthetic Polymer Type:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Carlisle Coatings & Waterproofing, Inc.; Barritech VP Fluid-Applied Membrane Air Barrier (Basis-of-Design).
      - 2) Grace Construction Products; W.R. Grace & Co.; Perm-A-Barrier VP.
      - 3) Tremco Incorporated.
  2. Physical and Performance Properties:
    - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
    - b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method, Procedure A. Not more than 1 Perm.
    - c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
    - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D4541.
    - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    - f. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

## 2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A 240M, Type 304, 0.0250 inch (0.64 mm) thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
- E. Rubber Flashing: Manufacturer's standard Pressure-Sensitive fully adhered, flexible, synthetic rubber flashing. Uncured EPDM laminated synthetic rubber, pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Air and Vapor Barrier: Carlisle; Sure-Seal Pressure Sensitive Elastoform (Basis-of-Design).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
  3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
  4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

### 3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
  - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
  - 1. Transition Strip: Roll firmly to enhance adhesion.
  - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

### 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
  - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
  - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one or more equal coats.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  - 2. Air-barrier dry film thickness.
  - 3. Continuous structural support of air-barrier system has been provided.
  - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  - 5. Site conditions for application temperature and dryness of substrates have been maintained.
  - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
  - 7. Surfaces have been primed, if applicable.
  - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  - 9. Termination mastic has been applied on cut edges.
  - 10. Strips and transition strips have been firmly adhered to substrate.
  - 11. Compatible materials have been used.

12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

## SECTION 074213 - FORMED METAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Standing-seam metal wall panels.
  - 2. Sub-girt framing as required for proper installation of system.
  - 3. Wall panel accessories.
  - 4. Recycled content.

#### 1.3 REFERENCED STANDARDS

- A. AISC - American Institute of Steel Construction.
  - 1. Code of Standard Practice.
- B. AISI - American Iron and Steel Institute.
  - 1. AISI Specification for the Design of Cold-Formed Steel Structural Members.
- C. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 3. ASTM C 645: Specification for Nonstructural Steel Framing Members.
  - 4. ASTM C 754: Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
  - 5. ASTM D 2244: Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
  - 6. ASTM D 4214: Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
  - 7. ASTM E 1592: Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- D. National Association of Architectural Metal Manufacturers.
  - 1. Metal Finishes Manual for Architectural and Metal Products.
- E. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.

1. Architectural Sheet Metal Manual.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide metal wall panel assemblies that comply with performance requirements specified.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
  1. Wind Loads: As indicated on Drawings.
  2. Other Design Loads: As indicated on Drawings.
  3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. Story Drift: Provide formed metal wall panel systems that accommodate design displacement of adjacent stories indicated.
  1. Design Displacement: As indicated on Structural Drawing S-001 "Design Loads".
    - a. Maximum Interstory Drifts - 0X (ASCE 7-10 Section 12.8.6).
      - 1) Ground to 2nd: 0X = 4-1/2 inches (114 mm).
      - 2) 2nd to Low Roof: 0X = 3-3/4 inches (95 mm).
      - 3) Low Roof to High Roof: 0X = 1-1/4 inches (32 mm).
  2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.
- D. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F (48.8 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.

#### 1.5 SUBMITTALS

- A. Submit product data, test reports, and certifications in accordance with quality assurance and performance requirements specified.
  1. Product data indicating percentages of postconsumer and preconsumer recycled content for products having recycled content.
- B. Submit panel shop drawings consisting of design and erection drawings, finish specifications, and other data necessary to clearly describe the design, materials, sizes, layouts, construction details, and erection. Submit small-scale layouts of panels and large-scale details of edge conditions, joints, fastener and sealant placement, flashings, penetrations, and special details. Distinction must be made between factory and field assembled work.

1. Drawings must be approved prior to fabrication.
- C. Submit structural design calculations, in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members, for the metal wall panel system.
  1. A professional Engineer registered in the state where project is located shall certify the calculations.
- D. Samples: Color charts for each type of metal wall panel indicated with factory-applied finishes.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturers Qualifications: The manufacturer shall have had a minimum of ten (10) years experience in the successful completion of projects employing similar materials, applications, and performance requirements.
  1. Manufacturer shall provide a list of five (5) similar completed projects with addresses of the project location, Architect, and Owner.
- B. Installers Qualifications: The wall systems contractor shall have had a minimum of ten (10) years experience in the successful completion of projects employing similar materials, applications, and performance requirements.
  1. The wall systems contractor shall provide a list of five (5) similar completed projects with addresses of the project location, Architect, and Owner.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

#### 1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

## 1.9 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including rupturing, cracking, or puncturing.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Surface Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 15 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 2 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Morin; a Kingspan Group company (Basis-of-Design).
  - 2. Fabral.
  - 3. Bestworth-Rommel, Inc.

### 2.2 PANEL MATERIALS

- A. Vertical-Rib, Snap-Joint, Standing-Seam Metal Wall Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Zinc/Aluminum Coated Sheet (AZ50): Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
  - a. Thickness: 0.040 inch (1.02 mm), unless otherwise indicated.
  - b. Surface: Smooth, flat finish.
  - c. Exterior Finish: "Solid/Opaque".
  - d. Color: Dark Bronze (437R279) (SR:0.27, E:0.85, SRI:26) "2-COAT (1MIL) Flouropon PVDF" or equal as approved by Architect.
2. Clips: Manufacturer's standard to accommodate thermal movement.
3. Panel Coverage: 12 inches (305 mm), as indicated on Drawings. Panel profile varies as follows:
  - a. Panel Profile A: Refer to Detail.
  - b. Panel Profile B: Refer to Detail.
  - c. Panel Profile C: Refer to Detail.
  - d. Panel Profile D (Mech Screen): Refer to Detail.
4. Panel Height: As indicated on Drawings.

## 2.3 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G90 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Fabricated from minimum 16 gage (1.5 mm) zinc coated steel conforming to ASTM A 653 SQ Grade 37, G90 coating.
- C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## 2.4 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

## 2.5 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
  1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Fabricated in the same material, gage, finish, and color as adjacent metal wall panels, unless otherwise noted.

## 2.6 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels with joints between panels designed to form weathertight seals.
- C. Provide panel profile full length of panel, unless otherwise indicated.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Wall panel systems contractor shall check the alignment of the structural supports. Alignment exceeding tolerances defined in the AISC Code of Standard Practice shall be corrected prior to proceeding with the installation of the wall panel system.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

### 3.3 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
  - 2. Shim or otherwise plumb substrates receiving metal wall panels.
  - 3. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
  - 4. Install screw fasteners in predrilled holes.
  - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 6. Install flashing and trim as metal wall panel work proceeds.
  - 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  - 9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  - 10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
  - 1. Steel Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

- C. Anchor Clips: Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
- E. Standing-Seam Metal Wall Panel Installation: Fasten metal wall panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
  - 1. Install clips to supports with self-tapping fasteners.
  - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
  - 4. Watertight Installation:
    - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
- F. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

### 3.4 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.

- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

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## SECTION 074216 – INSULATED-CORE METAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Foamed-insulation-core metal wall panels.
  - 2. Sub-girt framing as required for proper installation of system.
  - 3. Wall panel accessories.
  - 4. Recycled content.

#### 1.3 REFERENCED STANDARDS

- A. American Architectural Manufacturers Association.
  - 1. AAMA 501.1: Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure.
- B. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM A 755/A 755M: Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
  - 3. ASTM C 273: Test Method for Shear Properties in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores.
  - 4. ASTM C 297: Test Method for Tensile Strength of Flat Sandwich Constructions in Flatwise Plane.
  - 5. ASTM C 518: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 6. ASTM C 645 Standard Specification for Nonstructural Steel Framing Members.
  - 7. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 8. ASTM C 1311: Specification for Solvent Release Sealants.
  - 9. ASTM D 1621: Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
  - 10. ASTM D 1622: Test Method for Apparent Density of Rigid Cellular Plastics.
  - 11. ASTM D 2126: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
  - 12. ASTM D 2244: Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

13. ASTM D 2856: Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer.
14. ASTM D 4214: Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
15. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E 108: Test Methods for Fire Tests of Roof Coverings.
17. ASTM E 283: Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
18. ASTM E 330: Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
19. ASTM E 331: Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

C. NAAMM - National Association of Architectural Metal Manufacturers.

1. Metal Finishes Manual for Architectural and Metal Products.

D. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.

1. Architectural Sheet Metal Manual. 6th Edition.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Air Infiltration of the Wall Panels and Windows: Shall not exceed 0.06 cfm/ft<sup>2</sup> at a static pressure of 6.24 psf (equivalent to 49 mph wind) when tested in accordance with ASTM E 283. Mock-up test size should be approximately 10'-0 x 10'-0 in size to simulate actual field conditions.
- C. Water Penetration under Static Pressure: There shall be no uncontrolled water penetration through the panel joints at 12 psf (equivalent to 68.5 mph wind) when tested in accordance with ASTM E 331. Mock-up test size should be approximately 10'-0 x 10'-0 in size to simulate actual field conditions.
- D. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft.
  1. Water Leakage: As defined according to AAMA 501.1.
- E. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
  1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. As indicated on Structural Drawing S-001 "Design Loads".

2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 of the span.
- F. Story Drift: Provide metal wall panel systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Structural Drawing S-001 "Design Loads".
    - a. Maximum Interstory Drifts -  $\Delta$  (ASCE 7-10 Section 12.8.6).
      - 1) Ground to 2nd:  $\Delta = 4\text{-}1/2$  inches (114 mm).
      - 2) 2nd to Low Roof:  $\Delta = 3\text{-}3/4$  inches (95 mm).
      - 3) Low Roof to High Roof:  $\Delta = 1\text{-}1/4$  inches (32 mm).
  2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- H. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) as indicated on Drawings when tested according to ASTM C 518.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
1. Product data indicating percentages of postconsumer and preconsumer recycled content for products having recycled content.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory, shop, and field-assembled work.
- C. Samples: Color charts for each type of metal wall panel indicated with factory-applied finishes.
1. Include similar Samples of trim and accessories involving color selection.
  2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- D. Qualification Data: For Installer.

- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- F. Maintenance Data: For insulated-core metal wall panels to include in maintenance manuals.
- G. Warranties: Sample of special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of metal wall panel from single source from a single manufacturer.
- C. Surface-Burning Characteristics: Provide metal wall panels having insulation core material with surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- D. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
  - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
  - 8. Review wall panel observation and repair procedures after metal wall panel installation.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

#### 1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

#### 1.9 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  1. Galvanized Steel Sheet: ASTM A 653, grade 37, G90 coating designation; structural quality. Galvalume is unacceptable.
  2. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Panel Sealants:
  1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3.2 mm) thick.
  2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
  3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

### 2.2 INSULATION FOR PANEL CORES

- A. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place type, with maximum flame-spread index of 25 and smoke-developed index of 450.
  1. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.

### 2.3 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G90 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Fabricated from minimum 16 gage (1.5 mm) zinc coated steel conforming to ASTM A 653 SQ Grade 37, G90 coating.
- C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

## 2.4 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

## 2.5 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation. Laminated panels are unacceptable.

### 1. Panel Performance:

- a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297.
- b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
- c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F according to ASTM D 2126.
- d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F according to ASTM D 2126.
- e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. positive and negative wind load and with deflection of L/180 for 2 million cycles.
- f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
- g. Fire-Test-Response Characteristics: Class A according to ASTM E 108.

### 2. Polyisocyanurate Insulation-Core Performance:

- a. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
- b. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
- c. Shear Strength: 26 psi when tested according to ASTM C 273.

- B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

### 1. Manufacturers: Subject to compliance with requirements, provide one of the following:

- a. Kingspan Insulated Panels; KS Series Horizontal Application (Basis-of-Design).
- b. CENTRIA Architectural Systems.
- c. Or equal as approved by Architect.

### 2. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

- a. Material: G90 galvanized steel sheet, 22 gage (0.76 mm) thickness.
  - b. Exterior Face: 22 gage (0.76 mm); embossed finish.
  - c. Interior Liner: 22 gage (0.76 mm); embossed and planked.
  - d. Exterior and Interior Facing Finish: 3 coat metallic finish.
  - e. Finish Color: As selected by Architect from manufacturers standard offerings.
3. Panel Thickness: 3 inches (76 mm).
  4. Panel Module: As indicated on Drawings.
  5. End Joints: Trimless end joints with gasket assembly.
  6. R-Value: 22.5 minimum.

## 2.6 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch (25 mm) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from the same gage material and finish as wall panels, 22 gage minimum thickness, zinc-coated (galvanized) steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

## 2.7 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
  5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
  - 2. Shim or otherwise plumb substrates receiving metal wall panels.
  - 3. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
  - 4. Install screw fasteners in predrilled holes.
  - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 6. Install flashing and trim as metal wall panel work proceeds.
  - 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  - 9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  - 10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
  - 1. Metal Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
  - 1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

### 3.3 INSULATED-CORE METAL WALL PANEL INSTALLATION

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
1. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
  2. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
  3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
  4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
  6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.

### 3.4 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

### 3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074216

## SECTION 075400 - PVC ADHERED MEMBRANE ROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. PVC adhered membrane roofing system.
  - 2. Roof insulation.
  - 3. Miscellaneous roofing materials and accessories.
  - 4. Walkway pads.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM C 1289: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - 2. ASTM D 1079: Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
  - 3. ASTM D 4434: Standard Specification for Poly (Vinyl Chloride) Sheet Roofing.
  - 4. ASTM D 5036: Practice for Application of Adhered Poly (Vinyl Chloride) Sheet Roofing.
  - 5. ASTM E 108: Test Methods for Fire Tests of Roof Coverings.
  - 6. ASTM E 119: Test Method for Fire Tests of Building Construction and Materials.
- B. ASCE - American Society of Civil Engineers.
  - 1. ASCE: Minimum Design Loads for Buildings and Other Structures.
- C. FMG - Factory Mutual Global.
  - 1. FMG 4450: Approval Standard for Class 1 Insulated Steel Deck Roofs (with 1992 Supplement).
  - 2. FMG 4470: Approval Standard Class 1 Roof Covers (with 1987 and 1992 Supplements) Approval Guide.
- D. NRCA - National Roofing Contractors Association.
  - 1. NRCA ML104 - The NRCA Roofing and Waterproofing Manual.
- E. SPRI - Single Ply Roofing Institute.

1. ANSI/SPRI RP-4: Wind Design Standard for Ballasted Single-Ply Roofing Systems.
  - a. Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems.

F. UL - Underwriters Laboratories Inc.

1. UL (RMSD) - Roofing Materials and Systems Directory.

#### 1.4 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7 and SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems."
- D. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
  1. Fire/Windstorm Classification: Class 1A-90.
  2. Hail Resistance: SH.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
  - 1. Base flashings and membrane terminations.
  - 2. Tapered insulation, including slopes.
  - 3. Insulation fastening patterns.
- C. Samples: For the following products:
  - 1. 12-by-12-inch (305-by-305-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
  - 2. 12-by-12-inch (305-by-305-mm) square of roof insulation.
  - 3. 12-by-12-inch (305-by-305-mm) square of walkway pads.
  - 4. 12-inch (305-mm) length of metal termination bars.
  - 5. 12-inch (305-mm) length battens.
  - 6. Six fasteners of each type, length, and finish.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of meeting performance requirements.
- F. Qualification Data: For Installer and manufacturer.
- G. Maintenance Data: For roofing system to include in maintenance manuals.
- H. Warranties: Special warranties specified in this Section.
- I. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum ten (10) years documented experience and approved by manufacturer.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (10) years of documented experience.
- C. Source Limitations: Obtain components for membrane roofing system from same manufacturer as roofing membrane.
- D. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
  2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
- E. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Convene one week before starting work of this section.
  2. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  6. Review structural loading limitations of roof deck during and after roofing.
  7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
  8. Review governing regulations and requirements for insurance and certificates if applicable.
  9. Review temporary protection requirements for roofing system during and after installation.
  10. Review roof observation and repair procedures after roofing installation.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

## 1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
  - 1. Special warranty includes roofing membrane, base flashings, roofing accessories, roof insulation, fasteners, walkway products and other components of membrane roofing system.
  - 2. Warranty Period: Fifteen (15) years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, and walkway products, for the following warranty period:
  - 1. Warranty Period: Two (2) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PVC ROOFING MEMBRANE

- A. PVC Sheet: ASTM D 4434, Type II, Grade 1, fiber reinforced, as follows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sarnafil Inc.; Sarnafil G410 EnergySmart Roof Membrane (Basis-of-Design).
    - b. Carlisle SynTec Incorporated.
    - c. GenFlex Roofing Systems.
    - d. Johns Manville.
    - e. Sponsorship Sign - Coordinate with Owner (Refer to Drawing A-103).
  - 2. Thickness: 60 mils (1.5 mm), nominal.
  - 3. Exposed Face Color: White.
- B. Radiative Properties for ENERGY STAR, LEED, Green Globes, and California's Title 24 Criteria:
  - 1. Initial Solar Reflectance: 0.83
  - 2. 3 Year Reflectance: 0.70
  - 3. Initial Thermal Emittance: 0.90
  - 4. 3 Year Thermal Emittance: 0.86
  - 5. Initial Solar Reflectance Index: 104.

6. 3 Year Solar Reflectance Index: 85.

## 2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
  1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3.2 mm) thick; with anchors.
- E. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

## 2.3 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20PSI) glass fiber cellulosic felt on both major surfaces.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sarnafil; Sarnatherm (Basis-of-Design) or approved equal.
    - b. Dow Chemical Company.
    - c. Carlisle SynTec Incorporated.
    - d. Firestone Building Products Company.
  2. Facing: Glass fiber cellulosic both faces.
  3. Board Size: 48 by 96 inches (1219 by 2438 mm).
  4. Board Thickness: As required to meet R-Value.
  5. Thermal Resistance: R-Value of 30.
  6. Board Edges: Square.

- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch (6 mm) per 12 inches (305 mm), unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.4 ROOF SHEATHING

- A. Underlayment Board:
  - 1. 5/8 inch (15 mm) thick Dens Deck Prime or approved equal.
- B. Cover Board:
  - 1. 1/2 inch (13 mm) Dens Deck Prime or approved equal.

## 2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

## 2.6 ASPHALT MATERIALS

- A. Low Rise Foam Adhesive (7-12).

## 2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, and acceptable to membrane roofing system manufacturer.
  - 1. Recycled rubber, 30 by 30 by 1/4 inch (762 by 762 by 6 mm), button finish.
    - a. Basis-of-Design: Sarnatread (Sarnafil).
      - 1) Refer to Drawing Layout.

## 2.8 MAINTENANCE PAD

- A. PVC Netting: Walk-way protection mat used to protect roof membrane from mechanical abuse.
  - 1. 9/16" thick flexible pvc provided in rolls.

- a. Basis-of-Design: Crossgrip Walk (Sarnafil).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements.
  - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### 3.3 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten first layer of insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification and Manufacturer.

### 3.4 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
  - 1. Install sheet according to ASTM D 5036.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
  - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  - 3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

### 3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### 3.6 WALKWAY INSTALLATION

- A. Walkway Pads: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### 3.7 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
  - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.
- E. Submit report to Architect at completion.
- F. Job Start: Field Inspections to maintain manufacturer's warranty.

### 3.8 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

### 3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS \_\_\_\_\_ (insert name and address of Roofing Installer), herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

- 1. Owner: \_\_\_\_\_.
- 2. Address: \_\_\_\_\_.

3. Building Name/Type: \_\_\_\_\_.
4. Address: \_\_\_\_\_.
5. Area of Work: \_\_\_\_\_.
6. Acceptance Date: \_\_\_\_\_.
7. Warranty Period: \_\_\_\_\_.
8. Expiration Date: \_\_\_\_\_.

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a. lightning;
    - b. peak gust wind speed exceeding \_\_\_\_\_ (insert wind speed) mph;
    - c. fire;
    - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    - f. vapor condensation on bottom of roofing; and
    - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
  2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
  3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
  4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
  5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_ (insert day) day of \_\_\_\_\_ (insert month), \_\_\_\_\_ (insert year).

1. Authorized Signature: \_\_\_\_\_.
2. Name: \_\_\_\_\_.
3. Title: \_\_\_\_\_.

END OF SECTION 075400

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:

- 1. Flashings, counterflashings.
- 2. Reglets and accessories.

#### 1.3 REFERENCED STANDARDS

- A. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
- B. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM B 32: Specification for Solder Metal.
  - 3. ASTM B 749: Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
  - 4. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 5. ASTM C 1311: Specification for Solvent Release Sealants.
  - 6. ASTM D 4586: Specification for Asphalt Roof Cement, Asbestos-Free.
- C. FMG - FM Global.
  - 1. FMG Loss Prevention Data Sheet 1B49: Perimeter Flashing.
- D. NAAMM - National Association of Architectural Metal Manufacturers.
  - 1. Metal Finishes Manual for Architectural and Metal Products.
- E. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
  - 1. Architectural Sheet Metal Manual.

F. SSPC - The Society for Protective Coatings.

1. SSPC Paint 12: Paint Specification No. 12: Cold Applied Asphalt Mastic (Extra Thick Film).

1.4 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F (48.8 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.
- C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
  1. Identify material, thickness, weight, and finish for each item and location in Project.
  2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

1.6 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

#### 1.8 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

### PART 2 - PRODUCTS

#### 2.1 SHEET METALS

- A. Pre-Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; core steel, shop pre-coated with 3-coat fluoropolymer coating.
- B. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet, 2.5 lb/sq. ft. (12.2 kg/sq. m) thick.

#### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication. Form sections true to shape, accurate in size, square, and free from distortion or defects
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Form nonmoving seams in accessories with flat lock seams, except where otherwise indicated. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as sheet, minimum 12 inches (305 mm) wide, interlocking with sheet.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

- H. Form pieces in longest possible lengths.
- I. Fabricate corners from one piece with each leg extended to column centerline; seam for rigidity, double seal with sealant.
- J. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
  - 1. Flashing greater than 4 inches (101 mm) in vertical exposure: 18 gage (1.2 mm).
- K. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.
  - 1. Manufacturers:
    - a. Cheney Flashing Company, Inc.
    - b. Fry Reglet Corporation.
    - c. Heckmann Building Products Inc.
    - d. Hickman, W. P. Company.
  - 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
  - 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
  - 5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
  - 6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

## 2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: Kynar finish). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
  - a. Color and Gloss: Match Architect's sample.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  2. Proceed with installation only after unsatisfactory conditions have been corrected.
  3. Verify roofing termination and base flashings are in place, sealed, and secure.

### 3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### 3.3 INSTALLATION

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (305 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  - F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
  - G. Fasteners: Secure flashings in place using concealed fasteners.
    1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
  - H. Seal joints with elastomeric sealant as required for watertight construction.
    1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4.4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4.4 deg C).
    2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
  - I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.
  - J. Conform to SMACNA Architectural Sheet Metal Manual Drawing Details:
    1. Figure 4-3C and 4-3D: Counterflashing systems.
    2. Figure 4-15: Roof penetration flashing, structural steel.
  - K. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
  - L. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- 3.4 CLEANING AND PROTECTION
- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
  - B. Clean and neutralize flux materials. Clean off excess solder and sealants.
  - C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

### 3.5 FIELD QUALITY CONTROL

- A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 076200

## SECTION 077100 - ROOF SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Metal coping (Fascia).
  - 2. Copings system.
  - 3. Roof edge drainage systems.
  - 4. Miscellaneous materials and accessories.

#### 1.3 REFERENCED STANDARDS

- A. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 3. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 4. ASTM C 1311: Specification for Solvent Release Sealants.
  - 5. ASTM D 226: Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - 6. ASTM D 2244: Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
  - 7. ASTM D 4214: Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
  - 8. ASTM D 4397: Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
  - 9. ASTM D 4586: Specification for Asphalt Roof Cement, Asbestos-Free.
- C. NAAMM - National Association of Architectural Metal Manufacturers.

1. Metal Finishes Manual for Architectural and Metal Products.
- D. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
  1. Architectural Sheet Metal Manual.
- E. SPRI - Single Ply Roofing Institute.
  1. SPRI ES-1: Wind Design Standard for Edge Systems Used With Low Slope Roofing Systems (ANSI).
- F. SSPC - The Society for Protective Coatings.
  1. SSPC-Paint 12: Paint Specification No. 12: Cold Applied Asphalt Mastic (Extra Thick Film).

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for Windstorm Classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F (48.8 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
  1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
  2. Details for expansion and contraction.

- C. Warranty: Special warranty specified in this Section.

## 1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 EXPOSED METALS

- A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish with 3-coat fluoropolymer coating.
- B. Pre-Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; core steel, shop pre-coated with 3-coat fluoropolymer coating.

### 2.2 METAL COPING (FASCIA)

- A. Aluminum Extrusion Profile:
1. Thickness: 0.0125 inch (0.3 mm) unless noted otherwise. Refer to Details.
  2. Color: Finish to match Formed Metal Wall Panels Section 074213.

### 2.3 CONCEALED METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

### 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
  - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- G. Polyethylene Sheet: 6 mil (0.15 mm) thick polyethylene sheet complying with ASTM D 4397.
- H. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
  - 1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

## 2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Architectural Products Co.; G-Type Extruded Aluminum Coping.
    - b. Hickman, W. P. Company; Permasnap Coping.
    - c. MM Systems Corporation; Snap-Lok Coping System.
    - d. Architectural Roofing & Wall System.
    - e. Centria Roof Systems.
    - f. Met Fab Manufacturing
  - 2. Coping Caps: Snap-on, fabricated from the following exposed metal:
    - a. Aluminum: 0.063 inch (0.85 mm) thick, including special supports spaced at 60 inches (1524 mm) on center. Include corner plates to conceal and weather seal joints and attachment flanges.

3. Coping Cap Color: As selected by Architect from manufacturer's full range.
4. Corners: Mechanically clinched and sealed watertight.
5. Snap-on Coping Anchor Plates: Concealed, galvanized steel sheet, 12 inches (305 mm) wide, 0.028 inch (0.7 mm) thick, with integral cleats.
6. Face Leg Cleats: Concealed, continuous galvanized steel sheet.

## 2.6 ROOF EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. ATAS International, Inc.
  2. Metal-Era, Inc.
  3. MM Systems Corporation.
  4. Architectural Roofing & Wall System.
  5. Centria Roof Systems.
  6. Met Fab Manufacturing.
- B. Concealed Gutters and Downspouts: Manufactured formed gutter in uniform section lengths not exceeding 12 feet (3.6 m), with mitered and welded or soldered corner units, end caps, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front gutter rim. Furnish with flat-stock gutter straps and gutter support brackets and expansion joints and expansion-joint covers fabricated from same metal as gutters.
  1. Fabricate gutter from the following exposed metal:
    - a. Prepainted, Zinc-Coated Steel: 0.028 inch thick.
  2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
  3. Downspouts: Rectangular closed-face with mitered elbows, manufactured from the following exposed metal. Furnish wall brackets, from same material and finish as downspouts, with anchors.
    - a. Prepainted, Zinc-Coated Steel: 0.028 inch (0.7 mm) thick.
- C. Conductor Heads: Manufactured conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows.
  1. Fabricate conductor heads from the following exposed metal:
    - a. Prepainted, Zinc-Coated Steel: 0.0276 inch (0.7 mm) thick.

## 2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: Kynar finish). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
  - 1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
    - a. Color and Gloss: Match Architect's sample.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
- B. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  - 4. Torch cutting of roof specialties is not permitted.

- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties.
  - 1. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (457 mm) of corners or intersections unless otherwise shown on Drawings.
  - 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fasteners: Use fasteners of type and size recommended by manufacturer.
- E. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

### 3.3 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to meet performance requirements.
  - 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's recommended spacing.

### 3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

### 3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

## SECTION 077200 - ROOF ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Roof curbs and equipment supports.
  - 2. Roof ladders.
  - 3. Ship's ladders.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 3. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 4. ASTM C 1311: Specification for Solvent Release Sealants.
  - 5. ASTM D 226: Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - 6. ASTM D 4397: Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.
  - 7. ASTM D 4586: Specification for Asphalt Roof Cement, Asbestos-Free.
- B. NAAMM - National Association of Architectural Metal Manufacturers.
  - 1. Metal Finishes Manual for Architectural and Metal Products.
- C. NRCA - National Roofing Contractors Association.
- D. SMACNA - Sheet Metal Air-Conditioning Contractors' National Association.
  - 1. Architectural Sheet Metal Manual.
- E. SSPC - The Society for Protective Coatings.
  - 1. SSPC-Paint 12: Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).

F. UL - Underwriters Laboratories Inc.

1. UL 793: Automatically Operated Roof Vents for Smoke and Heat.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.5 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

1.6 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
- B. NRCA's "Roofing and Waterproofing Manual" details for installing units.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.8 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

## 1.9 WARRANTY

- A. Manufacturer's Standard Warranty: Materials shall be free of defects in material and workmanship for a period of five (5) years from the date of Substantial Completion. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

## PART 2 - PRODUCTS

### 2.1 METAL MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; core steel, shop pre-coated with 3-coat fluoropolymer coating.
- B. Powder-Coat Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; core steel, painted with baked-polymer thermosetting powder finish.
- C. Aluminum Extrusions and Tubes: ASTM B 221, alloy and temper recommended by manufacturer for type of use, mill finished.

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Underlayment:
  - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
  - 2. Polyethylene Sheet: 6 mil (0.15 mm) thick, polyethylene sheet complying with ASTM D 4397.
  - 3. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- D. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- F. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.3 ROOF CURBS AND EQUIPMENT SUPPORTS

- A. Roof Curbs and Equipment Supports: Prefabricated heavy gage aluminum-zinc alloy coated steel shell, base plate, and diverter, approximately 12 inches (305 mm) in height above finished roof, with factory installed wood nailer, formed with mounting flange, insulation return and 3 inch (76 mm) cant, and with an integral heavy gage aluminum-zinc alloy coated steel cap flashing, all corners full welded and ground smooth.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ThyCurb, Division of Thybar Corporation.
    - b. The Pate Company.
    - c. Custom Curb, Inc.
    - d. Roof Products and Systems, Inc.
  2. Sloping Roofs: Where roof deck exceeds 1:48, fabricated curb units with water diverter or cricket, and with height tapered to match slope to level tops of units, without saddle and diverter built into roof.
  3. Finish: Fluoropolymer 3-Coat coating system.
    - a. Color: Match Architect's sample.

## 2.4 ROOF LADDERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Roof Ladders:
    - a. ALACO Ladder Co.: Model 561 or equal as approved by Architect.
- B. Construction and Materials:
1. Aluminum ladders and their components shall be fabricated from 6061-T6 aluminum alloy for added safety, strength and long-lasting durability, with no painting required.
  2. Fixed wall ladders include side rails with 1-1/8 inches (29 mm) round rungs that are serrated and secured with cast aluminum connectors, 4 solid rivets and 3/8 inch (9.5 mm) thick brackets mounted to the walls.
    - a. Ladder Size: As indicated on Drawings.
  3. Note - Cages are required for wall ladders when installations are in excess of 20'-0" (6.1 m) in height. Platforms are required for ladders over 30'-0" (9.2 m).
- C. Finish: Mill finish aluminum.

## 2.5 SHIP'S LADDERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Ship's Ladders:
    - a. ALACO Ladder Co. or equal as approved by Architect.
- B. Construction and Materials:
  - 1. Ship's ladders and their components shall be fabricated from galvanized steel for added safety, strength and long-lasting durability, with no painting required.
  - 2. Steps, Mounting Brackets, and Handrails: As indicated on Drawings.
- C. Finish: Galvanized steel. Refer to Section 050300 "Hot Dip Galvanizing" for galvanized finish requirements.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
  - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
  - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
  - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
  - B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
    1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
    2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
    3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
  - C. Roof Curb and Equipment Supports Installation:
    1. Set roof curb so top surface of roof curb is level.
  - D. Roof Ladders Installation:
    1. Install top of the top rung, level with top of access/egress level or landing platform, served by the ladder stepping-off surface and space rungs 12 inches (305 mm) on centers to bottom rung.
    2. Note: Bottom rung height from ground will vary depending on roof height. Install parapet railing 42 inches (1067 mm) above top rung, then extend horizontally and return to roof or the rear of the parapet.
  - E. Ship's Ladders Installation:
    1. Attach ship's ladders according to manufacturer's written instructions.
  - F. Seal joints with elastomeric or butyl sealant as required by manufacturer of roof accessories.
- 3.3 REPAIR AND CLEANING
- A. Clean exposed surfaces according to manufacturer's written instructions.
  - B. Clean off excess sealants.
  - C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

## SECTION 078100 – APPLIED FIREPROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Concealed cementitious sprayed fire-resistive materials.
  - 2. Exposed cementitious sprayed fire-resistive materials.
  - 3. Exposed intumescent mastic fire-resistive coatings.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E 119: Test Methods for Fire Tests of Building Construction and Materials.
  - 3. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
  - 4. ASTM E 605: Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
  - 5. ASTM E 736: Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
  - 6. ASTM E 759: Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
  - 7. ASTM E 760: Test Method for Effect of Impact Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
  - 8. ASTM E 761: Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
  - 9. ASTM E 859: Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRM) Applied to Structural Members.
  - 10. ASTM E 937: Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
  - 11. ASTM G 21: Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. AWCI - Association of the Wall and Ceiling Industries.
  - 1. AWCI Technical Manual 12-A: Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials: An Annotated Guide.
- C. UL - Underwriters Laboratories Inc.

1. Fire Resistance Director.

#### 1.4 DEFINITIONS

- A. Concealed Sprayed Fire-Resistive Materials: Applied to surfaces that are concealed from view behind other construction when the Work is completed.
- B. Exposed Sprayed Fire-Resistive Materials: Applied to surfaces that are exposed to view when the Work is completed and surfaces that are accessible through acoustical panel ceilings.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Structural framing plans indicating the following:
  1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
  2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:
    - a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ).
    - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
    - c. Designation of restrained and unrestrained conditions based on definitions in ASTM E 119, Appendix X3 as determined by a qualified professional engineer.
  3. Treatment of sprayed fire-resistive material after application.
- C. Product Certificates: For each type of sprayed fire-resistive material, signed by product manufacturer.
- D. Qualification Data: For Installer, manufacturer and testing agency.
- E. Compatibility and Adhesion Test Reports: From sprayed fire-resistive material manufacturer indicating the following:
  1. Materials have been tested for bond with substrates.
  2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings.
  3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.
- G. Research/Evaluation Reports: For sprayed fire-resistive materials.
- H. Warranties: Special warranties specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. **Testing Agency Qualifications:** An independent testing agency, acceptable to Authorities Having Jurisdiction (AHJ), with the experience and capability to conduct the testing indicated.
  - 1. Continuous inspection is required for fire proofing and shall be coordinated with the AHJ.
- C. **Source Limitations:** Obtain sprayed fire-resistive materials through one source from a single manufacturer.
- D. **Sprayed Fire-Resistive Materials Testing:** By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
  - 1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ).
  - 2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
- E. **Compatibility and Adhesion Testing:** Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
  - 1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
  - 2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.
- F. **Fire-Test-Response Characteristics:** Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ). Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing and inspecting agency.
  - 1. **Fire-Resistance Ratings:** Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ), for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.
  - 2. **Surface-Burning Characteristics:** ASTM E 84.
- G. **Preinstallation Conference:** Convene one week before starting work of this section. Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:

1. Review and finalize construction schedule and verify sequencing and coordination requirements.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
- C. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

#### 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is 40 deg F (4.4 deg C) or lower unless temporary protection and heat is provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

#### 1.9 COORDINATION

- A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:
  1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
  2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
  3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
  4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
  5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
  6. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
  7. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
  - 1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
  - 2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
- B. Warranty Period: Five (5) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CONCEALED CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Concealed Cementitious Sprayed Fire-Resistive Material:
    - a. Grace, W. R. & Co., Construction Products Div.
    - b. Carbolite Co., Fireproofing Products Div.
    - c. Isolatek International Corp., Cafco Products.
    - d. Mandoval Vermiculite Products, Inc.
- C. Material Composition: As follows:
  - 1. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
- D. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
  - 1. Dry Density: 15 lb/cu. ft. (240 kg/cu. m) for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
  - 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9.5 mm), per ASTM E 605:

- a. Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch (6 mm).
  - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9.5 mm), the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch (9.5 mm) or 75 percent of the design thickness.
  - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft. (240 kg/cu. m)
3. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736 under the following conditions:
  - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
  - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.
  - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch (19 mm).
4. Compressive Strength: 5.21 lbf/sq. in. (35.9 kPa) as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified, but not less than 15 lb/cu. ft. (240 kg/cu. m)
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.27 g/sq. m) in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch (19 mm), maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ):
  - a. Flame-Spread Index: 10 or less.
  - b. Smoke-Developed Index: 0.
10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

## 2.2 EXPOSED CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For exposed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Exposed Cementitious Sprayed Fire-Resistive Material:

- a. Grace, W. R. & Co.--Conn., Construction Products Div.
- b. Carbolite Co., Fireproofing Products Div.
- c. Isolatek International Corp., Cafco Products.
- d. Mandoval Vermiculite Products, Inc.

- C. Exposed Cementitious Sprayed Fire-Resistive Material: Factory-mixed, dry, cement aggregate formulation; or chloride-free formulation of gypsum or portland cement binders, additives, and inorganic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, complying with the following requirements:

1. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWC Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 22 lb/cu. ft. (352 kg/cu.m).
2. Bond Strength: 434 lbf/sq. ft. (21 kPa) minimum per ASTM E 736.
3. Compressive Strength: 51 lbf/sq. in. (351 kPa) per ASTM E 761.
4. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
5. Deflection: No cracking, spalling, or delamination per ASTM E 759.
6. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
7. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.27 g/sq. m) per ASTM E 859.
8. Combustion Characteristics: Passes ASTM E 136.
9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ):
  - a. Flame-Spread Index: 10 or less.
  - b. Smoke-Developed Index: 0.
10. Fungal Resistance: No observed growth on specimens per ASTM G 21.
11. For exterior applications of sprayed fire-resistive material, provide formulation approved for surfaces exposed to exterior.

## 2.3 EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fire-Resistive, Water-Based Intumescent Mastic Coating Material:

- a. A/D Fire Protection Systems Inc.
- b. Albi Manufacturing, Division of StanChem Inc.
- c. Carbolite Co., Fireproofing Products Div.
- d. Isolatek International Corp., Cafco Products.

- B. Thin-Film Fire-Resistive Intumescent Mastic Coating: Factory-mixed formulation.

1. Water-Based Formulation: Approved by manufacturer and Authorities Having Jurisdiction (AHJ) for interior use.
  2. Multicomponent system consisting of intumescent base coat and topcoat.
- C. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.4 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ) for use in fire-resistance designs indicated.
- B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory," for coating materials based on a series of bond tests per ASTM E 736.
  2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of sprayed fire-resistive material per ASTM E 119 by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction (AHJ).
- C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric: Glass-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated, approved by manufacturer of intumescent mastic coating fire-resistive material.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance designs indicated, approved by manufacturer of intumescent mastic coating fire-resistive material. Include pins and attachment.
- G. Topcoat: Type recommended in writing by manufacturer of each sprayed fire-resistive material for application over concealed and exposed sprayed fire-resistive materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
  2. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
  3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of oil, rolling compounds, and other substances capable of interfering with bond.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, and incompatible primers, paints, and encapsulants.
- C. Prime substrates where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive sprayed fire-resistive material.
- D. For exposed applications, repair substrates to remove any surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

### 3.3 INSTALLATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

- C. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.
- D. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.
- E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.
- F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.
- G. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply sprayed fire-resistive material that differs in color from that of encapsulant over which it is applied.

#### 3.4 INSTALLATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed Sprayed Fire-Resistive Materials" Article.
- B. Apply topcoat to concealed sprayed fire-resistive material where indicated.

#### 3.5 INSTALLATION, EXPOSED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply exposed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
  - 1. For steel beams and bracing, provide a thickness of not less than 1 inch (25 mm).
  - 2. For metal floor or roof decks, provide a thickness of not less than 1/2 inch (13 mm).
- B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.
- C. Apply exposed cementitious sprayed fire-resistive material to produce the following finish:
  - 1. Spray-textured finish.
- D. Apply intumescent mastic fire-resistive coating as follows:

1. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
  2. Finish: Spray-textured finish with no further treatment.
- E. Apply thin-film intumescent mastic fire-resistive coating as follows:
1. Finish: Spray apply successive base coat(s) and finish topcoat. Allow to dry and cure between coats. Before applying finish topcoat, determine required dry film thickness according to manufacturer's written recommendations.
- F. Cure exposed cementitious sprayed fire-resistive material according to product manufacturer's written recommendations to prevent premature drying.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of completed applications of sprayed fire-resistive material shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of sprayed fire-resistive material for the next area until test results for previously completed applications of sprayed fire-resistive material show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93 sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.09 sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.
  2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
  3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
  4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
  5. If testing finds applications of sprayed fire-resistive material are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
- C. Remove and replace applications of sprayed fire-resistive material where test results indicate that it does not comply with specified requirements for cohesion and adhesion, for density, or for both.

- D. Apply additional sprayed fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect sprayed fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.
- C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.
- D. Repair or replace work that has not been successfully protected.

END OF SECTION 078100

## SECTION 078413 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

#### 1.2 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.
- B. Qualification Data: For qualified Installer.
- C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
  1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    - b. Classification markings on penetration firestopping correspond to designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

## 2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
  2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  1. Horizontal assemblies include floors.
  2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
  3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
  1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-wool-fiber or rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.
    - d. Fillers for sealants.
  2. Temporary forming materials.
  3. Substrate primers.
  4. Collars.
  5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
  1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

### 3.7 PENETRATION FIRESTOPPING SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Firestopping with No Penetrating Items:
  - 1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 0001-0999.
  - 2. F-Rating: 2 hours.
  - 3. T-Rating: 2 hours.
  - 4. Type of Fill Materials: As required to achieve rating.
- C. Firestopping for Metallic Pipes, Conduit, or Tubing:
  - 1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 1001-1999.
  - 2. F-Rating: 2 hours.
  - 3. T-Rating: 2 hours.
  - 4. Type of Fill Materials: As required to achieve rating.
- D. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
  - 1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 2001-2999.
  - 2. F-Rating: 1 hour.
  - 3. T-Rating: 1 hour.
  - 4. Type of Fill Materials: As required to achieve rating.
- E. Firestopping for Electrical Cables:
  - 1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 3001-3999.
  - 2. F-Rating: 2 hours.
  - 3. T-Rating: 2 hours.
  - 4. Type of Fill Materials: As required to achieve rating.
- F. Firestopping for Cable Trays with Electric Cables:
  - 1. UL-Classified Systems: W-J-; W-L- 4001-4999.
  - 2. F-Rating: 2 hours.
  - 3. T-Rating: 2 hours.
  - 4. Type of Fill Materials: As required to achieve rating.

G. Firestopping for Insulated Pipes:

1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 5001-5999.
2. F-Rating: 2 hours.
3. T-Rating: 2 hours.
4. Type of Fill Materials: As required to achieve rating.

H. Firestopping for Miscellaneous Electrical Penetrants:

1. UL-Classified Systems: F-A-; W-L-; W-J- 6001-6999.
2. F-Rating: 2 hours.
3. T-Rating: 2 hours.
4. Type of Fill Materials: As required to achieve rating.

I. Firestopping for Miscellaneous Mechanical Penetrants:

1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 7001-7999.
2. F-Rating: 2 hours.
3. T-Rating: 2 hours.
4. Type of Fill Materials: As required to achieve rating.

J. Firestopping for Groupings of Penetrants:

1. UL-Classified Systems: F-A-; F-C-; W-J-; W-L- 8001-8999.
2. F-Rating: 2 hours.
3. T-Rating: 2 hours.
4. Type of Fill Materials: As required to achieve rating.

END OF SECTION

## SECTION 078443 - JOINT FIRESTOPPING

### 1.1 QUALITY ASSURANCE

- A. Installer Qualifications: FM Global approved or UL qualified.

### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Low-emitting sealants.

### 1.3 FIRE-RESISTIVE JOINT SYSTEMS

- A. Joints in or between Fire-Resistance-Rated Construction: ASTM E 1966 or UL 2079.
- B. Joints at Exterior Curtain-Wall/Floor Intersections: ASTM E 119 or ASTM E 2307.

### 1.4 FIELD QUALITY CONTROL

- A. Inspection of Installed Firestopping: By Owner-engaged agency according to ASTM E 2393.

END OF SECTION 078443

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

#### 1.2 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

#### 1.4 INFORMATIONAL SUBMITTALS

A. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For fire-resistive joint system sealants, documentation including printed statement of VOC content.

B. Qualification Data: For qualified Installer.

- C. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
  - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
    - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
    - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

## PART 2 - PRODUCTS

### 2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls and floor or floor/ceiling assemblies.
  2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
  3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. A/D Fire Protection Systems Inc.
    - b. CEMCO.
    - c. Fire Trak Corp.
    - d. Grace Construction Products.
    - e. Hilti, Inc.
    - f. Johns Manville.
    - g. Nelson Firestop Products.
    - h. NUCO Inc.
    - i. Passive Fire Protection Partners.
    - j. RectorSeal Corporation.
    - k. Specified Technologies Inc.
    - l. 3M Fire Protection Products.
    - m. Tremco, Inc.; Tremco Fire Protection Systems Group.
    - n. USG Corporation.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. A/D Fire Protection Systems Inc.
    - b. Grace Construction Products.
    - c. Hilti, Inc.
    - d. Johns Manville.
    - e. Nelson Firestop Products.
    - f. NUCO Inc.
    - g. Passive Fire Protection Partners.
    - h. RectorSeal Corporation.
    - i. Specified Technologies Inc.
    - j. 3M Fire Protection Products.
    - k. Thermafiber, Inc.
    - l. Tremco, Inc.; Tremco Fire Protection Systems Group.
    - m. USG Corporation.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. A/D Fire Protection Systems Inc.

- b. Grace Construction Products.
  - c. Hilti, Inc.
  - d. Johns Manville.
  - e. Nelson Firestop Products.
  - f. NUCO Inc.
  - g. Passive Fire Protection Partners.
  - h. RectorSeal Corporation.
  - i. Specified Technologies Inc.
  - j. 3M Fire Protection Products.
  - k. Tremco, Inc.; Tremco Fire Protection Systems Group.
  - l. USG Corporation.
- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- 1. Architectural Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
  - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.

- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
  - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

### 3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Floor-to-Floor, Fire-Resistive Joint Systems:
  - 1. UL-Classified Systems: FF-S- 0000-0999.
  - 2. Assembly Rating: As indicated.
  - 3. Nominal Joint Width: As indicated.
  - 4. Movement Capabilities: Class I - 12-1/2 percent compression or extension.
- C. Wall-to-Wall, Fire-Resistive Joint Systems:
  - 1. UL-Classified Systems: WW-S-0000-0999.
  - 2. Assembly Rating: As indicated.
  - 3. Nominal Joint Width: As indicated.
  - 4. Movement Capabilities: Class I - 12-1/2 percent compression or extension.
- D. Floor-to-Wall, Fire-Resistive Joint Systems:
  - 1. UL-Classified Systems: FW-S-0000-0999.
  - 2. Assembly Rating: As indicated.
  - 3. Nominal Joint Width: As indicated.
  - 4. Movement Capabilities: Class I - 12-1/2 percent compression or extension.
- E. Head-of-Wall, Fire-Resistive Joint Systems:
  - 1. UL-Classified Systems: HW-S-0000-0999.

2. Assembly Rating: As indicated.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class I - 12-1/2 percent compression or extension.

F. Bottom-of-Wall, Fire-Resistive Joint Systems:

1. UL-Classified Systems: BW-S-0000-0999.
2. Assembly Rating: As indicated.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class I - 12-1/2 percent compression or extension.

G. Wall-to-Wall, Fire-Resistive Joint Systems Intended for Use as Corner Guards:

1. UL-Classified Systems: CG-S-0000-0999.
2. Assembly Rating: As indicated.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class I – 12-1/2 percent compression or extension.

END OF SECTION

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 079201 - JOINT SEALANTS (EXTERIOR)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Preformed joint sealants.
  - 4. Joint sealant backings and miscellaneous materials.
  - 5. Low-emitting materials for sealants and sealant primers.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 2. ASTM C 1193: Guide for Use of Joint Sealants.
  - 3. ASTM C 1247: Test Method for Sealants Exposed to Continuous Immersion in Liquids.
  - 4. ASTM C 1248: Test Method for Staining of Porous Substrate by Joint Sealants.
  - 5. ASTM C 1330: Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - 6. ASTM C 1521: Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- B. CFR - Code of Federal Regulations.
  - 1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- C. SWRI - Sealant, Waterproofing, and Restoration Institute.

#### 1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
  - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each application indicated below:

- a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
  - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
    - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

#### 1.5 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
  1. Include low-emitting materials for sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.
- B. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
  1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.
  4. Joint-sealant color.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- E. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- G. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

- H. Field-Adhesion Test Reports: For each sealant application tested.
- I. Warranties: Sample of special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

#### 1.7 PRE-SEALANT CONFERENCE AND PROTOTYPE INSTALLATION

- A. Arrange a conference at project site not more than 10 working days nor less than 2 working days before the commencement of sealant work, to review the specifications, details, job conditions, priming and application requirements, materials protection and scheduling. Architect and sealant manufacturer's representative including the supervisor of sealant work will attend. Make joint tour of job immediately before meeting. Installer will conduct conference and issue meeting record to all participants.
- B. Immediately following joint sealant discussion, install each type of joint sealant, using exact materials and procedures agreed upon in pre-sealant conference. Provide sealant color as approved from submitted samples:
  - 1. Install exact materials as required for project mockups.

#### 1.8 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C). Silicones are approved to -20 deg F (-28.8 deg C).
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### 1.9 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five (5) years from date of Substantial Completion.
  2. Warranty Period: Twenty (20) years for silicones like Dow Corning 756SMS, 790, 791, and 795.
  3. Warranty Period: Twenty (20) years nonstain warranty for silicones with Dow Corning 756SMS and 790.
- C. Special warranties specified in this Article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
  2. Disintegration of joint substrates from natural causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. VOC Content of Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project and offer a nonstain warranty.

- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 SILICONE JOINT SEALANTS

- A. Type A - General Purpose Neutral-Curing Silicone Sealant: Comply with ASTM C 920.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Dow Corning Corporation; 756SMS, 790, 791, 795, CCS, and CWS.
  - b. GE Advanced Materials - Silicones; SilPruf SCS2000.
  - c. BASF Building Systems; Omniseal.
  - d. Tremco; Spectrem 3.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Color: Custom, as selected by Architect.

## 2.3 URETHANE JOINT SEALANTS

- A. Type D - Multicomponent Nonsag Urethane Sealant: Comply with ASTM C 920.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Bostik Findley; Chem-Calk 500.
  - b. ITW Polymers Sealants North America, Inc.; Pacific Polymers Elasto-Thane 227 R Type II.
  - c. Polymeric Systems Inc.; PSI-270.
  - d. Tremco Incorporated; Dymeric 240.
2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50 or 25, as indicated.
4. Additional Movement Capability: 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
5. Use Related to Exposure: NT (nontraffic).
6. Color: Custom colors as selected by Architect.

- B. Type E - Multicomponent Self-Leveling Pourable Immersible Urethane Sealant: Comply with ASTM C 920.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Polymers Sealants North America, Inc.; Pacific Polymers Elasto-Thane 227 R Type II.
  - b. LymTal International, Inc.; Iso-Flex 880 GB.
  - c. May National Associates, Inc.; Bondaflex PUR 2 SL.
  - d. Tremco Incorporated; Vulkem 245.

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and I (immersible), Class 1.
5. Color: Custom color as selected by Architect.

## 2.4 PREFORMED JOINT SEALANTS

- A. Type J - Preformed Expanded Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
    - b. Willseal USA, LLC; Wilseal 250.
    - c. Dayton Superior Specialty Chemicals; Polytite Standard.
    - d. Sandell Manufacturing Co., Inc.; Polyseal.
  2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
    - a. Density: Manufacturer's standard.

## 2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:

- a. Perform 10 tests for the first 1000 feet (305 m) of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform 1 test for each 1000 feet (305 m) of joint length thereafter or 1 test per each floor per elevation.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull TabMethod B, Exposed Surface Finish Hand Pull TabMethod C, Field-Applied Sealant Joint Hand Pull Flap or Method D, Water Immersion in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
  4. Inspect tested joints and report on the following:
    - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    - b. Whether sealants filled joint cavities and are free of voids.
    - c. Whether sealant dimensions and configurations comply with specified requirements.
  5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
  6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- 3.5 CLEANING
- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- 3.6 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately

so installations with repaired areas are indistinguishable from original work.

### 3.7 JOINT-SEALANT SCHEDULE (EXTERIOR)

- A. Exterior Joints for Which No Other Sealant Type is Indicated: Type A or D; colors as selected by Architect.
- B. Control and Expansion Joints in Paving: Type E.
- C. Exterior Wall Expansion Joints: Type A or D.
- D. Control, Expansion, and Soft Joints in Masonry, and Between Masonry and Adjacent Work: Type A or D.
- E. Lap Joints in Exterior Sheet Metal Work: Type A, D or J where indicated.
- F. Joints Between Exterior Metal Frames, Aluminum Frame and Curtain Wall, and Adjacent Work (except masonry): Type A or D.
- G. Under Exterior Door Thresholds: Type E.

END OF SECTION 079201

## SECTION 079213 – INTERIOR JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Mildew-resistant joint sealants.
  - 2. Latex joint sealants.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for exterior joint sealants.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For sealants, indicating VOC content.
- B. Sample Warranties: For special warranties.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### 1.5 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.6 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
  1. Architectural sealants shall have a VOC content of 250 g/L or less.
  2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
  3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 786-M White.
    - b. GE Construction Sealants; SCS1700 Sanitary.
    - c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
    - d. Soudal USA; RTV GP.
    - e. Tremco Incorporated; Tremsil 200.

## 2.3 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Construction Chemicals, LLC, Building Systems; Sonolac.
    - b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex 600.
    - c. Pecora Corporation; AC-20.
    - d. Sherwin-Williams Company (The); 850A.
    - e. Tremco Incorporated; Tremflex 834.

## 2.4 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Construction Chemicals, LLC, Building Systems.
    - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

- a. Metal.
  - b. Glass.
  - c. Porcelain enamel.
  - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement, JS-1.
  - 1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Acrylic latex.
  - 3. Joint-Sealant Color: White.
- B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces, JS-2.
  - 1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

## SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior hollow-metal steel doors and frames.

#### 1.3 REFERENCED STANDARDS

- A. ANSI - American National Standards Institute.
  - 1. ANSI A250.6: Hardware on Steel Doors (Reinforcement - Application).
  - 2. ANSI A250.8: Recommended Specifications for Standard Steel Doors and Frames.
  - 3. ANSI A250.10: Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
  - 4. ANSI/DHI A115 Series (ANSI A115.1 through ANSI A115.18): Specifications for Steel Door and Frame Preparation for Hardware.
- B. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 2. ASTM A 591: Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight Application.
  - 3. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 4. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - 5. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 6. ASTM A 1011: Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 7. ASTM C 143: Test Method for Slump of Hydraulic Cement Concrete.
  - 8. ASTM C 476: Specification for Grout for Masonry.
  - 9. ASTM C 665: Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 10. ASTM C 1363: Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
  - 11. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degree C.

12. ASTM E 329: Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.
  - C. NAAMM - National Association of Architectural Metal Manufacturers.
    1. Metal Finishes Manual for Architectural and Metal Products.
  - D. SSPC - The Society for Protective Coatings.
    1. SSPC-Paint 12: Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).
    2. SSPC-Paint 20: Paint Specification No. 20: Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
    3. SSPC-SP 1: Surface Preparation Specification No. 1: Solvent Cleaning.
    4. SSPC-SP 3: Surface Preparation Specification No. 3: Power Tool Cleaning.
    5. SSPC-SP 6/NACE No. 3: Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning.
  - E. SDI - Steel Door Institute.
    1. SDI 105: Recommended Erection Instructions for Steel Frames.
    2. SDI 117: Manufacturing Tolerances for Standard Steel Doors and Frames.
- 1.4 DEFINITIONS
- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- 1.5 SUBMITTALS
- A. Product Data: Include construction details, material descriptions, core descriptions, and finishes for each type of steel door and frame specified.
  - B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
  - C. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
  - B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
  - C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
  - D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4 inch (6 mm) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
  - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4 inch (6 mm) space between each stacked door to permit air circulation.

## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.9 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door Products.
  - 2. CURRIES Company.
  - 3. Republic Builders Products Company.
  - 4. Steelcraft; an Ingersoll-Rand Company.

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.

- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- G. Grout: Comply with ASTM C 476, with a slump of 4 inches (6 mm) for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 lb/cu. ft. (96 to 192 kg/ cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil (0.76 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.3 STEEL DOORS AND FRAMES

### A. Requirements for All Doors and Frames:

- 1. Accessibility: Comply with ANSI/ICC A117.1.
- 2. Door Top and Bottom Closures: Flush with top of faces and edges. Reinforced with 0.053 inch (1.3 mm) thick steel channel welded continuously on both sides and weather sealed.
- 3. Door Edge Profile: Beveled on both edges.
- 4. Door Face: Smooth faces; no visible seams on surfaces or along vertical edges.
- 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated.
- 6. Hardware Preparation: In accordance with DHI A115 Series, with reinforcement welded in place and as follows:
  - a. Hinges and Pivots: Steel plates 3/16 inch (5 mm) thick x 1-1/2 inch (38 mm) wide x 6 inch (152 mm) longer than hinge; secure with at least 6 spot welds.
  - b. Lock Face, Closers, and Concealed Holders: 0.093 inch (2.4 mm).
  - c. All Other Surface-Mounted Hardware: 0.053 inch (1.3 mm).
- 7. Finish: Factory primed, for field finishing.

- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

## 2.4 STEEL DOORS

### A. Exterior Doors:

1. Grade: ANSI A250.8 Level 4, physical performance Level A, Model 2, seamless.
2. Core: Vertical steel stiffeners, fiberglass insulated full height.
3. Top Closures for Outswinging Doors: Flush with top of faces and edges.
4. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.
5. Texture: Smooth faces.
6. Insulating Value: U-value of 0.067, when tested in accordance with ASTM C 1363.
7. Weatherstripping: Separate; Refer to Section 087100 "Door Hardware."

## 2.5 STEEL FRAMES

### A. General:

1. Comply with the requirements of grade specified for corresponding door, except:
  - a. ANSI A250.8 Level 4 Doors: 0.067 inch (1.7 mm) thick.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cutouts in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (101 mm) high to fill opening without cutting masonry units.
5. Frames Wider than 48 inches (1.2 m): Reinforce with steel channel fitted tightly into frame head, flush with top.
6. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

### B. Exterior Door Frames: Face welded, seamless with joints filled.

1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Integral, recessed into door edge or frame.

### C. Mullions for Pairs of Doors: Fixed, except where removable is indicated, of profile similar to jambs.

### D. Frames for Glazing, Borrowed Lights, or Transoms: Construction and face dimensions of tubular mullion and transom bars with stops and beads.

### E. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

## 2.6 STOPS AND MOLDINGS

### A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

- B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.
- D. Astragals for Double Doors:
  - 1. Exterior Doors: Steel, Z-shaped.

## 2.7 FABRICATION

- A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Standard Steel Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 2. Glazed Lites: Factory cut openings in doors.
- C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
  - 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry or Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c.
    - b. Compression Type: Not less than two anchors in each jamb.
    - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  - 6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
    - a. Resilient Rubber: Fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."
1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
  2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
  2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior doors and frames.
  4. Provide loose stops and moldings on inside of doors and frames.
  5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.8 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish standard steel door and frames after assembly.
- B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
1. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
  - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch (1.5 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch (1.5 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch (1.5 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch (1.5 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Standard Steel Frames: Install standard steel frames for doors, sidelights, transoms, borrowed lights and other openings, of size and profile indicated. Comply with SDI 105.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - b. Install frames with removable glazing stops located on secure side of opening.
    - c. Install door silencers in frames before grouting.

- d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - f. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  5. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
  9. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch (1.5 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch (1.5 mm), measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch (1.5 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch (1.5 mm), measured at jambs at floor.
- C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
  1. Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/16 inch (1.5 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) plus or minus 1/16 inch (1.5 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with standard steel door and frame manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (225 mm) o.c., and not more than 2 inches (51 mm) o.c. from each corner.

#### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

## SECTION 081116 - ALUMINUM FLUSH DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Aluminum flush doors with aluminum frames.

#### 1.3 REFERENCE STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM B 221: Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tube.
  - 3. ASTM D 1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 4. ASTM D 1623: Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
  - 5. ASTM D 2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
  - 6. ASTM E 283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - 7. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
- B. Air Infiltration: For a single door, test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.28 cfm per square foot.
- C. Uniform Structural Load: For a single door, test specimen shall be tested in accordance with ASTM E 330: Plus or minus 120 pounds per square foot.

- D. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.
- E. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.
- F. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.
- G. Thermal and Humid Aging, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

#### 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
- B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, framing, hardware schedule, finish, options, and accessories.
- C. Samples:
  - 1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, finish, and accessories.
  - 2. Color: Submit manufacturer's samples of standard colors of doors and frames.
- D. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
  - 1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
  - 2. Door and frame components from same manufacturer.
  - 3. Evidence of a compliant documented quality management system.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

## 1.8 WARRANTY

- A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: Failure of corner joinery, core deterioration, delamination or bubbling of door skin.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Special-Lite, Inc. (Basis-of-Design).
  - 2. Cline Doors, Inc.
  - 3. Alutech Corporation.

### 2.2 ALUMINUM FLUSH DOORS

- A. Type: Aluminum flush doors with aluminum frames.
- B. Door Opening Size: As indicated on the Drawings.
- C. Construction:
  - 1. Door Thickness: 1-3/4 inches.
  - 2. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.
  - 3. Corners: Mitered.
  - 4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware.
  - 5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery.
  - 6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
  - 7. Extrude top and bottom rail legs for interlocking continuous weather bar.
  - 8. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
  - 9. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
- D. Face Sheet:
  - 1. Material: 0.062-inch thick aluminum.
  - 2. Texture: As selected by Architect from manufacturer's standard offerings.
- E. Core:

1. Material: Poured-in-place polyurethane foam.
2. Density: Minimum of 5 pounds per cubic foot.
3. R-Value: Minimum of 9.

F. Hardware:

1. Premachine doors in accordance with templates from hardware manufacturers and hardware schedule.

## 2.3 MATERIALS

A. Aluminum Members:

1. Extrusions: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:

1. Material: Aluminum, 18-8 stainless steel, or other non-corrosive metal.
2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

## 2.4 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:

1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.

D. Fit:

1. Maintain continuity of line and accurate relation of planes and angles.
2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

## 2.5 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:

1. Size and Type: As indicated on the Drawings.

2. Materials: Aluminum Alloy 6063-T5, 1/8-inch minimum wall thickness.
3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Doorstop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
4. Frame Members: Box type with 4 enclosed sides.
5. Caulking: Caulk joints before assembling frame members.
6. Joints:
  - a. Secure joints with fasteners.
  - b. Provide hairline butt joint appearance.
7. Applied Stops: Shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
8. Hardware:
  - a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
9. Anchors:
  - a. Anchors appropriate for wall conditions to anchor framing to wall materials.
  - b. Door jamb and header mounting holes shall be spaced no more than 24 inches apart.

## 2.6 HARDWARE

- A. Premachine doors in accordance with templates from hardware manufacturers and hardware schedule.
- B. Door Hardware: Hardware to be furnished by hardware supplier and factory installed. Refer to Section 087100 "Door Hardware."

## 2.7 ALUMINUM FINISHES

- A. Finish: Dark Bronze.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

### 3.3 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions.
- B. Install doors plumb, level, square, true to line, and without warp or rack.
- C. Anchor frames securely in place.
- D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
- E. Set thresholds in bed of mastic and backseal.
- F. Install exterior doors to be weathertight in closed position.
- G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

### 3.5 ADJUSTING

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

### 3.6 CLEANING

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

### 3.7 PROTECTION

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 081116

## SECTION 081216 - ALUMINUM FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior aluminum frames for doors installed in gypsum board partitions.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum frames:

1. Include elevations, sections, and installation details for each wall-opening condition.
2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
3. Include locations of reinforcements and preparations for hardware.
4. Include details of anchorages, joints, field splices, connections, and accessories.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of seals, gaskets, and accessories involving color selection.

D. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum frames to include in maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide Western Integrated Materials, Inc.; Series 300 or comparable products by one of the following:
  - 1. Advanced Architectural Frames.
  - 2. Alpha Aluminum Products, Inc.
  - 3. Dual Lock Partition Systems, Inc.; Avalon International Aluminum.
  - 4. Frameworks Manufacturing.
  - 5. Interior Components Inc.
  - 6. Modulex, Inc; Division of Pacific National Group.
  - 7. RACO Interior Products, Inc.
  - 8. Versatrac.
  - 9. Wilson Partitions.
- B. Source Limitations: Obtain aluminum frames from single source from single manufacturer.

### 2.2 COMPONENTS

- A. Aluminum Framing: ASTM B 221, with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch thick.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
- C. Trim: Extruded aluminum, not less than 0.062 inch thick; removable, snap-in casing trim and door stops, without exposed fasteners.
  - 1. Trim Style: 1-1/2 inch.
- D. Frame and Trim Finish: Factory-applied, baked-enamel or powder-coat finish.
  - 1. Color: White.

### 2.3 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals in black color.
- C. Door Hardware: As specified in Section 087100 "Door Hardware."

## 2.4 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.
- B. Factory prepare aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."
  - 1. Locate hardware cutouts and reinforcements as required by fire-rated label for assembly.
- C. Fabricate components to allow secure installation without exposed fasteners.

## 2.5 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.6 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.
- B. Install frame components in the longest possible lengths with no piece less than 48 inches; components 96 inches or shorter shall be one piece.
  - 1. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
  - 2. Secure clips to extruded main-frame components and not to snap-in or trim members.

3. Do not leave screws or other fasteners exposed to view when installation is complete.

C. Doors: Install doors aligned with frames and fitted with required hardware.

D. Door Hardware: Install according to Section 087100 "Door Hardware" and aluminum-frame manufacturer's written instructions.

### 3.3 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly, and lubricate as recommended by manufacturer.

C. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 & 610.

D. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION 081216

## SECTION 081416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with MDO faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Doors to be factory finished and finish requirements.
6. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

B. Sample Warranty: For special warranty.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons or cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

#### 1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

#### 1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
- b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc.
  2. Chappell Door Co.
  3. Eggers Industries.
  4. Graham Wood Doors; an Assa Abloy Group company.
  5. Marshfield Door Systems, Inc.
  6. Mohawk Flush Doors, Inc.
  7. Oshkosh Door Company.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

### 2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards or WDMA I.S.1-A, "Architectural Wood Flush Doors."
1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
  2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Regional Materials: Wood doors shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- C. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
- E. Composite Wood Products: Products shall be made without urea formaldehyde.
- F. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- G. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- H. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- I. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.
  2. Blocking: Provide wood blocking in particleboard-core doors as follows:
    - a. 5-inch top-rail blocking, in doors indicated to have closers.
    - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
    - c. 5-inch midrail blocking, in doors indicated to have exit devices.
- J. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
    - a. 5-inch top-rail blocking.
    - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
    - c. 5-inch midrail blocking, in doors indicated to have armor plates.
    - d. 5-inch midrail blocking, in doors indicated to have exit devices.
  3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
    - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

## 2.3 DOORS FOR OPAQUE FINISH

### A. Interior Solid-Core Doors:

1. Grade: Premium.
2. Faces: MDO.
  - a. Apply MDO to standard-thickness, closed-grain, hardwood face veneers or directly to high-density hardboard crossbands.
  - b. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
  - c. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
3. Exposed Vertical and Top Edges: Any closed-grain hardwood.
4. Core: Particleboard.

5. Construction: Three plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
6. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

## 2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  1. Wood Species: Same species as door faces.
  2. Profile: Flush rectangular beads.
  3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
  1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
  1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

## 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.

C. Opaque Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
1. Install fire-rated doors according to NFPA 80.
  2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

## SECTION 083113 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- B. Related Requirements:
  - 1. Section 083483 "Floor Doors" for doors installed in floors.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
- C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

### PART 2 - PRODUCTS

#### 2.1 ACCESS DOORS AND FRAMES

- A. Recessed Access Doors with Concealed Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Acudor Products, Inc.
    - b. Babcock-Davis.
    - c. Cendrex Inc.
    - d. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
    - e. Jensen Industries; Div. of Broan-Nutone, LLC.
    - f. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
    - g. Karp Associates, Inc.
    - h. Larsen's Manufacturing Company.
    - i. Maxam Metal Products Limited.
    - j. Metropolitan Door Industries Corp.
    - k. MIFAB, Inc.
    - l. Milcor Inc.
    - m. Nystrom, Inc.

n. Williams Bros. Corporation of America (The).

2. Description: Door face recessed 5/8 inch for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: As indicated.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
6. Latch and Lock: Cam latch, screwdriver operated.

## 2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

## 2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

#### 3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 083313 - COILING COUNTER DOORS

### 1.1 COUNTER DOOR ASSEMBLY

- A. Counter Door: Door curtain of galvanized steel.
- B. Hood: Galvanized steel.
- C. Sill Configuration: No sill.
- D. Electric Door Operator: Standard duty, with emergency manual push-up operation.
  - 1. Obstruction-detection device.
  - 2. Other Equipment: Keyed lock-out for control station.
- E. Finish: Baked Powder Coat primer and paint finish.
  - 1. Color: Match Architect's sample.

### 1.2 INSTALLATION

- A. Factory-authorized representative to perform startup service and testing and train Owner's personnel.

END OF SECTION 083313

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 083323 - OVERHEAD COILING DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following types of overhead coiling doors:

- 1. Insulated service doors, electrically operated.

#### 1.3 REFERENCED STANDARDS

- A. AA - Aluminum Association, Inc.
- B. ADA - Americans with Disabilities Act.
- C. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
- D. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 36: Standard Specification for Carbon Structural Steel.
  - 2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 4. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 5. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 6. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
- E. NAAMM - National Association of Architectural Metal Manufacturers
  - 1. Metal Finishes Manual for Architectural and Metal Products.
- F. NEMA - National Electrical Manufacturers Association.
  - 1. NEMA ICS 1: Industrial Control and Systems General Requirements.
  - 2. NEMA ICS 2: Industrial Control Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC (ANSI).
  - 3. NEMA ICS 6: Industrial Control and Systems Enclosures.
  - 4. NEMA MG 1: Motors and Generators (ANSI).

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
  - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

#### 1.5 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
  - 1. Summary of forces and loads on walls and jambs.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
  - 1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cookson Company.
  - 2. Cornell Iron Works Inc.
  - 3. Dynamic Closures Corporation.
  - 4. Overhead Door Corp.
  - 5. Raynor.
  - 6. Wayne-Dalton Corp.

## 2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) or ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
    - a. Aluminum Extrusion Thickness: Not less than 0.051 inch (1.30 mm).
    - b. Flat profile slats.
  2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
  3. Inside Curtain Slat Face: To match material of outside metal curtain slat.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3.2 mm) thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.
- D. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16 inch (5 mm) thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

## 2.3 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
1. Fabricate hoods for aluminum doors, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; 0.032-inch (0.8-mm) minimum thickness, complying with ASTM B 209 (ASTM B 209M).
  2. Include automatic drop baffle to guard against passage of smoke or flame.
  3. Shape: Round.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8 inch (3.2 mm) thick, replaceable, continuous sheet secured to inside of hood.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
  2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8 inch (3.2 mm) thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.
- C. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- D. Safety Interlock Switch: For power operated doors, provide safety interlock switch to disengage power supply when door is locked.

## 2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

## 2.5 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, belt-reduction drive, and chain and sprocket secondary drive.
- G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps (0.2 mps) and not more than 1 fps (0.3 mps), without exceeding nameplate ratings or service factor.
  - 1. Type: Polyphase, medium-induction type.
  - 2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
  - 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
  - 4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
- H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
  - 1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
  - 2. Provide exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
  - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
    - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
- J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

## 2.6 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.7 ALUMINUM FINISHES

- A. Class II, Color Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, coating 0.010 mm or thicker) complying with AAMA 611.
  - 1. Color: Dark Bronze.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

### 3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

### 3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors. Refer to Section 017700 "Closeout Procedures."

END OF SECTION 083323

## SECTION 083333 – INTERIOR OVERHEAD COILING DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Service doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

### 2.3 DOOR ASSEMBLY

- A. OCD-1, Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ACME Rolling Doors.
    - b. Alpine Overhead Doors, Inc.
    - c. Alumatec Pacific Products.
    - d. Amarr Garage Doors.
    - e. ASTA Door Corporation.
    - f. C.H.I. Overhead Doors.
    - g. City-Gates.
    - h. Clopay Building Products.
    - i. Cookson Company.
    - j. Cornell Iron Works, Inc.
    - k. Janus International Corporation.
    - l. Lawrence Roll-Up Doors, Inc.
    - m. McKeon Rolling Steel Door Company, Inc.
    - n. Metro Door.
    - o. Overhead Door Corporation.
    - p. QMI Security Solutions.
    - q. Raynor.
    - r. Southwestern Rolling Steel Door Co.
    - s. Wayne-Dalton Corp.

- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
  - 1. Include tamperproof cycle counter.
- C. Door Curtain Material: Galvanized steel.
- D. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
- E. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
  - 1. Shape: Round.
  - 2. Mounting: As shown on Drawings.
- H. Locking Devices: Equip door with locking device assembly.
  - 1. Locking Device Assembly: Cremona type, both jamb sides locking bars, operable from inside and outside with cylinders.
- I. Manual Door Operator: Chain-hoist operator.
- J. Curtain Accessories: Equip door with push/pull handles.
- K. Door Finish:
  - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

## 2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

## 2.5 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
  - 1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

## 2.6 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock Cylinders: Cylinders specified in Section 087100 "Door Hardware".
  - 2. Keys: Three for each cylinder.

## 2.7 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
  - 1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
  - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.
- B. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

## 2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

## 2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

### 3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Perform installation and startup checks according to manufacturer's written instructions.

### 3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

### 3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include three months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Perform maintenance, including emergency callback service, during normal working hours.
  - 2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

END OF SECTION 083333

## SECTION 083419 - ROLLING RUBBER INDUSTRIAL DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Manual overhead rolling rubber doors.
- B. Related Sections:
  - 1. 05 50 00 Metal Fabrications. Door opening jamb and head members.
  - 2. 06 10 00 Rough Carpentry. Door opening jamb and head members.

#### 1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Cycle Life: Design doors of standard construction with a counterbalance spring rating of 50,000 cycles.

#### 1.3 ACTION SUBMITTALS

- A. Product Data.
- B. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
- C. Quality Assurance/Control Submittals:
  - 1. Provide proof of manufacturer and installer qualifications.
  - 2. Provide manufacturer's installation instructions.
- D. Closeout Submittals:
  - 1. Operation and Maintenance Manual.
  - 2. Certificate stating that installed materials comply with this specification.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's approval.

#### 1.5 DELIVERY STORAGE AND HANDLING

- A. Follow manufacturer's instructions.

## 1.6 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship. Lifetime warranty on curtain, NEWGEN Guide and CurtainLok system.
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Basis-of-Design Product: Provide The Cookson Company, Inc; CMS-10 or comparable product by one of the following:
  - 1. Amarr
  - 2. Clopay
  - 3. Cornell Iron Works

### 2.2 MATERIALS

- A. Curtain:
  - 1. Two layers of black Styrene Butadiene Rubber (SBR) each 1/8" thick, 70 durometer; sandwiched with 1-ply, 110 lbs. polyester cord center. Material provides normal resiliency and flexibility at temperatures ranging from -40° F - +180° F.
  - 2. Bottom Bar: Constructed of two steel angles bolted together that extends the full width of the curtain and shall have knock-away section to reduce the risk of damage during accidental impacts. Knock-away section bottom bar to be reset without the need to open side frames. Finish: Xylene pre-treatment followed by a Durogloss SP491, CRM Alkyd Grey Primer; minimum of 1.5 mils cured film thickness followed by a corrosion resistant Durogloss, Industrial Enamel; minimum of 1.5 mils cured film thickness.
  - 3. Fabricate curtain with NEWGEN CurtainLoks that are mechanically secured with plated steel rolling thread screws. CurtainLoks retain curtain in guides under extreme wind load conditions. Continuous glued SBR windlocks or molded-in place Teflon windlock designs will not be accepted.
- B. Guides: Fabricate with NEWGEN one-piece extruded aluminum channels with a steel mounting angle or channel as recommended by door manufacturer. Aluminum channels are to be of sufficient thickness and rigidity to maintain the NEWGEN CurtainLoks within the guides during normal operation while enabling the NEWGEN CurtainLoks to release during impacts. Spring loaded guides will not be accepted.
  - 1. Finish: Aluminum Channels: Mill finish – T6 6061.
  - 2. Steel Mounting Angle: Xylene pre-treatment followed by a Durogloss SP491, CRM Alkyd Grey Primer; minimum of 1.5 mils cured film thickness followed by a corrosion resistant Durogloss, Industrial Enamel; minimum of 1.5 mils cured film thickness.
- C. Counterbalance Shaft Assembly:

1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width. Both of the drive barrel shafts are to be constructed of a minimum 1-1/2 inch C1018 cold rolled steel shafts. Finish: Xylene pre-treatment followed by a Durogloss SP491, CRM Alkyd Grey Primer; minimum of 1.5 mils cured film thickness followed by a corrosion resistant Durogloss, Industrial Enamel; minimum of 1.5 mils cured film thickness. Shaft to be painted same color as curtain color with industrial enamel paint.
2. Spring Balance: Oil-tempered, heat-treated steel helical outboard torsion spring assembly design.
  - a. Counterbalance springs to be rated for 50,000 cycles.
- D. Idler Barrel: Fabricate from minimum 4 inch O.D. round H.S.S structural tubing with a minimum thickness of .134 inch supported by minimum 1-1/4 inch C1018 Cold Rolled steel at both ends. Idler barrel to be guide mounted to ensure proper tracking of curtain into NEWGEN Guides. Finish: Xylene pre-treatment followed by a Durogloss SP491, CRM Alkyd Grey Primer; minimum of 1.5 mils cured film thickness followed by a corrosion resistant Durogloss, Industrial Enamel; minimum of 1.5 mils cured film thickness. Barrel to be painted same color as curtain color with industrial enamel paint.
- E. Brackets: Fabricate from minimum 1/4 inch (6mm) hot rolled steel plate with sealed heavy-duty, self-aligning bearings with cast iron housings at rotating support points to support the shaft assembly and form end closures. Bearings shall be load rated at a minimum of 5600 lbs. (2540 kg) dynamic and 3360 lbs. static load as recommended by door manufacturer. Welded truss shall brace brackets together at the top and bottom of the bracket with C3 x 4.1 channel and 2" x 1/4" flatbar diagonal bracing or 2" x 4"x .188" HSS and 2" x 1" x .125" HSS diagonal bracing as recommended by door manufacturer.
  1. Finish: Steel, Xylene pre-treatment followed by a Durogloss SP491, CRM Alkyd Grey Primer; minimum of 1.5 mils cured film thickness followed by a corrosion resistant Durogloss, Industrial Enamel; minimum of 1.5 mils cured film thickness.
- F. Hood: 18 gauge galvanized steel, unpainted.

## 2.3 ACCESSORIES

- A. Operator [and Bracket Mechanism] Cover: Provide 18 gauge galvanized steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.
- B. Spring Cover: Provide 18 gauge galvanized steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.
- C. Guide Guards: Provide steel angle guards to protect the guides at a minimum height of 5'. Finish: Xylene pre-treatment followed by a Durogloss SP491, CRM Alkyd Grey Primer; minimum of 1.5 mils cured film thickness followed by a corrosion resistant Durogloss, Industrial Enamel; minimum of 1.5 mils cured film thickness.

## 2.4 OPERATION

- A. Manual Chain Hoist: Provide chain hoist operator with sufficient capacity to operate a door with a maximum pull requirement of 20 to 30 lbs. The static load on the hand chain to hold the door in any position must not exceed 11 lbs.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate.

### 3.2 INSTALLATION

- A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
- B. Follow manufacturer's installation instructions.

### 3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

### 3.4 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

### 3.5 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION 083419

## SECTION 083483 - FLOOR DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes floor doors.
- B. Related Requirements:
  - 1. Section 083113 "Access Doors and Frames" for wall- and ceiling-mounted access doors and frames.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details materials, individual components and profiles, and finishes.
- B. Product Schedule: For floor doors. Use same designations indicated on Drawings.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Basis-of-Design Product: Provide The Bilco Company; Type TER Floor Access Door or comparable product by one of the following:
  - 1. Acudor Products, Inc.
  - 2. Babcock-Davis.
  - 3. Milcor Inc.
  - 4. Nystrom, Inc.
  - 5. Thompson Fabricating, LLC.
  - 6. U.S.F. Fabrication.
  - 7. Williams Bros. Corporation of America (The).

#### 2.2 ACCESS DOOR

- A. Furnish and install vault access door, size as shown. Length denotes hinge side. The floor access door shall be single leaf and pre-assembled from the manufacturer.
- B. Performance characteristics:
  - 1. Cover: Shall be reinforced to support a minimum live load of 150 psf with a maximum deflection of 1/150th of the span.

2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
  3. Operation of the cover shall not be affected by temperature.
- C. Cover shall have a 1" fillable pan to receive mortar and specified flooring material.
- D. Frame: Shall be extruded aluminum with full anchor flange around the perimeter.
- E. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate.
- F. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the floor door and the latch release shall be protected by a flush, gasketed, removable screw plug.
- G. Hardware:
1. Hinges: Shall be a continuous heavy duty Type 316 stainless steel hinge that is accessible only when the cover is in the open position.
  2. Cover shall be equipped with an aluminum hold open arm that automatically locks the cover in the open position.
  3. Cover shall be fitted with the required number and size of compression spring operators.
  4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
  5. Hardware: Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material, and all other hardware shall be zinc plated and chromate sealed.
- H. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

## 2.3 FABRICATION

- A. General: Provide floor doors manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure floor doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

## 2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor doors.

### 3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083483

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Aluminum-framed entrances and storefronts.
  - 2. Low-emitting materials for adhesives and sealants.

#### 1.3 REFERENCED STANDARDS

- A. AA - Aluminum Association, Inc.
- B. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 501.1: Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure.
  - 2. AAMA 501.2: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
  - 3. AAMA 501.4: Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts.
  - 4. AAMA 501.5: Test Method for Thermal Cycling of Exterior Walls.
  - 5. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
  - 6. AAMA 1503: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
  - 7. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels.
- C. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 36: Standard Specification for Carbon Structural Steel.
  - 2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 4. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 5. ASTM A 1011: Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 6. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

7. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
8. ASTM B 308: Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
9. ASTM B 429: Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
10. ASTM C 920: Specification for Elastomeric Joint Sealants.
11. ASTM C 1184: Specification for Structural Silicone Sealants.
12. ASTM C 1401: Guide for Structural Sealant Glazing.
13. ASTM E 283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
14. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
15. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
16. ASTM E 699: Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.
17. ASTM E 783: Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors
18. ASTM E 1105: Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference

D. AWS - American Welding Society.

1. AWS A5.10: Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.
2. AWS D1.2: Structural Welding Code - Aluminum.

E. CFR - Code of Federal Regulations.

1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.

F. International Code Council.

1. ICC/ANSI A117.1: Accessible and Usable Buildings and Facilities.

G. SSPC - The Society for Protective Coatings.

1. SSPC-Paint 12: Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).
2. SSPC-PS Guide No. 12.00: Guide to Zinc-Rich Coating Systems.
3. SSPC-SP COM: Surface Preparation Specifications: Surface Preparation Commentary for Steel and Concrete Substrates.

## 1.4 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

## 1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
  2. Dimensional tolerances of building frame and other adjacent construction.
  3. Failure includes the following:
    - a. Deflection exceeding specified limits.
    - b. Thermal stresses transferring to building structure.
    - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    - d. Glazing-to-glazing contact.
    - e. Noise or vibration created by wind and by thermal and structural movements.
    - f. Loosening or weakening of fasteners, attachments, and other components.
    - g. Sealant failure.
    - h. Failure of operating units.
- B. Structural Loads: As indicated on Drawings by Structural Engineer.
- C. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed  $L/175$  of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
  2. Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or 1/8 inch (3.2 mm), whichever is smaller.
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.
- E. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Structural Drawing S-001 "Design Loads".
    - a. Maximum Interstory Drifts - 0X (ASCE 7-10 Section 12.8.6).
      - 1) Ground to 2nd: 0X = 4-1/2 inches (114 mm).
      - 2) 2nd to Low Roof: 0X = 3-3/4 inches (95 mm).
      - 3) Low Roof to High Roof: 0X = 1-1/4 inches (32 mm).

2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
- H. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
  1. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.
- I. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
  2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
    - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
    - b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
  3. Interior Ambient-Air Temperature: 75 deg F (24 deg C).
- J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
- K. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.
- L. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
  2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
- M. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

## 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
1. For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
  2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- E. Field quality-control reports.
- F. Warranties: Sample of special warranties.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- D. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.

1. Test a minimum of eight (8) samples each of metal, glazing, and other material.
  2. Prepare samples using techniques and primers required for installed systems.
  3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.
- E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

#### 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals and other materials beyond normal weathering.
    - d. Adhesive or cohesive sealant failures.
    - e. Water leakage through fixed glazing and framing areas.
    - f. Failure of operating components.
  2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kawneer Company, Inc. Trifab VG 451/451T (Basis-of-Design).
  2. Vistawall Architectural Products.
  3. EFCO Corporation.
  4. Arcadia, Inc.

### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

### 2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: As indicated on Drawings.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
  1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
    - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Color: Black.
  2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
    - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Color: Matching structural sealant.

## 2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
  - 1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
  - 2. Door Design: Narrow stile; 2-1/8-inch (53.9-mm) nominal width.
    - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.
  - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
    - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in Section 087100 "Door Hardware."

## 2.6 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 "Joint Sealants."
  - 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

## 2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.
  5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
  7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using shear-block, screw-spline, or head-and-sill-receptor system with shear blocks at intermediate horizontal members.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
  2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
  2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.8 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color: Dark Bronze.

## 2.9 SOURCE QUALITY CONTROL

- A. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations, including, but not limited to, system material-qualification procedures, sealant testing, and system fabrication reviews and checks.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. General:

- 1. Comply with manufacturer's written instructions.
- 2. Do not install damaged components.
- 3. Fit joints to produce hairline joints free of burrs and distortion.
- 4. Rigidly secure nonmovement joints.
- 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
- 6. Seal joints watertight unless otherwise indicated.

#### B. Metal Protection:

- 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
- 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

#### C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

#### D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

#### E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

#### F. Install glazing as specified in Section 088000 "Glazing."

##### 1. Structural-Sealant Glazing:

- a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- b. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

#### G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Install perimeter joint sealants as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

### 3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
  2. Alignment:
    - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
    - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
1. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
  2. Structural-Sealant Glazing Inspection: After installation of aluminum-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to recommendations in ASTM C 1401.
  3. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
  4. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft. (200 Pa), and shall not evidence water penetration.
  5. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

- C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
  - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION 084113

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 084126 - ALL-GLASS ENTRANCES AND STOREFRONTS

### 1.1 SUMMARY

- A. Interior swinging and sliding all-glass entrance doors.
- B. All-glass sidelights and transoms.
- C. Interior all-glass storefronts.

### 1.2 WARRANTY

- A. All-Glass Systems: Two years.
- B. Concealed Floor Closers: 25 years.

### 1.3 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC, CS, or CI:
  - 1. Low-emitting sealants.

### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Contractor to design all-glass entrances and storefronts.
  - 1. Air pressure Loads: 5 psf.
  - 2. Concentrated load: 300 lb, applied at 4 feet above the floor.
  - 3. Other Design Loads: As indicated on Drawings.
  - 4. Deflection Normal to Glazing Plane: Limited to 1 inch (25 mm).

### 1.5 COMPONENTS

- A. Fitting Configuration:
  - 1. Manual-Swinging, All-Glass Entrance Doors Sidelights and Transoms: Continuous rail fitting at top and bottom, and patch fittings where indicated.
  - 2. Manual-Sliding, All-Glass Entrance Doors Sidelights and Transoms: Continuous rail fitting at top and bottom.
  - 3. All-Glass Storefronts: Recessed glazing channel at top and continuous rail fitting at bottom.
- B. Fittings: Stainless-steel-clad aluminum, satin finish.
- C. Accessory Fittings:
  - 1. Overhead doorstop.

2. Center-housing lock.
- D. Glass: Fully tempered.
1. Class 1, Clear Monolithic:
    - a. Thickness: 1/2 inch (13 mm) minimum.
    - b. Applied decorative film where indicated.
- E. Entrance Door Hardware: Heavy-duty type.
1. Concealed floor closers and top pivots.
  2. Concealed overhead holder.
  3. Push-pull set.
  4. Single-door and active-leaf locksets.
  5. Inactive-leaf locksets.
  6. Cylinders.
  7. Exit devices.
  8. Threshold.
  9. Manual-sliding entrance door hardware.

END OF SECTION 084126

## SECTION 084130 - ALUMINUM-FRAMED FOLDING SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Folding aluminum and glass door system, including aluminum frame, threshold, panels, folding and locking hardware, weather stripping, glass and glazing; designed to provide an opening glass wall, with sizes and configurations as shown on Drawings.

#### 1.3 REFERENCED STANDARDS

- A. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
  - 2. AAMA 2603, Voluntary Specifications, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 3. AAMA 1303.5, Voluntary Specifications for Forced Entry Resistant Aluminum Glass Doors.
- B. ANSI - American National Standards Institute.
  - 1. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used In Buildings.
- C. ASTM - American Society for Testing and Materials International.
  - 1. ASTM E 283: Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
  - 2. ASTM E 330: Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - 3. ASTM E 547: Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
- D. CPSC - Consumer Product Safety Commission.
  - 1. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials.

E. NFRC - National Fenestration Rating Council.

1. NFRC 100, Procedure for Determining Fenestration Product Thermal Materials.
2. NFRC 200, Procedure for Determining Solar Heat Gain Coefficient.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's literature including independently tested data listing performance criteria and Owner's Manual with installation instructions.
- B. Shop Drawings: Indicate dimensioning, configuration, typical head jamb, side jambs and sill details, type of glazing material, and handle height.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 15 years experience in providing folding door systems.
- B. Performance Requirements: Unit to comply with applicable manufacturer's independently certified testing results. Testing results include air infiltration in accordance with ASTM E 283, water penetration in accordance with ASTM E 547, structural loading in accordance with ASTM E 330, and forced entry in accordance with AAMA 1303.5 and CAWM 300-96.
- C. Thermal Performance: Unit to comply with the U value, rated, certified and labeled or simulated in accordance with NFRC 100, shown in manufacturer's latest published data for the glazing and sill specified.
- D. Solar Heat Gain Coefficient: Unit to comply with the solar heat gain coefficient, simulated in accordance with NFRC 200, shown in manufacturer's latest published data for the glazing specified.
- E. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least 3 projects of similar scale and complexity successfully completed in the last 3 years. Provide project names, locations, completion dates, names and telephone numbers of General Contractor and Owner's contact person.

1.6 WARRANTY

- A. Provide manufacturer's standard warranty against defects in materials and workmanship.
- B. Warranty Period: Ten years for seal failure of insulated glass supplied. For all other components, one year from date of delivery by manufacturer.

1.7 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

- A. In addition to general delivery, storage and handling requirements, comply with the following:

1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  1. Eclipse Architectural Exterior Folding Door Systems; Thermally Broken Aluminum-Framed Folding System (Basis-of-Design) or equal as approved by Architect.

### 2.2 MATERIALS

- A. Frame and Panels: From manufacturer's standard profiles, provide head jamb, side jambs, and panels with dimensions shown on Drawings.
  1. Provide panels as shown on Drawings.
  2. Provide standard bottom rail.
  3. Aluminum Extrusion: Extrusions with nominal thickness of .078 inch (2.0 mm). Alloy specified as AlMgSi0.5 with strength rated as 6063-T5. Anodized conforming to AAMA 611.98.
  4. Thermally broken with 1-1/4 inch (32 mm) polyamide plastic reinforced with glass fibers.
  5. Aluminum Finish: Clear anodized.
- B. Glass: Refer to Section 088000 "Glazing" for glass requirements.
  1. Provide EPDM gaskets and extruded aluminum snap-in glazing bead for dry glazing per manufacturer's instructions.
  2. All glass to comply with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR 1201.
- C. Locking Hardware and Handles: Provide manufacturer's standard nylon handle and concealed two point locking hardware operated by 180 degree turn of handle between each pair of folding panels.
  1. Nylon Handle Finish: Match frame and panel finish.
  2. Aluminum locking rods with fiber glass reinforced polyamide end caps at top and bottom. Rods to have a stroke of 15/16 inch (24 mm).
  3. Provide handle height centered at 41-3/8 inches from bottom of panel, unless otherwise indicated.
- D. Folding Hardware: Provide manufacturer's standard folding hardware and threshold. All running carriages to be with sealed, self-lubrication, ball bearing multi-rollers.
  1. Threshold: Provide matching, thermally broken with 3/4 inch (18.5 mm) polyamide, clear anodized, E6 EV1 flush sill.

2. Hinges: Zinc die cast.
  - a. Finish: Match finish of frame and panels.
  - b. Provide stainless steel security hinge pins with set screws.
3. Adjustment: Provide folding hardware capable of specified amount of compensation and adjustments, in width, 1/8 inch (3 mm) per hinge and in height, 3/16 inch (4 mm) up and down.

E. Miscellaneous Components:

1. Weather Stripping: Provide manufacturer's standard double layer EPDM or brush seals with a two layer fiber glass reinforced polyamide fin at both the inner and outer edge of door panels or on frame for sealing between panels and between panel and frame.
2. Provide tapered pins or stainless steel screws for connecting frame components.

2.3 FABRICATION

- A. Use extruded aluminum frame and panel profiles, corner connectors and hinges, folding hardware, locking hardware and handles, glass and glazing and weather stripping as specified herein to make a folding glass wall. Factory pre-assemble as is standard for manufacturer and ship with all components and installation instructions.
  1. Sizes and Configurations: See Drawings for selected number of panels and configuration. Inward opening unit.

2.4 ALUMINUM FINISH

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 ERECTION

- A. Because of the large dimensions involved and the weight and movement of the panels, verify the structural integrity of the header such that the deflection with the live load is limited to the lesser of L/720 of the span and 1/4 inch.
- B. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square, with no unevenness, bowing, or bumps on floor.
- C. Installation of units constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Install frame in accordance with manufacturer's recommendations and installation instructions. Properly flash and waterproof around the perimeter of the opening.

- B. Installer to provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.
- C. Install panels, handles and lock set in accordance with manufacturer's recommendations and installation instructions.
- D. If necessary, adjust hardware for proper operation.

END OF SECTION 084130

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes the following:
  - 1. Glazed aluminum curtain walls.
  - 2. Aluminum plate panels (wall, soffits and beam covers).
  - 3. Low-emitting materials for sealants.

#### 1.3 REFERENCED STANDARDS

- A. AA - Aluminum Association, Inc.
- B. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 501.1 (Part of AAMA 501): Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure.
  - 2. AAMA 501.2 (Part of AAMA 501): Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.
  - 3. AAMA 501.4: Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts.
  - 4. AAMA 501.5: Methods of Tests for Exterior Walls.
  - 5. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
  - 6. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels.
- C. ASCE - American Society of Civil Engineers.
  - 1. ASCE 7: Minimum Design Loads for Buildings and Other Structures.
- D. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 36: Standard Specification for Carbon Structural Steel.
  - 2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A 153/A 153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A 1008/A 1008M: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
  5. ASTM A 1011/A 1011M: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
  6. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  7. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  8. ASTM B 429: Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
  9. ASTM E 90: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  10. ASTM E 283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  11. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  12. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  13. ASTM E 699: Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components.
  14. ASTM E 783: Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
  15. ASTM E 1105: Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
  16. ASTM E 1332: Standard Classification for Determination of Outdoor-Indoor Transmission Class.
- E. AWS - American Welding Society.
1. AWS A5.10/A5.10M: Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.
  2. AWS D1.1/D1.1M: Structural Welding Code - Steel.
  3. AWS D1.2/D1.2M: Structural Welding Code - Aluminum.
- F. CFR - Code of Federal Regulations.
1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- G. NFRC - National Fenestration Rating Council.
1. NFRC 500: Procedure for Determining Fenestration Product Condensation Resistance Values.
- H. SSPC - The Society for Protective Coatings.
1. SSPC-Paint 12: Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).
  2. SSPC-PS Guide No. 12.00: Guide to Zinc-Rich Coating Systems.
  3. SSPC-SP COM: Surface Preparation Specifications: Surface Preparation Commentary for Steel and Concrete Substrates.

I. SEI - Structural Engineering Institute/American Society of Civil Engineers.

1. SEI/ASCE 7: Minimum Design Loads for Buildings and Other Structures.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
  - a. Thermal stresses transferring to building structure.
  - b. Glass breakage.
  - c. Noise or vibration created by wind and thermal and structural movements.
  - d. Loosening or weakening of fasteners, attachments, and other components.
  - e. Failure of operating units.

B. Structural Loads: As indicated on Drawings by Structural Engineer and as follows:

1. Wind Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding wind-load design pressures calculated according to applicable building codes or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
2. Seismic Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of applicable building codes or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.
3. Dead Loads: Provide glazed aluminum curtain wall system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load. Provide a minimum 1/8-inch (3.2 mm) clearance between members and top of fixed panels, glazing, or other fixed part immediately below.
4. Live Loads: Provide glazed aluminum curtain wall system, including anchorage, that accommodates supporting structure's deflection from uniformly distributed and concentrated live loads indicated on Drawings without failure of materials or permanent deformation.

C. Structural-Test Performance: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding  $L/175$  of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to  $3/4$  inch (19 mm), whichever is less.
  2. Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or  $1/8$  inch (3.2 mm), whichever is smaller.
    - a. Operable Units: Provide a minimum  $1/16$ -inch (1.6-mm) clearance between framing members and operable units.
  3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
- E. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
- F. Story Drift: Provide glazed aluminum curtain wall systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Structural Drawing S-001 "Design Loads".
    - a. Maximum Interstory Drifts -  $OX$  (ASCE 7-10 Section 12.8.6).
      - 1) Ground to 2nd:  $OX = 4-1/2$  inches (114 mm).
      - 2) 2nd to Low Roof:  $OX = 3-3/4$  inches (95 mm).
      - 3) Low Roof to High Roof:  $OX = 1-1/4$  inches (32 mm).
  2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.
- G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).
- H. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).
1. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
- I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
  2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).

3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
- J. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
  1. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
  2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 55 as determined according to NFRC 500.
- K. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
  1. Outdoor-Indoor Transmission Class: Minimum 26 when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  1. For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
  1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  2. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by a professional engineer registered in the state where project is located responsible for their preparation.
- C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
  1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- E. Field quality-control reports.
- F. Warranties: Sample of special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
  - 1. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for curtain wall systems, including drawings, testing program development, test result interpretation, and comprehensive engineering analysis that shows systems' compliance with specified requirements.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- D. Source Limitations: Obtain each type of glazed aluminum curtain wall system from one source and by a single manufacturer.
- E. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
  - 1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.
- F. Preinstallation Conference: Conduct conference at Project site.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.8 WARRANTY

- A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kawneer North America; an Alcoa company; (Basis-of-Design).
  2. Vistawall Architectural Products.
  3. EFCO Corporation.
  4. Arcadia, Inc.
- B. Basis-of-Design Products: Kawneer 1600 Wall System, 2 Horizontal SSG.
1. Standard 2.5 x 7 inches (63 x 178 mm).
  2. Deep mullion at Visitor Entry.
    - a. Provide steel support as needed (coordinate with selected manufacturer).
    - b. Reference Drawing Details on A-340's.

### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.3 FRAMING

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  1. Construction: Thermally broken.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Front.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  2. Reinforce members as required to receive fastener threads.
  3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
  1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing Sealants: Manufacturer's standard sealants.

## 2.4 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
  1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 OPERABLE UNITS

- A. Doors: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts."

## 2.6 ALUMINUM PLATE PANELS

- A. Aluminum Plate Panels (wall, soffits and beam covers):
  - 1. Panel Sizes: 5'-0" x 8'-0" (1524 x 2438 mm) maximum with 1 inch (25 mm) formed pans.
  - 2. Install with concealed fasteners.
  - 3. Finish: To match curtainwall.

## 2.7 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

## 2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
  - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components that, when assembled, have the following characteristics:
  - 1. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using shear-block, screw-spline, or head-and-sill-receptor system with shear blocks at intermediate horizontal members.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Seal joints watertight unless otherwise indicated.
3. Install glazing to comply with requirements in Section 088000 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color: Dark Bronze, unless noted otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088000 "Glazing."

### 3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
  1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
  2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
  3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
    - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
  4. Location: Limit variation from plane or location shown on Shop Drawings to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
  1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. (2.25 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
  2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.

3. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 084413

## SECTION 084500 - TRANSLUCENT SANDWICH PANEL SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes insulated translucent sandwich panel system and accessories, factory unitized, as shown and specified. Work includes providing and installing the following:
  - 1. Flat factory prefabricated structural insulated translucent sandwich panels.
  - 2. Aluminum installation system.
  - 3. Aluminum sill flashing.
  - 4. Thermal break windows.

#### 1.3 REFERENCED STANDARDS

- A. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 1503: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
  - 2. AAMA 2604: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
  - 3. AAMA/NWWDA 101/I.S.2: Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors (ANSI).
- B. ASTM - American Society for Testing and Materials International.
  - 1. ASTM C 297: Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions.
  - 2. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
  - 3. ASTM D 572: Standard Test Method for Rubber - Deterioration by Heat and Oxygen.
  - 4. ASTM D 1002: Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
  - 5. ASTM D 1037: Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
  - 6. ASTM D 2244: Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
  - 7. ASTM D 4060: Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
  - 8. ASTM E 72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

- C. IBC - International Building Code.
- D. ICC - International Code Council, Inc.
- E. National Fenestration Rating Council
  - 1. NFRC 100: Procedure for Determining Fenestration Product Thermal Properties (Currently Limited to U-Values)
- F. UL - Underwriters Laboratories Inc.
  - 1. UL 723: Test for Surface Burning Characteristics of Building Materials.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Story Drift: Provide translucent sandwich panel system that accommodates design displacement of adjacent stories indicated.
  - 1. Design Displacement: As indicated on Structural Drawing S-001 "Design Loads".
    - a. Maximum Interstory Drifts - 0X (ASCE 7-10 Section 12.8.6).
      - 1) Ground to 2nd: 0X = 4-1/2 inches (114 mm).
      - 2) 2nd to Low Roof: 0X = 3-3/4 inches (95 mm).
      - 3) Low Roof to High Roof: 0X = 1-1/4 inches (32 mm).
  - 2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

#### 1.5 SUBMITTALS

- A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of components.
- B. Submit shop drawings. Include elevations, details, dimensions and attachments to other work.
- C. Submit manufacturer's color charts showing the full range of colors available for factory finished aluminum.
  - 1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
    - a. Sandwich panels: 14 by 28 inches (355 by 711 mm) units.
    - b. Factory finished aluminum: 5 inches (127 mm) long sections.
- D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

- E. Submit product test reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.
  - 1. Test reports required are:
    - a. Flame Spread and Smoke Developed (UL 723) - Submit UL Card.
    - b. Burn Extent (ASTM D 635).
    - c. Color Difference (ASTM D 2244).
    - d. Abrasion/Erosion Resistance (ASTM D 4060).
    - e. Impact Strength (UL 972).
    - f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037).
    - g. Bond Shear Strength (ASTM D 1002).
    - h. Beam Bending Strength (ASTM E 72).
    - i. Insulation U-Factor (NFRC 100).
    - j. NFRC System Certification.
    - k. Condensation Resistance Factor (AAMA 1503).
    - l. Performance for Windows (AAMA/NWWDA 101/I.S.2).
- F. Submit current documentation indicating regular, independent quality control monitoring under a nationally recognized building code review and listing program.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
  - 1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten (10) consecutive years and which can show evidence of those materials being satisfactorily used on at least six (6) projects of similar size, scope and location. At least three (3) of the projects shall have been in successful use for ten (10) years or longer.
  - 2. Panel system must be listed by the International Code Council - Evaluation Service (ICC-ES) which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an approved agency.
  - 3. Quality control inspections and required testing shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with "Acceptance Criteria for Sandwich Panels" as regulated by the ICC-ES.
- B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.
- C. Performance Requirements: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.
  - 1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.7 DELIVERY STORAGE AND HANDLING

- A. Deliver panel system, components and materials in manufacturer's standard protective packaging.
- B. Store panels on the long edge, several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

## 1.8 WARRANTY

- A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work which fails in materials or workmanship within one (1) year of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Kalwall Corporation (Basis-of-Design) or equal as approved by Architect.

### 2.2 PANEL COMPONENTS

- A. Face Sheets:
  - 1. Translucent Faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
  - 2. Flammability of interior face sheets:
    - a. Flamespread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flamespread rating no greater than 50 and smoke developed no greater than 250 when tested in accordance with UL 723.
    - b. Burn extent by ASTM D 635 shall be no greater than 1 inch (25 mm).
    - c. Face sheets shall not deform, deflect or drip when subjected to fire or flame.
    - d. Face sheets shall not delaminate when exposed to 200 deg F (93 deg C) for 30 minutes per IBC.
  - 3. Weatherability of Exterior Face Sheets:
    - a. Color Stability: Full thickness of the exterior face sheet shall not change color more than 3.0 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5 degrees facing south, determined by the average of at least three (3) white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.

- b. Erosion barrier: Exterior face shall have a permanent glass erosion barrier embedded beneath the surface to provide long-term resistance to reinforcing fiber exposure. Exterior face surface loss shall not exceed .7 mils and 40 mgs when tested in accordance with ASTM D 4060 employing CS17 abrasive wheels at a head load of 1 lbs. (500 grams) for 1000 cycles. Sacrificial surface films or coatings are not acceptable erosion barriers.
- 4. Appearance:
  - a. Exterior face sheets: Smooth, 0.070 inch thick (1.8 mm) and white in color.
  - b. Interior face sheets: Smooth, 0.045 inch (1.1 mm) thick and crystal in color.
  - c. Face sheets shall not vary more than +/- 10 percent in thickness and be uniform in color.
- 5. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact equal to 70 ft. lbs. (9.6 kg. m.) without fracture or tear when impacted by a 3-1/4 inches (79 mm) diameter, 5 lb. (2.27 kg) free-falling ball per UL 972.

B. Grid Core:

- 1. Aluminum I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16 inches (11 mm). The I-beam grid shall be machined to tolerances of not greater than +/- .002 inches (0.05 mm).

C. Laminate Adhesive:

- 1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives."
- 2. Minimum tensile strength of 750 psi ( 5175 kPa) when the panel assembly is tested by ASTM C 297 after two (2) exposures to six (6) cycles each of the aging conditions prescribed by ASTM D 1037.
- 3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to five (5) separate conditions:
  - a. 50 Percent Relative Humidity at 73 deg F (23 deg C): 540 psi (3726 kPa).
  - b. 182 deg F (83 deg C).
  - c. Accelerated Aging by ASTM D 1037 at room temperature: 800 psi (5520 kPa).
  - d. Accelerated Aging by ASTM D 1037 at 182 deg F (23 deg C): 250 psi (1725 kPa).
  - e. 500 Hour Oxygen Bomb by ASTM D 572: 1400 psi (9660 kPa).

## 2.3 PANEL CONSTRUCTION

- A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets resin laminated to a grid core of mechanically interlocking thermally broken (aluminum) I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
  - 1. Thickness: 2-3/4 inches (70 mm).
  - 2. Light transmission: 18 percent.
  - 3. Solar heat gain coefficient: 0.19.
  - 4. U-factor by NFRC certified laboratory: 0.29.

5. Grid pattern: (4) equal vertical spaces as indicated on Drawings.

- B. Panels shall be deflect no more than 1.9 inches (48 mm) at 30 psf in 10'-0" (146 ksm in 3 mm) span without a supporting frame by ASTM E 72.
- C. Panels shall withstand 1200 deg F (649 deg C) fire for minimum one (1) hour without collapse or exterior flaming.

## 2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

- A. Closure System: Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system. Thermally broken perimeter system shall have a urethane bridge.
- B. Sealing Tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.
- C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.
- D. Finish: Exposed aluminum to be manufacturer's factory applied finish that meets the performance requirements of AAMA 2604.
  - 1. Color: White, per manufacturer's standard color.

## 2.5 WINDOWS

- A. Windows shall be designed specifically for inclusion in the translucent panel unit wall system and factory utilized to panels.
  - 1. Windows shall be of the following type(s):
    - a. Project-out bottom.
    - b. Fixed lite.
- B. Performance: Windows shall pass requirements of AAMA/NWWDA 101/I.S.2.
  - 1. F-HC 70 windows shall pass requirements at uniform load of 105 psf (513 ksm), air infiltration at 6.24 psf (300 Pa) of .01 cfm/sq. ft. (0.16 cu. m/h x sq. m) and no water entry at 12 psf (58 ksm).
  - 2. AP-HC 70 windows shall pass requirements at uniform load of 105 psf (513 ksm), air infiltration at 6.24 psf (300 Pa) of 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) and no water entry at 10.5 psf (51 ksm).
- C. Construction: All window frame members shall be of heavy guage 6063-T5 extruded aluminum with a thermal break. Frame sections shall be coped and joined by stainless steel screws at each corner. All joints exposed to the weather shall be sealed with an elastic compound. All openings shall be double weather-stripped using T-slot bulb gaskets to insure minimum air infiltration.

1. Operating sash shall be hollow extruded design, mitered and joined with heavy reinforcing corners and marine glazed using continuous wrap around extruded vinyl glazing channel to reduce sound transmission and insure water tightness.
    - a. AP-HC 55 sash shall be glazed with an expanded EPDM closed cell sponge gasket to exterior, with aluminum glazing bead and a driven EPDM wedge gasket to the interior for rapid removal and replacement.
  2. Fixed lites shall be inside glazed with neoprene glazing splines for rapid removal and replacement.
- D. Hardware:
1. Hinges on operating windows shall be four (4) bar stainless steel with adjustable friction blocks.
  2. Locking hardware shall be of cam lever design and shall be made of cast white bronze.
- E. Glazing:
1. Heavy commercial (HC) windows shall be glazed with 1 inch (25 mm) double insulated glass.
- F. Finish of Exposed Aluminum:
1. Manufacturer's factory applied finish which meets the requirements of AAMA 2604. Color to be selected from manufacturer's standards.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, supporting structure and installation conditions. Do not proceed with panel erection until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Metal Protection:
  1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
  2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.
  3. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

### 3.3 INSTALLATION

- A. Install the panel system in accordance with the manufacturer's installation recommendations and approved shop drawings.
  - 1. Anchor component parts securely in place by permanent mechanical attachment system.
  - 2. Accommodate thermal and mechanical movements.
  - 3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.
- B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

### 3.4 CLEANING

- A. Clean the panel system inside and outside, immediately after installation, according to manufacturer's written recommendations.

END OF SECTION 084500

## SECTION 085619 - ALUMINUM TICKET WINDOWS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Aluminum bullet resistant ticket windows as indicated on Drawings.

#### 1.3 REFERENCED STANDARDS

- A. UL - Underwriters Laboratory Inc.
  - 1. Underwriters Laboratory UL 752 11th Edition Standard for Bullet Resisting Equipment.

#### 1.4 SUBMITTALS

- A. Product Data: Submit Manufacturer's technical product data substantiating that products comply.
- B. Shop drawings: Submit for fabrication and installation of windows. Include details, elevations and installation requirement of finish hardware and cleaning.
- C. Certification: Provide printed data in sufficient detail to indicate compliance with the contract documents.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver windows crated to provide protection during transit and job storage
- B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
- C. Store windows at building site under cover in dry location.

## 1.6 PROJECT CONDITIONS

- A. Field measurements: Check opening by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

## 1.7 WARRANTY

- A. All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. C.R. Laurence Co., Inc.
  - 2. Creative Industries, Inc.
  - 3. GAFFCO.

### 2.2 MATERIALS

- A. Frames: Aluminum bullet resistant frame modules shall be to the standards established by U.L. 752 Protection Level 2.
  - 1. Frames are to be constructed of 6063-T5 extruded aluminum lined with U.L. listed bullet resistant fiberglass.
  - 2. Replacement of glazing shall be from the secure side of the window or wall unit and does not require the removal of the frame from the opening.
  - 3. Shapes and sizes are to be in accordance with the contract drawings.
  - 4. Frames must utilize testing recognized under the standards established by U.L. 752 for bullet resistant components.
- B. Finish: All aluminum to be Kynar painted.
  - 1. Color: To match "Aluminum-Framed Entrances and Storefronts" Section 084113.
- C. Glazing: The glazing must be in accordance with U.L. 752 testing standards Level 2, laminated glass.
- D. Shelf: Provide a shelf not less than 2 inches (50.8 mm) thick with recessed tray. The shelf is to be the full width of the window and a minimum of 18 inches (457 mm) deep centered under the glazing.
- E. Voice Transmission: Electronic through glass communicator.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install frames and glazing in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed by the Architect or replace with new units.

### 3.2 CLEANING

- A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

### 3.3 PROTECTION

- A. Institute protective measures required throughout the remainder of the construction period to ensure that all the aluminum ticket windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION 085619

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Automatic operators.
  - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 08 Section "Door Hardware Schedule".
  - 2. Division 08 Section "Hollow Metal Doors and Frames".
  - 3. Division 08 Section "Interior Aluminum Doors and Frames".
  - 4. Division 08 Section "Flush Wood Doors".
  - 5. Division 08 Section "Automatic Door Operators".
  - 6. Division 08 Section "Access Control Hardware".
  - 7. Division 28 Section "Access Control".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
  - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C - Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
  - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
  1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
  2. Plans for existing and future key system expansion.
  3. Requirements for key control storage and software.
  4. Installation of permanent keys, cylinder cores and software.
  5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Ten years for mortise locks and latches.
  - 2. Five years for exit hardware.
  - 3. Twenty five years for manual surface door closer bodies.
  - 4. Ten years for heavy duty floor closers.
  - 5. Two years for shallow depth floor closers.
  - 6. Two years for electromechanical door hardware.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  - 4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
  - 5. Acceptable Manufacturers:
    - a. McKinney Products (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Acceptable Manufacturers:
  - a. McKinney Products (MK).
  - b. Pemko Manufacturing (PE).
- C. Continuous Geared Double-acting Hinges. ANSI/BHMA A156.26 Grade 1-600 Certified continuous geared hinges. Hinges are non-handed and allow the door to swing up to 100 degrees in either direction.
  1. Acceptable Manufacturers:
    - a. Pemko Manufacturing (PE) - DHS Series.
- D. Floor Closers: ANSI/BHMA A156.4 certified floor closers. Provide independent and adjustable valves for closing speed, latch speed, and backcheck with built-in dead stop and hold open features as specified. Provide finished cover plates or thresholds as indicated in door Hardware Sets.
  1. Acceptable Manufacturers:
    - a. Rixson Door Controls (RF).
- E. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.
  1. Acceptable Manufacturers:
    - a. Rixson Door Controls (RF).
- F. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.
  1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
  2. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
  3. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
  4. Acceptable Manufacturers:
    - a. Pemko Manufacturing (PE).

## 2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:
  - a. Pemko Manufacturing (PE) - EL-CEPT Series.
  - b. Securitron (SU) - EL-CEPT Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
  - a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
  - b. McKinney Products (MK) - Connector Hand Tool: QC-R003.
2. Acceptable Manufacturers:
  - a. McKinney Products (MK) - QC-C Series.
  - b. McKinney Products (MK) - PoE Series.

## 2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
  1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Acceptable Manufacturers:
    - a. Rockwood Manufacturing (RO).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
  1. Acceptable Manufacturers:
    - a. Rockwood Manufacturing (RO).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
  1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
5. Acceptable Manufacturers:
  - a. Rockwood Manufacturing (RO).

D. Locking Pull System: Post-mount style door pulls with integrated deadbolt locking system in type and design as specified in the Hardware Sets. Pulls available in multiple head, floor, or combination locking options, with outside keyed rim cylinder operation and inside turn piece activation. Mounting applications for aluminum, glass, steel and wood doors, with customized sizing and configuration options. Pull finishes include brass, bronze, and stainless steel.

1. Acceptable Manufacturers:
  - a. Rockwood Manufacturing (RO) - LP Series.

## 2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Manufacturer's Standard.
- D. Key Quantity: Provide the following minimum number of keys:
  1. Change Keys per Cylinder: Two (2)
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
  1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

- G. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

- H. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Wizard" software.

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Acceptable Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML2000 Series.
- b. Sargent Manufacturing (SA) - 8200 Series.

## 2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Acceptable Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML20900 Series.
- b. Sargent Manufacturing (SA) - 8200 Series.

## 2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

## 2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
7. Egress Pathway Exit Devices: Egress pathway devices connect to the building fire alarm system and when activated begin a looping sequence of synchronized signals integrating flashing LEDs, a conical beam laser and white noise followed by voice commands creating clear pathway to safety and emergency exit locations.
8. Electroluminescent exit devices increase visibility of exit locations supplementing life safety codes requiring egress path marking systems. Integral "EXIT" green-blue electroluminescent signage provides 3 to 5 times the visibility of other light sources. Devices can be used as a stand-alone feature or wired in conjunction with the fire alarm system.
9. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
  - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.

- b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  - 10. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  - 11. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  - 12. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  - 13. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  - 14. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
- 1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    - b. Sargent Manufacturing (SA) - 80 Series.

## 2.10 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
- 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  - 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
  - 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  - 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
    - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    - c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    - d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
  - B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
    1. Acceptable Manufacturers:
      - a. Corbin Russwin Hardware (RU) - DC8000 Series.
      - b. Sargent Manufacturing (SA) - 351 Series.
      - c. Norton Door Controls (NO) - 7500 Series.
  - C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA 156.4, Grade 1 certified surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
    1. Acceptable Manufacturers:
      - a. Corbin Russwin Hardware (RU) - Unitrol DC8000 Series.
      - b. Norton Door Controls (NO) - Unitrol 7500 Series.
- 2.11 AUTOMATIC DOOR OPERATORS
- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
    1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
  - B. Electrohydraulic Door Operators: Self-contained low-pressure units with rack and pinion design contained within a cast aluminum housing. Door closing speed controlled by independent hydraulic adjustment valves in the sweep and latch range of the closing cycle. Operator is to provide conventional door closer opening and closing forces unless the power operator motor is activated. Unit is to include an adjustable hydraulic backcheck valve to cushion the door speed if opened violently. Non-handed units for both push and pull side applications.
  - C. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
  - D. Standard: Certified ANSI/BHMA A156.19.

1. Performance Requirements:

- a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
- b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

E. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.

F. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

1. On-off switch to control power to be key switch operated.

G. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

H. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

I. Activation Devices: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

J. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

1. Acceptable Manufacturers:

- a. Norton Door Controls (NO) - 6000 Series.

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

- a. Rockwood Manufacturing (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  - 1. Acceptable Manufacturers:
    - a. Rixson Door Controls (RF).
    - b. Rockwood Manufacturing (RO).
    - c. Sargent Manufacturing (SA).

## 2.13 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
  - 1. Pemko Manufacturing (PE).

## 2.14 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.15 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

- 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
1. MK - McKinney
  2. PE - Pemko
  3. RO - Rockwood
  4. RF - Rixson
  5. AD - Adams Rite
  6. RU - Corbin Russwin
  7. SU - Securitron
  8. 00 - Other
  9. FO - Folger Adam
  10. NO - Norton
  11. BM - Besam

#### Hardware Schedule

Set: 01

Doors: 1037.1-EXT, 1037.2-EXT

2 Floor Closer	PH SC 28N Less Top Pivot	626	RF
2 Pivot	345	626	RF
1 PRL Exit Device	PL100	630	00
1 PRL Exit Device	PL100 w/ Cylinder	630	00
1 Interchangeable Core	8000-	626	RU
1 Cylinder	3080-114- CT6R	626	RU
2 Pull	RM3301-96 Mtg-Type 15XHD MP	US32D	RO
2 Concealed Overhead Stop	1-X36	630	RF
1 Threshold	Type 11 x 2748A MSES25SS		PE
2 Door Bottom	2221APK		PE

Set: 02

Doors: EX1053.2, EX1053.3, EX1053.4, EX1060.5, EX1060.6, EX1060.7, EX1060.8, EX1080.1

2 Continuous Hinge	KCFMXX-HD1		PE
2 Exit Device	ED5860 M110	630	RU
2 Pull	RM3301-72 Mtg-Type 12XHD	US32D	RO
2 Concealed Overhead Holder	1-X26 LS	630	RF
2 Door Closer	PR7500	689	NO
2 Drop Plate	7788	689	NO
1 Threshold	272A MSES25		PE
2 Door Bottom	2221APK		PE

Notes: Perimeter seals are furnished by the door supplier.

Set: 03

Doors: EX1001.1, EX1053.1, EX1083.1

2 Continuous Hinge	KCFMXX-HD1 PT		PE
2 Exit Device	ED5860 M110 M92 M94	630	RU
2 Pull	RM3301-72 Mtg-Type 12XHD	US32D	RO
2 Door Operator	6060	689	NO
1 Threshold	272A MSES25		PE
2 Door Bottom	2221APK		PE
2 Electric Power Transfer	EL-CEPT		SU
2 ElectroLynx Harness	QC-C012P		MK
2 ElectroLynx Harness	QC-C1500P		MK
2 Position Switch	DPS-M-BK		SU
2 Push Plate	639		NO
1 Controller	782		RU

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Perimeter seals are furnished by the door supplier.

Set: 04

Doors: EX1038.1

2 Continuous Hinge	KCFMXX-HD1 PT		PE
2 Exit Device	ED5860 M110 M92 M94	630	RU
2 Pull	RM3301-72 Mtg-Type 12XHD	US32D	RO
2 Door Closer	UNIJ7500	689	NO
2 Drop Plate	7786BP	689	NO
1 Threshold	272A MSES25		PE
2 Door Bottom	2221APK		PE
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C012P		MK
1 ElectroLynx Harness	QC-C1500P		MK
1 Controller	782		RU

Notes: Perimeter seals are furnished by the door supplier.

The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 05

Doors: EX1071.1, EX1074.1, EX1084.1

3 Hinge	TA2314 x NRP 4-1/2" x 4-1/2"	US32D	MK
1 Hinge	TA2314 x NRP PoE 4-1/2" x 4-1/2"	US32D	MK
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 Threshold	272A MSES25		PE
1 Rain Guard	346C		PE
1 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	2221APK		PE
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK
1 Latch Protector	320	US32D	RO
1 Cylinder Guard	MS4043-00	130	AD

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 06

Doors: EX1063.1, EX1066.1

4 Hinge	TA2314 x NRP 4-1/2" x 4-1/2"	US32D	MK
1 Storeroom Lock w/ Deadbolt	ML2059 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Concealed Overhead Stop	1-X36	630	RF
1 Door Closer	7500	689	NO
1 Threshold	272A MSES25		PE
1 Rain Guard	346C		PE
1 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	2221APK		PE
1 Latch Protector	320	US32D	RO
1 Cylinder Guard	MS4043-00	130	AD

Set: 07

Doors: EX1067.1

3 Hinge	TA2314 x NRP 4-1/2" x 4-1/2"	US32D	MK
1 Hinge	TA2314 x NRP PoE 4-1/2" x 4-1/2"	US32D	MK
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Concealed Overhead Stop	1-X36	630	RF
1 Door Closer	PR7500	689	NO
1 Threshold	272A MSES25		PE
1 Rain Guard	346C		PE
1 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	2221APK		PE
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK

1 Latch Protector	320	US32D	RO
1 Cylinder Guard	MS4043-00	130	AD

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 08

Doors: EX1070.1

3 Hinge	TA2314 x NRP 4-1/2" x 4-1/2"	US32D	MK
1 Hinge	TA2314 x NRP PoE 4-1/2" x 4-1/2"	US32D	MK
1 Access Control Exit Device (PoE)281300281300281300	ED5634L 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 Threshold	272A MSES25		PE
1 Rain Guard	346C		PE
1 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	2221APK		PE
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK
1 Latch Protector	320	US32D	RO
1 Cylinder Guard	MS4043-00	130	AD

Set: 09

Doors: 1054.2, 1055.1, 1084.2, 1084.3, EX1054.1, EX1067.2

1 Overhead Door	All hardware is furnished by the door supplier.		00
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Set: 10

Doors: 1002A.3, 1028.3, 1028.4, 1041.1

2 Floor Closer	PH SC 28N Less Top Pivot	626	RF
2 Pivot	345	626	RF
4 Pull	RM3301-72 Mtg-Type 14	US32D	RO

Set: 11

Doors: 1028.1, 1030.1, 1060.2, 1060.5, 1083.1

8 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
2 Exit Device	ED5860 M110	630	RU
2 Pull	RM3301-72 Mtg-Type 12XHD	US32D	RO
2 Concealed Overhead Stop	1-X36	630	RF
2 Door Closer	PR7500	689	NO
1 Astragal	S772BL		PE
2 Silencer	608		RO

Notes: Perimeter seals are furnished by the door supplier.

Set: 12  
Doors: 1028.2

2 Continuous Hinge	KCFMXX-HD1		PE
1 Exit Device	ED5860 M110	630	RU
1 Exit Device	ED5860 124955 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
2 Concealed Overhead Stop	1-X36	630	RF
2 Door Closer	PR7500	689	NO
1 Astragal	S772BL		PE

Notes: Perimeter seals are furnished by the door supplier.

Set: 13  
Doors: 1029.1

2 Floor Closer	PH SC 28N Less Top Pivot	626	RF
2 Pivot	345	626	RF
4 Magnetic Lock	SAM		SU
2 Pull	RM3301-96 Mtg-Type 15XHD MP	US32D	RO
1 Motion Sensor	XMS		SU
1 Push Button	EEB3N		SU
1 Power Supply	BPS-24-1		SU

Notes: The access control system is furnished by the security contractor.

System Operaton:  
Egress: Free at all times.  
Ingress: By access credential or when fire alarm is activated.

Set: 14  
Doors: 1030.2

6 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-QC12 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5860 M110 M92	630	RU
1 Access Control Exit Device (PoE)281300281300281300	ED5634L 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Threshold	173A MSSES25		PE
2 Gasketing	S88BL (Head & Jamb)		PE
2 Door Bottom	PDB411AE		PE
1 Astragal	355CP		PE
1 ElectroLynx Harness	QC-C012P		MK
1 ElectroLynx Harness	QC-C1500P		MK

1 ElectroLynx Harness	PoE-C300P	MK
1 ElectroLynx Harness	PoE-C1500P	MK
1 Position Switch	DPS-W-BK	SU

Notes: STC 30The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 15

Doors: 1034.1, 1038.1, 1038.2, 1055.4, 1083.2, 1083.3, 2126.2, 2126.3

6 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-QC12 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5860 M110 M92	630	RU
1 Access Control Exit Device (PoE)281300281300281300	ED5634L 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	355CP		PE
1 ElectroLynx Harness	QC-C012P		MK
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK
1 Position Switch	DPS-W-BK		SU

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 16

Doors: 1055.3

6 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-QC12 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5860 M110 M92	630	RU
1 Access Control Exit Device (PoE)281300281300281300	ED5634L 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	357SP		PE

2 Silencer	608	RO
1 ElectroLynx Harness	QC-C012P	MK
1 ElectroLynx Harness	QC-C1500P	MK
1 ElectroLynx Harness	PoE-C300P	MK
1 ElectroLynx Harness	PoE-C1500P	MK
1 Position Switch	DPS-M-BK	SU

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 17

Doors: 1060.6

7 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	1962	US32D	RO
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	355CP		PE
1 Position Switch	DPS-W-BK		SU

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 18

Doors: 1071.1

7 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	2842	US32D	RO
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	357SP		PE
2 Silencer	608		RO

1 Position Switch DPS-M-BK SU

Notes: The access control system is furnished by the security contractor.

System Operation:  
Egress: Free at all times.  
Ingress: By key or access credential.

Set: 19  
Doors: 2058.1, 2058.2, 2058.3, 2106.1, 2106.2

8 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	555 36"	US26D	RO
1 Flush Bolt	557	US26D	RO
1 Storeroom Lock	ML2057 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
2 Concealed Overhead Holder	1-X26 LS	630	RF
1 Astragal	355CP		PE

Set: 20  
Doors: 2063.1

6 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-QC12 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5860 M110 M92	630	RU
1 Access Control Exit Device (PoE)281300281300281300	ED5634L 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	UNIJ7500	689	NO
2 Drop Plate	7786BP	689	NO
2 Door Stop	406	US32D	RO
1 ElectroLynx Harness	QC-C012P		MK
1 ElectroLynx Harness	QC-C1500P		MK
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK
1 Position Switch	DPS-W-BK		SU

Notes: The access control system is furnished by the security contractor.

System Operation:  
Egress: Free at all times.  
Ingress: By key or access credential.

Set: 21  
Doors: 2090.1, 2090.2, 2090.3

2 Continuous Hinge	KCFMXX-HD1		PE
2 Pull	RM3301-96 Mtg-Type 15XHD MP	US32D	RO

2 Push Bar	RM3112 Mtg-Type 15XHD 32"	US32D	RO
2 Door Closer	UNIJ7500	689	NO
2 Drop Plate	7786BP	689	NO

Set: 22  
Doors: 2116.1

8 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	2842	US32D	RO
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	357SP		PE
2 Silencer	608		RO

Set: 23  
Doors: 2123.1

7 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	1962	US32D	RO
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
2 Door Closer	7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	355CP		PE
1 Position Switch	DPS-W-BK		SU

Notes: The access control system is furnished by the security contractor.

System Operation:  
Egress: Free at all times.  
Ingress: By key or access credential.

Set: 24  
Doors: 2133.2

8 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	1962	US32D	RO
1 Passage Latch	ML2010 124T	630	RU
1 Coordinator	1600	US28	RO
1 Mounting Bracket	1601AB/C	US28	RO
2 Door Closer	PR7500	689	NO
2 Door Stop	406	US32D	RO
1 Astragal	355CP		PE

Set: 25

Doors: 1045.1, 2119.2

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	ML2057 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	R 7500	689	NO
1 Door Stop	406	US32D	RO
1 Gasketing	S88BL (Head & Jamb)		PE

Set: 26

Doors: 1060.1, 2094.2

3 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Exit Device (PoE)281300281300281300	ED5634AL 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 Gasketing	S88BL (Head & Jamb)		PE
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 27

Doors: 1069.1, 2094.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5600AL 1249M10 M110	630	RU
1 Door Closer	R 7500	689	NO
1 Door Stop	406	US32D	RO
1 Gasketing	S88BL (Head & Jamb)		PE

Set: 28

Doors: 1002.1

1 Floor Closer	PH SC 28N Less Top Pivot	626	RF
1 Pivot	345	626	RF
1 Pull	RM2540-16 Mtg-Type 15XHD	US32D	RO

Set: 29

Doors: 1002.1.1, 1003.1.1, 1007.1, 1013.1, 1037.2, 1059.1

4 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
1 Flush Bolt	1962	US32D	RO

1 Storeroom Lock	ML2057 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Coordinator	1600	US28	RO
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO
1 Astragal	355CP		PE

Set: 30

Doors: 1003.1, 1005.1

1 Floor Closer	PH SC 28N Less Top Pivot	626	RF
1 Pivot	345	626	RF
1 Magnetic Lock	SAM		SU
2 Pull	RM3301-96 Mtg-Type 15XHD MP	US32D	RO
1 Motion Sensor	XMS		SU
1 Push Button	EEB3N		SU
1 Power Supply	BPS-24-1		SU

Notes: The access control system is furnished by the security contractor.

System Operator:

Egress: Free at all times.

Ingress: By access credential or when fire alarm is activated.

Set: 31

Doors: 1004.1, 2008.1, 2047.1

1 Floor Closer	PH SC 28N Less Top Pivot	626	RF
1 Pivot	345	626	RF
1 Interchangeable Core	8000-	626	RU
1 Cylinder	3080-114- CT6R	626	RU
1 Locking Pull	LP3301DBU ADA LC	US32D	RO

Set: 32

Doors: 1004.1.1, 1011.2, 1026.2, 1027.1, 1050.1, 1053.1, 1073.1, 1074.1, 1084.1, 2012.2, 2092.2, 2095.3, 2096.1, 2097.2

4 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	ML2057 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Stop	406	US32D	RO

Set: 33

Doors: 1008.1

4 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	ML2010 124T	630	RU
1 Door Stop	406	US32D	RO

Set: 34

Doors: 1011.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
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1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO
1 Threshold	173A MSES25		PE
2 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	PDB411AE		PE

Notes: STC 30

Set: 35

Doors: 1012.1, 1016.1, 1043.1, 1047.1, 1054.1, 1058.1, 2009.1, 2011.1, 2015.1, 2031.2, 2033.1, 2035.1, 2046.1, 2049.1, 2068.1, 2076.1, 2087.1, 2102.1, 2109.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	ML2057 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Stop	406	US32D	RO

Set: 36

Doors: 1014.1

4 Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
2 Pull	RM2540-8 Mtg-Type 5HD	US32D	RO
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO

Set: 37

Doors: 1015.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C	US32D-MS	RO
1 Pull Plate	106x70C	US32D-MS	RO
1 Door Closer	7500	689	NO
1 Kickplate	K1050 10" 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" 4BE CSK	US32D	RO
1 Door Stop	406	US32D	RO

Set: 38

Doors: 1021.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
4 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO
1 Threshold	173A MSES25		PE
2 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	PDB411AE		PE
1 ElectroLynx Harness	PoE-C300P		MK

1 ElectroLynx Harness PoE-C1500P MK

Notes: STC 30

The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 39

Doors: 1021.2, 2031.1, 2034.1

4 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO

Set: 40

Doors: 1023.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Concealed Overhead Stop	1-X36	630	RF
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO

Set: 41

Doors: 1024.1, 1046.1, 1068.1, 2005.1, 2007.1, 2048.1, 2067.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	ML2051 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Stop	406	US32D	RO

Set: 42

Doors: 1026.1

4 Hinge (heavy weight)	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5600L 1249M55 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO

Set: 43

Doors: 1033.1, 1033.2, 1048.1, 1051.1, 2012.1, 2013.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C	US32D-	RO
		MS	
1 Pull Plate	106x70C	US32D-	RO

		MS	
1 Door Closer	7500	689	NO
1 Kickplate	K1050 10" 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" 4BE CSK	US32D	RO
1 Door Stop	406	US32D	RO

Set: 44

Doors: 1035.1, 1036.1, 1044.1, 2060.1, 2064.1, 2065.1, 2088.1, 2089.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Latch	ML2030 124T M19V	630	RU
1 Door Closer	7500	689	NO
1 Kickplate	K1050 10" 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" 4BE CSK	US32D	RO
1 Door Stop	406	US32D	RO

Set: 45

Doors: 1037.1

1 Floor Closer	PH SC H28S 90 Less Top Pivot	626	RF
1 Pivot	H345	626	RF
2 Pull	RM3301-72 Mtg-Type 14	US32D	RO
1 Door Stop	481H	US26D	RO

Set: 46

Doors: 1038.3

1 Hinge (heavy weight)	T4A3786 PoE 4-1/2" x 4-1/2"	US26D	MK
3 Hinge (heavy weight)	T4A3786 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Exit Device (PoE)281300281300281300	ED5634L 1249M834 TCIP1 M812 CT6R M110 (Furnished under section 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 ElectroLynx Harness	PoE-C1500P		MK
1 ElectroLynx Harness	PoE-C400P		MK

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 47

Doors: 1041.2

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO

1 Threshold	173A MSES25	PE
2 Gasketing	S88BL (Head & Jamb)	PE
1 Door Bottom	PDB411AE	PE
1 ElectroLynx Harness	PoE-C300P	MK
1 ElectroLynx Harness	PoE-C1500P	MK

Notes: STC 40

The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 48

Doors: 1042.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 Threshold	173A MSES25		PE
2 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	PDB411AE		PE

Notes: STC 40

Set: 49

Doors: 1049.1, 1052.1, 2002.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Latch	ML2030 124T M19V	630	RU
1 Door Stop	406	US32D	RO

Set: 50

Doors: 1060.3, 1060.4

4 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5657L K1M57 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
1 Pull	RM3301-72 Mtg-Type 12XHD	US32D	RO
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
3 Silencer	608		RO

Set: 51

Doors: 1062.1, 2001.1, 2001.2, 2001.3, 2087.3

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK

1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 52

Doors: 1064.1, 1065.1, 2052.1, 2077.1, 2086.1, 2092.1, 2113.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Stop	406	US32D	RO

Set: 53

Doors: 1075.1

4 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO

Set: 54

Doors: 1085.1, 2020.1, 2030.1, 2051.1, 2051.2

1 Floor Closer	PH SC 28N Less Top Pivot	626	RF
1 Pivot	345	626	RF
2 Pull	RM3301-72 Mtg-Type 14	US32D	RO

Set: 55

Doors: 2087.2

1 Hinge (heavy weight)	T4A3786 PoE 4-1/2" x 4-1/2"	US26D	MK
3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO
1 ElectroLynx Harness	PoE-C1500P		MK
1 ElectroLynx Harness	PoE-C400P		MK

Notes: The access control system is furnished by the security contractor.

System Operation:  
Egress: Free at all times.  
Ingress: By key or access credential.

Set: 56  
Doors: 2093.1

3 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Mort Lock	ML20836 x TCIP1 x M812 124Z CT6R (Furnished under div. 281300)	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK

Notes: The access control system is furnished by the security contractor.

System Operation:  
Egress: Free at all times.  
Ingress: By key or access credential.

Set: 57  
Doors: 2095.1, 2095.2, 2098.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	689	NO
1 Door Stop	406	US32D	RO

Set: 58  
Doors: 2097.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ML2055 124T CT6R	630	RU
1 Interchangeable Core	8000-	626	RU
1 Concealed Overhead Stop	1-X36	630	RF
1 Door Closer	7500	689	NO

Set: 59  
Doors: 2100.3, 2100.6, 2105.1

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	ML2010 124T	630	RU
1 Door Stop	406	US32D	RO

Set: 60  
Doors: 2119.1, 2126.1

4 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
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1 Exit Device	ED5600L 1249M55 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
1 Door Stop	406	US32D	RO

Set: 61

Doors: 1009.1, 1010.1, 2008.2, 2014.1, 2016.1, 2017.1, 2018.1, 2021.1, 2021.2, 2021.3, 2021.4, 2021.5, 2021.6, 2021.7, 2021.8, 2037.1, 2038.1, 2039.1, 2040.1, 2041.2, 2042.1, 2043.1, 2044.1, 2053.1, 2054.1, 2055.1, 2056.1, 2057.1, 2070.1, 2072.1, 2073.1, 2074.1, 2078.1, 2079.1, 2080.1, 2081.1, 2082.1, 2083.1, 2084.1, 2085.1, 2099.1, 2100.1, 2100.2, 2101.1, 2105.2, 2105.3, 2107.1, 2108.1, 2110.1, 2111.1, 2112.1, 2114.1, 2115.1, 2117.1, 2118.1, 2118.2

1 Track System	G70/8 8'2"		PE
2 Pull	RM3301-72 Mtg-Type 14	US32D	RO

Set: 62

Doors: 2003.1

1 Sliding Door Hdwe	PF28200A7280		PE
1 Edge Pull	880	US26D	RO
1 Privacy Door Latch	891	US26D	RO

Set: 63

Doors: 2004.1, 2004.2, 2006.1, 2036.1, 2061.1

1 Track System	G70/6 6'6"		PE
2 Pull	RM3301-72 Mtg-Type 14	US32D	RO

Set: 64

Doors: 2100.4, 2100.5

1 Edge Pull	880	US26D	RO
1 Sliding Door Hdwe	PF28200A9684		PE
1 Privacy Door Latch	891	US26D	RO

Set: 65

Doors: 1039.1, 2062.1

4 Hinge	TA2714 x NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	ED5657AL K1M57 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
1 Flush Pull	BF97L	US32D	RO
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 Astragal	S772BL		PE

Set: 66

Doors: DG-1, DG-2

1 Removable Mullion	907 7' M57		RU
1 Exit Device	ED4200S M110	630	RU
1 Exit Device	ED4200S K157 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
2 Pull	RM2540-16 Mtg-Type 12XHD	US32D	RO
2 Door Closer	7500	600 x	NO

		689	
2 Bracket	7798	600 x	NO
		689	
2 Door Stop	481H	US26D	RO

Notes: Hinges are furnished by the gate supplier.

Install mullion in sleeve in ground. Provide mechanism to secure mullion in place with a padlock.

Set: 67

Doors: DG3, DG4, DG5, DG6

1 Exit Device	ED4200S K157 M110 CT6B	630	RU
1 Interchangeable Core	8000-	626	RU
1 Pull	RM2540-16 Mtg-Type 12XHD	US32D	RO
		600 x	
1 Door Closer	7500	689	NO
		600 x	
1 Bracket	7798	689	NO
		US26D	
1 Door Stop	481H		RO

Notes: Hinges are furnished by the gate supplier.

Set: 68

Doors: EX1061.1

4 Hinge	TA2314 x NRP 4-1/2" x 4-1/2"	US32D	MK
1 Exit Device	ED5860 M110	630	RU
1 Door Closer	PR7500	689	NO
1 Door Stop	406	US32D	RO
1 Threshold	272A MSES25		PE
1 Rain Guard	346C		PE
1 Gasketing	S88BL (Head & Jamb)		PE
1 Door Bottom	2221APK		PE

Set: 69

Doors: EX2119.1

4 Electric Hinge	TA2714-PoE 4-1/2" x 4-1/2"	US26D	MK
1 Access Control Exit Device	ED5634L 1249M834 TCIP1 M812 CT6R	630	RU
(PoE)281300281300281300	M110 (Furnished under section 281300)		
1 Interchangeable Core	8000-	626	RU
1 Door Closer	R 7500	689	NO
1 Door Stop	406	US32D	RO
3 Silencer	608		RO
1 ElectroLynx Harness	PoE-C300P		MK
1 ElectroLynx Harness	PoE-C1500P		MK

Notes: The access control system is furnished by the security contractor.

System Operation:

Egress: Free at all times.

Ingress: By key or access credential.

Set: 70

Doors: EX3000.1

1 Storeroom Lock	CL3357 NZD CT6R	626	RU
1 Interchangeable Core	8000-	626	RU
1 Door Closer	7500	600 x	NO
		689	
1 Drop Plate	7786BP	689	NO
1 Rain Guard	346C		PE
3 Silencer	608		RO

Notes: The balance of the hardware is furnished by the door supplier.

Set: 71

Doors: EX1020.59

1 Specialty Door	All hardware is furnished by the door supplier.	00
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END OF SECTION 087100

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 088000 - GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Doors and windows.
  - 2. Glazed curtain walls.
  - 3. Glazed entrances.
  - 4. Storefront framing.
  - 5. Low-emitting materials for sealants.

#### 1.3 REFERENCED STANDARDS

- A. AAMA - American Architectural Manufacturers Association.
  - 1. AAMA 800: Voluntary Specifications and Test Methods for Sealants.
  - 2. AAMA GD SG-1: Glass Design for Sloped Glazing.
  - 3. AAMA TIR-A7: Sloped Glazing Guidelines.
- B. ANSI - American National Standards Institute.
  - 1. ANSI Z97.1: Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM - American Society for Testing and Materials International.
  - 1. ASTM C 509: Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
  - 2. ASTM C 542: Specification for Lock-Strip Gaskets.
  - 3. ASTM C 716: Specification for Installing Lock-Strip Gaskets and Infill Glazing Materials.
  - 4. ASTM C 864: Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
  - 5. ASTM C 920: Specification for Elastomeric Joint Sealants.
  - 6. ASTM C 1021: Practice for Laboratories Engaged in the Testing of Building Sealants
  - 7. ASTM C 1036: Specification for Flat Glass.
  - 8. ASTM C 1048: Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

9. ASTM C 1087: Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
  10. ASTM C 1115: Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
  11. ASTM C 1172: Specification for Laminated Architectural Flat Glass.
  12. ASTM C 1281: Specification for Preformed Tape Sealants for Glazing Applications.
  13. ASTM C 1330: Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  14. ASTM E 774: Specification for the Classification of the Durability of Sealed Insulating Glass Units.
  15. ASTM E 1300: Practice for Determining Load Resistance of Glass in Buildings.
- D. CFR - Code of Federal Regulations.
1. 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
  2. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- E. FGMA - Flat Glass Marketing Association.
- F. GANA - Glass Association of North America.
1. Glazing Manual.
  2. Laminated Glass Design Guide.
  3. Engineering Standards Manual.
- G. IGCC - Insulating Glass Certification Council.
- H. IGMA - Insulating Glass Manufacturers Alliance.
1. IGMA TB-3001: Sloped Glazing Guidelines.
  2. SIGMA TM-3000: Glazing Guidelines for Sealed Insulating Glass Units.
- I. Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; Building Technologies Department; Windows & Daylighting Group.
1. LBL-44789 WINDOW 5.0: A PC Program for Analyzing Window Thermal Performance. (Available online at [windows.lbl.gov/software](http://windows.lbl.gov/software)).
- J. NFRC - National Fenestration Rating Council.
1. NFRC 100: Procedure for Determining Fenestration Product Thermal Properties (Currently Limited to U-Factors).
  2. NFRC 300: Procedures for Determining Solar Optical Properties of Simple Fenestration Products.
- K. NFPA - National Fire Protection Association International.
1. NFPA 252: Fire Tests of Door Assemblies.
  2. NFPA 257: Fire Test for Window and Glass Block Assemblies.

#### 1.4 DEFINITIONS

- A. Glass Manufacturers: Firms that produces primary, fabricated, or etched and pattern glass, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed, heat treated, etched, or patterned) required to meet or exceed specified performance criteria.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (48.8 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.

#### 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
  - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
  - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

## 1.7 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
  - 1. For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
- B. Glass Samples: Submit two samples 12 by 12 inches (305 by 305 mm) in size of glass units.
- C. Product Certificates: For glass and glazing products, from manufacturer.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass, glazing sealants, and glazing gaskets.
- E. Warranties: Special warranties specified in this section.

## 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience.
- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
  - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
  - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
  - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

- H. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.
- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- J. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review temporary protection requirements for glazing during and after installation.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

#### 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

#### 1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

#### 1.12 EXTRA MATERIALS

- A. Provide two (2) of each glass size and each glass type, of insulated glass units.

### PART 2 - PRODUCTS

#### 2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

#### 2.2 GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Guardian Industries Corp.

2. Pilkington Libbey-Owens-Ford.
3. PPG Industries, Inc.
4. Visteon Glass Systems.

B. Tempered Glass: Clear, fully tempered with horizontal tempering.

1. Comply with ASTM C 1048, Type FT (fully tempered), Quality-Q3 glazing select.
2. Comply with ANSI Z97.1.
3. 1/4 inch (6 mm) thick, minimum.

C. Spandrel Glass: Tempered, clear.

1. Ceramic fused frit, color on back surface, as scheduled.
2. Comply with ASTM C 1048, Type FT (fully tempered), Quality-Q3 glazing select.
3. Comply with ANSI Z97.1.
4. Comply with ASTM C 1036 Type I, transparent flat, Class 1 clear, Quality-Q3.
5. 1/4 inch (6 mm) thick.

## 2.3 SEALED INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Guardian Industries Corp. (Basis-of-Design).
2. Viracon, Apogee Enterprises, Inc.
3. Interpane Glass Co.
4. Pdc.
5. Dykstra.

B. Insulated Glass Units: Double pane with polyisobutylene primary and secondary silicone sealant edge seal.

1. Outer 1/4 inch (6 mm) thick and inner 1/4 inch (6 mm) thick pane as scheduled.
2. Comply with ASTM E 774 for Class CBA.
3. Purge interpane space with dry hermetic air.
4. Total unit thickness of 1 inch (25 mm) minimum, unless scheduled otherwise.
5. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article.
6. Spacer: Aluminum with clear anodized finish, unless scheduled otherwise.
7. Desiccant: Molecular sieve or silica gel or blend of both.
8. Corner Construction: Manufacturer's standard reinforced construction.
9. Performance Requirements: Refer to exterior glass type schedule.

## 2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

## 2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
  - 1. Neoprene complying with ASTM C 864.
  - 2. EPDM complying with ASTM C 864.
  - 3. Silicone complying with ASTM C 1115.
  - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
  - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

## 2.6 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
  - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT, unless otherwise indicated.
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
  2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
  2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## 2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant, where indicated.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

### 3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.9 SCHEDULE OF EXTERIOR GLASS TYPES

#### A. GT-1: (Dark Tint) Guardian Sunguard SuperNeutral 54.

- 1. Outdoor Lite: 1/4 inch (6 mm) Guardian Crystal/Gray Tint with Low-E coating Guardian SuperNeutral 54 on #2 surface.
- 2. Indoor Lite: 1/4 inch (6 mm) clear.
- 3. Interspace: 1/2 inch (13 mm) airspace.
- 4. Performance Requirements:
  - a. Visible Light Transmittance: 39 percent.
  - b. Outdoor Visible Reflectance: 9 percent.
  - c. Indoor Visible Reflectance: 17 percent.
  - d. Winter Nighttime U-Factor: 0.29 Btu/(hr x sq ft x deg F).
  - e. Solar Heat Gain Coefficient: 0.23
  - f. Light to Solar Gain Ratio: 1.68

#### B. GT-2: (Dark Translucent) Guardian Sunguard SN-54.

- 1. Outdoor Lite: 1/4 inch (6 mm) Guardian Crystal/Gray Tint with Guardian SuperNeutral 54 on #2 surface.
- 2. Indoor Lite: 1/4 inch (6 mm) clear with Guardian SatinDeco acid etch on #3 surface.
- 3. Interspace: 1/2 inch (13 mm) airspace.
- 4. Performance Requirements:
  - a. Visible Light Transmittance: 38 percent.
  - b. Outdoor Visible Reflectance: 9 percent.
  - c. Indoor Visible Reflectance: 17 percent.
  - d. Winter Nighttime U-Factor: 0.29 Btu/(hr x sq ft x deg F).
  - e. Shading Coefficient: 0.26
  - f. Solar Heat Gain Coefficient: 0.23
  - g. Light to Solar Gain Ratio: 1.64

#### C. GT-3: (Clear) Guardian Sunguard SNX 62/27.

- 1. Outdoor Lite: 1/4 inch (6 mm) clear with Low-E coating Guardian SNX 62/27.
- 2. Indoor Lite: 1/4 inch (6 mm) clear.
- 3. Interspace: 1/2 inch (13 mm) airspace.
- 4. Performance Requirements:
  - a. Visible Light Transmittance: 62 percent.
  - b. Outdoor Visible Reflectance: 11 percent.
  - c. Indoor Visible Reflectance: 12 percent.
  - d. Winter Nighttime U-Factor: 0.29 Btu/(hr x sq ft x deg F).
  - e. Shading Coefficient: 0.30

- f. Solar Heat Gain Coefficient: 0.27
  - g. Light to Solar Gain Ratio: 2.35
- D. GT-4: Level 1 Bullet Resistant Glass at ticket windows.
- E. GT-5: (Courtyard Translucent) Guardian SatinDeco (Acid Etched).
  - 1. Outdoor Lite: 1/4 inch (6 mm) clear.
  - 2. Indoor Lite: 1/4 inch (6 mm) clear with Guardian SatinDeco acid-etch on #3 surface.
  - 3. Interspace: 1/2 inch (13 mm) airspace.
  - 4. Performance Requirements:
    - a. Visible Light Transmittance: 77 percent.
    - b. Outdoor Visible Reflectance: 15 percent.
    - c. Indoor Visible Reflectance: 15 percent.
    - d. Winter Nighttime U-Factor: 0.46 Btu/(hr x sq ft x deg F).
    - e. Shading Coefficient: 0.83
    - f. Solar Heat Gain Coefficient: 0.72
    - g. Light to Solar Gain Ratio: 1.08

END OF SECTION 088000

## SECTION 088013 – INTERIOR GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Glass for windows, interior borrowed lites.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 057300 "Decorative Metal Railings" for glazing in railings.
2. Section 088300 "Mirrors."
3. Section 088853 "Security Glazing."
4. Section 102215 "Fixed Glass Panel Partitions."
5. Section 102219 "Demountable Partitions."

#### 1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

#### 1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Accessory Samples: For sealants, in 12-inch lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For sealants, indicating VOC content.
- B. Qualification Data: For Installer.
- C. Sample Warranties: For special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

#### 1.9 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single source from single manufacturer.
  2. Obtain reflective-coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glass shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, experienced in designing glass work indicated, and licensed in the State of the place of the Project, to design glazing.
1. Provide glass capable of withstanding temperature changes, and impact from normal operation for doors and windows, without failure of any kind, including loss or glass breakage attributable to the following:
    - a. Defective manufacture, fabrication, and installation.
    - b. Deterioration of glazing materials.
    - c. Failure of glazing sealants or gaskets to remain watertight and airtight.
    - d. Other defects in construction.
  2. Unless otherwise recommended by the glass manufacturers, provide minimum 3/8-inch nominal glass bite depth for monolithic lites.
  3. Provide either laminated or fully tempered glass complying with ANSI Z97.1 requirements for Drop Height Class A wherever safety glazing is required by the authorities having jurisdiction. Wire glass is not permitted.
  4. Glass thicknesses indicated are estimates used for detailing purposes only.

- a. Confirm glass thicknesses by analyzing Project loads and in-service conditions.
  - b. Provide glazing materials, complying with ASTM E 1300, in the nominal thicknesses indicated for each opening size, but not less than the thicknesses and strength required in order to meet or exceed the specified performance requirements.
  - c. Unless otherwise indicated or specified, overall thickness of each glass type and composite thickness of multiple layer glass types shall be consistent throughout the Project.
- 5. Comply with the combined recommendations of the glass manufacturer, sealant manufacturer and manufacturers of other materials used in glazing operations, except where more stringent requirements are specified.
  - a. Where joint movement may result in a variable glass bite depth, increase nominal bit to provide minimum 3/8-inch glass bite depth and minimum 1/4-inch edge clearance.
  - b. Installed glass shall be free from rattle.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## 2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
  - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

## 2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 2. Spacer: Manufacturer's standard spacer material and construction.
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.7 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Sealant shall have a VOC content of 250 g/L or less.
  - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.7 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-1: Clear fully tempered float glass.
  - 1. Minimum Thickness: 6 mm.
  - 2. Safety glazing required.
- B. Glass Type GL-2: Clear fully tempered float glass.
  - 1. Minimum Thickness: 12 mm.
  - 2. Safety glazing required.

### 3.8 LAMINATED GLASS SCHEDULE

- A. Glass Type GL-7: Clear laminated glass with four plies of fully tempered float glass.
  - 1. Basis-of-Design Product: Safe Glass.
  - 2. Components:
    - a. 3/16" clear tempered glass.
    - b. .060 clear PVB interlayer.
    - c. 1/4" clear tempered glass.
    - d. .060 clear PVB interlayer.
    - e. 1/4" clear tempered glass.
    - f. .060 clear PVB interlayer.
    - g. 3/16" clear tempered glass.
  - 3. Safety glazing required.

### 3.9 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type GL-3: Clear insulating laminated acoustic glass.
  - 1. Basis-of-Design Product: Viracon; Double Laminated Insulating Acoustical glass.
  - 2. Overall Unit Thickness: 1 inch.
  - 3. Outdoor Lite: Clear laminated glass with two plies of fully tempered float glass.
    - a. Minimum Thickness of Each Glass Ply: 3 mm.
    - b. Interlayer Thickness: 0.030 inch.

4. Interspace Content: Air.
5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
  - a. Minimum Thickness of Each Glass Ply: 3 mm.
  - b. Interlayer Thickness: 0.030 inch.
6. STC: 42.
7. OITC: 33.
8. Safety glazing required.

END OF SECTION 088013

## SECTION 088113 - DECORATIVE GLASS GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Glass with decorative film overlay.

B. Related Requirements:

1. Section 088013 "Interior Glazing" for interior glass.
2. Section 088300 "Mirrors" for mirror glass.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For decorative glass. Show fabrication and installation details. Include the following:

1. Size and location of penetrations.
2. Glazing method.
3. Mounting method.
4. Attachments to other work.
5. Full-size details of edge-finished profiles.

C. Glass Samples: For the following products, 12 inches square:

1. Each decorative film overlay on type of decorative glass.

D. Decorative Glazing Schedule: List decorative glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

#### 1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of decorative film overlay to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect decorative glazing materials according to manufacturer's written instructions. Prevent damage to glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain each type of decorative glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer, for each product and installation method.

#### 2.2 GLASS PRODUCTS

- A. Decorative Film Overlay: Translucent, dimensionally stable, cast PVC film, 2-mil- minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Avery Dennison Graphics.
    - b. FDC Graphic Films, Inc.
    - c. 3M.

## 2.3 DECORATIVE-GLASS FABRICATION

- A. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying, in pattern indicated on Drawings to, or with graphic image as indicated on Drawings to the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for decorative film overlay for compliance with manufacturer's requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Set decorative film overlay in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.
- B. Install decorative film overlay with proper orientation so that each outer surface faces the direction indicated on Drawings.
- C. Install decorative film overlay in locations indicated on Drawings.

### 3.3 GLAZING, GENERAL

- A. Comply with written instructions of decorative film overlay manufacturer.

### 3.4 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect decorative film overlay from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with decorative film overlay, remove substances immediately as recommended in writing by decorative film overlay manufacturer.
- C. Remove and replace decorative film overlay that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.5 DECORATIVE GLASS SCHEDULE

- A. Decorative Glass DG: Glass with decorative film overlay.
  - 1. Use: Suitable for exterior and interior applications.
  - 2. Outdoor Durability: Not less than five years.
  - 3. Pattern: As selected by Architect from manufacturer's full range.

END OF SECTION 088113

## SECTION 088300 - MIRRORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
  - 1. Annealed monolithic glass mirrors.
  - 2. Film-backed glass mirrors qualifying as safety glazing.
  - 3. Acid etched mirrors.
- B. Related Requirements:
  - 1. Section 102800 "Toilet Accessories" for metal-framed mirrors.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Delegated-Design Submittal: For mirrors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
- B. Qualification Data: For Installer.
- C. Sample Warranty: For special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

- 1. Warranty Period: Five years from date of manufacture.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. General: Installed mirrors systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, experienced in designing glazing work indicated, and licensed in the State of the place of the Project, to design mirrors.
  - 1. Provide glazing systems capable of withstanding temperature changes, and impact from normal operation, without failure of any kind, including loss or glass breakage attributable to the following:
    - a. Defective manufacture, fabrication, and installation.
    - b. Deterioration of glazing materials.

- c. Other defects in construction.

## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Avalon Glass and Mirror Company.
  - 2. Binswanger Glass.
  - 3. Donisi Mirror Company.
  - 4. D & W Incorporated.
  - 5. Gardner Glass Products, Inc.
  - 6. Glasswerks LA, Inc.
  - 7. Guardian Industries Corp.
  - 8. Independent Mirror Industries, Inc.
  - 9. Lenoir Mirror Company.
  - 10. National Glass Industries.
  - 11. Trulite Glass & Aluminum Solutions.
  - 12. Virginia Mirror Company, Inc.
  - 13. Walker Glass Co., Ltd.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

## 2.3 GL-05, ACID ETCHED SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear.
  - 1. Nominal Thickness: 6.0 mm.
  - 2. Acid-etched glass with decorative pattern/graphic evenly etched into glass.
    - a. Pattern: Custom graphic pattern to match Architect's samples.
- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

## 2.4 GL-06, SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear.
  - 1. Nominal Thickness: 6.0 mm.

- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

## 2.5 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Franklin International.
    - b. Laurence, C. R. Co., Inc.
    - c. Liquid Nails Adhesive.
    - d. Macco Adhesives.
    - e. Palmer Products Corporation.
    - f. Pecora Corporation.
    - g. Royal Adhesives & Sealants, LLC.
  - 2. Adhesives shall have a VOC content of 70 g/L or less.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

## 2.6 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
  - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Andscot Company, Inc.
      - 2) Laurence, C. R. Co., Inc.
      - 3) Stylmark, Inc.
  - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Andscot Company, Inc.
  - 2) Laurence, C. R. Co., Inc.
  - 3) Stylmark, Inc.
- 3. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

## 2.7 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
  - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
  - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

### 3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

### 3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
  - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
  - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
  - 2. Install mastic as follows:
    - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

### 3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

## SECTION 088853 - SECURITY GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes glass-clad polycarbonate for the following applications:
  - 1. Windows.

#### 1.2 DEFINITIONS

- A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.
- B. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

#### 1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Security Glazing Samples: For each type of security glazing; 12 inches square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
- E. Delegated-Design Submittal: For security glazing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
  - B. Qualification Data: For installers.
  - C. Product Certificates: For each type of product indicated, from manufacturer.
  - D. Product Test Reports: For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency.
  - E. Sample Warranties: For special warranties.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
- 1.8 FIELD CONDITIONS
- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
    1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.
- 1.9 WARRANTY
- A. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration of glass-clad polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
    1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each security glazing type indicated.
- B. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed security glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, experienced in designing security glazing work indicated, and licensed in the State of the place of the Project, to design security glazing.
  - 1. Provide security glazing systems capable of withstanding temperature changes, wind loading, and impact from normal operation for doors and windows, without failure of any kind, including loss or glass breakage attributable to the following:
    - a. Defective manufacture, fabrication, and installation.
    - b. Deterioration of glazing materials.
    - c. Failure of glazing sealants or gaskets to remain watertight and airtight.
    - d. Other defects in construction.
  - 2. Unless otherwise recommended by the glass and glazing material manufacturers, provide minimum 3/8-inch nominal glass bite depth for monolithic lites and 1/2-inch nominal glass bite depth for insulated glass units.
  - 3. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

### 2.3 SECURITY GLAZING, GENERAL

- A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

## 2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
  - 2. For heat-strengthened float glass, comply with requirements for Kind HS.
  - 3. For fully tempered float glass, comply with requirements for Kind FT.
  - 4. For uncoated glass, comply with requirements for Condition A.

## 2.5 GL-4, POLYCARBONATE SECURITY GLAZING

- A. Glass-Clad Polycarbonate: ASTM C 1349.

## 2.6 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Sealant shall have a VOC content of 250 g/L or less.
  - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C 920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C 661.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Construction Chemicals, LLC, Building Systems; Sonolastic Ultra.
    - b. Pecora Corporation; DynaFlex.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.9 FABRICATION OF SECURITY GLAZING

- A. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed security glazing edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing for security glazing, with Installer present, for compliance with the following:
  1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Presence and functioning of weep system.
  3. Minimum required face or edge clearances.
  4. Minimum required bite.
  5. Effective sealing between joints of framing members.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
- F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
- H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.

- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket securely in place between glazing unit and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
- C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

### 3.8 GLASS-CLAD POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing Type GL-4: Clear symmetrical glass-clad polycarbonate.
  - 1. Basis-of-Design Products: Subject to compliance with requirements, provide Global Security Glazing; glass-clad polycarbonate, UL Level 3 - Secur-Tem + Poly, SP311 or comparable products by one of the following:
    - a. Altuglas International.
    - b. Amerilux International, LLC.
    - c. Bayer MaterialScience, LLC.

- d. Palram Industries LTD.
  - e. SABIC Innovative Plastics Holding BV
  - f. Safeguard Security Services, Ltd. Armortex Bullet-Resistant and Detention Glazing.
- 2. Ballistic Resistance: Level 3 according to UL 752.
  - 3. Maximum Overall Unit Thickness: 1-1/8 inches.
  - 4. Components:
    - a. 9 mm clear glass (threat side).
    - b. 0.050 polyurethane interlayer.
    - c. 9 mm clear glass.
    - d. 0.025 polyurethane interlayer.
    - e. 1/8 inch polycarbonate.
    - f. 0.025 polyurethane interlayer.
    - g. 5 mm clear glass (safe side).

END OF SECTION 088853

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 092116 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes gypsum board shaft wall assemblies.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
  - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Regional Materials: Products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

### 2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. STC Rating: As indicated.
- C. Gypsum Shaftliner Board:
  - 1. Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch thick, with double beveled long edges.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) American Gypsum; Shaft Liner.
      - 2) CertainTeed Corp.; ProRoc Shaftliner.
      - 3) Continental Building Products, LLC.; Firecheck Type X Shaftliner.
      - 4) Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
      - 5) National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
      - 6) PABCO Gypsum; Pabcore Shaftliner Type X.
      - 7) Temple-Inland Inc.; Fire-Rated SilentGuard Gypsum Shaftliner System.
      - 8) USG Corporation; Sheetrock Brand Gypsum Liner Panel.
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C 645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
  - 1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

- E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
  - 1. Depth: As indicated.
  - 2. Minimum Base-Metal Thickness: 0.033 inch.
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
- G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fire Trak Corp.; Fire Trak System.
    - b. Grace Construction Products; FlameSafe FlowTrak System.
    - c. Metal-Lite, Inc.; The System.
    - d. Steel Network Inc. (The); VertiClip SLD Series.
- H. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
- I. Finish Panels: Gypsum board as specified in Section 092900 "Gypsum Board."

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  - 1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: Section 092900 "Gypsum Board."

G. Gypsum Board Cants:

1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.
2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
  1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
  2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.

- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.
  - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
  - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116

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Los Angeles, CA  
RA Project No. 2014-015

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### 2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  - 2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645.
  - 1. Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: 0.0329 inch.
    - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  - 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
      - 2) MBA Building Supplies; FlatSteel Deflection Track.
      - 3) Steel Network Inc. (The); VertiClip SLD Series.
      - 4) Telling Industries; Vertical Slip Track.
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fire Trak Corp.; Fire Trak System.
    - b. Metal-Lite, Inc.; The System.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0598 inch.
- G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch.
  - 2. Depth: 7/8 inch.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
  - 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
  - 1. Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0329 inch.
    - b. Depth: As indicated on Drawings.
  - 2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base-Metal Thickness: 0.0179 inch.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension.
    - c. United State Gypsum Company; Drywall Suspension System.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
  1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

#### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.

- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092116 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

C. INFORMATIONAL SUBMITTALS

D. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Product Data: For adhesives and sealants, indicating VOC content.

#### 1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. GYPSUM BOARD, GENERAL
- D. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Regional Materials: Products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- F. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

#### 2.2 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum.
    - b. CertainTeed Corp.
    - c. Continental Building Products, LLC.
    - d. Georgia-Pacific Gypsum LLC.
    - e. National Gypsum Company.

- f. PABCO Gypsum.
    - g. Temple-Inland.
    - h. USG Corporation.
  - 2. Thickness: 5/8 inch.
  - 3. Long Edges: Tapered.
- B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum.
    - b. CertainTeed Corp.
    - c. Continental Building Products, LLC.
    - d. Georgia-Pacific Gypsum LLC.
    - e. National Gypsum Company.
    - f. PABCO Gypsum.
    - g. Temple-Inland.
    - h. USG Corporation.
  - 2. Thickness: 1/2 inch.
  - 3. Long Edges: Tapered.
- C. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum.
    - b. CertainTeed Corp.
    - c. Continental Building Products, LLC.
    - d. Georgia-Pacific Gypsum LLC.
    - e. National Gypsum Company.
    - f. PABCO Gypsum.
    - g. Temple-Inland.
    - h. USG Corporation.
  - 2. Core: 5/8 inch, Type X.
  - 3. Surface Abrasion: Meets or exceeds Level 2 requirements.
  - 4. Surface Indentation: Meets or exceeds Level 1 requirements.
  - 5. Single-Drop Soft-Body Impact: Meets or exceeds Level 3 requirements.
  - 6. Hard-Body Impact: Meets or exceeds Level 3 requirements according to test in Annex A1.
  - 7. Long Edges: Tapered.
  - 8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. WRGWB, Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Gypsum.
  - b. CertainTeed Corp.
  - c. Continental Building Products, LLC.
  - d. Georgia-Pacific Gypsum LLC.
  - e. National Gypsum Company.
  - f. PABCO Gypsum.
  - g. Temple-Inland.
  - h. USG Corporation.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.3 SPECIALTY GYPSUM BOARD

- A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Continental Building Products, LLC.
    - b. Georgia-Pacific Building Products.
    - c. National Gypsum Company.
    - d. Temple-Inland Building Products by Georgia-Pacific.
  2. Core: 5/8 inch, abuse resistant.
  3. Long Edges: Tapered.
  4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Georgia-Pacific Building Products.
    - c. National Gypsum Company.
    - d. Temple-Inland Building Products by Georgia-Pacific.
  2. Core: 5/8 inch, Type X.
  3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. TRIM ACCESSORIES
- C. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. Expansion (control) joint.
  - d. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fry Reglet Corporation.
  - b. Gordon Inc.
  - c. Pittcon Industries.
4. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
5. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.
  2. Exterior Gypsum Soffit Board: Paper.
  3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
  1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

## 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
  - 2. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
  - 3. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 4. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 5. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  - 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Accumetric LLC.
    - b. Grabber Construction Products.
    - c. Pecora Corporation.
    - d. Specified Technologies, Inc.
    - e. USG Corporation.
  - 2. Sealant shall have a VOC content of 250 g/L or less.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Type X: Vertical surfaces unless otherwise indicated.
  - 2. Ceiling Type: Ceiling surfaces.
  - 3. Impact-Resistant Type: As indicated on Drawings.

4. Mold-Resistant Type: As indicated on Drawings.
5. Glass-Mat Interior Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. Aluminum Trim: Install in locations indicated on Drawings.

### 3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: Panels that are substrate for tile.
  3. Level 3: Mechanical Rooms, Electrical Rooms, and similar spaces.
  4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  5. Level 5: All exposed drywall surfaces within main entrance hallways, elevator corridors, and areas scheduled to receive accent lighting or semi-gloss finishes, refer to room finish schedules for locations. At locations of visual display coatings and where indicated on Drawings.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
    - b. Provide Level 5 finish consisting of drying-type, all-purpose compound skim coat, sand and prime, for surfaces behind visual display wall coverings.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

### 3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## SECTION 093000 - TILING

### 1.1 QUALITY ASSURANCE

- A. Mockup for each type of floor tile installation.
- B. Mockup for each type of wall tile installation.

### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Low-emitting adhesives.
  - 2. Low emitting flooring system.

### 1.3 TILE PRODUCTS

- A. Tile Type: Unglazed porcelain ceramic mosaic tile.
  - 1. Basis-of-Design Product: As indicated in the Materials Legend on the Drawings.
  - 2. Size: As indicated.
  - 3. Trim Shapes: As indicated.
- B. Tile Type: Unglazed porcelain tile.
  - 1. Basis-of-Design Product: As indicated in the Materials Legend on the Drawings.
  - 2. Size: As indicated.
  - 3. Face Size Variation: Rectified.
  - 4. Trim Shapes: As indicated.
- C. Tile Type: Glazed wall tile.
  - 1. Basis-of-Design Product: As indicated in the Materials Legend on the Drawings.
  - 2. Size: As indicated.
  - 3. Face Size Variation: Rectified.
  - 4. Trim Shapes: Coved base Surface bullnose wainscot cap Surface bullnose external corner.

### 1.4 ACCESSORY MATERIALS

- A. Thresholds: Solid-surfacing material.
- B. Tile Backing Panels: See section 092900 Gypsum Board.
- C. Steam Room Tile backing panels: Cement Backer Board.
- D. Steam Room Insulation: Extruded Polystyrene, Type IV, 1-1/2 inch thickness.

- E. Waterproof Membrane: Fabric-reinforced, fluid-applied membrane.
- F. Crack Isolation Membrane: Fabric-reinforced, fluid-applied membrane.
- G. Decoupling/Waterproofing membrane: Schluter Ditra.
- H. Metal edge strips.

#### 1.5 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floors on Concrete:
  - 1. At recessed floors: Cement mortar bed on decoupling/waterproofing membrane. Thinset mortar. Water-cleanable epoxy grout.
  - 2. At floors without recess: Thinset mortar on decoupling/waterproofing membrane. Water-cleanable epoxy grout.
- B. Interior Walls, Masonry or Concrete:
  - 1. Dry walls: Thinset mortar. Water-cleanable epoxy grout.
  - 2. Shower walls: Thinset mortar on waterproof membrane. Water-cleanable epoxy grout.
- C. Interior Walls and ceilings, Metal Studs or Furring:
  - 1. Dry walls: Thinset mortar. Water-cleanable epoxy grout.
  - 2. Shower walls: Thinset mortar on waterproof membrane. Water-cleanable epoxy grout.
- D. Interior Steam Room walls and ceiling, Metal Studs or Furring:
  - 1. Rigid extruded polyethylene foam insulation, Cement Backer Board, Waterproofing membrane, Thinset mortar. Water-cleanable epoxy grout.

END OF SECTION 093000

## SECTION 093013 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Quarry tile.
2. Porcelain tile.
3. Stone thresholds.
4. Waterproof membrane for thinset applications.
5. Crack isolation membrane.
6. Metal edge strips.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for glass-mat, water-resistant backer board.

#### 1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
- B. Qualification Data: For Installer.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
  2. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Stone thresholds.
  - 2. Waterproof membrane.
  - 3. Crack isolation membrane.
  - 4. Metal edge strips.

### 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

### 2.3 TILE PRODUCTS

- A. Ceramic Tile Type: QT, square-edged quarry tile.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product acceptable to the Architect.
  - 2. Face Size: As indicated.
  - 3. Wearing Surface: Nonabrasive, smooth.

4. Dynamic Coefficient of Friction: Not less than 0.42.
5. Tile Color and Pattern: As indicated.
6. Grout Color: As selected by Architect from manufacturer's full range.

B. Ceramic Tile Type: CT, porcelain tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product acceptable to the Architect.
2. Face Size: As indicated.
3. Face Size Variation: Rectified.
4. Grout Color: As selected by Architect from manufacturer's full range.

C. Ceramic Tile Type: CT, Glazed wall tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product acceptable to the Architect.
2. Module Size: As indicated.
3. Face Size Variation: Rectified.
4. Grout Color: As selected by Architect from manufacturer's full range.

## 2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

## 2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Ardex Americas; Ardex S 1-K One-Component Waterproofing Compound.
  - b. Boiardi Products Corporation, a QEP company; Elastiment 644 Membrane Waterproofing System.
  - c. Bonsal American, an Oldcastle company; B 6000 Waterproof-Crack Isolation Membrane.
  - d. Bostik, Inc.; Durabond D-222 Duraguard Membrane.
  - e. C-Cure; Pro-Red Waterproofing Membrane 963.

- f. Custom Building Products; RedGard Waterproofing and Crack Prevention Membrane.
- g. Jamo Inc.; Waterproof.
- h. Laticrete International, Inc.; Laticrete Hydro Ban.
- i. MAPEI Corporation; Mapelastic AquaDefense.
- j. Merkrete Systems, Parex USA, Inc.; Hydro-Guard 1.
- k. National Applied Construction Products, Inc.; SubSeal Liquid Waterproofing Membrane.
- l. Southern Grouts & Mortars, Inc.; Southcrete 1132.
- m. TEC, H. B. Fuller Construction Products Inc.; HydraFlex - Waterproofing Crack Isolation Membrane.

## 2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Bostik, Inc.; Durabond D-222 Duraguard Membrane.
    - b. C-Cure; CureLastic 949.
    - c. Custom Building Products; RedGard Waterproofing and Crack Prevention Membrane.
    - d. Jamo Inc.; Waterproof.
    - e. Laticrete International, Inc.; Laticrete Hydro Ban.
    - f. MAPEI Corporation; Mapelastic AquaDefense.
    - g. Merkrete Systems, Parex USA, Inc.; Fracture Guard 5000.
    - h. Southern Grouts & Mortars, Inc.; Southcrete 1132.
    - i. TEC, H. B. Fuller Construction Products Inc.; HydraFlex - Waterproofing Crack Isolation Membrane.

## 2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
  - 1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
  - 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
  - 3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
    - a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
    - b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
    - c. Configuration over Studs and Furring: Flat.

- d. Configuration over Solid Surfaces: Self-furring.
    - e. Weight: 2.5 lb/sq. yd.
  - 4. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ardex Americas.
    - b. Boiardi Products Corporation; a QEP company.
    - c. Bonsal American; an Oldcastle company.
    - d. Bostik, Inc.
    - e. C-Cure.
    - f. Custom Building Products.
    - g. Jamo Inc.
    - h. Laticrete International, Inc.
    - i. MAPEI Corporation.
    - j. Merkrete Systems; Parex USA, Inc.
    - k. Southern Grouts & Mortars, Inc.
    - l. Summitville Tiles, Inc.
    - m. TEC; H. B. Fuller Construction Products Inc.
  - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- C. Medium-Bed, Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ardex Americas.
    - b. Bonsal American; an Oldcastle company.
    - c. Bostik, Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. Jamo Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Merkrete Systems; Parex USA, Inc.
    - j. Southern Grouts & Mortars, Inc.
    - k. Summitville Tiles, Inc.
    - l. TEC; H. B. Fuller Construction Products Inc.

## 2.8 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ardex Americas.
  - b. Boiardi Products Corporation; a QEP company.
  - c. Bonsal American; an Oldcastle company.
  - d. Bostik, Inc.
  - e. C-Cure.
  - f. Custom Building Products.
  - g. Jamo Inc.
  - h. Laticrete International, Inc.
  - i. MAPEI Corporation.
  - j. Southern Grouts & Mortars, Inc.
  - k. Summitville Tiles, Inc.
  - l. TEC; H. B. Fuller Construction Products Inc.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Atlas Minerals & Chemicals, Inc.
  - b. Boiardi Products Corporation; a QEP company.
  - c. Bonsal American; an Oldcastle company.
  - d. Bostik, Inc.
  - e. C-Cure.
  - f. Custom Building Products.
  - g. Jamo Inc.
  - h. Laticrete International, Inc.
  - i. MAPEI Corporation.
  - j. Merkrete Systems; Parex USA, Inc.
  - k. Southern Grouts & Mortars, Inc.
  - l. Summitville Tiles, Inc.
  - m. TEC; H. B. Fuller Construction Products Inc.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

## 2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; white zinc alloy exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Blanke Corporation.
    - b. Ceramic Tool Company, Inc.
    - c. Schluter Systems L.P.
  - D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- 2.10 MIXING MORTARS AND GROUT
- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
  - B. Add materials, water, and additives in accurate proportions.
  - C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors consisting of tiles 8 by 8 inches or larger.
    - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Quarry Tile: 1/4 inch.
2. Glazed Wall Tile: 1/8 inch.
3. Porcelain Tile: 1/8 inch.

- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
  2. Do not extend waterproofing or crack isolation membrane under thresholds set in modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.
- J. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

### 3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.5 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.8 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
  1. Ceramic Tile Installation: TCNA F121 and ANSI A108.1C; cement mortar bed (thickset) on waterproof membrane.
    - a. Ceramic Tile Type: QT-01A.
    - b. Bond Coat for Cured-Bed Method: Modified dry-set mortar.
    - c. Grout: High-performance sanded grout.
  2. Ceramic Tile Installation: TCNA F125-Partial; thinset mortar on crack isolation membrane.
    - a. Ceramic Tile Type: CT-01A, CT-02A, CT-03A, CT-04A.
    - b. Thinset Mortar: Modified dry-set mortar.
    - c. Grout: High-performance sanded grout.
- B. Interior Wall Installations, Metal Studs or Furring:
  1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
    - a. Ceramic Tile Type: CT-01C, CT-01D, CT-02C, CT-02D, CT-03C, CT-03D, CT-04C, CT-04D, CT-05B, QT-01D.
    - b. Thinset Mortar: Modified dry-set mortar.
    - c. Grout: High-performance unsanded grout.
- C. Shower Receptor and Wall Installations:
  1. Ceramic Tile Installation: TCNA B415; thinset mortar on waterproof membrane over cementitious backer units.

- a. Ceramic Tile Type: CT-01B, CT-03B.
- b. Thinset Mortar: Modified dry-set mortar.
- c. Grout: High-performance unsanded grout.

D. Steam Room Installations:

- 1. Ceramic Tile Installation: TCNA SR614; thinset mortar on waterproof membrane over cementitious backer units over vapor-retarder membrane.
  - a. Ceramic Tile Type: CT-2A (floor), CT-02C (Walls / ceiling), CT-02D (Base).
  - b. Thinset Mortar: Modified dry-set mortar.
  - c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Related Requirements:
  - 1. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.
  - 3. Clips: Full-size impact and seismic clips.
- C. Delegated-Design Submittal: For seismic restraints for ceiling systems.
  - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Ceiling suspension-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:
  - a. Lighting fixtures.
  - b. Diffusers.
  - c. Grilles.
  - d. Speakers.
  - e. Sprinklers.
  - f. Access panels.
  - g. Perimeter moldings.
7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.

- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
  2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
  3. Impact Clips: Equal to 2 percent of quantity installed.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E 1264.
  - 2. Smoke-Developed Index: 50 or less.

### 2.3 ACT-1, ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. CertainTeed Corp.
  - 2. Chicago Metallic Corporation.
  - 3. Tectum Inc.
  - 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Classification: Provide panels as follows:
  - 1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
  - 2. Pattern: E (lightly textured), I (embossed), K (surface scored).
- E. Color: White.
- F. Light Reflectance (LR): Not less than 0.85.
- G. Ceiling Attenuation Class (CAC): Not less than 35.

- H. Noise Reduction Coefficient (NRC): Not less than 0.65.
- I. Edge/Joint Detail: Beveled tegular.
- J. Thickness: 3/4 inch.
- K. Modular Size: As indicated on Drawings.
- L. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

#### 2.4 ACT-2, ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corp.
  - 3. Chicago Metallic Corporation.
  - 4. Tectum Inc.
  - 5. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Classification: Provide panels as follows:
  - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
  - 2. Pattern: E (lightly textured).
- E. Color: White.
- F. Light Reflectance (LR): Not less than 0.90.
- G. Ceiling Attenuation Class (CAC): Not less than 35.
- H. Noise Reduction Coefficient (NRC): Not less than 0.70.
- I. Edge/Joint Detail: Beveled tegular.
- J. Thickness: 3/4 inch.
- K. Modular Size: As indicated on Drawings.

- L. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.5 ACT-3, ACOUSTICAL PANELS

- A. Not Used

## 2.6 ACT-4, ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corp.
  - 3. Chicago Metallic Corporation.
  - 4. Tectum Inc.
  - 5. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Classification: Provide panels as follows:
  - 1. Type and Form: Type IX, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
  - 2. Pattern: G (smooth).
- E. Color: White.
- F. Light Reflectance (LR): Not less than 0.89.
- G. Ceiling Attenuation Class (CAC): Not less than 33.
- H. Edge/Joint Detail: Square.
- I. Thickness: 5/8 inch.
- J. Modular Size: As indicated on Drawings.
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.7 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corp.
  - 3. Chicago Metallic Corporation.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
  - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. ACT-1, Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch- wide metal caps on flanges.
  - 1. Structural Classification: Intermediate-duty system.
  - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  - 3. Face Design: Flat, flush.
  - 4. Cap Material: Cold-rolled steel.
  - 5. Cap Finish: Painted white.
- E. ACT-2, Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch- wide aluminum caps on flanges.
  - 1. Structural Classification: Intermediate-duty system.
  - 2. Face Design: Flat, flush.
  - 3. Cap Finish: Painted white.
- F. ACT-4, Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch- wide aluminum caps on flanges.
  - 1. Structural Classification: Heavy-duty system.
  - 2. Face Design: Flat, flush.
  - 3. Cap Finish: Painted white.

## 2.8 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- G. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- H. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

## 2.9 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
  2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

### 3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  4. Install impact and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
- 3.4 ERECTION TOLERANCES
- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- 3.5 FIELD QUALITY CONTROL
- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.
  - B. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
    1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
    2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
  - C. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
  - D. Prepare test and inspection reports.
- 3.6 CLEANING
- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
  - B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 095436 - SUSPENDED DECORATIVE GRIDS

### 1.1 QUALITY ASSURANCE

- A. Mockups for each form of ceiling system and finish.

### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Recycled content.

### 1.3 SUSPENDED DECORATIVE GRIDS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.

### 1.4 PRODUCTS

- A. Formed Steel or Aluminum Beam Units:
  - 1. Beam Module: 24 inches on center.
  - 2. Beam Width by Height: 2 inches by 18 inches.
  - 3. Finish: Wood veneer.
  - 4. Perforations: Acoustical micro-perforation.
  - 5. Acoustical Insulation: Fiberglass board.
- B. Seismic struts.

END OF SECTION 095436

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 096400 - WOOD FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Field-finished wood flooring.
2. Related Requirements:
  - a. Section 096466 "Wood Athletic Flooring" for wood resilient systems used in sports-activity areas.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor assembly and accessory. Include plans, sections, and attachment details. Include expansion provisions and trim details.
- C. Samples: For each exposed product and for each color and texture specified, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: For adhesives, indicating VOC content.
5. Product Data: For coatings, indicating VOC content.
6. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Wood Flooring: Equal to 1 percent of amount installed for each type, color, and finish of wood flooring indicated.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

## 1.7 FIELD CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
  - 1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
  - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
    - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
    - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- B. Composite Wood Products: Products shall be made without urea formaldehyde.
- C. Hardwood Flooring: Comply with NWFA A500 for species, grade, and cut.
  - 1. Certification: Provide flooring that carries NWFA grade stamp on each bundle or piece.
- D. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
  - 1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
- E. Softwood Flooring: Comply with WCLIB No. 17 grading rules for species, grade, and cut.

### 2.2 FIELD-FINISHED WOOD FLOORING

- A. WD-01 and WD-02, Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content; tongue and groove and end matched; with backs channeled.
  - 1. Manufacturers: Subject to compliance with requirements, provide products indicated.
  - 2. Cut: Plain sawn.
  - 3. Thickness: 25/32 inch.
  - 4. Face Width: 3-1/2 inches.
  - 5. Lengths: Random-length strips complying with applicable grading rules.
  - 6. Urethane Finish System: Complete water-based system of compatible components that is recommended by finish manufacturer for application indicated.
  - 7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 8. Basic Coatings, Inc.
    - a. BonaKemi USA Inc.
    - b. Dura Seal.
    - c. Hillyard, Inc.
    - d. PoloPlaz Coatings.
  - 9. VOC Content: Provide coating with VOC content of 350 g/L or less.
  - 10. Floor Sealer: Pliable, penetrating type.
  - 11. Finish Coats: Formulated for multicoat application on wood flooring.

### 2.3 ACCESSORY MATERIALS

- A. Wood Sleepers and Subfloor: As specified in Section 061000 "Rough Carpentry" and Section 061600 "Sheathing."

- B. Wood Underlayment: As specified in Section 061600 "Sheathing."
- C. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 8.0 mils thick.
- D. Asphalt-Saturated Felt: ASTM D 4869/D 4869M, Type II.
- E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
- F. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines."
- G. Thresholds and Saddles: To match wood flooring. Tapered on each side.
- H. Reducer Strips: To match wood flooring. 2 inches wide, tapered, and in thickness required to match height of flooring.
- I. Cork Expansion Strip: Composition cork strip.
- J. Feature Strips: 2-inch-wide, square-edged walnut strips, furnished in lengths as long as practical and in thickness to match wood flooring.
- K. Custom Decorative logos: As indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
  - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    - c. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

### 3.2 PREPARATION

#### A. Concrete Slabs:

1. Grind high spots and fill low spots to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
3. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

- #### B.
- Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- #### A.
- Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines."

- #### B.
- Wood Sleepers and Subfloor: Install according to requirements in Section 061000 "Rough Carpentry" and Section 061600 "Sheathing."

- #### C.
- Wood Underlayment: Install according to requirements in Section 061600 "Sheathing."

- #### D.
- Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.

- #### E.
- Vapor Retarder: Comply with the following for vapor retarder installation:

1. Wood Flooring Nailed to Sleepers over Concrete: Install flooring over a layer of polyethylene sheet with edges overlapped over sleepers and turned up behind baseboards.
2. Solid-Wood Flooring: Blind nail or staple flooring to substrate.

### 3.4 FIELD FINISHING

- #### A.
- Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

1. Comply with applicable recommendations in NWFA's "Installation Guidelines."

- #### B.
- Fill and repair wood flooring defects.

- #### C.
- Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.

1. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

- D. Cover wood flooring before finishing.
- E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

### 3.5 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
  - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400

## SECTION 096466 – WOOD ATHLETIC FLOORING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. ATH-01, Wood athletic flooring.

#### 1.2 COORDINATION

- A. Coordinate layout and installation of slab depressions to accommodate layout and height of wood athletic flooring assembly.
  - 1. Concrete and Concrete Finishing Section 033000.
    - a. Concrete Slab Depression: 3" using 25/32" flooring
    - b. Surface Finish: steel troweled and finished smooth.
    - c. Concrete Tolerance: 1/8" in radius of 10'.
    - d. Compressive Strength: Concrete shall be a minimum of 3,000 psi and a maximum of 4000 psi compressive strength after 28 days.
    - e. Concrete shall be free of washed river gravel, pea gravel, flint or hardener additives. No lightweight concrete.
    - f. Floor Flatness and Floor Levelness (FF and FL) numbers are not recognized.
- B. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood athletic flooring.
- B. Shop Drawings: For each type of floor assembly, include the following:
  - 1. Plans, sections, and attachment details.
  - 2. Details of concrete-slab depressions.
  - 3. Locations of different grades of wood flooring.
  - 4. Expansion provisions and trim details.
  - 5. Layout, colors, widths, and dimensions of game lines and markers.
  - 6. Locations of floor inserts for athletic equipment installed through flooring assembly.
- C. Samples: For each exposed product and for each color and texture specified, approximately 12 inches in size.
  - 1. Include Sample sets showing the full range of normal color and texture variations expected in wood flooring.

2. Include Sample sets showing finishes and game-line and marker paints applied to wood flooring.

#### 1.4 INFORMATIONAL SUBMITTALS

##### A. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
3. Product Data: For adhesives, indicating VOC content.
4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

##### B. Concrete Guidelines:

1. Submit MFMA Recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive wood flooring.
2. Submit Robbins Technical Services "Concrete Guide Specification" for further information regarding conditions and requirements of concrete prior to installation.

#### 1.5 CLOSEOUT SUBMITTALS

- ##### A. Maintenance Data: For wood athletic flooring and finish systems to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- ##### A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

- ##### B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

- ##### C. Installer Qualifications: A firm or individual that has been approved by MFMA as an accredited Installer according to the MFMA Accreditation Program.

1. Installer responsibilities include installation and field finishing of wood athletic flooring components and accessories, and application of game lines and markers.
2. Robbins Authorized Dealer, Pacific Floor Company – Mark Herthel (818) 775-0438.
3. Flooring contractor shall be a firm experienced in flooring field and approved by manufacturer.
4. Submit a list of at least three completed projects of similar magnitude and complexity.

##### D. Surface Appearance:

1. Expansion spaces will not exceed 1/64" at time of installation and will be spread evenly across the floor with each row of flooring.
2. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content (EMC).

## 1.7 DELIVERY, STORAGE AND HANDLING

### A. Delivery of Materials

1. Materials shall not be delivered, stored or installed until all masonry, painting, plastering tilework, marble and terrazzo work is complete, and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature of 55-80 degrees Fahrenheit and relative humidity of 35-50 % are to be maintained. In- Slab Relative Humidity shall be 85% or less using ASTM F 2170 In-Slab Relative Humidity test. Ideal installation/storage conditions are the same as those that will prevail when building is occupied
2. Materials shall not be stored at the installation location if the In-Slab relative humidity level for the concrete slab is above 85% using ASTM F 2170 In-Slab Relative Humidity test.

## 1.8 FIELD CONDITIONS

- A. Do not install floor system until concrete has been cured 60 days.
- B. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.
- C. Permanent heat, light and ventilation shall be installed and operating during and after installation. Maintain a temperature range of 55 to 80 degrees Fahrenheit and a relative humidity range of 35 to 50%. Consult MFMA guidelines for further information.
- D. After floors are finished, area to be kept locked by general contractor to allow curing time for the finish. If after required curing time general contractor or owner requires use of gym, he shall protect the floor by covering with non-fibered kraft paper or red rosin paper with taped joints, until acceptance by Owner of complete gymnasium floor.

## 1.9 WARRANTY

- A. Guarantee shall not cover damage caused in whole or in part by casualty, ordinary wear and tear, abuse, use for which material is not designed, faulty construction of the building, settlement of the building walls, failure of the other contractors to adhere to specifications, separation of the concrete slab and excessive dryness or excessive moisture from humidity, spillage, migration through the slab or wall, or any other source.
- B. Manufacturer warrants wood athletic flooring material to be free from manufacturing defects for a period of 1 year. This warranty is in lieu of all other warranties, expressed or implied including but not limited to any warranty of merchantability or fitness for a particular purpose, and of any other obligations on the part of Manufacturer. In the event of breach of any warranty, the liability of Manufacturer shall be limited to repairing or replacing wood athletic flooring material and system components supplied by Manufacturer and proven to be defective in manufacture, and shall not include any other damages, either direct or consequential.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. ATH-01, Basis-of-Design Product: Provide Robbins Sports Surfaces; Bio-Channel Classic floor system.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Certified Wood: Wood products shall be certified as "FSC Pure" according to FSC STD-01-00 and FSC STD-40-004.
- B. Composite Wood Products: Products shall be made without urea formaldehyde.

### 2.3 MATERIAL

- A. Vapor Barrier: 6-mil polyethylene.
  - 1. Provide Moisture Suppression System when required for projects with high concrete moisture.
- B. Subfloor:
  - 1. Robbins Bio-Channels: engineered-wooden sleeper with 7/16" EPDM Bio-Pads attached, factory encased in a steel channel. Sleeper must be free to move vertically within steel channel confines to assure proper uniformity of resiliency and function.
  - 2. 23/32" structural rated sheathing, exposure 1 (CD-X).
- C. Maple Flooring:
  - 1. 25/32" thick x 2-1/4" width, 1st grade, Unfinished TGEM, KD Northern Hard Maple, Random Length (RL) Flooring as manufactured by Robbins and graded in accordance with MFMA-RL rules.
  - 2. Profiled Maple. Cross-profiled Channel Cushion II maple for added flexibility and resilience.
    - a. Finish treatment: Factory-Sanded.
- D. Fasteners:
  - 1. Flooring: 1-3/4" barbed cleats or staples.
  - 2. Subfloor: 1-5/8" to 1-3/4" subflooring nails or staples.
  - 3. Channel anchors: 1-1/4" long steel, powder actuated, pneumatic anchors, Powers SPIKE anchors, or Tapcons.
- E. Finish Materials: Robbins Miracle or approved equal polyurethane sealer and finish.

- F. Gamelines: Gameline paint shall be recommended by the finishing materials manufacturer, and must be compatible with the finish.
- G. Perimeter Base: Robbins 3" x 4" ventilating type.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect concrete slab for proper tolerance and dryness, and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8" in a 10'. Moisture content of the concrete slab shall not exceed 85% using ASTM F 2170 In-Slab Relative Humidity test.
- B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.
- C. Subfloor shall be broom cleaned by general contractor.
- D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

### 3.2 INSTALLATION

- A. Vapor Barrier:
  - 1. Install polyethylene with joints lapped a minimum of 6" and turned up 4" at the walls.
- B. Subfloor:
  - 1. Place Bio-Channels 17" on center (necessary for diagonal placement of plywood subfloor) end-to-end staggering end joints in adjacent rows, perpendicular to the intended direction of the maple flooring. Gap the ends of the sleepers approximately 1/4". Provide 1-1/2" to 2" expansion void at the perimeter and all vertical obstructions.
  - 2. Anchor Bio-Channels at predetermined locations.
    - a. Anchor sleepers in 3 of the pre-determined holes, at both ends and in center. When shimming for leveling is necessary, anchor in all 5 holes.
    - b. If extensive shimming is necessary, alternate anchoring 'non-standard' method may be necessary. Additional costs for this 'non-standard' method are to be borne by the purchaser.
  - 3. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
  - 4. Install Bleacher Blocking per manufacturer's recommendations.
  - 5. Install 23/32" plywood subfloor diagonal to sleeper channels and securely fasten subfloor 6" on center along each channel sleeper.

C. Maple Flooring:

1. Machine nail maple finish flooring 10" to 12" O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Consult your local Robbins "Certified" contractor. Provide 2" expansion voids at the perimeter and at all vertical obstructions.

3.3 FINISHING

A. Sanding:

1. Sand per manufacturer's recommendations.
2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
3. Inspect entire area of floor to insure the floor presents a smooth surface without drum stop marks, gouges, streaks or shiners.
4. Vacuum and/or tack floor before first coat of seal.
5. Floor should be clean and completely free of dirt and sanding dust.

B. Finishing:

1. Gymnasiums:
  - a. Apply specified combination of seal, gameline paint, and finish in accordance with manufacturer's instructions.
  - b. Buff and vacuum and/or tack between each coat after it dries.
  - c. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Game lines shall be painted between seal coats and finish coats. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by architect.

3.4 WALL BASE INSTALLATION

- A. Install Robbins vent cove base anchored to walls with base cement or screws and anchors. Use pre-molded outside corners and neatly mitered inside corner.

3.5 CLEANING

- A. Clean up all unused materials and debris and remove it from the premises.

END OF SECTION 096466

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient stair accessories.
  - 3. Resilient molding accessories.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## 1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 RB, THERMOSET-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products indicated or comparable products by one of the following:
  - 1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
  - 2. Flexco.
  - 3. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
  - 1. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient flooring.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated.

## 2.2 RSA, RUBBER STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Roppe Corporation, USA; Underlap Stair Nosings or comparable products by one of the following:
  - 1. AB; American Biltrite.
  - 2. Allstate Rubber Corp.
  - 3. Armstrong World Industries, Inc.
  - 4. Burke Mercer Flooring Products, Division of Burke Industries Inc.
  - 5. Flexco.
  - 6. Johnsonite; A Tarkett Company.
  - 7. Mondo American Inc.
  - 8. Musson Rubber Company.
  - 9. Nora Systems, Inc.
  - 10. PRF USA, Inc.
  - 11. R.C.A. Rubber Company (The).
  - 12. VPI Corporation.
- C. Stair Nosings: ASTM F 2169.
  - 1. Type: TS (rubber, vulcanized thermoset).
  - 2. Class: 2 (pattern; embossed, grooved, or ribbed).
  - 3. Nosing Style: Square.
  - 4. Nosing Height: 1-1/2 inches.
  - 5. Thickness: As required to accommodate adjacent carpet.
  - 6. Size: Lengths and depths to fit each stair tread in one piece.
- D. Locations: Provide rubber stair accessories in areas indicated.
- E. Colors and Patterns: Black.

## 2.3 RMA, RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Roppe Corporation, USA.
  - 2. VPI Corporation.
- B. Description: Rubber reducer strip for resilient flooring; joiner for tile and carpet; transition strips.
- C. Profile and Dimensions: As indicated.
- D. Locations: Provide rubber molding accessories in areas indicated.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter corners to minimize open joints.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 096520 - RESILIENT BOTANOL FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes: Resilient floor covering and accessories.

#### 1.2 REFERENCE STANDARDS

- A. ASTM International

1. C 1028 Standard Test Method for Determining the Static Coefficient of Friction by the Horizontal Dynamometer Pull-Meter Method.
2. E 648 Standard Test Method for Critical Radiant Flux of Flooring Systems Using a Radiant Energy Source.
3. E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
4. F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. F 925 Standard Test Method for Resistance to Chemicals of Resilient Flooring.
6. F 970 Standard Test Method for Static Load Limit.
7. F 1482 Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
8. F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
9. F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.

- B. Other referenced documents

1. LEED-NC, version 3.
2. GreenGuard Certification.
3. EMICODE.
4. European Norms (EN).
  - a. EN 433 Residual indentation.
  - b. EN 434 Dimensional stability.
  - c. EN 1815 Antistatic behavior.
  - d. EN 20105-B02 Color fastness to light.
5. International Standards Organization (ISO): ISO 10140 Sound absorption, ISO 8302 Thermal resistance.

#### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Install floor covering after finishing operations, including painting and ceiling operations, have been completed.

- B. Preinstallation Meetings: Meet to confirm project requirements, substrate conditions, manufacturer's installation instructions and warranty requirements in compliance with Division 1 requirements.
- C. Sequencing: Do not install floor covering over concrete substrates until substrates have cured and are dry to bond with adhesive as determined using test methods specified in ASTM F710 and following adhesive manufacturer's instructions.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For specified products, submit latest edition of product supplier's technical specifications data.
- B. Samples: Submit selection and verification samples showing the required finishes, colors, designs, and textures for flooring, as well as samples of adhesives and applicable accessories such as welding rods, game line paint, etc.
- C. Installation Quality Assurance Submittals:
  - 1. Installations requiring heat-welded seams: submit manufacturer's standard sample (not less than 9"x12") clearly showing smoothly joined heat-weld seam for each color and pattern required. Heat-weld seam shall run lengthwise and in center of sample applied to a rigid backing, and shall be prepared by the Installer for this project.
  - 2. Installations requiring integral flash cove base: submit both an inside and outside corner utilizing colors and patterns required for this project. Integral flash cove base submittal samples shall be applied to a rigid backing, and shall be prepared by the Installer for this project.

#### 1.5 INFORMATION SUBMITTALS

- A. Test and Evaluation Reports
  - 1. Product test reports: As required by Conditions of the Contract and Division 1 Regulatory Requirements Section, submit test certificates from an independent test laboratory showing compliance with specified performance characteristics and physical properties.
  - 2. Compatibility and adhesion test reports: Submit test reports confirming adhesive's effectiveness with the product(s) specified.
- B. Manufacturer Instructions: For specified products, submit latest editions of product supplier's installation and cleaning & maintenance instructions.
- C. Sustainable Design Submittals:
  - 1. For PURline indoor installations: submit documentation substantiating that Mats Inc. Uzin KE66 adhesive is EMICODE certified and therefore contributes to Indoor Environmental Quality Credit 4.1.
  - 2. Submit documentation substantiating that PURline is Greenguard Gold certified and therefore contributes to Indoor Environmental Quality Credit 4.3.

3. Submit documentation substantiating that PURline contains a minimum of 90% rapidly renewable content and therefore contributes to Materials & Resources Credit 6.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Warranty documentation: For specified products and accessories, submit product supplier's warranty documents.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer: Manufacturer shall be ISO 9001 certified.
- B. Installer: To be qualified to install the material, installer shall fulfill one of the following requirements.
  1. Installer shall have a minimum of five years of proven experience in performing work of this section and in installing sheet vinyl floor covering, synthetic rubber sheet floor covering, and linoleum sheet floor covering – including heat welding and flash coving, if applicable -- similar to that required for this project and shall provide a minimum of three references for comparable systems and installations successfully performed by the installer within the last 18 months.
  2. Installer shall be certified in resilient flooring installation. Acceptable certifications include The International Standards and Training Alliance (INSTALL), The International Certified Floorcovering Installers Association (CFI), and Flooring America University.
- C. Testing Agency: Agency shall be independent and qualified to perform concrete substrate moisture and humidity testing according to ASTM F710 prior to the flooring being installed.
- D. Preconstruction Testing:
  1. Concrete substrate: Reference Standard ASTM F710 for more detail. To partially summarize here, regardless of its age or grade level or history of use, perform the following concrete tests:
    - a. Concrete Moisture Test: Perform moisture tests (ASTM F1869 and ASTM F2170) on concrete with a minimum of three tests for the first 1000 square feet and one additional test for each 1000 square feet or fraction thereof. A diagram of the area showing the location and results of each test shall be dated and submitted to the architect, general contractor, and/or end user. If test results exceed the floor covering manufacturer's limits, installation shall not commence until results conform to limits.
    - b. If test results exceed the following limits, installation shall not commence until results conform to limits:
      - 1) ASTM F 1869: 5 lbs/1000 sq feet/24 hours.
      - 2) ASTM F 2170: 82% relative humidity.
    - c. Concrete pH Test: Perform pH tests on concrete. Readings below 7.0 and above 10.0 can adversely affect resilient flooring or adhesives, or both.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Comply with the product supplier's ordering and lead time requirements to avoid construction delays, and to allow material to acclimatize as required in the specified product's installation instructions. Accept delivery of materials only if they are in unopened, undamaged packaging that bears the name and brand of the manufacturer/product supplier, project identification, and shipping and handling instructions.
- B. Storage and Handling Requirements: Upon receiving floor covering, immediately remove from pallet and lay on a flat surface. Store material - including underlayment panels, patching or underlayment compound, floor covering material, adhesive, and welding rods - in the original packaging (as delivered) in areas that are enclosed and weather tight with the permanent HVAC system set at a temperature of between 65°F and 80°F for a minimum of 48 hours prior to commencement of installation. In addition, comply with storage and handling requirements listed on product packaging, and described in the latest edition of the product's installation instructions.

## 1.9 AMBIENT SITE CONDITIONS

- A. The permanent HVAC system shall be operational and set at a temperature of between 65 deg F and 80 deg F for a minimum of 48 hours prior to commencement of installation, during the time of installation, and for 48 hours after installation has been completed. Thereafter, minimum temperature shall be 55 deg F. Refer to the latest version of the installation instructions for additional ambient requirements (humidity, completion of related work or substrates, etc.) under which the work must be performed in order for the work results to provide the specified quality.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. RF-1, Basis-of-Design Product: Provide Mats Inc.; PURline- Heterogeneous Commercial Botanol Floor Covering.
  - 1. PURline - Heterogeneous commercial botanol floor covering consisting of bio-polyurethane, glass fiber reinforcement, paper print layer, and PU top coat.
  - 2. Color: As scheduled.
- B. Sustainable Design:
  - 1. IEQ Credit 4.1: Low-emitting adhesives, EMICODE EC 1 Plus Certified.
  - 2. IEQ Credit 4.3: Low-emitting flooring, GreenGuard Gold.
  - 3. MR Credit 6: rapidly renewable, 90% rapidly renewable.

### 2.2 ACCESSORY PRODUCTS

- A. Adhesive: As recommended by manufacturer to comply with installation instructions.
- B. Welding rods: Manufacturer's welding rods. Color to match the floor covering unless otherwise noted.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Inspect all substrates and subfloors for proper tolerances and dryness, and report any discrepancies to the general contractor in writing.
- B. Preinstallation Testing: Verify that concrete testing per ASTM F710 has been conducted by an independent testing agency, and that results are within the adhesive and floor covering manufacturers' requirements.
- C. Evaluation and Assessment: See the state requirements for the project location.

### 3.2 SURFACE PREPARATION

- A. Prepare concrete substrates per ASTM F710. All work required to put the concrete subfloor in acceptable condition shall be the responsibility of the general contractor. See the state requirements for the project location.

### 3.3 INSTALLATION

- A. Comply with manufacturer's installation instructions.
- B. Interface with Other Work: If transitions are required to and/or from the specified floor covering, contact the supplier for suitable transition material.

### 3.4 CLEANING

- A. General: Clean up job site, including sweeping or dust mopping the floor to remove all dirt or grit, and put all waste in general contractor's dumpster.
- B. Initial Maintenance: Conduct a full initial maintenance following the latest edition of the manufacturer's maintenance instructions.

END OF SECTION 096520

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 096536 - STATIC-CONTROL RESILIENT FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Static-dissipative, rubber floor tile.
2. Related Requirements:
3. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient flooring.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of static-control resilient flooring. Include floor-covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
1. Show details of special patterns.
  2. Show locations of inscribed maintenance tiles.
  3. Submit grounding diagram showing location of grounding strips and connections.
- C. Samples: For each type of static-control resilient flooring.
- D. Seam Samples: For seamless-installation technique indicated and for each static-control resilient flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For static-control resilient flooring. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Product Data: For chemical-bonding compounds, indicating VOC content.
3. Qualification Data: For Installer.

B. Field quality-control reports.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of static-control resilient flooring to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for static-control resilient flooring and seaming method.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 50 deg F or more than 90 deg F.
  - 1. Floor Tile: Store on flat surfaces.

#### 1.8 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive static-control resilient flooring during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during static-control resilient flooring installation.
- D. Close spaces to traffic for 48 hours after static-control resilient flooring installation.
- E. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
  - 1. Electrical Resistance: Test per ESD-STM-7.1.
    - a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
    - b. Average greater than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.
  - 2. Static Generation: Less than 300 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
  - 3. Static Decay: 5000 to zero V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 2.2 RF-03, STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS

- A. Static-Dissipative Rubber Floor Tile: ASTM F 1344; except in manufacturer's standard hardness when tested per ASTM D 2240 using Shore, Type A durometer.
  - 1. Smooth-Surface Floor Tile: Class I-B (homogenous rubber, through-mottled pattern).
    - a. Products: Provide product indicated.
    - b. Thickness: Not less than 0.08 inch.
    - c. Size: 24 by 24 inches.
    - d. Seaming Method: Heat welded.
- B. INSTALLATION MATERIALS
- C. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- D. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
  - 2. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.
- E. Seamless-Installation Accessories:

1. Heat-Welding Bead: Solid-strand product of manufacturer for heat welding seams.
    - a. Color: As selected by Architect from manufacturer's full range.
  2. Integral-Flash-Cove Base Accessories:
  3. Cove Strip: 1-inch radius support strip provided or approved by manufacturer.
  4. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by manufacturer.
  5. Corners: Metal inside and outside corners and end stops provided or approved by floor-covering manufacturer.
- F. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion or static-control characteristics of floor coverings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Remove substrate coatings and other substances that are incompatible with floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft. in 24 hours.
    - b. Perform relative-humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative-humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

- D. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.
  - 1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

### 3.3 INSTALLATION, GENERAL

- A. Install static-control resilient flooring according to manufacturer's written instructions.
- B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.
- C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Adhere static-control resilient flooring to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- G. Seamless Installation:
  - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor-covering surfaces.
  - 2. Integral-Flash-Cove Base: Cove static-control flooring 6 inches up vertical surfaces. Support static-control resilient flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
  - 3. Install metal corners at inside and outside corners.

### 3.4 FLOOR-TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
  - 1. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

2. In each space where conductive, solid vinyl floor tile is installed, install maintenance floor tile identifying conductive floor tile in locations approved by Architect.

### 3.5 SHEET FLOOR-COVERING INSTALLATION

- A. Comply with manufacturer's written instructions for installing sheet floor coverings.
- B. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.
- C. Lay out sheet floor coverings as follows:
  1. Maintain uniformity of sheet floor-covering direction.
  2. Minimize number of seams and place them in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor-covering substrates.
  3. Match edges of floor coverings for color shading at seams.
  4. Avoid cross seams.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.
  1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.
  2. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

### 3.7 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.
- B. Perform the following operations immediately after completing static-control resilient flooring:
  1. Remove static-control adhesive and other blemishes from exposed surfaces.
  2. Sweep and vacuum surfaces thoroughly.
  3. Damp-mop surfaces to remove marks and soil.
- C. Protect static-control resilient flooring from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
  1. Do not wax static-control resilient flooring.
  2. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION 096536

## SECTION 096566 - RESILIENT ATHLETIC FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interlocking, rubber floor tile.
2. Related Requirements:
3. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

#### 1.2 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions of game lines and markers.
4. Locations of floor inserts for athletic equipment installed through flooring.
5. Samples for Initial Selection: For each type of resilient athletic flooring.
6. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch-square in size and of same thickness and material indicated for the Work.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.
3. Product Data: For paints and coatings, indicating VOC content.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish no fewer than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, and size of floor tile installed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration.
  - 1. Store tiles on flat surfaces.
  - 2. Store rolls upright.

## 1.8 FIELD CONDITIONS

- A. Adhesively Applied Products:
  - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
  - 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
  - 3. Close spaces to traffic during flooring installation.
  - 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 RF-02, INTERLOCKING, RUBBER FLOOR TILE

- A. Basis-of-Design Product: As indicated on finish legend in drawings, Basis of Design by Robbins Sports Surfaces. Provide product indicated or comparable product by one of the following:
  - 1. Conner Sports Surface Solutions.
  - 2. Ecore Commercial Flooring
  - 3. Mondo America Inc.
  - 4. Tarkett Sports; a division of the Tarkett Group.
- B. Description: Athletic flooring consisting of modular rubber tiles with precision cut, interlocking edges, for free-lay installation.

C. Material: Rubber.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Traffic-Surface Texture: Smooth.

1. Provide reversible tiles (with traffic-surface texture on both sides).

E. Size: As indicated in drawings.

F. Thickness: As indicated in drawings.

G. Color and Pattern: As indicated in drawings.

## 2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

1. Adhesives shall have a VOC content of 60 g/L or less.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

- B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.

3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
  - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
  - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
  1. Do not install flooring until it is the same temperature as space where it is to be installed.
- F. Product should be unrolled and allowed to relax before final cutting and fitting, 12 to 24 hours.
- G. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

### 3.4 FLOOR TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  1. Lay tiles square with room axis.
- B. Discard broken, cracked, chipped, or deformed tiles.

- C. Tile Matching: Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.
  - 1. Adhered Floor Tile Where Shown: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
  - 2. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- D. Free-Lay Tile Where Shown: Place flooring at locations indicated with units securely interconnected and fully seated on substrate to form a smooth, level surface.

### 3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing flooring installation:
  - 1. Remove adhesive and other blemishes from flooring surfaces.
  - 2. Sweep and vacuum flooring thoroughly.
  - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
  - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096566

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 096813 - TILE CARPETING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes modular carpet tile.
- B. Related Requirements:
  - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
  - 2. Section 096816 "Sheet Carpeting" for carpet roll goods.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
  - 2. Carpet tile type, color, and dye lot.
  - 3. Type of subfloor.
  - 4. Type of installation.
  - 5. Pattern of installation.
  - 6. Pattern type, location, and direction.
  - 7. Pile direction.
  - 8. Type, color, and location of insets and borders.
  - 9. Type, color, and location of edge, transition, and other accessory strips.
  - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For flooring products, indicating compliance with requirements for testing and product requirements of CRI's "Green Label Plus" testing program.
- B. Qualification Data: For Installer.
- C. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II or Master II certification level.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

### 1.8 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

## 1.9 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. More than 10 percent edge raveling, snags, and runs.
    - b. Dimensional instability.
    - c. Excess static discharge.
    - d. Loss of tuft-bind strength.
    - e. Loss of face fiber.
    - f. Delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CPT, CARPET TILE

- A. Products: Provide products indicated.
- B. Primary Backing/Backcoating: Manufacturer's standard composite materials.
- C. Secondary Backing: Manufacturer's standard material.
- D. Applied Treatments:
  - 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
  - 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
    - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
- E. Sustainable Design Requirements:
  - 1. Sustainable Product Certification: Gold level certification according to ANSI/NSF 140.
- F. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
  1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
  1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  2. Remove yarns that protrude from carpet tile surface.
  3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

## SECTION 096816 - SHEET CARPETING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Tufted carpet.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
2. Section 096813 "Tile Carpeting" for modular carpet tiles.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics and durability.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Types, colors, and locations of insets and borders.
10. Types, colors, and locations of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- square Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

D. Product Schedule: For carpet. Use same designations indicated on Drawings.

E. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For flooring products, indicating compliance with requirements for testing and product requirements of CRI's "Green Label Plus" testing program.
- B. Qualification Data: For Installer.
- C. Sample Warranties: For special warranties.

### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II or Master II certification level.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

### 1.8 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

## 1.9 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
    - b. Loss of tuft bind strength.
    - c. Excess static discharge.
    - d. Delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CPT, TUFTED CARPET

- A. Products: Provide products indicated
- B. Primary Backing: Manufacturer's standard material.
- C. Secondary Backing: Manufacturer's standard material.
- D. Backcoating: Manufacturer's standard material.
- E. Applied Treatments:
  - 1. Applied Soil-Resistance Treatment: Manufacturer's standard material.
  - 2. Antimicrobial Treatment: Manufacturer's standard material.
    - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
- F. Sustainable Design Requirements:
  - 1. Sustainable Product Certification: Gold level certification according to ANSI/NSF 140.
- G. Performance Characteristics:
  - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.

2. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
  1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
- D. Resilient Stair Nosings: As indicated in 09 65 13.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
  1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    - c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard" and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

### 3.3 CARPET INSTALLATION

- A. Comply with CRI's "CRI Carpet Installation Standard" and carpet manufacturer's written installation instructions for the following:
  - 1. Direct-glue-down installation.
- B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Install as indicated on Drawings.
- D. Do not bridge building expansion joints with carpet.
- E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.

- B. Protect installed carpet to comply with CRI's "CRI Carpet Installation Standard."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

## SECTION 097200 - WALL COVERINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.

C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- long in size.

1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied. Show complete pattern repeat.
2. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
  - 1. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- B. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 50 or less.

### 2.2 VWC, VINYL WALL COVERING

- A. Basis-of-Design Product: Provide product indicated.
  - 1. Description: Provide mildew-resistant products in rolls from same production run and complying with the following:
  - 2. FS CCC-W-408D and CFFA-W-101-D for Type II, Medium-Duty products.
  - 3. ASTM F 793 for peelable or strippable wall coverings.
- B. Width: 54 inches.
- C. Backing: Osnaburg fabric.

### 2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.

2. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
  2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  3. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

#### 3.3 WALL-COVERING INSTALLATION

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Match pattern 72 inches above the finish floor.
- F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

#### 3.4 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

## SECTION 098433 - SOUND-ABSORBING WALL UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
  - 1. Sound-absorbing wall panels.

#### 1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For unit assembly and installation.
  - 1. Include plans, elevations, sections, and mounting devices and details.
  - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
  - 3. Include details at cutouts and penetrations for other work.
  - 4. Include direction of fabric weave and pattern matching.
- C. Samples for Initial Selection: For each type of fabric facing.
  - 1. Include Samples of hardware and accessories involving color or finish selection.
- D. Samples for Verification: For the following products:
  - 1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
  - 2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
  - 3. Core Material: 12-inch- square Sample at corner.
  - 4. Mounting Devices: Full-size Samples.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
  2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
  3. Product Data: For adhesives, indicating VOC content.
- B. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Electrical outlets, switches, and thermostats.
  2. Items penetrating or covered by units including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Alarms.
    - e. Sprinklers.
    - f. Access panels.
  3. Show operation of hinged and sliding components covered by or adjacent to units.
- C. Sample Warranty: For manufacturer's special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.
  2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to the following:
    - a. Acoustical performance.
    - b. Fabric sagging, distorting, or releasing from panel edge.
    - c. Warping of core.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section and ceiling units specified in Section 098436 "Sound-Absorbing Ceiling Units from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

## 2.3 SOUND-ABSORBING WALL UNITS

- A. AWP, Sound-Absorbing Wall Panel: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acoustical Panel Systems (APS, Inc.).
  - b. Acoustical Solutions, Inc.
  - c. Armstrong World Industries.
  - d. AVL Systems, Inc.
  - e. Benton Brothers Solutions, Inc.
  - f. Conwed Designscape; an Owens Corning company.
  - g. Decoustics Limited; a Saint Gobain company.
  - h. Golterman & Sabo.
  - i. Lamvin, Inc.
  - j. MBI Products Company, Inc.
  - k. Perdue Acoustics, Inc.
  - l. Sound Concepts Canada, Inc.
  - m. Sound Management Group LLC.
  - n. Tectum Inc.
  - o. Wall Technology, Inc.; an Owens Corning company.
  - p. Wenger Corporation.
  - q. Working Walls, Inc.
2. Panel Shape: Flat.
3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
4. Core: Glass-fiber board.
5. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
6. Edge Profile: Square.
7. Corner Detail in Elevation: Square with continuous edge profile indicated.
8. Facing Material: As indicated on Drawings.
9. Acoustical Performance: Sound absorption NRC of not less than 0.65 according to ASTM C 423 for Type A mounting according to ASTM E 795.
10. Nominal Overall Panel Thickness: 1 inch.
11. Panel Width: As indicated on Drawings.
12. Panel Height: As indicated on Drawings.

## 2.4 MATERIALS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- B. Regional Materials: Products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Core Materials: Manufacturer's standard.
  - 1. Glass-Fiber Board: ASTM C 612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. , unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- D. Facing Material: Fabric from same dye lot; color and pattern as scheduled.
- E. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
  - 1. Splines: Manufacturer's standard concealed metal or plastic splines that engage the kerfed edges of the unit, with other moldings and trim for interior corners, exterior corners, and exposed edges, with factory-applied finish on exposed items.
  - 2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

## 2.5 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.
- C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
- D. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
  - 1. Square Corners: Tailor corners.
  - 2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
  - 1. Thickness.
  - 2. Edge straightness.
  - 3. Overall length and width.
  - 4. Squareness from corner to corner.
  - 5. Chords, radii, and diameters.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain as indicated on Drawings.

### 3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation of Joint Width: Not more than 1/16-inch variation from hairline or reveal line in 48 inches, noncumulative.

### 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

## SECTION 098436 - SOUND-ABSORBING CEILING UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
  - 1. Sound-absorbing ceiling panels.

#### 1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For unit assembly and installation.
  - 1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
  - 2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.
  - 3. Include direction of fabric weave and pattern matching.
- C. Samples for Verification: For the following products:
  - 1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
  - 2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
  - 3. Core Material: 12-inch- square Sample at corner.
  - 4. Mounting Devices: Full-size Samples.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
- B. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Electrical outlets.
  2. Suspended ceiling components above ceiling units.
  3. Structural members to which suspension devices will be attached.
  4. Items penetrating or covered by units including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Alarms.
    - e. Sprinklers.
    - f. Access panels.
  5. Show operation of hinged and sliding components covered by or adjacent to units.
- C. Sample Warranty: For manufacturer's special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Fabric: For each fabric, color, and pattern installed, furnish length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.
  2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Acoustical performance.
    - b. Fabric sagging, distorting, or releasing from panel edge.
    - c. Warping of core.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain ceiling units specified in this Section and wall units specified in Section 098433 "Sound-Absorbing Wall Units" from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Ceiling products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

## 2.3 SOUND-ABSORBING CEILING UNITS

- A. ACP, Sound-Absorbing Ceiling Panel: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Acoustical Panel Systems (APS, Inc.).
    - b. Acoustical Solutions, Inc.
    - c. Armstrong World Industries.
    - d. AVL Systems, Inc.
    - e. Benton Brothers Solutions, Inc.
    - f. Conwed Designscape; an Owens Corning company.
    - g. Decoustics Limited; a CertainTeed Ceilings company.
    - h. Golterman & Sabo.
    - i. Lamvin, Inc.
    - j. MBI Products Company, Inc.
    - k. Perdue Acoustics.
    - l. Sound Concepts Canada, Inc.
    - m. Sound Management Group LLC.
    - n. Tectum Inc.
    - o. Wall Technology, Inc.; an Owens Corning company.
    - p. Wenger Corporation.
    - q. Working Walls, Inc.
  2. Panel Shape: Flat.
  3. Mounting: Back mounted with manufacturer's standard metal clips, secured to substrate.
  4. Core: Glass-fiber board.
  5. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
  6. Edge Profile: Square.
  7. Corner Detail in Elevation: Square with continuous edge profile indicated.
  8. Facing Material: As indicated on Drawings.
  9. Acoustical Performance: Sound absorption NRC of not less than 0.65 according to ASTM C 423 for Type A mounting according to ASTM E 795.
  10. Nominal Overall Panel Thickness: 1 inch.
  11. Panel Width: As indicated on Drawings.
  12. Panel Height: As indicated on Drawings.

## 2.4 MATERIALS

### A. Sustainable Design Requirements:

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
2. Regional Materials: Products shall be fabricated within 500 miles of Project site from materials that have been extracted, harvested, or recovered within 500 miles of Project site.

### B. Core Materials: Manufacturer's standard.

1. Glass-Fiber Board: ASTM C 612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

### C. Facing Material: Fabric from same dye lot; color and pattern as scheduled.

### D. Mounting Devices: Concealed on back or top edge of unit, recommended by manufacturer to support weight of unit.

## 2.5 FABRICATION

### A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.

### B. Measure each area and establish layout of panels and joints of sizes indicated on Drawings within a given area.

### C. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.

### D. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners.
2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches adjacent units.

### E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain as indicated on Drawings.

### 3.3 INSTALLATION TOLERANCES

- A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation from Level: Plus or minus 1/16 inch.
- C. Variation of Joint Width: Not more than 1/16 inch wide from hairline or reveal line in 48 inches, noncumulative.

### 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098436

## SECTION 099113 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Use products specified in this Section to finish exterior surfaces exposed to view, as indicated.
- B. Do not paint the following:
  - 1. Items specified or provided with factory finish.
  - 2. Items indicated to receive other finish.
  - 3. Items indicated to remain naturally finished.
  - 4. Stainless steel, anodized aluminum, bronze, terne, or lead.
  - 5. Equipment nameplates, fire rating labels, and operating parts of equipment.
- C. Materials and products having factory-applied primer are not considered factory finished.
- D. For paint systems, see Schedules at end of Section.
- E. For colors and finish, refer to Finish Legend, except for colors for mechanical and electrical color coding.

#### 1.3 REFERENCED STANDARDS

- A. CFR- Code of Federal Regulations.
  - 1. 40 CFR 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- B. MPI - Master Painters Institute.
  - 1. MPI Approved Products List.
  - 2. MPI Architectural Painting Specification Manual.
- C. SSPC: The Society for Protective Coatings.
  - 1. SSPC-PA 1 2000: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
- C. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
  - 3. VOC content.

#### 1.5 QUALITY ASSURANCE

- A. MPI Standards:
  - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
  - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on benchmark samples.
    - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

## 1.7 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. ICI Paints.
  - 3. PPG Architectural Finishes, Inc.
  - 4. Sherwin-Williams Company (The).
  - 5. Tnemec Company, Inc.
  - 6. Pratt and Lambert.

### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Colors and Finish: Refer to Finish Legend.

### 2.3 PRIMERS/SEALERS

- A. Alkali-Resistant Primer: MPI #3.

## 2.4 METAL PRIMERS

- A. Alkyd, Quick Dry, for Metal Primer: MPI #76.
- B. Waterborne Galvanized-Metal Primer: MPI #134.

## 2.5 WATER-BASED PAINTS

- A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
- B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
- C. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

## 2.6 SOLVENT-BASED PAINTS

- A. Alkyd, Quick Dry, Semi-Gloss (Gloss Level 5): MPI #81.
  - 1. Basis-of-Design: Benjamin Moore Super Spec HP D.T.M. Alkyd Semi-Gloss Enamel Pastel Base.
    - a. Screen Panel 'Sponsor Sign': Refer to A-312's.
      - 1) Color: PNT-01 as selected by Architect.
    - b. Covered Parking Exposed Structural Steel: Refer to A-390's.
      - 1) Color: PNT-02 as selected by Architect.
- B. Alkyd, Quick Dry, Gloss (Gloss Level 7): MPI #96.

## 2.7 TEXTURED AND HIGH-BUILD COATINGS

- A. Latex Stucco and Masonry Textured Coating: MPI #42.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Plaster: 12 percent.

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
  - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- H. Exterior Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Paint entire exposed surface of window frames and sashes.
  5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
    - a. Equipment, including panelboards and switch gear.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
  2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINTING SCHEDULE

#### A. Steel Substrates:

##### 1. Quick-Drying Enamel System:

- a. Prime Coat: Quick-drying alkyd metal primer.
- b. Intermediate Coat: Quick-drying enamel matching topcoat.
- c. Topcoat: Quick-drying enamel.
- d. Colors and Finish: Refer to Finish Legend.

#### B. Galvanized-Metal Substrates:

##### 1. Latex Over Water-Based Primer System:

- a. Prime Coat: Waterborne galvanized-metal primer.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex.
- d. Colors and Finish: Refer to Finish Legend.

#### C. Stucco Substrates:

##### 1. Latex Over Alkali-Resistant Primer System:

- a. Prime Coat: Alkali-resistant primer.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex.
- d. Colors and Finish: Refer to Finish Legend.

END OF SECTION 099113

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete.
  - 2. Steel.
  - 3. Galvanized metal.
  - 4. Gypsum board.
- B. Related Requirements:
  - 1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
  - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
  - 3. Section 055013 "Interior Metal Fabrications" for shop priming interior metal fabrications.
  - 4. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
  - 5. Section 099613 "Interior High-Performance Coatings" for tile-like coatings.

#### 1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Sustainable Design Submittals:
  - 1. Product Data: For paints and coatings, indicating VOC content.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

#### 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

## 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Nonflat Paints and Coatings: 150 g/L.
  - 3. Dry-Fog Coatings: 400 g/L.
  - 4. Primers, Sealers, and Undercoaters: 200 g/L.
  - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  - 7. Pretreatment Wash Primers: 420 g/L.
  - 8. Shellacs, Clear: 730 g/L.
  - 9. Shellacs, Pigmented: 550 g/L.
- D. Colors: As indicated in a color schedule.

## 2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 2. Testing agency will perform tests for compliance with product requirements.
  - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in equipment rooms:
    - a. Equipment, including panelboards and switch gear.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.
    - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
  - 2. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  1. Contractor shall touch up and restore painted surfaces damaged by testing.
  2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Traffic Surfaces:
  1. CONC-1, Water-Based Concrete Floor Sealer System MPI INT 3.2G:
    - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
    - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.
- B. Steel Substrates:
  1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
    - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
    - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
  2. Water-Based Dry-Fall System MPI INT 5.1C:
    - a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.

- b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.

C. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:

- a. Prime Coat: Primer, galvanized, water based, MPI #134.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

2. Water-Based Dry-Fall System MPI INT 5.3H:

- a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
- b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:

- a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

2. P-03, Projection Screen Paint:

a. Products:

- 1) Paint on Screen; S-1 Screen Paint, Silver.
- 2) Goo Systems; High Contrast +20.

END OF SECTION 099123

Back-Check No. 2 - ASI 009  
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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 099600 - HIGH-PERFORMANCE COATINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes surface preparation and application of high-performance coating systems.

#### 1.3 REFERENCED STANDARDS

- A. CFR - Code of Federal Regulations.
  - 1. 40 CFR 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- B. MPI - Master Painters Institute.
  - 1. MPI Approved Products List.
  - 2. MPI Architectural Painting Specification Manual.
- C. SSPC - SSPC: The Society for Protective Coatings.
  - 1. SSPC-SP 7/NACE No. 4: Joint Surface Preparation Standard.
  - 2. SSPC-SP 7/NACE No. 4: Brush-Off Blast Cleaning.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of coating system and in each color and finish coat indicated.
- C. Product List: For each product indicated, include the following.
  - 1. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in Schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
  - 3. VOC content.

## 1.5 QUALITY ASSURANCE

### A. Master Painters Institute (MPI) Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

### B. Mockups: Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of coating and substrate.
2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.
  - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

## 1.6 DELIVERY, STORAGE, AND HANDLING

### A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

## 1.7 PROJECT CONDITIONS

### A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).

### B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## 1.8 EXTRA MATERIALS

### A. Extra Materials: Supply for each finish coating material, color, and finish specified, two (2) gallons (7.5 L) of coating material, in sealed one (1) gallon (3.8 L) containers, marked with color and finish identification.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Tnemec Company, Inc.
  2. Coronado Paint.
  3. ICI Paints North America.
  4. PPG Architectural Finishes, Inc.

### 2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. Provide products of same manufacturer for each coat in a coating system.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior coatings applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 150 g/L.
  3. Primers, Sealers, and Undercoaters: 200 g/L.
  4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
  5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  6. Pre-Treatment Wash Primers: 420 g/L.
  7. Floor Coatings: 100 g/L.
  8. Shellacs, Clear: 730 g/L.
  9. Shellacs, Pigmented: 550 g/L.
- C. Colors and Finish: Refer to Finish Legend.

### 2.3 METAL PRIMERS

- A. Cold-Curing Epoxy Primer: MPI #101.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Tnemec Company, Inc.; Polyamide Epoxy, Tnemec Series V27 Typoxy or Series 97-90 Tnemec-Zinc.
    - b. Coronado Paint; Polyamide Epoxy Primer, 1201-147.
    - c. ICI Paints North America; Bar-Rust 235, Multi-Purpose Epoxy Coating, DC235K3501.
    - d. PPG Architectural Finishes, Inc.; Rapidcoat 95-245.

## 2.4 EPOXY COATINGS

### A. Epoxy, Cold-Cured Coating: MPI #77.

#### 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Tnemec Company, Inc.; Series N69 Hi-Build Epoxoline II Polyamide Epoxy.
- b. Coronado Paint; Polyamide Epoxy Coating, 101 Line.
- c. ICI Paints North America; Devoe/Fuller, Guardcote, DP34UXX.
- d. PPG Architectural Finishes, Inc.; Aquapon, Epoxy Cold Cured, 95-1.

### B. High-Build Epoxy Coating: MPI #108.

#### 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Tnemec Company, Inc.; Series N69 Hi-Build Epoxoline II Polyamide Epoxy.
- b. Coronado Paint; Polyamide Epoxy Coating, 101-251.
- c. ICI Paints North America; Devoe Coatings, Bar-Rust 236, 236.
- d. PPG Architectural Finishes, Inc.; Aquapon, High Build Epoxy Marine Coating, 97-130/97-139.

## 2.5 POLYURETHANE COATINGS

### A. Polyurethane, Two-Component Coating: MPI #72.

#### 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Tnemec Company, Inc.; Tnemec Series 73 Endura-Shield.
- b. Coronado Paint; Superthane, Aliphatic Acrylic Urethane, 827 Line.
- c. ICI Paints North America; Devoe Coatings, Aliphatic Urethane Enamel, 389.
- d. PPG Architectural Finishes, Inc.; Pitthane, Urethane Aliphatic, 95-850.

## 2.6 SOURCE QUALITY CONTROL

### A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
  - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 3. Coating application indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  - 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
- D. Steel Substrates: Remove rust and loose mill scale.
  - 1. Blast clean according to SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

### 3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for coating and substrate indicated.
  - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
  - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 099600

## SECTION 099613 – INTERIOR HIGH-PERFORMANCE COATINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
  - 1. Interior Substrates:
    - a. Concrete, horizontal surfaces.
    - b. Related Requirements:
      - 1) Section 099123 "Interior Painting" for general field painting.

#### 1.2 DEFINITIONS

- A. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For paints and coatings, indicating VOC content.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
  - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
  - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
  - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### 1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

#### 2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
6. Pretreatment Wash Primers: 420 g/L.
7. Floor Coatings: 100 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.

### 3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  1. Use applicators and techniques suited for coating and substrate indicated.
  2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
  1. Contractor shall touch up and restore coated surfaces damaged by testing.
  2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

### 3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Horizontal Surfaces.
  - 1. Clear (Two-Component) Polyurethane System MPI INT 3.2K:
    - a. Prime Coat: Two-component polyurethane matching topcoat.
    - b. Topcoat: Varnish, aliphatic polyurethane, two component (MPI Gloss Level 6, MPI #78).

END OF SECTION 099613

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 099646 - INTUMESCENT PAINTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes surface preparation and application of fire-retardant intumescent paint to interior and exterior items and surfaces.

#### 1.3 REFERENCED STANDARDS

- A. ASTM - American Society for Testing and Materials International.
  - 1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
- B. PDCA - Painting and Decorating Contractors of America.
  - 1. PDCA P1: Touch-up Painting and Damage Repair - Financial Responsibility.
- C. UL - Underwriters Laboratories Inc.
  - 1. Building Materials Directory.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include manufacturer's recommended spreading rate for each separate coat for each type of substrate indicated.
  - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies coatings approved by MPI, with the proposed product highlighted.
- B. Samples: For each type of coating system and each color and gloss of intumescent paint finish indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each paint system from single source from single manufacturer or provide a system approved in writing by intumescent paint manufacturer.

- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- C. MPI Standards: Comply with indicated requirements for the following:
  - 1. Products: MPI standards indicated and listed in "MPI Approved Products List."
  - 2. Preparation and Workmanship: "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.7 PROJECT CONDITIONS

- A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 45 and 95 deg F (7 and 35 deg C).
- C. Do not apply intumescent paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- D. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent of each color applied, but not less than 1 gal. (3.8 L) of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 INTUMESCENT PAINT MATERIALS, GENERAL

#### A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each material or coat, provide products and spreading rates recommended in writing by intumescent paint manufacturer for use on substrate indicated. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.

#### B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.

#### C. Colors and Finish: Refer to Finish Legend.

### 2.2 EXTERIOR, PIGMENTED, INTUMESCENT PAINT SYSTEM

#### A. Primer: Intumescent paint manufacturer's recommended primer, if required, compatible with substrate and other materials indicated.

#### B. Fire-Retardant Intumescent Paint and Overcoat: Fire-retardant paint for exterior wood surfaces and fire-inert, weather-resistant, protective overcoat that will not affect fire-retardant class of intumescent coating.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Flame Control Coatings, LLC; No. 149 and No. 400.
  - b. Magna Coatings Technology Inc.; SafeCoat Exterior Intumescent and SafeCoat 725 Sealer/Overcoat.
  - c. Albi Manufacturing, a division of StanChem, Inc.; Albi-Cote 107A and Albi 144 Fire Inert Overcoat.
  - d. Fire Research Laboratories/Ocean Fire Retardants Inc.; FireCoat 320 and TopCoat A.
  - e. NoFire Technologies, Inc.; A-18/manufacturer-approved topcoat.

### 2.3 INTERIOR, PIGMENTED, INTUMESCENT PAINT SYSTEM

#### A. Primer: Intumescent paint manufacturer's recommended primer compatible with substrate and other materials indicated.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Albi Manufacturing, a division of StanChem, Inc.; primer approved by Albi.
  - b. Fire Research Laboratories/Ocean Fire Retardants Inc.; latex primer approved by manufacturer.
  - c. Flame Control Coatings, LLC; No. 3001 Primer.
  - d. International Fire Resistant Systems, Inc.; primer approved by manufacturer.
  - e. Magna Coatings Technology Inc.; SafeCoat 725 Sealer/Overcoat.
  - f. NoFire Technologies, Inc.; primer approved by manufacturer.
- B. Fire-Retardant Intumescent Paint: Water-based, latex-type, fire-retardant paint for interior wood and other combustible surfaces; MPI #64.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Flame Control Coatings, LLC; No. 20-20.
    - b. Magna Coatings Technology Inc.; SafeCoat 451.
    - c. NoFire Technologies, Inc.; A-18.
    - d. Albi Manufacturing, a division of StanChem, Inc.; Albi-Cote FRL.
    - e. Fire Research Laboratories/Ocean Fire Retardants Inc.; FireCoat 320.
    - f. International Fire Resistant Systems, Inc.; Firefree88.
- C. Topcoat/Overcoat: Water-based, latex-type, pigmented, fire-inert, protective-finish coating that will not affect fire-retardant class of intumescent coating; MPI #67.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Flame Control Coatings, LLC; No. 40-40.
    - b. Magna Coatings Technology Inc.; no coating recommended.
    - c. NoFire Technologies, Inc.; latex-based coating approved by NoFire.
    - d. Albi Manufacturing; a division of StanChem, Inc.; Albi-Cote TC Latex.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.
- B. Begin coating only when moisture content of wood substrate is 15 percent or less when measured with an electronic moisture meter.
- C. Begin coating no sooner than 28 days after substrate is constructed and is visually dry on both sides.
- D. Verify suitability of substrates, including surface conditions, and compatibility with existing finishes and primers.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in the "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances, including dirt, oil, grease, and incompatible paints and encapsulants, that could impair bond of coatings. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.
  - 1. Remove incompatible primers, and reprime substrate with compatible primers as required to produce coating systems indicated.
  - 2. Perform cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.

### 3.3 APPLICATION

- A. General: Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for fire-retardant coating classification.
  - 1. Use equipment and techniques best suited for substrate and type of material being applied.
  - 2. Coat surfaces behind movable items the same as similar exposed surfaces.
  - 3. Apply each coat separately according to manufacturer's written instructions.
  - 4. Finish doors on faces with intumescent finish. Paint tops, bottoms, and side edges with fire-inert finish.
- B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
  - 1. Pigmented Finishes: If undercoats or other conditions show through pigmented topcoat/overcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
  - 2. Clear Finishes: Produce a smooth surface film of even sheen using multiple coats.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities, touch up and restore damaged or defaced coated surfaces.

### 3.5 PAINT SYSTEM SCHEDULE

- A. Prime Coat: If required and approved by intumescent paint manufacturer.
- B. Fire-Retardant Intumescent Coating: Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.
- C. Topcoat/Overcoat: Apply if required or recommended and approved by intumescent paint manufacturer.

END OF SECTION 099646

## SECTION 101100 - VISUAL DISPLAY UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.
2. Glass markerboards.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. Include electrical characteristics for motorized units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Show locations and layout of special-purpose graphics.
4. Include sections of typical trim members.
5. Include wiring diagrams for power and control wiring.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.
2. Actual factory-finish color samples, applied to aluminum substrate.
3. Include accessory Samples to verify color selected.

D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For installation adhesives, indicating VOC content.
2. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

B. Qualification Data: For qualified Installer.

C. Sample Warranties: For special warranties.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display units to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

#### 1.8 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: 50 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.

## 2.3 VDS, VISUAL DISPLAY BOARD ASSEMBLY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A-1 Visual Systems.
  - 2. AARCO Products, Inc.
  - 3. ADP Lemco, Inc.
  - 4. Architectural School Products Ltd.
  - 5. Aristocrat Industries, Inc.
  - 6. Aywon.
  - 7. Bangor Cork Company, Inc.
  - 8. Best-Rite Manufacturing; a brand division of MooreCo, Inc.
  - 9. Claridge Products and Equipment, Inc.
  - 10. Egan Visual Inc.
  - 11. EverWhite; a division of Glenroy, Inc.
  - 12. Ghent Manufacturing, Inc.
  - 13. Marsh Industries, Inc.; Visual Products Group.
  - 14. Newline Products, Inc.
  - 15. Peter Pepper Products, Inc.
  - 16. Platinum Visual Systems; a division of ABC School Equipment, Inc.
- B. Visual Display Board Assembly: Field or factory fabricated.
  - 1. Assembly: Markerboard.
  - 2. Corners: Square.
  - 3. Width: As indicated on Drawings.
  - 4. Height: As indicated on Drawings.
  - 5. Mounting Method: Direct to wall.
- C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
  - 1. Color: As selected by Architect from full range of industry colors.
- D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.
  - 1. Aluminum Finish: Clear anodic finish.
- E. Chalktray: Manufacturer's standard; continuous.
  - 1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

- F. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
1. Size: 2 inches high by full length of visual display unit
  2. Tackboard Insert Color: As selected by Architect from full range of industry colors.
  3. Aluminum Color: Match finish of visual display assembly trim.

## 2.4 VDS, GLASS MARKERBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. A-1 Visual Systems.
  2. Architectural School Products Ltd.
  3. Best-Rite Manufacturing; A brand division of MooreCo, Inc.
  4. Claridge Products and Equipment, Inc.
  5. Clarus Glassboards, LLC.
  6. Egan Visual Inc.
  7. Ghent Manufacturing, Inc.
  8. Marsh Industries Inc.; Visual Products Group.
- B. Glass Markerboards: 6-mm tempered glass markerboard, with smooth polished edge and eased corners; color coated on back surface.
- C. Mounting: Round, stainless-steel standoffs, holding glass approximately 1 inch from wall surface; mounted through holes in markerboard.
- D. Color and Surface: Glossy translucent. Color to be selected.
- E. Marker Tray: Glass, supported by stainless-steel clips.
- F. Size: As shown.

## 2.5 VDS, MARKERBOARD PANELS

- A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
  2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
  3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

## 2.6 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

- B. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
- C. Extruded Aluminum: ASTM B 221, Alloy 6063.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

### 3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
  - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
  - 2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
- D. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

### 3.4 CLEANING AND PROTECTION

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

## SECTION 101146 - VISUAL DISPLAY COATINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes dry-erase wall coatings.
- B. Related Requirements:
  - 1. Section 097200 "Wall Coverings" for standard vinyl wall coverings.
  - 2. Section 101100 "Visual Display Units" for manufactured visual display units, including markerboards.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of dry-erase wall coating. Include data on physical characteristics, durability, and flame-resistance characteristics.
- B. Samples for Initial Selection: For each type of dry-erase wall coating.
- C. Product Schedule: For dry-erase wall coatings. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of dry-erase wall coatings.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For dry-erase wall coatings to include in maintenance manuals.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install dry-erase wall coatings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Lighting: Do not install dry-erase wall covering until a permanent level of lighting is provided on the surfaces to receive dry-erase wall coating.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

### 2.2 P-02, DRY-ERASE WALL COATINGS

- A. Dry-Erase Wall Coating: Intended for use with dry-erase markers.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide IdeaPaint; IdeaPaint PRO, 2-part, solvent-based coating.
  - 2. Color: As selected by Architect from manufacturer's full range.
- B. ACCESSORIES
- C. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099123 "Interior Painting" and recommended in writing by dry-erase wall covering manufacturer for intended substrate.
  - 1. Product: Sherwin-Williams Multi-Purpose Latex Primer, and Kilz Premium Latex Primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, moisture content, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation for dry-erase wall coating.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, including dirt, mold, and mildew, that could impair the bond of dry-erase wall coatings or affect the smooth, finished surfaces of dry-erase wall coatings.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, and depressions.

- D. Prepare substrates indicated to receive dry-erase wall coating as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
  - 1. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
  - 2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 3. Painted Surfaces: Treat areas susceptible to pigment bleeding.

### 3.3 INSTALLATION

- A. Dry-Erase Wall Coating: Comply with dry-erase wall-coating manufacturers' written installation instructions.

### 3.4 CLEANING AND PROTECTION

- A. Clean dry-erase wall coating according to manufacturer's written instructions. Attach one removable cleaning instructions label to dry-erase wall coating in each room.
- B. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 101146

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 101400 - SIGNAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior building signage.
  - 2. Provide new materials and workmanship of the best grades of their respective kinds for the purpose.
  - 3. Provide adequate protection for all signage units from damage to materials or finish due to handling, storage, assembly and installation. Package each unit individually.
  - 4. In the event of damage, immediately make all repairs and replacements at no additional cost to Owner.

#### 1.3 REFERENCED STANDARDS

- A. AISI - American Iron and Steel Institute.
- B. ANSI - American National Standards Institute.
  - 1. ANSI A117.1: Accessible and Usable Building and Facilities.
- C. ASTM - American Society for Testing and Materials International.
  - 1. ASTM A 153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 2. ASTM A 167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 3. ASTM A 500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 4. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 5. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- D. CABO - Council of American Building Officials.
- E. NAAMM - National Association of Architectural Metal Manufacturers.
  - 1. Metal Finishes Manual for Architectural and Metal Products.

#### 1.4 SUBMITTALS

- A. Submit shop drawings, minimum 11 by 17 inch (279 by 432 mm) format drawings and samples of each item listed below in accordance with Section 013300 "Submittal Procedures." Include catalog cuts of material finishes.
- B. Submit a schedule with quotation for this work. Indicate fabrication time and delivery dates after approvals, and a schedule of expected submittal dates after award of contract.
- C. Submit typical layouts of each sign type for approval of graphic quality, letter forms and symbols, as well as for visual correction and type spacing.
- D. Submit with the shop drawings, a complete list of all materials and fastening items to be furnished by him, giving manufacturer's name and catalog number. Provide materials and hardware not specified, but necessary to the complete functioning of the unit, from sources optional to fabricator, and conform to the quality level established.
- E. Submit four copies of all maintenance and instructional information for use by Owner. Describe proper maintenance procedures, such as cleaning and touch-up, and include all guarantees and replacement data.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide qualified manufacturer and installer with not less than five (5) years experience in the fabrication and installation of the specified items.
- B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

#### 1.6 WARRANTIES

- A. Warrant finish against finish and color deterioration for five (5) years after installation. In case of paint failure, refinish or replace at no additional cost to Owner.

#### 1.7 DELIVERY, PROTECTION & HANDLING

- A. Protect all work from damage, staining and corrosion, at all times.
- B. Remove protective coverings only as required during fabrication and installation.
- C. Separate aluminum from direct contact with dissimilar metals by painting contact surfaces with a zinc chromate primer and aluminum paint, or with a coat of heavy-bodied bituminous paint, or by non-absorptive tape or gasket.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Apco Graphics Inc.
2. ASI Sign Systems
3. The Supersine Company
4. Vomar Products, Inc.
5. Ford & Earl Associates.

## 2.2 MATERIALS

- A. Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.
- B. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.
- C. Stainless Steel Plate, Sheet, and Strip: AISI Type 302, meeting requirements of ASTM A 167.
- D. Anchors/Inserts/Fasteners: Provide anchors, inserts, or fasteners compatible with sign materials and do not result in galvanic action or chemical interaction of adhesives, and demonstrate sufficient strength for intended use:
  1. Steel Anchors and Fasteners: Galvanized in accordance with ASTM A 153.
  2. Anchor Bolts in Concrete: Provided by the Signage Installer, set by template. Manufacturer to furnish templates and instructions for setting of anchors and bearing plates.

## 2.3 MISCELLANEOUS MATERIALS

- A. Related Materials: Other materials, not specifically described, but required for a complete and proper installation of signs, as approved.

## 2.4 EXTERIOR BUILDING SIGNAGE

- A. Sign Construction: Refer to Overall Sign Plan on Sheet A-390.
  1. Provide 1/4" (6 mm) thick cutout aluminum letters. Precision cut free of pits with smooth edges; stud mount.
  2. Sizes, copy, and color as indicated.
  3. Provide to fit radius or substrate indicated.
  4. Adhesive mount at metal panels and pin mount at stone locations.
- B. Roof Signage: Refer to Overall Sign Plan on Sheet A-390.
  1. Sign Type E-1: Sarnafil; Sika Corporation. Similar to 'Staples Center' or approved equal; <http://usa.sarnafil.sika.com>
    - a. Membrane that is glued then hot-air welded onto the rooftop.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION

- A. Install all signage in accordance with the approved shop drawings, the manufacturer's printed instructions and as specified.
- B. The signage manufacturer is totally responsible for the structural integrity and design of framing for signage.
- C. Engineer each assembly to eliminate buckling of any members, failure of any points, distortion, or other damage.

### 3.2 INSTALLATION

- A. Fastening Signs: Install sign units and components at locations shown or scheduled, securely mounted with concealed theft-resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with manufacturer's instructions, unless otherwise indicated.
- B. Installation: Install level, plumb, and at the proper height. Cooperate with work of other sections for installation of sign units to finish surfaces.
- C. Exterior Signs: Arrange letters exactly according to approved full-size template. Drill holes in wall to match position of spikes on letters. Fill holes with rapid setting epoxy cement; take care to seal all penetrations of the box beam assembly of the Marquee Sign; install letters. Verify alignment as work progresses, and at completion.

### 3.3 CLEANING & ACCEPTANCE

- A. Clean all exposed-to-view surfaces upon completion, according to the manufacturer's instructions.
- B. Instruct Owner as to proper care and maintenance of the finish surfaces.

END OF SECTION 101400

## SECTION 102113 - STAINLESS-STEEL TOILET COMPARTMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes stainless-steel toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
  - 1. Section 102800 "Toilet Accessories" for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
  - 1. Include plans, elevations, sections, details, and attachment details.
  - 2. Show locations of cutouts for compartment-mounted toilet accessories.
  - 3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
  - 4. Show locations of centerlines of toilet fixtures.
  - 5. Show locations of floor drains.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
  - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
  - 2. Each type of hardware and accessory.
- D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- B. Product Certificates: For each type of toilet compartment.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Door Hinges: Two hinges with associated fasteners.
  - 2. Latch and Keeper: Two latches and keeper(s) with associated fasteners.
  - 3. Door Bumper: Two door bumpers with associated fasteners.
  - 4. Door Pull: Two door pulls with associated fasteners.
  - 5. Fasteners: Ten fasteners of each size and type.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

#### 2.2 STAINLESS-STEEL TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. All American Metal Corp.
  - 2. Flush Metal Partition, LLC.
  - 3. General Partitions Mfg. Corp.
  - 4. Global Steel Products Corp.
  - 5. Knickerbocker Partition Corporation.
  - 6. Marlite.
  - 7. Metpar Corp.
  - 8. Shanahan's Manufacturing Limited.
- B. Toilet-Enclosure Style: Floor anchored.
- C. Urinal-Screen Style: Wall hung flat panel.

- D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Provide with no-sightline system. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
  - 1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
  - 2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf, when tested according to ASTM F 446, without deformation of panel.
  - 3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
- E. Urinal-Screen Construction:
  - 1. Flat-Panel Urinal Screen: Matching panel construction.
- F. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses as follows:
  - 1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch.
  - 2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.050 inch.
  - 3. Panels: Manufacturer's standard thickness, but not less than 0.031 inch.
  - 4. Doors: Manufacturer's standard thickness, but not less than 0.031 inch.
  - 5. Flat-Panel Urinal Screens: Thickness matching the panels.
- G. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- H. Brackets (Fittings):
  - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- I. Stainless-Steel Finish: No. 4 bright, directional polish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

## 2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
  - 1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.

2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
  3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
  4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
  5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel anchors compatible with related materials.

## 2.4 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743/A 743M.

## 2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories and solid blocking within panel where required for attachment of toilet accessories.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  1. Confirm location and adequacy of blocking and supports required for installation.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

### 3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 102215 – FIXED GLASS PANEL PARTITIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes fixed, frameless glass panel partitions with swinging glass doors.
- B. Related Requirements: Related project requirements can be found in the following documents:
  - 1. Section 055000 "Metal Fabrications" for overhead supports that attach glass panel partition tracks to structure.

#### 1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate installation of glass panel partitions with installation of floor, wall, and ceiling construction to comply with substrate tolerance requirements of partition manufacturer.
  - 2. Coordinate installation of anchors and secondary structural members indicated on approved glass panel partition shop drawings and specified in other sections.
- B. Preinstallation Conference: Conduct conference at Project Site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each glass panel partition and door component specified, including:
  - 1. Glass panels.
  - 2. Frame and sill tracks.
  - 3. Door hardware and accessories.
- B. Shop Drawings: For fixed glass panel partitions.
  - 1. Include plans, elevations, sections, and details. Provide numbered panel installation sequence.
  - 2. Show locations and requirements for tracks, bracing, blocking, and attachments to other work.
- C. Samples for Verification: For each exposed component including hardware, for each color and finish selected, of size indicated below:
  - 1. Glass: Units 12 inches square.
  - 2. Exposed Frame, Track, and Sill Members: Not less than 6 inches long.
  - 3. Hardware: One of each type of exposed door hardware items.

- D. Delegated-Design Submittal: For glass panel partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified installer.
- B. Warranty: Sample of unexecuted manufacturer warranty.
- C. Delegated-Design Submittal: For frameless glass panel partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced Installer equipped and trained for installation of glass panel partitions required for this Project with record of successful completion of not less than five projects of similar scope.
- B. Single Source Responsibility: Provide glass panel partitions and associated hardware by a single manufacturer through a single source.
- C. Mockups: Provide mockup consisting of initial sections of tracks, frames, and glass panels with operating doors and hardware, in location as directed by Architect. Proceed with work upon approval of mockup by Architect.

#### 1.6 WARRANTY

- A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to repair or replace components of glass panel partitions that demonstrate deterioration or faulty operation due to defects in materials or workmanship under normal use within warranty period specified.
  - 1. Warranty Period: Five years date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Product: Provide PURE Frameless glass panel partitions with swinging or sliding glass doors, manufactured by DORMA USA, Inc.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glass panel partitions shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, experienced in designing glass panel partitions work indicated, and licensed in the State of the place of the Project, to design glazing.
  - 1. Provide glass panel partitions capable of withstanding temperature changes, and impact from normal operation for doors and windows, without failure of any kind, including loss or glass breakage attributable to the following:
    - a. Defective manufacture, fabrication, and installation.
    - b. Deterioration of glazing materials.
    - c. Failure of glazing sealants or gaskets to remain watertight and airtight.
    - d. Other defects in construction.
  - 2. Unless otherwise recommended by the glass panel partitions manufacturers, provide minimum 3/8-inch nominal glass bite depth for monolithic lites.
  - 3. Provide either laminated or fully tempered glass complying with ANSI Z97.1 requirements for Drop Height Class A wherever safety glazing is required by the authorities having jurisdiction. Wire glass is not permitted.
  - 4. Glass thicknesses indicated are estimates used for detailing purposes only.
    - a. Confirm glass thicknesses by analyzing Project loads and in-service conditions.
    - b. Provide glazing materials, complying with ASTM E 1300, in the nominal thicknesses indicated for each opening size, but not less than the thicknesses and strength required in order to meet or exceed the specified performance requirements.
    - c. Unless otherwise indicated or specified, overall thickness of each glass type and composite thickness of multiple layer glass types shall be consistent throughout the Project.
  - 5. Comply with the combined recommendations of the glass manufacturer, sealant manufacturer and manufacturers of other materials used in glazing operations, except where more stringent requirements are specified.
    - a. Where joint movement may result in a variable glass bite depth, increase nominal bit to provide minimum 3/8-inch glass bite depth and minimum 1/4-inch edge clearance.
    - b. Installed glass shall be free from rattle.
- C. Acoustical Performance: Provide glass panel partition tested by qualified testing agency as follows:
  - 1. Sound-Transmission Requirements: Tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than STC indicated.

## 2.3 GLASS PANEL PARTITIONS

- A. Fixed Glass Panel Partitions: Frameless glass panel partition with top track and bottom sill guide, with butt-glazed dry joint between panels, and equipped with swinging doors where indicated.
  - 1. Basis of Design: Provide DORMA; PURE or comparable product acceptable to the "Architect.
  - 2. Sound Transmission Class (STC), ASTM E 90 and Outdoor-Indoor Transmission Class (OITC), ASTM E 1332:
    - a. Swinging door with 12.0 mm thick tempered glass: STC 15; OITC 15.
  - 3. Partition Top Track: Aluminum extrusion, low-profile.
  - 4. Sill Guide: Aluminum extrusion.

## 2.4 GLASS PANELS AND DOORS

- A. Glass Panels, General: Provide glass panels that comply with 16 CFR 1201, Category II requirements for safety glazing. Permanently mark glazing with certification label of the SGCC.
  - 1. Glass and Door Panel Thickness: Thickness required for size of panel based upon manufacturer's written recommendations, but not less than 12 mm.
- B. Fully Tempered Clear Float Glass ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; thickness 12.0 mm

## 2.5 SWINGING DOORS

- A. Accessibility Standard: Comply with applicable provisions in ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 and the Georgia Accessibility Code.
- B. Single Door: Glass panel matching partition panel material and thickness: Refer to door schedule for door sizes.
- C. Double Door: Glass panel matching partition panel material and thickness: Refer to door schedule for door sizes.

## 2.6 MATERIALS

- A. Aluminum: ASTM B221, with strength and durability characteristics of not less than Alloy 6063-T5.
- B. Stainless Steel: ASTM A666, Type 304.

## 2.7 FINISHES

- A. Stainless Steel Finishes: No. 4 directional satin finish.

## 2.8 DOOR HARDWARE AND FITTINGS

- A. Door Hardware, General: All-glass door hardware units in types, sizes, quantities, and mounting locations recommended by manufacturer for glass door types, sizes, and operation. For exposed components, match metal and finish of exposed partition fittings unless otherwise noted.
- B. Locking Ladder Pull: Pair of tubular lockable pull handles with thumb turns, Grade 316L stainless steel, accommodating key cylinder, with floor-recessed deadbolt].
  - 1. Basis of Design: DORMA, Locking Ladder Pulls.
  - 2. Unit Length: 60 inch.
- C. Pulls and Handles: Back-to-back, 1-1/4 inch diameter.
  - 1. Design: 30-inch ladder pull as specified in hardware sets.
- D. Lock Cylinders: As specified in Section 087100 "Door Hardware."
- E. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to adjacent glass panel and armature plate attached to door; full interior type.
  - 1. Provide power pack for electrified door hardware for concealed installation.
  - 2. Coordinate lock operation with requirements of Section 281300 "Access Control."
- F. Patch Fittings for Swinging Doors: At head and sill on pivot side
  - 1. Basis of Design: DORMA, PURE Pivot Header.
- G. Concealed Overhead Closers and Bottom Pivots: Center hung; BHMA A156.4, Grade 1. Provide housings, bottom arms, top walking beam pivots, mounting plates, and accessories.
  - 1. Basis of Design: DORMA, RTS88.
  - 2. Swing: Single acting.
  - 3. Hold Open: 105 degree. Omit hold open on doors with card readers.
  - 4. Opening Force: Comply with 5 lbs. of opening force as required by the Georgia Accessibility Code.
- H. Exit Devices: BHMA A156.3 and UL 305.
  - 1. Basis of Design: DORMA, DG1000.
  - 2. Function: Operation by push-pull when inside operator is locked down (dogged).
  - 3. Latching: Fixed strike or Electric strike for access control, located at door head as specified in hardware sets.
  - 4. Pull: Type F.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine partition substrates to determine if work is within glass panel partition manufacturer's required tolerances and ready to receive work. Proceed with installation of partitions once conditions affecting installation and performance of partitions meet manufacturer's requirements.

### 3.2 PARTITION INSTALLATION

- A. General: Comply with glass panel partition manufacturer's written installation instructions and approved shop drawings.
- B. Install glass panel partitions after other finishing operations have been completed.
- C. Set units level, plumb, and true to line, with uniform joints.
- D. Fasten glass panel partition track and sill to building structure and supports as indicated on approved shop drawings, utilizing approved fasteners and spacing.

### 3.3 ADJUSTING

- A. Adjust doors and hardware to produce smooth operation and tight, uniform fit.
- B. Adjust door closers to required timing and force.
- C. Adjust latches and locks for smooth operation.
- D. Test and adjust hardware linked to access control system.
- E. Replace damaged panels and accessories.

### 3.4 CLEANING

- A. Clean glass panels in accordance with glass manufacturer's written instructions. Do not use cleaning agents or methods not approved by glass manufacturer.
- B. Clean exposed metal surfaces to factory new appearance.

END OF SECTION 102215

## SECTION 102219 - DEMOUNTABLE PARTITIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Site-assembled demountable partitions.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For demountable partitions.

1. Include plans, elevations, sections, and attachment details at floors, columns, permanent partitions, and ceilings; and method of erection and disassembly.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of hardware and accessories involving color or finish selection.

D. Delegated-Design Submittal: For demountable partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

B. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from the installers of the items involved:

1. Suspended-ceiling components and dimensioned ceiling-grid layout.
2. Locations of fixed door and window mullions.
3. Overhead bracing, seismic restraints, and related structural members.
4. Ductwork above ceiling.

C. Qualification Data: For Installer.

D. Product Certificates: For each type of demountable partition.

- E. Product Test Reports: For each type of demountable-partition assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For demountable partitions to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

#### 1.6 FIELD CONDITIONS

- A. Finished Spaces: Do not deliver or install demountable partitions until finishes in spaces to receive them are complete, including suspended ceilings, floors, carpeting, and painting.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Installed demountable partitions systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, experienced in designing demountable partitions work indicated, and licensed in the State of the place of the Project, to design glazing.
  - 1. Provide demountable partitions systems capable of withstanding temperature changes, wind loading, and impact from normal operation for doors and windows, without failure of any kind, including loss or glass breakage attributable to the following:
    - a. Defective manufacture, fabrication, and installation.
    - b. Deterioration of glazing materials.
    - c. Failure of glazing sealants or gaskets to remain watertight and airtight.
    - d. Other defects in construction.
  - 2. Unless otherwise recommended by the demountable partitions manufacturers, provide minimum 3/8-inch nominal glass bite depth for monolithic lites.
  - 3. Provide either laminated or fully tempered glass complying with ANSI Z97.1 requirements for Drop Height Class A wherever safety glazing is required by the authorities having jurisdiction. Wire glass is not permitted.
  - 4. Glass thicknesses indicated are estimates used for detailing purposes only.
    - a. Confirm glass thicknesses by analyzing Project loads and in-service conditions.

- b. Provide glazing materials, complying with ASTM E 1300, in the nominal thicknesses indicated for each opening size, but not less than the thicknesses and strength required in order to meet or exceed the specified performance requirements.
    - c. Unless otherwise indicated or specified, overall thickness of each glass type and composite thickness of multiple layer glass types shall be consistent throughout the Project.
  - 5. Comply with the combined recommendations of the glass manufacturer, sealant manufacturer and manufacturers of other materials used in glazing operations, except where more stringent requirements are specified.
    - a. Where joint movement may result in a variable glass bite depth, increase nominal bit to provide minimum 3/8-inch glass bite depth and minimum 1/4-inch edge clearance.
    - b. Installed glass shall be free from rattle.
- C. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

## 2.2 SITE-ASSEMBLED DEMOUNTABLE PARTITIONS

- A. General: Site-assembled, demountable-partition assembly and components that are the standard products of manufacturer.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUR Walls by MAI; or comparable product by the following:
    - a. Muraflex; MIMO.
- B. Doors: Manufacturer's standard frameless glass door construction.
  - 1. Door Operation: Pivoting and Sliding as shown.
- C. Door Hardware: As selected by Architect from manufacturer's full range.
- D. Glazing Frames: Manufacturer's standard aluminum frames for frameless (top and bottom-supported) glazing thickness indicated.
  - 1. Frame Finish: Clear-anodized aluminum.
  - 2. Top Track: 2-1/2 inches deep.
  - 3. Bottom Track: 15/16 inches deep.
- E. Glazing: Manufacturer's standard fully tempered clear float glass.
- F. Frameless Glazing: Manufacturer's standard fully tempered clear float glass for butt-glazing with top and bottom support.
- G. Seals: Manufacturer's standard polycarbonate joint fillers.

## 2.3 FABRICATION

- A. General: Fabricate demountable walls for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings. Fabricate systems for installation with continuous seals at floor, ceiling, and other locations where partitions abut fixed construction.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker over a nonspecular as fabricated mechanical finish.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine components before installation. Reject components that are wet, moisture damaged, mold damaged, broken, cracked, chipped, deformed, or unmatched.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install demountable partitions after other finishing operations have been completed.
  - 1. Install partitions rigid, level, plumb, and aligned. Install seals at butt-jointed glass panels.
- B. Suspended-Ceiling System: Do not alter suspended-ceiling system.
- C. Doors and Frames: Install door-and-frame and glazing-and-glazing-frame assemblies securely anchored to partitions and with doors aligned and fitted. Install and adjust door hardware for proper operation.

### 3.3 ERECTION TOLERANCES

- A. Install each demountable partition so surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent partitions.

### 3.4 ADJUSTING

- A. Inspect installation, correct misalignments, and tighten loose connections.
- B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly, and lubricate as recommended by manufacturer. Verify that latches and locks engage accurately and securely without forcing or binding.
- C. Remove and replace defaced or damaged components that cannot be satisfactorily repaired.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, assemble, disassemble, and maintain demountable partitions.

END OF SECTION 102219

Back-Check No. 2 - ASI 009  
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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 102239 - FOLDING PANEL PARTITIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Electrically operated, acoustical panel partitions.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
2. Section 092900 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.
3. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.

#### 1.2 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
1. Include plans, elevations, sections, details, and attachments to other work.
  2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
  3. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
1. Include Samples of accessories involving color selection.
- D. Delegated-Design Submittal: For operable panel partitions.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Partition track, track supports and bracing, switches, turning space, and storage layout.
  2. Suspended ceiling components.
  3. Structural members to which suspension systems are attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. HVAC ductwork, outlets, and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Smoke detectors.
    - f. Access panels.
  6. Plenum acoustical barriers.
- C. Setting Drawings: For embedded items and cutouts required in other work.
- D. Qualification Data: For qualified Installer.
- E. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:
  1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
  2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.
- F. Sample Warranty: For manufacturer's special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
    - b. Seals, hardware, track, track switches, carriers, and other operating components.
    - c. Electric operator and controls.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of operable panel partitions.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.
- B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the partition panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."
- C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
- D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Provide letter from manufacturer attesting panel is constructed with non-combustible materials and testing of finish materials is acceptable:
  1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Panelfold Inc.; Moduflex Model 840GWE with Ribtex Acoustical Wall Carpeting or comparable product by one of the following:
    - a. Advanced Equipment Corporation.
    - b. Hufcor Inc.
    - c. KWIK-WALL Company.
    - d. Modernfold, Inc.
- B. Panel Operation: Electrically operated, continuously hinged panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
  1. Panel Width: Standard widths.
- E. STC: Not less than 45.
- F. Panel Weight: 8.2 lb/sq. ft. maximum.
- G. Panel Thickness: Not less than 3-1/4 inches.

H. Panel Materials:

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
2. Adhesives: Do not use adhesives that contain urea formaldehyde.
3. Composite Wood Products: Products shall be made without urea formaldehyde.
4. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
5. Steel Face/Liner Sheets: Tension-levleed steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.

I. Panel Closure: Manufacturer's standard unless otherwise indicated.

1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
2. Final Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

## 2.3 SEALS

A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.

C. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.

D. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

1. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less 2-1/2" (64mm) automatic compensating and adjustable. Downward pressure of all clearance type bottom seal mechanisms shall assure an acoustical seal and resist panel movement

## 2.4 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
  - 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
- B. Carpet Wall Covering: Manufacturer's standard nonwoven, needle-punched carpet with fibers fused to backing, from same dye lot, treated to resist stains.
  - 1. Color/Pattern: As selected by Architect from manufacturer's full range.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

## 2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum mounted directly to overhead structural support, or with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
  - 1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
  - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

## 2.6 ELECTRIC OPERATORS

- A. General: Factory-assembled electric operation system of size and capacity recommended and provided by operable panel partition manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, chain drive, control stations, control devices, and accessories required for operation. Include wiring from control stations to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
- B. Comply with NFPA 70.

- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
- D. Motor Electrical Characteristics:
  - 1. Horsepower: Manufacturer's standard.
- E. Control Stations: Two single-key-operated, constant-pressure control stations located remotely from each other on opposite sides and opposite ends of partition run. Wire in series to require simultaneous activation of both key stations to operate partition. Each three-position control station labeled "Open," "Close," and "Stop." Furnish two keys per station.
- F. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop operable panel partition at fully extended and fully stacked positions.
- G. Emergency Release Mechanism: Quick disconnect-release of electric-motor drive system, permitting manual operation in event of operating failure.
- H. Electric Interlock: Equip each motorized operable panel partition with electric interlocks at locations indicated, to prevent operation of operable panel partition under the following conditions:
  - 1. On storage pocket door, to prevent operation if door is not in fully open position.
  - 2. On partitions at location of convergence by another partition, to prevent operation if merging partitions are in place.

## 2.7 ACCESSORIES

- A. Pass Doors: Swinging door built into and matching panel materials, construction, acoustical qualities, finish and thickness, complete with frames and operating hardware. Hinges finished to match other exposed hardware.
  - 1. Accessibility Standard: Fabricate doors to comply with applicable provisions in ICC A117.1 and the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.
  - 2. Single Pass Door: 36 by 96 inches.
  - 3. Pass-Door Hardware: Equip pass door with the following:
    - a. Door Seals: Mechanically operated floor seal on panels containing pass doors.
    - b. Latchset: Passage set.
    - c. Lock: Key-operated lock with cylinder, keyed to master key system, operable from both sides of door. Include two keys per lock.
- B. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.
  - 1. Manufacturer's standard method to secure storage pocket door in closed position.
  - 2. Lock: Footbolt.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

### 3.3 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust [pass doors] [and] [storage pocket doors] to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

## SECTION 102240 - FOLDING GLASS-PANEL PARTITIONS

### PART 1 - GENERAL

#### 1.1 WARRANTY

- A. Materials and Workmanship: Two years.

#### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Recycled content.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Seismic bracing of tracks to structure above.
- B. Seismic Performance: According to SEI/ASCE 7.
- C. Flame-Spread Index: 25 or less.

#### 1.4 OPERABLE GLASS PANELS

- A. Frame Type: Frameless aluminum.
- B. Panel Operation: Manually operated, continuously hinged panels.
- C. Glass and Glazing: Manufacturer's standard safety glass; clear.
- D. Panel Width: As indicated.
- E. STC: Not less than 36.
- F. Panel Weight: 8 lb/sq. ft. (40 kg/sq. m) maximum.
- G. Hardware: Manufacturer's standard hinges.
- H. Aluminum Finish for Frame: Clear anodized.

#### 1.5 ACCESSORIES

- A. Pass Doors: Double full height all glass doors, with panic hardware and lockset.

1.6 MAINTENANCE SERVICE

- A. Full-Maintenance Service: 12 months.

END OF SECTION 102240

## SECTION 102249 - ROTATING PANEL PARTITIONS

### 1.1 WARRANTY

- A. Materials and Workmanship: Two years.

### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Recycled content.
  - 2. Low emitting composite wood.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Seismic bracing of tracks to structure above.
- B. Seismic Performance: According to SEI/ASCE 7.
- C. Flame-Spread Index: 25 or less.

### 1.4 OPERABLE ACOUSTICAL PANELS

- A. Basis of Design Manufacturer and Product: Hufcore; Smartition rotating wall system.
- B. Panel Operation: Manually operated single rotating panels suspended on overhead track.
- C. Panel Width: As indicated on the Drawings.
- D. STC: Not less than 49.
- E. Panel Weight: 12 lb/sq. ft. (50 kg/sq. m) maximum.
- F. Panel Thickness: Not less than 4 inches (100 mm).
- G. Panel Materials:
  - 1. Frame: Steel.
  - 2. Face/Liner Sheets: Veneered wood.
  - 3. Acoustical Insulation: Semi-rigid fiberglass board.
- H. Hardware: Concealed (invisible) hinges.
- I. Finish Facing: Painted steel.

1.5      MANUAL OPERATION

- A.      Rotating panels.
- B.      Locking floor bolts.

1.6      FIELD QUALITY CONTROL

- A.      NIC Testing: By Owner-engaged agency.

END OF SECTION 102249

## SECTION 102600 - WALL AND DOOR PROTECTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Wall guards.
2. Corner guards.
3. Abuse-resistant wall coverings.
4. Related Requirements:
5. Section 057300 "Decorative Metal Railings" for metal handrails without plastic bumpers.
6. Section 087100 "Door Hardware" for metal and plastic protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Wall Guards: 12 inches long. Include examples of joinery, corners, end caps, top caps, and field splices.
2. Handrails: 12 inches long. Include examples of joinery, corners, and field splices.
3. Corner and End-Wall Guards: 12 inches long. Include example top caps.
4. Abuse-Resistant Wall Covering: 6 by 6 inches square.
5. Door-Surface Protection: 6 by 6 inches square.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
3. Sample Warranty: For special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Wall-Guard and Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 96-inch-long units.
  - 2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch-long units.
  - 3. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
  - 2. Keep plastic materials out of direct sunlight.
  - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
    - a. Store corner-guard covers in a vertical position.
    - b. Store wall-guard and handrail covers in a horizontal position.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

### 2.3 WALL GUARDS

- A. WG-1, Crash Rail: Heavy-duty, PVC-free assembly consisting of continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties; BCR-48N or comparable product by one of the following:
    - a. American Floor Products Co., Inc.
    - b. Babcock-Davis.
    - c. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    - d. Korogard Wall Protection Systems; a division of RJF International Corporation.
    - e. Musson Rubber Company.
    - f. Nystrom, Inc.
    - g. Pawling Corporation.
    - h. Tepromark International, Inc.
    - i. WallGuard.com.
  2. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness; as follows:
    - a. Profile: Flat.
      - 1) Dimensions: Nominal 6 inches high by 1 inch deep.
      - 2) Surface: Uniform.
    - b. Color and Texture: As selected by Architect from manufacturer's full range.

3. Continuous Retainer: Minimum 0.080-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips designed for heavy-duty performance.
5. Bumper: Continuous, resilient bumper cushion(s).
6. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
7. Accessories: Concealed splices and mounting hardware.
8. Mounting: Surface mounted directly to wall\ bumper cushion(s).

## 2.4 CORNER GUARDS

- A. CG-1, Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties, Inc.; CO-8 or comparable product by one of the following:
    - a. American Floor Products Co., Inc.
    - b. Babcock-Davis.
    - c. Boston Retail Products.
    - d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    - e. Korogard Wall Protection Systems; a division of RJF International Corporation.
    - f. Nystrom, Inc.
    - g. Pawling Corporation.
    - h. Tepromark International, Inc.
    - i. WallGuard.com.
  2. Material: Stainless-steel sheet, Type 304.
    - a. Thickness: Minimum 0.0625 inch.
    - b. Finish: Directional satin, No. 4.
  3. Wing Size: Nominal 3" x 3" Insert dimensions.
  4. Corner Radius: 1/8 inch.
- B. Mounting: Adhesive.

## 2.5 ABUSE-RESISTANT WALL COVERINGS

- A. IWC-1, Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, Fiberglass reinforced plastic sheet wall-covering material.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites, Inc.; Glasbord FXE or comparable product acceptable to the Architect.
  2. Size: As shown.
  3. Nominal Thickness: 0.10 inch (2.5 mm).
  4. Surface Burning Characteristics: Class A.
  5. Surface Finish: Pebbled embossed texture.
  6. Scratch Resistance, ASTM D 2583, Barcol Hardness: 55.

7. Abrasion Resistance, Taber Abrasion Test, CS-17 abrasive wheels with 1,000 g weight: Weight loss after 25 cycles of no more than 0.038 percent.
8. Impact Strength, ASTM D 5420: 11.0 in-lbs (0.58 J), showing no visible damage on finish side.
9. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color, configured to cover panel edges and corners.
10. Mounting: Adhesive.
11. Panel Seam Sealant: Bright white, 2-part urethane sealant, as recommended by FRP panel manufacturer.

## 2.6 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- C. Adhesive: As recommended by protection product manufacturer.
  1. Adhesives shall have a VOC content of 70 g/L or less.

## 2.7 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Curved Panels: Preform curved semirigid, abuse-resistant sheet wall covering in factory for radius and sheet thickness as follows:
  1. Sheet Thickness of 0.040 Inch: 24-inch radius.
  2. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.8 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
  - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
  - 1. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
  - 2. Provide anchoring devices and suitable locations to withstand imposed loads.
  - 3. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
  - 4. Adjust end and top caps as required to ensure tight seams.
- C. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.
- D. Fire Doors: Install protection according to the listing of each item.

### 3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

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## SECTION 102641 - BULLET RESISTANT PANELS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes bullet resistant fiberglass panels.

#### 1.2 REFERENCES

- A. American Society for Testing and Materials:
  - 1. ASTM E119-98 Standard Test for One-Hour Fire-Rating of Building Construction and Materials.
  - 2. ASTM F1233-98 Standard Test Method for Forced Entry Testing of Materials/Assemblies, Class IV.
- B. International Organization for Standardization:
  - 1. ISO 9001:2008 Quality Management System.
- C. National Institute of Justice Ballistic Standards:
  - 1. NIJ Standard 0108.01 – Type III-A.
- D. Small Business Administration:
  - 1. SBA Small Business Size Standard.
- E. Underwriters Laboratories:
  - 1. UL 752 Specifications and Ammunition, 11th Edition, Standard for Bullet Resisting Equipment published September 9, 2005, revised December 21, 2006, Level 3.
- F. The United States Department of State:
  - 1. The International Traffic in Arms Regulations (ITAR).

#### 1.3 ACTION SUBMITTALS

- A. Submittals for Review: Submit for approval prior to fabrication.
  - 1. Product Data: Include specifications, brochures, and samples.
- B. Delegated-Design Submittal: For bullet resistant fiberglass panels indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Instructions for installation of Bullet Resistant Fiberglass Panels.
- B. Certificates: Submit printed data to indicate compliance with following requirements.
  - 1. UL LISTING Verification and UL752 Current Test Results as provided by Underwriters Laboratories.
  - 2. ASTM E119-98 One-Hour Fire Rating of Building Construction and Materials.
  - 3. ASTM F1233-98 Standard Test Method for Forced Entry Testing of Materials/Assemblies.
  - 4. Manufacturer's third party certificate of registration with ISO 9001:2008.
  - 5. Manufacturer's U.S. Dept. of State ITAR Statement of Registration.
  - 6. Manufacturer's SBA Profile verifying small business status by the SBA.

#### 1.5 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials to project with manufacturer's UL LISTED Labels intact and legible.
- B. Handle material with care to prevent damage. Store materials inside under cover, stack flat and off the floor.

#### 1.6 WARRANTY

- A. Warrant all materials and workmanship against defects for a period of ten (10) years from the date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Basis of Design Product: Subject to compliance with requirements, provide Waco Composites, Ltd.; ArmorCore Bullet-Resistant Fiberglass Panels or a comparable product by one of the following:
  - 1. C.R. Laurence Co., Inc.

#### 2.2 PERFORMANCE CRITERIA

- A. Delegated Design: Engage a qualified professional engineer, experienced in designing bullet resistant fiberglass panels work indicated, and licensed in the State of the place of the Project, to design bullet resistant fiberglass panels.
  - 1. Provide bullet resistant fiberglass panels systems capable of withstanding temperature changes, wind loading, and impact from normal operation for doors and windows, without failure of any kind, including loss or glass breakage attributable to the following:
    - a. Defective manufacture, fabrication, and installation.

- b. Deterioration of glazing materials.
  - c. Failure of glazing sealants or gaskets to remain watertight and airtight.
  - d. Other defects in construction.
- 2. Unless otherwise recommended by the glass and glazing material manufacturers, provide minimum 3/8-inch nominal glass bite depth for monolithic lites and 1/2-inch nominal glass bite depth for insulated glass units.
  - 3. Installed bullet resistant fiberglass panels shall withstand security-related loads and forces without damage to the bullet resistant fiberglass panels beyond that allowed by referenced standards.
  - 4. Bullet Resistant Fiberglass Panels shall be "non-ricochet type" to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.
  - 5. Panel Rating: UL752 Level 3.
  - 6. Bullet resistance of joints: equal to that of the panel.

## 2.3 MATERIALS

- A. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.
- B. Thickness: 7/16" nominal thickness
- C. Nominal Weight: 4.8 lbs. per sq. ft.
- D. Panels manufactured in the United States of America with raw materials sourced from the U.S.A. for quality assurance purposes and to comply with any applicable "Buy American" provisions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to starting installation, verify work of related trades required in contract documents and architectural drawings is complete to the point where work of this Section may properly commence.

### 3.2 JOINTS

- A. Reinforce joints with a back-up layer of bullet resistive material. Minimum width of reinforcing layer at joint shall be 4-inches, centered on panel joints.

### 3.3 APPLICATION

- A. Install armor in accordance with manufacturer's printed recommendations and as required by contract documents.
- B. Secure armor panels using screws, bolts, or an industrial adhesive.

1. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and the like.

END OF SECTION 102641

## SECTION 102800 - TOILET ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Bathroom accessories.
  - 2. Childcare accessories.
  - 3. Related Requirements:
  - 4. Section 088300 "Mirrors" for frameless mirrors.

#### 1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Include electrical characteristics.
- B. Samples: Full size, for each exposed product and for each finish specified.
  - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated.
  - 2. Identify accessories using designations indicated.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

## 1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, visible silver spoilage defects.
  - 2. Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 TA, BATHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated.

### 2.3 TA, CHILDCARE ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated.

### 2.4 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

## 2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

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## SECTION 104400 - FIRE PROTECTION SPECIALTIES

### 1.1 SUMMARY

- A. Hand-carried fire extinguishers.
- B. Fire Extinguisher Cabinets.

### 1.2 QUALITY ASSURANCE

- A. Fire Extinguishers: NFPA 10.

### 1.3 PRODUCTS

- A. Portable, Hand-Carried Fire Extinguishers:
  - 1. Multipurpose dry-chemical type, steel container.
    - a. Extinguisher: 3A, 40 BC, 5 lb or 6 lb.
  - 2. Type K: Provide at Kitchen cooking apparatus.
- B. Mounting Brackets [FE-1]:
  - 1. Steel with identification lettering.
  - 2. Fire extinguisher.
- C. Fire Protection Cabinet [FEC-1]:
  - 1. Type: For fire extinguisher.
  - 2. Construction: Nonrated and 1-hour fire rated (Match wall fire rating).
  - 3. Mounting: Recessed.
  - 4. Door Style: Solid door, completely concealing frame.
  - 5. Accessories: Door locks.
  - 6. Finish: Stainless-steel,
    - a. Type: Type 304,
    - b. Finish: #4 Directional polish.
  - 7. Fire extinguisher.
- D. Fire Protection Cabinet [FEC-2]:
  - 1. Type: For fire extinguisher.
  - 2. Construction: Nonrated and 1-hour fire rated (Match wall fire rating).
  - 3. Mounting: Recessed, or Semi-Recessed as required by wall depth.
  - 4. Door Style: Vertical Duo.

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5. Glazing: Tempered glass.
6. Accessories: Door locks.
7. Finish: Prime for field painting,

END OF SECTION 104400

## SECTION 104413 - FIRE PROTECTION CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Requirements:
  - 1. Section 104416 "Fire Extinguishers."

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed- or semirecessed- method and relationships of box and trim to surrounding construction.
  - 1. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Product Schedule: For fire-protection cabinets. Indicate whether recessed or semirecessed. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

#### 1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

## 1.5 SEQUENCING

- A. Apply decals or vinyl lettering on field-painted fire-protection cabinets after painting is complete.

## PART 2 - PRODUCTS

### 2.1 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher, FEC.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. American Specialties, Inc.
    - b. Fire-End & Croker Corporation.
    - c. GMR International Equipment Corporation.
    - d. Guardian Fire Equipment, Inc.
    - e. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - f. Kidde Residential and Commercial Division.
    - g. Larsens Manufacturing Company.
    - h. Modern Metal Products, Division of Technico Inc.
    - i. MOON American.
    - j. Nystrom, Inc.
    - k. Potter Roemer LLC.
    - l. Strike First Corporation of America.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
  - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
  - 1. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Clear float glass.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
  - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
    - 1) Location: Applied to cabinet door.
    - 2) Application Process: Decals or Pressure-sensitive vinyl letters.
    - 3) Lettering Color: Black.
    - 4) Orientation: Vertical.

L. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel or powder coat.
  - b. Color: As selected by Architect from full range of industry colors and color densities.
2. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 3 mm thick.

## 2.2 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.3 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
  - 1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals or vinyl lettering at locations indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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## SECTION 104416 - FIRE EXTINGUISHERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
  - 1. Section 104413 "Fire Protection Cabinets."
  - 2. Division 23 for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### 1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Failure of hydrostatic test according to NFPA 10.
  - b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  1. Provide fire extinguishers approved, listed, and labeled by FM Global.

### 2.2 FE, PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Amerex Corporation.
    - a. Ansul Incorporated.
    - b. Badger Fire Protection.
    - c. Buckeye Fire Equipment Company.
    - d. Fire End & Croker Corporation.
    - e. Guardian Fire Equipment, Inc.
    - f. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - h. Larsens Manufacturing Company.
    - i. Moon American.
    - j. Nystrom Building Products.
    - k. Pem All Fire Extinguisher Corp.
    - l. Potter Roemer LLC.
    - m. Pyro-Chem; Tyco Safety Products.
    - n. Strike First Corporation of America.
  3. Valves: Manufacturer's standard.
  4. Handles and Levers: Manufacturer's standard.
  5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

- B. FE-1, Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

## 2.3 FEB, MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated.
    - c. Badger Fire Protection.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. Guardian Fire Equipment, Inc.
    - g. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - h. Larsens Manufacturing Company.
    - i. Nystrom Building Products.
    - j. Potter Roemer LLC.
    - k. Strike First Corporation of America.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

## SECTION 105116 - WOOD LOCKERS

### 1.1 SUSTAINABILITY REQUIREMENTS

#### A. LEED 2009 NC:

1. Recycled content.
2. Regional materials.
3. Certified wood.
4. Low-emitting composite wood products.

### 1.2 PRODUCTS

#### A. Custom Wood-Faced Wood Lockers:

1. Construction Style: Flush overlay.
2. Locker Body: Particleboard-core panels covered with thermoset decorative overlay.
3. Doors and drawer fronts: Flush, veneer.
4. Wood Species: As indicated in the Materials Legend on the Drawings.
5. Continuous finish base.
6. Location for flat screen video monitor.
7. Location for power and digital access ports
8. Veneer Matching: For each door.
9. Factory Finish: Transparent, clear catalyzed polyurethane.

#### B. Hardware:

1. Door Locks: Programmable Digital keypad lock.
2. Hinges: Frameless (European).
3. Back-mounted pulls.
4. Drawer locks: Programmable Digital keypad lock
5. Exposed Hardware Finish: Satin chrome.

#### C. Accessories:

1. Number plates.
2. Nameplates.
3. Hanging rack.
4. Hooks.

END OF SECTION 105116

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## SECTION 105123 - PLASTIC-LAMINATE-CLAD LOCKERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes plastic-laminate-clad wood lockers and benches].

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of plastic-laminate-clad wood locker.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker
- B. Shop Drawings: For plastic-laminate-clad wood lockers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for items installed in lockers.
  - 4. Show locker fillers, trim, base, sloping tops, and accessories.
  - 5. Show locker numbering sequence.
- C. Samples for Initial Selection: For the following:
  - 1. Factory-applied transparent finishes.
  - 2. High-pressure decorative laminates.
  - 3. Thermoset decorative overlay panels.
- D. Samples for Verification: For the following products:
  - 1. Plastic-laminate-clad panels, not less than 8 by 10 inches, for each type, color, pattern, and surface finish, with separate samples of un-faced panel product used for core.
  - 2. Thermoset decorative-overlay-surfaced panels, not less than 8 by 10 inches, for each type, color, pattern, and surface finish.
  - 3. Corner pieces of locker front frame joints between stiles and rail, as well as exposed end pieces, not less than 18 inches wide by 18 inches high by 6 inches deep.
  - 4. Exposed cabinet hardware and accessories, one unit for each type and finish.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.

2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Chain-of-Custody Qualification Data: For manufacturer and vendor.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
6. Product Data: For adhesives, indicating that product contains no urea formaldehyde.

- B. Sample Warranty: For special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Full-size locker doors, complete with specified door hardware. Furnish no fewer than five doors of each type and color installed.
2. Full-size units of the following locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
  - a. Hinges.
  - b. Pulls.
  - c. Shelf rests.
  - d. Keyless Locks

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location, and comply with requirements specified in "Field Conditions" Article.

- B. Deliver master and control keys to Owner by registered mail or overnight package service to the attention of:

Lisa Estrada  
The Los Angeles Lakers, Inc.  
555 North Nash Street  
El Segundo, CA 90245  
(310) 426-6000 (call before delivery to verify current mailing address)

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

#### 1.9 COORDINATION

- A. Coordinate sizes and locations of concealed wood support bases.
1. Requirements are specified in Section 061000 "Rough Carpentry."
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.

#### 1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
- a. Structural failures.
  - b. Faulty operation of locks or hardware.
  - c. Deterioration of wood and other materials beyond normal use.
2. Warranty Period: Three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the 2013 California Building Code, U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, and ICC A117.1.

### 2.2 LKR, PLASTIC-LAMINATE-CLAD WOOD LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Hollman, Inc.; "Dallas Maverick's Visitors Lockers", 30" w x 30" d x 96" h including integrated bench seat with Maharam fabric (assume allowance of \$60/yard material only) cushion or comparable product by one of the following:
1. Classic Woodworking, LLC.
  2. Club Resource Group.
  3. Famous Lockers.
  4. Ideal Products, Inc.
  5. Legacy Lockers.
  6. List Industries Inc.
  7. Treeforms.
- B. Regional Materials: Products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Construction Style: Flush overlay Retain "Reveal Dimension" Subparagraph below if retaining "Reveal overlay" option in "Construction Style" Paragraph above. Dimension given is an example only.
1. Reveal Dimension: NTE 1/2 inch (13 mm)
- E. Locker Body: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.
1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch thick.
  2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch thick.
  3. Top Panel: [Manufacturer's standard 3/4 or 5/8 inch thick.
  4. Bottom Panel: [Manufacturer's standard 3/4 or 5/8 inch thick.
  5. Exposed Panel Edges: [High-pressure decorative laminate, Grade HGS, to match panels
- F. Plastic-Laminate-Clad Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of medium-density-fiberboard core.
1. Thickness: 3/4 inch.
  2. Panel Edges High-pressure decorative laminate, Grade VGS, to match panels.

- G. End Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.
- H. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; fixed.
  - 1. Thickness: 3/4 inch.
  - 2. Exposed Edges: High-pressure decorative laminate, Grade VGS, to match panel.
- I. Drawer Faces: Match style, material, construction, and finish of plastic-laminate-clad wood doors. Attach drawer faces to sub-fronts with mounting screws from drawer interior.
- J. Drawer Sub-fronts, Sides, and Backs: Fabricated from particleboard - core panels covered on both sides with thermoset decorative overlay.
  - 1. Thickness: 1/2 inch.
  - 2. Exposed Edges: High-pressure decorative laminate, Grade VGS, to match panels.
- K. Drawer Bottoms: 1/4-inch - thick, thermoset decorative overlay over particleboard core.
- L. Corners and Filler Panels: 3/4-inch- thick panels. Match style, material, construction, and finish of plastic-laminate-clad wood doors.
- M. Continuous Finish Base: Plastic-laminate-clad, 3/4-inch- thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.
- N. Continuously Sloping Tops: Plastic-laminate-clad, 3/4-inch- thick panel that matches door faces for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:
  - 1. Closures: Vertical end type.
  - 2. Sloping-top corner fillers, mitered.
- O. Plastic-Laminate Colors, Patterns, and Finishes:
  - 1. As selected by Architect from plastic-laminate manufacturer's full range of standard colors

## 2.3 MATERIALS

- A. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Composite Wood Products: Products shall be made without urea formaldehyde.
  - 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130
  - 3. Particleboard: ANSI A208.1, Grade M-2
  - 4. Softwood Plywood: DOC PS 1 medium-density overlay
  - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
- B. High-Pressure Decorative Laminate: NEMA LD 3, grades as follows:

1. Horizontal Surfaces: Grade HGS
  2. Post-formed Surfaces: Grade HGP.
  3. Vertical Surfaces: Grade VGS.
- C. Fire-Retardant-Treated Materials: Where fire-retardant-treated materials are indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to authorities having jurisdiction to produce products with fire-test-response characteristics specified.
1. Do not use treated material that does not comply with requirements of referenced material standards or material that is warped, discolored, or otherwise defective.
  2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
  3. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84:
    - a. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: density, 45 lb/cu. ft; modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 lbf and 225 lbf, respectively.
  4. Fire-Retardant Fiberboard: Medium-density panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
- E. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- F. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- G. Lumber treated with manufacturer's standard preservative-treatment, pressure process.
- 2.4 HARDWARE
- A. Built-in Keyless Combination Locks:
1. Product: Match Keyless Security LLC KSL21772.
  2. Designed for permanently assigned access via entry of user's four-digit code.
  3. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.
- B. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening.

- C. Provide two hinges for pocket doors Wire Pulls: Match Hollman, Inc.; "Dallas Maverick's Visitors Lockers"
- D. Accessible Handle: Metal, fixed, graspable lever handle and rose trim; surface mounted.
- E. Shelf Rests: BHMA A156.9, B04013.
- F. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, and rated for a load of 100 lbf.
- G. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; chrome finished. Attach hooks with at least two fasteners.
  - 1. Match Hollman, Inc.; "Dallas Maverick's Visitors Locker".
- H. Coat Rods:
  - 1. Match Hollman, Inc.; "Dallas Maverick's Visitors Locker".
  - 2. Exposed Hardware Finishes: Satin Chrome - Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

## 2.5 ACCESSORIES

- A. Door Trays: Fabricated from solid wood. Match Hollman, Inc.; "Dallas Maverick's Visitors Lockers".
- B. Mirrors: ASTM C 1036, Type I, Class 1, Quality q2; with second (back) surface coated with successive layers of chemically deposited silver, copper, and protective organic coating to produce coating system complying with performance requirements in ASTM C 1503 for mirror-quality glazing.
  - 1. Glass Thickness: 3 mm minimum unless otherwise indicated.
  - 2. Frame: Solid wood.
- C. Security Lock Boxes Security Vaults: Match Hollman, Inc.; "Dallas Maverick's Visitors Locker" Protective Mats: Match Hollman, Inc.; "Dallas Maverick's Visitors Locker".
- D. Number Plates: 1-1/2-inch- diameter, etched, embossed, or stamped, stainless-steel plates with black numbers and letters at least 1/2 inch high. Identify lockers in sequence indicated on Drawings. Finish plates to match other locker hardware.
- E. Provide integrated USB charging station.

## 2.6 FABRICATION

- A. Fabricate each locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.
  - 1. Fabricate lockers to dimensions, profiles, and details indicated.
  - 2. Ease edges of corners of solid-wood members to 1/16-inch radius.

- B. Fabricate components square, rigid, without warp, and with finished faces flat and free of scratches and chips. Accurately factory machine components for attachments. Make joints tight and true.
  - 1. Fabricate lockers using manufacturer's standard construction, with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.
  - 2. Join drawer sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- C. Accessible Lockers: Fabricate as follows:
  - 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
  - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- D. Venting: Fabricate lockers with space between doors and locker assembly of not less than 3/4 inch, with painted metal security screen attached to each shelf between doors.
- E. Number Plates: Inlay number plates flush in each locker door, near top, centered.
- F. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- G. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- H. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Condition lockers to average prevailing humidity conditions in installation areas before installation.
- B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

### 3.3 INSTALLATION

- A. Install wood support base with 1/2-inch thick plywood top.
- B. Assemble knocked-down lockers with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- C. Install lockers level, plumb, and true; use concealed shims.
- D. Connect groups of lockers together with manufacturer's standard [brass-finished] fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.
- E. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.
- F. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches o.c. with No. 8 flush-head wood screws sized for 1-inch penetration into wood base.
- G. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.
- H. Attach sloping-top units to lockers, with end panels covering exposed ends.
- I. Install number plates and nameplates after lockers are in place.
  - 1. Attach number plate on each locker door, near top, centered, with at least two screws with finish matching number plate.
  - 2. Attach nameplate on each locker door, centered below number plate, with at least two screws, with finish matching nameplate.
  - 3. Insert nameplate into matching nameplate holder on each door, centered below number plate. Attach nameplate holder with at least two screws.
- J. Anchor locker benches to floors.
  - 1. Uniformly space pedestals not more than 72 inches apart; securely fasten pedestals to bench top and anchor to floor.

### 3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and drawers to operate easily without binding. Verify that integral locking devices operate properly.
- B. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- C. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

## SECTION 105626 - MOBILE STORAGE SHELVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Mechanically operated systems.
  - 2. Steel four-post shelving.

#### 1.2 COORDINATION

- A. Recessed Tracks: Coordinate size and location of recesses in concrete with installation of recessed tracks.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for mobile shelving systems and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Show shelving layout.
  - 3. Show location and extent of rail system including depth required if recessed.
  - 4. Show clear-aisle widths from face of carriages.
  - 5. Detail fabrication and installation of mobile shelving systems including methods of anchoring shelves to carriages and rails to building structure as required for seismic restraint.
  - 6. Samples for Initial Selection: For units with factory-applied finishes, 6 inches in size.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
  - 2. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
  - 3. Seismic Design Calculations: For seismic design of mobile storage shelving systems including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For Installer.

- C. Sample Warranty: For manufacturer's special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mobile shelving systems to include in maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Shelf Units: 2 of each size and type indicated.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of mobile shelving systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metals, metal finishes, and other materials beyond normal wear.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Spacesaver Corporation; McMurray Stern Mobile System or comparable product by one of the following:
  - 1. Adjustable Shelving Products Co., Inc.; a division of Karp Associates, Inc.
  - 2. Ames Color File; a division of Ames Safety Envelope.
  - 3. ASRS of America.
  - 4. Borroughs Corporation.
  - 5. Datum Filing Systems, Inc.
  - 6. Jeter Systems.
  - 7. Kardex Systems, Inc.
  - 8. Montel Inc.
  - 9. Nordplan USA, Inc.
  - 10. Richards-Wilcox, Inc.
  - 11. Spacenow! Corporation.

12. Tab US.

- B. Source Limitations: Obtain mobile storage systems including shelving from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Mobile shelving systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Structural Performance: Provide mobile shelving systems capable of supporting the following:
1. Load per Linear Foot of Carriage: 1000 lb/ft.
  2. Total Load: 5000 lb. per carriage.
- C. SYSTEMS AND COMPONENTS
- D. General: Provide manufacturer's standard mobile storage shelving systems and components. Where components are not otherwise indicated, provide manufacturer's standard components as required for a complete system.
- E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- F. Inserts: Furnish required concrete inserts and similar anchorage devices for installing track system, and furnish other components of work where installation of devices is specified in another Section.
- G. Flooring: Underlayment in thickness required to bring aisle floor finish flush with rail tops.
1. Composite Wood Products: Products shall be made without urea formaldehyde.
  2. Plywood Underlayment: DOC PS 1, Interior, Underlayment.
    - a. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84.
  3. Particleboard Underlayment: ANSI A208.1, Grade PBU.
  4. Ramps: Manufacturer's standard metallic-coated, cold-rolled steel ramp not steeper than 1:12, with non-slip finish.
  5. Floor Finish: Manufacturer's standard 12-inch-square vinyl tile; color as selected by Architect from manufacturer's full range.
- H. Tracks: Steel rails with tops machined to mate with guide wheels and with ends designed to provide smooth, secure continuity between sections without field welding. Provide mounting brackets, anchorage devices, adjustable leveling devices, and stops at terminations of rails to prevent carriages from running off track ends.
1. Mounting: Recessed.
- I. Carriages: Rigid frames consisting of C-shaped cold-formed steel beams and cross beams, designed to allow secure anchorage of shelving units.
1. Carriage Width: As shown.

2. Carriage Length: As shown.
  3. Wheels: Manufacturer's standard number of bearing-mounted, steel wheels, precision ground to mate with tracks.
  4. Bumpers: Provide two rubber bumpers with minimum depth of 1/2 inch each side.
- J. Anti-Tip Brackets: Mount on carriage for engagement with track system to secure units against tipping.
- K. Carriage End Panels: Full depth and height of shelving units. Provide at the operating end of each range.
1. Material: Manufacturer's standard.

## 2.3 MECHANICALLY OPERATED SYSTEMS

- A. Drive Systems: Geared transmission and chain systems with tensioning device to provide mechanical assistance and uniform movement along entire length of each carriage. Permanently shielded and lubricated.
- B. Drive Shaft: Continuous tubular or solid steel shaft, capable of transmitting torque from drive system without distortion. All wheels on one side of carriage shall drive.
- C. Locking Pins: Located on range end panels to allow locking of individual range carriage when depressed.

## 2.4 STEEL FOUR-POST SHELVING

- A. Steel Four-Post Shelving: Shelving consisting of four angle-iron uprights per section, with adjustable shelves resting on shelf supports hung on uprights. Configure units for mounting on mobile carriages.
- B. Shelving Units:
1. Type: Self-supporting unit.
  2. Configuration: Open with center dividers and Closed back and ends.
  3. Width: 36 inches.
  4. Height: 88 inches.
  5. Shelf Depth: 18 inches nominal.
  6. Shelf Styles: Provide the following styles and numbers of adjustable shelves:
    - a. Flat; six shelves.
    - b. Adjustable divider for each shelf. Provide five adjustable partitions per shelf with hooks or tabs to fit in slots in divider shelves.
- C. Uprights: Double-wall steel posts, 2 inches wide, 0.048 inch thick, in manufacturer's standard T-shape for common-post use or L-shape at range ends, with keyhole perforations on the inner wall at 1-1/2 inches o.c.
- D. Steel Spacers: Provide 0.048-inch- thick steel spacers, 3 inches high, welded to posts at bottom, center, and top of open units to prevent deflection.

- E. Closed Back and Ends: 0.024-inch- thick cold-rolled steel sheet.
- F. Center Divider: 0.024-inch- thick cold-rolled steel sheets.
- G. Base: Manufacturer's standard for attachment to mobile carriages.
- H. Adjustable Steel Shelves: 0.030-inch- thick cold-rolled steel sheet.
  - 1. Shelf Supports: Full-shelf-width supports; 0.075-inch- thick steel, minimum 3/4 inches high, with flange to support shelf reinforcements and with ear at each end containing two shoulder rivets with 7/16-inch heads spaced to set into keyhole slots on uprights.
  - 2. Shelf Reinforcements: Channel shapes equal in length to depth of the supported shelf; 0.060-inch- thick steel channels, with notched ends to fit over inside lip of shelf support.
- I. Drawers: 0.030-inch- thick cold-rolled steel sheet.

## 2.5 STEEL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to achieve a minimum dry film thickness of 2 mils.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.6 SYSTEM ACCESSORIES

- A. Floor Lock: Key-operated floor lock capable of securing entire system. Provide two keys.
- B. EXECUTION

## 2.7 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, minimum recess depth, and other conditions affecting performance of mobile shelving systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2.8 INSTALLATION

- A. Level and plumb tracks to a tolerance of 0.09 inch in 120 inches with no more than 0.06-inch variation between adjacent rails. Use permanent shims or non-shrink grout as indicated by manufacturer.

- B. Recessed Track Systems: Solidly fill gaps between slab and rail according to manufacturer's written instructions to secure tracks and prevent movement.
- C. Carriage Installation: Mount mobile carriages on track system with anti-tip brackets engaged by rails and adjust for smooth operation. Provide non-moving carriages securely fixed to rails where indicated.

## 2.9 SHELVING INSTALLATION

- A. Attach shelving units to carriages according to manufacturer's written instructions and as required to prevent vibration during movement.
  - 1. Level and plumb shelving units to a tolerance of 1/8 inch in 96 inches.
- B. Install shelves in shelving units at locations indicated on Drawings and according to manufacturer's written instructions.
- C. Shelving Enclosure Panels: Install end panels with concealed fasteners.

## 2.10 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Protect installed products from damage during remainder of the construction period.

## 2.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain mobile storage shelving.

END OF SECTION 105626

## SECTION 111200 - PARKING CONTROL EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Furnish all material, equipment, labor, and supervision to install in place a fully operating Parking Control System, as specified herein and indicated on the Drawings. Included will be supply, delivery, unloading, setting, anchoring, and control wiring installation and wiring termination, and start up of all parking, revenue control, and access control equipment.
- B. Electrical Subcontractor shall furnish and install all conduit and power wiring in proper size and location to the parking control equipment and empty conduit for control wiring as required.
- C. Manufacturer of Parking Control System shall provide those responsible for related work with:
  - 1. Installation diagrams and details for setting indoor and outdoor mounted equipment.
  - 2. Templates for setting indoor and outdoors mounted equipment.
  - 3. Templates and cast-in inserts to anchor freestanding equipment to curbs and bases.
  - 4. Electrical wiring diagrams and details.
  - 5. Electrical installation requirements.
  - 6. Electrical power requirements.

#### 1.3 SYSTEM DESCRIPTION

- A. General:
  - 1. This parking facility is to be used by tenants and employee parkers. Tenant and employee parkers will activate entrance and exit lane gates utilizing a hands free Automatic Vehicle Identification (AVI) system.
  - 2. The parking equipment will be on-line with a parking control computer.
- B. Vehicle Entrance and Exit Locations:
  - 1. Two dedicated Entrance Lanes are provided.
  - 2. Two dedicated Exit Lanes are provided.
- C. Dedicated Entrance Lanes:

1. During regular operating hours, tenants and employees will enter the facility through the entrance lanes. The presence of a vehicle over the entering detector loop shall activate a Hands Free Controller Antenna. The Hands Free Controller Antenna mounted in the entrance lane will recognize a valid Radio Frequency Transponder in the parkers' vehicle. The Antenna shall activate and open the overhead door.
2. The entrance lane overhead door shall close automatically after the vehicle has passed over the closing detector loop. The circuitry shall be such that the entrance cycle of a vehicle shall be completed before the system will accept the entry of another vehicle through the same lane.
3. The access control transponder reader shall only accept properly coded transponders meeting anti-passback criteria as specified. If the transponder passes all validity and anti-passback checks the gate shall open. If the transponder fails validity or anti-passback checks an alarm signal shall be triggered in the builder manager's office, the central controller shall print an "invalid attempt" statement indicating transponder reader location, user I.D. number, and type of invalid access (English text), and the gate shall open (soft anti-passback) or remain closed (hard anti-passback) at the Owner's option.

D. Dedicated Exit Lanes:

1. The tenant parkers shall proceed to the exit lane. The presence of a vehicle over the entering detector loop shall activate a Hands Free Controller Antenna. The Hands Free Controller Antenna mounted in the entrance lane will recognize a valid Radio Frequency Transponder in the parkers' vehicle. The Antenna shall activate and open the overhead door.
2. The exit lane shall close automatically after the vehicle has passed over the closing detector loop. The circuitry shall be such that the exit cycle of a vehicle shall be completed before the system will accept the exit of another vehicle through the same lane.

1.4 QUALITY CONTROL

- A. Manufacturer of Parking Control System shall provide an experienced field representative to meet with Electrical Subcontractor, before any rough-in work begins, to review building plans as they relate to Parking Control Equipment, to explain details or precautions necessary to assure that all parking and revenue control equipment, and in particular, detector loops will work properly and to determine that all required conduits and wiring are properly laid out.
- B. Installer shall have previously worked successfully with the equipment Manufacturer prior to being awarded a contract.
- C. Installers shall be approved in writing by the parking control system Manufacturer.
- D. Installer shall service and maintain the parking control system and have an Engineer approved equipment service center located to provide service within 24 hours.
- E. Provide equipment service and maintenance as follows:
  1. Use experienced, Manufacturer trained personnel.
  2. Assume total responsibility for proper installation and operation of all components within the system.

## 1.5 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for review and approval. Included are equipment-wiring diagrams, equipment cut sheets and specifications, booth shop drawings, and equipment color charts.
- B. System Testing Procedures: Submit for record, 30 days prior to installing the Parking Control Equipment, procedures for testing electrical, mechanical, and program functions of the system.
- C. Maintenance Data: Provide the Owner with two final Copies of each:
  - 1. Maintenance Manual.
  - 2. Operating Manual.
  - 3. Equipment electrical circuitry diagram.
  - 4. As built equipment wiring diagram.
- D. Keys: Provide Owner with two sets of keys for each piece of equipment with locks and two sets of master keys.
  - 1. Note: Keys shall be unique to this parking equipment; they shall not fit any other equipment in the same city.

## 1.6 TRANSPORTATION AND HANDLING

- A. Deliver equipment to the site packaged, to prevent damage and marked for easy identification.
- B. Store equipment in a clean, dry location protected from damage. Replace damaged materials at no cost to the Owner.
- C. Deliver items required to be built into the concrete promptly to the site so they may be built in as the work progresses.

## 1.7 OPERATING CONDITIONS

- A. Equipment shall be designed, fabricated, and installed to operate effectively under the climate and exposure conditions to which the equipment will be exposed. All equipment is for exterior, exposed to weather use.
- B. If parking and revenue control systems self-contained heating and cooling devices do not operate to the Owners satisfaction within the warranty period, they shall be repaired and/or replaced by the Manufacturer.
- C. It is recognized that certain solid state and computer type parking and revenue control equipment may require special electrical power and grounding considerations. If required by the parking and revenue control equipment, the Manufacturer of the parking control system should:
  - 1. Include in the bid amount, the cost to provide and install voltage stabilization modules or devices to protect each component from normal voltage variations.
  - 2. Advise the Engineer in writing at the time of the award of contract of any special electrical power and grounding requirements.

## 1.8 WARRANTY

### A. Provide Manufacturers Warranty:

1. Warranty shall be for one (1) year covering all labor and materials.
2. Warranty shall commence when equipment is 100 percent operational and acceptable to the Owner, as approved in writing by the Owner and Engineer.
3. Maintain equipment operational during the warranty period such that, if defective, equipment will be serviced and made operational by the completion of the next business day following notification by the Owner.
4. Warranty shall cover all equipment furnished as specified in this Section, both manufacture and installation, but excluding misuse or vandalism.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

#### A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Amtech Systems; Parking Control Equipment.
2. Aiphone; Intercom System.
3. Or equal as approved by Architect.

### 2.2 EQUIPMENT LIST

- A. General: All equipment colors shall be standard Manufacturer colors except where specifically noted.
- B. The following equipment list consists of basic system components. Provide auxiliary items required for the proper functioning of the system, whether mentioned or not, including but not limited to, heaters, coolers, wiring, transformers, relays, pedestals, etc. It is the sole responsibility of the Parking Control Equipment (Sub) Contractor to provide every component necessary for a complete functioning system.
- C. Locate equipment as indicated on the Drawings.
- D. Equipment List:
  1. Provide Parking Control Equipment for each lane as indicated.
  2. Lane Types:
    - a. Lane A - Dedicated Entrance Lane - 2 total.
    - b. Lane B - Dedicated Exit Lane - 2 total.

3. Equipment List:

Item	Quantity per Lane	Total Required
	A	B
Digital self-tuning vehicle detector	1	1
Detector loop - sawcut *	2	2
Transponder	1	1
Hands Free Antenna Controller	1	1
Dual Intercom Station	1	1

(Quantity and detector loop sizes to be determined by the system manufacturer).

4. Office Equipment:

- a. Dual Master Intercom Station.
- b. Port Controller with software and modem

2.3 ON-LINE TRANSPONDER READER SYSTEM

- A. The on-line hands free antenna shall be located at the entrance and exit lanes where indicated on the Drawings. Intercoms, where indicated on Drawings, to be provided by the Parking Control Equipment Contractor.
- B. System Capabilities:
  1. The access control system shall be an on-line system. If the central controller is not functional, the hands free antenna shall function off-line. Transponder validity checks shall be made, but not anti-passback checks when the central controller is down.
  2. System shall be able to add transponders to memory with the ability to define where and when the transponder holder may use the transponder. On a gate-by-gate basis, valid access times shall be definable.
  3. System shall be able to delete transponders from memory as well as modify access control privileges of individual transponders. Four thousand (4,000) transponders shall be provided in base bid.
  4. System shall be able to select transponder-controlled areas that are to operate in an antipassback (APB) mode and select whether contact closure (e.g. gate up) is required to change antipassback status. APB shall include forgive command which resets the sequence control to a neutral state. The antipassback status shall be restored within the transponder system when the transponder is next used in either entrance or exit reader. SOFT APB (printer lists the illegal use but autogate still opens) and HARD APB (printer lists the illegal use and autogate does not open) shall be selectively programmable.
  5. All system activity messages to the operator shall be printed in plain language English text including transponder holder name.
  6. The transponder system shall be capable of automatically scanning the transponder and sending the transponder number to the transponder controller to verify current status. Reading rejects shall not exceed one percent of transponder communications.
  7. Both housing and stand shall be treated for corrosion resistance and finished externally with two coats of acrylic enamel in same color as other equipment as selected by the Owner.

8. Transponder Readers shall be on-line with the system computer.

## 2.4 EMBEDDED LOOPS AND VEHICLE DETECTORS

- A. The parking equipment detector loops shall be saw cut into the slab-on-grade.
- B. Directional logic detection shall be provided by a count system. Provide loops as required for directional detection and counting.

## 2.5 INTERCOM SYSTEM

- A. Intercom shall be mounted at entrance and exit lanes, and shall include "Press for Assistance" engraved signs and push button operation. At booths, intercoms shall be desk-mounted. Intercoms shall be capable of two-way communication with the dual master intercom stations.
- B. Master intercoms shall be located in the office and in the Barrier Free Booth and shall include call alert audio and light signal feature. Master intercoms shall be capable of handling up to 12 stations.
- C. Acceptable Products:
  1. Aiphone, LAF-10 and PS 12C power supply or equivalent.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect setting surfaces, power wiring and conduit installation for booths and equipment and report immediately in writing to the Engineer, as required in the General Conditions, any conditions of Related Work which are unsuitable for proper execution of this Work.

### 3.2 INSTALLATION

- A. Install parking control system in accordance with Manufacturer's recommendations and the approved shop drawings. Also see Quality Assurance Requirements.
- B. Installation shall be by factory-trained mechanics experienced in installation of equipment of this type.
- C. Provide and pull control wiring and make final connections of all wiring.

### 3.3 ADJUSTMENT AND SYSTEM START-UP

- A. Adjust and tune the system as required assuring proper operation. After installation, test all functions of the Parking and Revenue Control Systems.

- B. Demonstrate the satisfactory electrical and functional performance of the entire parking control system by the following operations:
  - 1. The successful use of an employee parker transponder to enter and exit the facility with all information recorded.
  - 2. The successful transfer of transponder access data from the on-line equipment to the transponder access controller.
  - 3. The proper operation of the intercoms.
- C. Provide 8 hours of on-site instructions to Owner's personnel. Instructions shall include but not be limited to, programming of transponder readers. Coordinate schedule with Owner.

END OF SECTION 111200

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 111300 - AUDIO VIDEO EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section. Reference AV drawings for additional information.
- B. All materials, equipment, transportation, and labor necessary to achieve a complete and functional system.
- C. The work of this section also includes:
  - 1. Required licenses, insurance and permits including payment of charges and fees.
  - 2. Verification of dimensions and conditions at the job site.
  - 3. Preparation of submittal information.
  - 4. Development and implementation of AV control software code and control panel layouts, which will become the property of the owner.
  - 5. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
  - 6. Extension of electrical service, including ground, to equipment locations if required.
  - 7. Initial tests and adjustments, written report, and documentation.
  - 8. Instruction of operating personnel.
  - 9. Provision of manuals.
  - 10. Maintenance services and warranty.

#### 1.2 RESPONSIBILITY

- A. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.
- B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the contractor to supply systems in full working order. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, the Occupational Safety and Health Act and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Owner prior to bid opening, the Owner will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.
- C. All structural support, design, and engineering for installation of all system components.
- D. Power shall be provided at rack locations, display monitors, projectors, electric screens, connection panels and subwoofers. The contractor shall be responsible for distributing electrical power from the isolator to the equipment as required. This will include necessary distribution boards and cabling for a complete installation.

- E. The contractor shall be responsible for connecting appropriate grounds to all equipment in accordance with applicable codes and standards.
- F. Coordinate work with other trades to avoid causing delays in construction schedule.

### 1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 27: Electrical Work.
  - 1. Conduit, wireways, floor boxes, wall boxes, pull boxes, junction boxes, AC power circuits and ground wiring.

### 1.4 REFERENCES

- A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
  - 1. American National Safety Institute (ANSI),
  - 2. American Society of Testing and Materials (ASTM),
  - 3. Electronics Industries Association (EIA),
  - 4. Federal Communications Commission (FCC),
  - 5. Institute of Electrical and Electronic Engineers (IEEE),
  - 6. National Electrical Manufacturer's Association (NEMA),
  - 7. National Electrical Code (NEC),
  - 8. Underwriters Laboratories (UL),
  - 9. Occupational Safety and Health Administration (OSHA)
  - 10. Davis and Davis, Sound System Engineering (2nd Edition), Howard W. Sams, 1987.
  - 11. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 1990.

### 1.5 DESCRIPTIONS AND REQUIREMENTS

- A. The following is intended to further describe the Video/Audio/Control system work and clarify design intent and is not an exhaustive description of the systems.
- B. Theater (Team Classroom):
  - 1. One video projector and screen or One large, wall mounted LCD monitor.
  - 2. Laptop inputs to be connected to a wall location located at the front and rear of room. Other sources include a TV tuner, DVD, iPod and a team furnished computer for display of video coaching material.
  - 3. The ability to show content from a mobile device on the display will be provided.
  - 4. Program audio playback from the above listed sources shall be reproduced via a surround sound processor through recessed, ceiling mounted speakers and recessed wall mounted subwoofer. Program audio volume control/equalization/amplification shall be provided.
  - 5. System control shall be provided and be available via wired touch panel. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
    - a. Source selection: DVD, TV Tuner, Computer, etc. (Laptop/Interactive Whiteboard).

- b. Channel selection via keypad.
      - c. Program Audio Volume - up/down, mute.
      - d. Transport control of playback units.
      - e. System power - on/off.
      - f. Dimming of room lights (if available).
  6. Equipment racks for switchers, amplifiers and signal processing equipment.
- C. Large Offices:
1. Multiple wall mounted flat panel displays that have the ability to switch between a distributed TV source and laptop connection at desk location via basic TV manufacturer's remote control.
  2. Program playback audio shall be reproduced via TV speakers.
- D. Large Conference Room:
1. One large, wall mounted LCD monitor.
  2. Laptop inputs to be connected at table location. Other sources include a TV tuner, DVD, iPod and a team furnished computer for playback of video coaching material.
  3. Program audio playback from the above listed sources shall be reproduced via recessed, ceiling mounted speakers. Program audio volume control/equalization/amplification shall be provided.
  4. System control shall be provided and be available via wireless touch panel. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
    - a. Source selection: DVD, TV Tuner, Computer, etc. (Laptop/Interactive Whiteboard).
    - b. Channel selection via keypad.
    - c. Program Audio Volume - up/down, mute.
    - d. Transport control of playback units.
    - e. System power - on/off.
  5. Equipment racks for switchers, amplifiers and signal processing equipment.
- E. Employee Hub:
1. Several large, wall mounted LCD monitors.
  2. Laptop inputs to be connected at room location. Other sources include a TV tuner, DVD, iPod and a team furnished computer.
  3. The ability to show content from a mobile device or tablet on the displays will be provided.
  4. Program audio playback from the above listed sources shall be reproduced via recessed, ceiling mounted speakers. Program audio volume control/equalization/amplification shall be provided.
  5. System control shall available via wired touch panel. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
    - a. Source selection: DVD, TV Tuner, Computer, etc.
    - b. Channel selection via keypad.
    - c. Program Audio Volume - up/down, mute.
    - d. Transport control of playback units.
    - e. System power - on/off.

6. Equipment racks for switchers, amplifiers and signal processing equipment.

F. Small Conference and Meeting Rooms:

1. One large LCD monitor shall be provided.
2. Wall mounted flat panel display that has the ability to switch between a distributed TV source and laptop connection at the table via basic TV manufacturer's remote control.
3. Program playback from the above listed sources shall be reproduced via TV speakers.

G. Team Lounge and Locker Room:

1. Flat panel LCD monitors shall be in the room.
2. Monitors to have the ability to display NBA stats and standings information.
3. Input sources shall be from a TV tuner, music source (iPod/iPad, etc.) and DVD unit. The music source can be connected wirelessly.
4. Program audio reinforcement audio shall be via recessed ceiling speakers within the lounge and in the courtyard.
5. System control shall be available via wired wall mounted touch panel controller.
6. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
  - a. Channel selection via keypad.
  - b. Source selection: DVD, Tuner, Computer, Laptop, iPod, aux.
  - c. Program audio volume - up/down/mute.
  - d. System power - on/off.

7. Equipment racks for switchers, amplifiers and signal processing equipment.

H. Small Offices:

1. One wall mounted flat panel display.
2. An interface shall be provided at the desk with connections for a laptop to the flat panel display. Program playback audio shall be reproduced via flat panel display speakers.
3. System control shall be provided via television remote control.

I. Weight Room:

1. Flat panel displays will be mounted throughout the area.
2. Input sources shall be from an iPod connection that can be connected via wire or wirelessly.
3. Program playback audio shall be reproduced via low and high frequency ceiling speakers.
4. Program audio volume control/equalization/amplification shall be provided.
5. System control shall be available via basic push button panel located in the equipment rack. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
  - a. Source selection.
  - b. Channel selection via keypad.
  - c. Program Audio Volume - up/down, mute.
  - d. System power - on/off.
6. Equipment racks for switchers, playback, amplifiers and signal processing equipment.

J. Training:

1. Wall mounted flat panel displays.

K. Press Room:

1. Flat panel display will be mounted in the area.
2. Program playback audio shall be reproduced via low and high frequency ceiling speakers.
3. Program audio volume control/equalization/amplification shall be provided.
4. System control shall be available via basic push button panel recessed in the wall. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
  - a. Reproducing interview table audio.
  - b. Source selection.
  - c. Channel selection via keypad.
  - d. Program Audio Volume - up/down, mute.
  - e. System power - on/off.
5. Equipment racks for switchers, playback, amplifiers and signal processing equipment.

L. Headquarters Suite:

1. Wall mounted flat panel displays will be located throughout the room.
2. Input sources shall be from court PA system, a TV tuner, music source (iPod/iPad) and DVD unit.
3. Program playback audio shall be reproduced via a series of recessed ceiling speakers.
4. Program audio volume control/equalization/amplification shall be provided.
5. System control shall be available via touch panel. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
  - a. Source selection: DVD, TV Tuner, Aux (video games).
  - b. Channel selection via keypad.
  - c. Program Audio Volume - up/down, mute.
  - d. System power - on/off.
6. Equipment racks for switchers, playback, amplifiers and signal processing equipment.

M. Entry Lobby:

1. One high brightness video projector.
2. Sources include a TV tuner, digital media player and/or a team furnished computer.
3. Program audio playback from the above listed sources shall be reproduced via ceiling mounted speakers. Program audio volume control/equalization/amplification shall be provided.
4. System control shall be available via wired touch panel. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
  - a. Source selection: DMP, TV Tuner, Computer, etc. Channel selection via keypad.
  - b. Program Audio Volume - up/down, mute.

- c. Transport control of playback units.
  - d. System power - on/off.
- 5. Equipment racks for switchers, amplifiers and signal processing equipment shall be provided and located in an equipment rack.
- N. Common Areas and Non Coaching Offices:
  - 1. Wall mounted flat panel display.
  - 2. Input sources shall be from a distributed TV source.
  - 3. Program playback audio shall be reproduced via display speakers.
- O. Hydrotherapy:
  - 1. Wall mounted flat panel displays.
  - 2. Local iPod connection to ceiling mounted speakers.
- P. Playing Courts:
  - 1. Sound coverage shall expand to the public restrooms and exhibition area. Each court has a dedicated set of low and high frequency speakers providing sound coverage for the lower level. An additional set of speakers provides sound coverage for the upper level.
  - 2. The loudspeaker system is expected to have a maximum sound level of 98 - 101 dBA, with a uniformity of coverage of 3 dBA across the fixed seating. The frequency response of the system is expected to be at least 80 Hz to 12,000 Hz, 3 dB.
  - 3. The speaker system for each court is controlled by audio equipment mounted in a portable cart. The sound cart will contain a 12 input mixing console to control the level of microphone inputs, and other program sources, such as compact discs, game announcer, clips playing device and other audio signals. The cart will also contain a wireless microphone system and a compact disc player.
  - 4. Program audio volume control/equalization/amplification shall be provided.
  - 5. System shall be able to combine courts and separate when partition is engaged.
  - 6. System control shall be available via touch screens located around the courts as well as through a portable audio mixer when games are being played. Control functions are to be grouped in a logical and reasonable arrangement. The system should be capable of:
    - a. Source selection.
    - b. Program Audio Volume - up/down, mute.
    - c. System power - on/off.
  - 7. Equipment racks for switchers, playback, amplifiers and signal processing equipment.
  - 8. Surface mounted ceiling speakers not to be mounted below lowest ceiling point structure.
- Q. Video Coaching:
  - 1. Will be Owner Provided. The following description is provided to give an understanding of the infrastructure provided.
    - a. Multiple camera locations mounted around the courts.
    - b. Microphone locations within the basketball goal backboard.

## 1.6 SUBMITTALS

- A. The Contractor shall submit a number of copies of product data and drawings. Refer to Division 1 submittals section for number of copies. The submittals will be marked by the Consultant and returned to the Contractor for his use, distribution, correction or re submittal as required. The Consultant will retain one set. After final review and correction of the submittal, the Contractor shall send one corrected set to the Consultant.
1. Provide the following in one submission for approval within thirty days of issuance of Notice to Proceed and prior to commencement of Work:
    - a. Provide a list of equipment and manufacturer's data sheet on product to be incorporated within the Work in specification order. Submit bound originals of:
      - 1) Manufacturer's product technical data for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.
    - b. Shop Drawings:
      - 1) Functional Diagrams/Schematics:
        - a) Detailed, redrawn wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and designators, and device designators for each system. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
      - 2) Coordination Drawings:
        - a) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the audio and video system in relationship with other building components. Prepare drawings to an accurate scale of 1/8"=1'-0" or larger on suitable sized media.
        - b) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the Work including but not necessarily limited to the following:
          - c) Equipment housings.
          - d) Wall mounted devices.
          - e) Ceiling mounted devices.
      - 3) Equipment: Location of equipment within racks, consoles, or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
      - 4) Patch panel(s): Layouts and designation (labeling) strips, including color schemes.
      - 5) Full fabrication details of any custom enclosures and millwork indicating size, material, finish and openings for equipment.

- 6) Projector, loudspeaker, camera mounting details, include hardware types and load capacity.
- 7) Fabricated Plates and Panels: Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
- 8) Labeling: Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
- 9) Schedules: Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.
- 10) Any other pertinent data generated which is necessary to provide the Work.

B. Contract close-out submittals:

1. Submit four bound originals of the following Project Record Manual information after substantial completion but prior to final inspection:
  - a. Product Data: Product actually incorporated within the Work:
    - 1) Manufacturer's data sheet for each type of product conforming to the submission format specified herein.
    - 2) Supply manufacturer's serial numbers for each product.
    - 3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
    - 4) Manufacturer's wiring diagram for each type of product actually incorporated.
    - 5) Manufacturer's maintenance and care instructions.
    - 6) Separately bind list by manufacturer and model or part number of product incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately.
  - b. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
  - c. Test Reports: Recorded findings of Contractor's Commissioning.
  - d. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
    - 1) Describe the operation of system capabilities.
    - 2) Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
  - e. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
  - f. Any other pertinent data generated during the Project or required for future service.
2. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

C. Close-out submittal format:

1. Each submittal shall include a unique number and be numbered in consecutive order.
2. Provide a complete table of contents with the following information:
  - a. Project title and number.
  - b. Submittal number - In the case of a re submittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
3. Date of submission.
4. Referenced addendum or change order number as applicable.
5. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
6. Index Product Data sheets by manufacturer and model or part number unless specified otherwise herein.
7. Each submission page stamped with Contractor's certification stamp, initialed or signed certifying:
  - a. Review, approval and acceptance of submission.
  - b. Certification of product compliance to specification.
  - c. Verification product may be incorporated within the work.
8. Arrange product data list in specification order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer's data sheets, arranged in the same order. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
9. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'-0".
10. Bind Project Record Manual in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.

D. Resubmission Requirements:

1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate any changes that have been made other than those requested.
3. Cost for the Owner's consultant to review any re-submittals after the first re-submittals will be the responsibility of the Contractor and billed at the rate in affect at that time.

1.7 CUSTOM SOFTWARE

A. Introduction:

1. Proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor shall agree that 3rd party proprietary software provided with the system shall be subject to this agreement.
3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.

4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership:

1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
2. Except as expressly set forth in this agreement, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of Owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modifications, and Use:

1. Source code shall be available to Owner for a period of not less than 10 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of Owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right for Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

D. Warranties and Representations:

1. Contractor represents and warrants to Owner that:
  - a. it has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to Owner;
  - b. the goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners; and
  - c. the software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.

2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.
3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

## 1.8 QUALITY ASSURANCE

- A. Contractor's Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
  1. No less than three years of experience with equipment and systems of the specified types.
  2. Experience with at least three comparable scale projects within the last two years.
  3. Be a franchised dealer and service facility for the manufacturer's products furnished.
  4. Maintain a fully staffed and equipped service facility with full time field technicians.
  5. Have at least one supervisory employee having completed and certified CTS-I by ICIA. Proof shall be supplied as submittal item.
  6. At the request of the Owner, demonstrate that:
    - a. Adequate plant and equipment is available to complete the work.
    - b. Adequate staff with commensurate technical experience is available.
- B. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
  1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
  2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
  3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- C. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the architect and General Contractor.
- D. Seismic loads: Provide required bracing, suspension rods and other support components to resist seismic loads based on product weight, project location, and installation details. Finished installation components and methods shall comply with requirements for the seismic zone designated by the State of New York.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Ship product in its original container, to prevent damaging or entrance of foreign matter.
- B. Handling and shipping in accordance with manufacturer's recommendation.

- C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.
- D. Replace at no expense to Owner, product damaged during storage, theft, handling or the course of construction.

#### 1.10 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify General Contractor in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the General Contractor for approval, showing how the work may be installed.

#### 1.11 WARRANTY

- A. Warrant labor and product for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.
- C. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty four hours.
- D. Contractor to provide team with the name and telephone number of the person to call for service. This information to be part of Project Record Drawings.
- E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by the team. Warranty replacement and service of equipment shall not apply to team furnished equipment. Coordinate inspection visit with the Thunder.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Product quantity is as required. If a quantity is given, contractor shall provide at least the given amount.
- B. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

- C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.
- D. Take care during installation to prevent scratches, dents, chips, etc. Any damage shall be repaired at no cost to the Owner.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed as an Acceptable Product of function, performance, and quality.
- B. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.
- C. Model numbers and manufacturers included in this specification are listed as a standard of quality.
- D. Provide new equipment and materials that conform to applicable UL, CSA, or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.
- E. Other qualified manufacturers will be considered subject to prior approval of complete technical data, samples, and, if requested, results of independent testing laboratory tests of proposed equipment.

## 2.3 OWNER FURNISHED EQUIPMENT

- A. Video Coaching System

## 2.4 ALTERNATES/OPTIONS

- A. Alternate 11 13 00-A. Provide televisions and brackets.
  - 1. A1 - Unit costs to provide televisions and brackets as indicated on schedule.
  - 2. A2 - Cost to provide and install televisions and brackets as indicated on schedule.
- B. Alternate 11 13 00-B. Cost to provide and install video wall/signage system in the Entry. Includes all cable, mounting, software programming.
  - 1. B1 - At Entry Area
    - a. Digital Media Player (DMP).
    - b. Click Effects Blaze.
    - c. Type 3 Amplifier (AMP<sub>3</sub>).
    - d. Type 7 speakers.
    - e. Type 1 Touch Screen Panel (TP<sub>1</sub>).
    - f. Digital Signal Processor (DSP).
    - g. TV Tuner (TVT).
    - h. Ethernet Switch (ETH).
    - i. HDMI Extender (DTP-TX).
    - j. HDMI Receiver (DTP-RX).

- k. Equipment Rack Type 4 (ER-4).
- l. 2.5mm Nano Slim LED display.

1) 9.5' x 15.75'.

- C. Alternate 11 13 00-C. Cost to replace base bid projector and screen in the Team Theater with 100" LCD Display.
- D. Alternate 11 13 00-D. Cost to furnish, install and configure Video Coaching Cameras at court locations.

## 2.5 SOURCE EQUIPMENT

### A. DVD Blu Ray Player (DVD):

- 1. HDMI output.
- 2. Discrete control input.
- 3. Able to read and play multiple video and audio formats.
- 4. Streaming service support.
- 5. Acceptable product:

a. Denon DBT-1713UD.

### B. Wireless Music Bridge (WMB):

- 1. AirPlay iOS & OSX.
- 2. Bluetooth A2DP.
- 3. DLNA for Android & Windows devices.
- 4. Stereo analog & Digital Coax outputs.
- 5. Acceptable product:

a. Control4 C4-WMB-B.

### C. Wireless Video Bridge (WVB)

- 1. Wirelessly share content from personal mobile devices.
- 2. Windows, Apple, Android compatible.
- 3. Simultaneously display four separate devices.
- 4. HDMI output.
- 5. Acceptable Product:

a. Extron ShareLink 200.

### D. CD Player (CD):

- 1. Slot loading.
- 2. RS232 control.
- 3. CD-R/RW and MP3 playback and record.
- 4. Lightning and 30-Pin iPod/iPhone dock.
- 5. Stereo mini jack input.
- 6. Acceptable product:

- a. Tascam CD-200 iL.
- b. Denon.

E. AM/FM Tuner (AFT):

- 1. IR Control.
- 2. Provide with AM/FM outdoor antenna and necessary mounting hardware.
- 3. Acceptable product:
  - a. Tascam TU-690.
  - b. Pixel PIX-AFXSM-6 or equivalent.

F. AM/FM Antenna:

- 1. Provide active, high impedance unit with single amplifier and high pass filter.
- 2. Aluminum tube construction with end-seal elements.
- 3. Wind loading requirement: withstand 100 mph.
- 4. Acceptable product:
  - a. Pixel Technologies.
  - b. Blonder Tongue.
    - 1) Antenna: Pixel Technologies AFHD-4.
    - 2) Splitter (SPL9): MBS-4.
    - 3) Twin Lead Adapter.
    - 4) Extender Amplifier (AMP1): Blonder Tongue DA-33.
    - 5) Fixed Attenuators: Pixel Technologies (as required).
  - c. Surge Protector: Pixel Technologies.

G. TV Tuner (TVT)

- 1. Receives ATSC and QAM channels.
- 2. HDMI Output.
- 3. 1 RU height.
- 4. RS-232 Control.
- 5. Acceptable Product:
  - a. Contemporary Research 232-ATSC+1.
  - b. Aurora Multimedia.

H. Digital Media Player (DMP)

- 1. Full HD.
- 2. HDMI, stereo analog audio out, RS-232, network capabilities.
- 3. Live Text, media, social media feeds, database integration.
  - a. Goal is to display team and league stats and standings from database feed.
- 4. Windowing, graphics, images.
- 5. Creation and publishing software.
  - a. BrightSign HD1020.

- b. Gefen EXT-HD-DSMP.
- c. As approved.

## 2.6 AUDIO SIGNAL PROCESSING

### A. Reinforcement Console:

1. Four channel, 12 microphone inputs.
2. Frequency response:  $\pm 1$  dB, 20 Hz to 50 kHz with less than 0.010 percent THD at +14 dBu.
3. Noise generation: at least -128 dBm (equivalent input).
4. Input configuration: nominal 150 ohm microphone and 10k line balanced input, electronically balanced.
5. Input attenuator to provide attenuation allowing signal levels from -60 to +10 dBm without overload or distortion.
6. Input Module: four-channel buss selection, pan system to allow panning between odd and even output busses, cue switch, and six auxiliary send busses.
7. Equalizer section: four separate bands. High and low frequency bands, fixed frequency, 15 dB boost/cut. Two mid frequencies, continuously variable frequency selection, 15 dB boost/cut.
8. Master module: main mix, master level controls for the auxiliary sends, and dual LED meters.
9. Acceptable product:
  - a. Allen and Heath Mix Wizard 3 12:2.
  - b. Mackie 1204 VLZ.
  - c. Soundcraft FX-12.

### B. Peak Limiter (PLIM):

1. Provided to limit signal inputs to power amplifiers.
2. Input impedance: 10 kohm balanced.
3. Output impedance: 600 ohm balanced.
4. Maximum input level: +20 dBm.
5. Maximum output level: +24 dBm into 600 ohm load.
6. Stereo multi-band.
7. Bar graph display indicating limiting.
8. Acceptable product:
  - a. Aphex Dominator II Model 720.

### C. Back of House areas Digital Signal Processor (DSP<sub>1</sub>):

1. 12x8 digital matrix.
  - a. (12) mic-line inputs.
  - b. (8) outputs.
2. LED front panel indication.
3. RS-232 control.
4. Acceptable product:

a. EXTRON DMP 128.

D. Court System Digital Signal Processor (DSP<sub>2</sub>).

1. Signal processing shall be performed by computer based system.
2. The DSP system shall be fully operational 60 days prior to the first use of the installed system.
3. The system shall have the following capabilities:

a. Digital Signal Processing Unit:

- 1) Unit to be at least eight in and eight out digital processing unit.
- 2) Interior configuration of signal flow and routing to be fully user configurable.
- 3) Unit to permit hardwire connection of external switches for recalling presets.
- 4) Unit to be able to be networked together for common computer control.
- 5) Unit to have no external user adjustable controls.
- 6) Unit to monitor each amplifier output and provide low voltage "trigger" to fire alarm system to notify operator of amplifier channel failure.
- 7) Unit to monitor each speaker line impedance and provide low voltage trigger to notify operator if impedance exceeds normal limits.
- 8) Acceptable product:
  - a) BSS SoundWeb.
  - b) QSC BASIS.

E. Surround Sound Processor (SSP):

1. Supports Dolby and DTS formats.
2. Automatic format detection and decoding.
3. Nine-band parametric EQ.
4. RS-232 control.
5. Acceptable product:

a. EXTRON SSP 7.1.

F. Surround Sound AV Receiver (AVR):

1. Dolby digital 9.2 capable.
2. AV Source Switcher.
3. (7) HDMI Inputs.
4. (3) HDMI Outputs.
5. AirPlay.
6. Internet Radio.
7. RS-232 Control.
8. 150W x 9 channels (8 Ohms, 20 Hz-20 kHz, 0.5%THD).
9. Acceptable Product:

a. Denon AVR-4520CI.

## 2.7 POWER AMPLIFIERS

A. Power Amplifier (PA):

1. Provide protection of circuit components in the event of input over-drive, output overload, or short circuits.
2. Frequency response:  $\pm 1$  dB, 20 Hz to 20 kHz with less than 1 per cent THD at rated output.
3. Input impedance: 10 kohm balanced.
4. Noise generation: at least 85 dB below rated output with input shorted.
5. Cooling: Convection.
6. Acceptable products:
  - a. Type 1 Power Amplifier (PA<sub>1</sub>):
    - 1) Four (4) Channel - 700 Watts Per Channel Into 4 Ohms.
      - a) Lab Gruppen C28:4.
  - b. Type 2 Power Amplifier (PA<sub>2</sub>):
    - 1) Four (4) Channel - 200 Watts Per Channel Into 4 Ohms.
      - a) EXTRON XPA 2004.
  - c. Type 3 Power Amplifier (PA<sub>3</sub>):
    - 1) Two (2) Channel Amplifier - 400 Watts Per Channel Into 4 Ohms.
      - a) EXTRON XPA 4002.
  - d. Type 4 Power Amplifier (PA<sub>4</sub>):
    - 1) Two (2) Channel Amplifier - 400 Watts Per Channel Into 70 Volts.
      - a) EXTRON XPA 4002-70V.
  - e. Type 5 Power Amplifier (PA<sub>5</sub>):
    - 1) One channel 160W.
    - 2) 70V capable.
      - a) Crown 1160A.

## 2.8 MICROPHONES

### A. Goal Microphone (M)

1. Mount under rim in padding.
2. Small profile unit capable of picking up court audio.
3. Omni-directional lavalier condenser microphone.
4. Low distortion, wide dynamic range.
5. Acceptable product:
  - a. Shure SM93.

B. Announcer Microphone:

1. Configuration: boom microphone mounted on headphones.
2. Coordinate wiring of headphones with Owner.
3. Include Interface with Announce microphone.
4. Interface to allow microphone to be muted with push button switch.
5. Interface to also provide phantom power for condenser microphones.
6. Acceptable products:

a. Headset Microphone:

- 1) AKG HSC 200 SR (Quantity: 3).
- 2) Beyer DT280 (Quantity: 3).

b. Interface Box:

- 1) Clear Com AB-120 (Quantity: 3).
- 2) Studio Technologies, Inc. Model 230.

C. Microphone Accessories

1. Stands and Mounting Hardware:
  - a. AKG KM 201A/2 Black (Quantity: 6).
  - b. AKG KM 211 Black (Quantity: 2).

D. Handheld Microphone

1. Rugged construction.
2. Condenser microphone.
3. Acceptable product:
  - a. Shure SM58 (Quantity: 2 per court).

E. Wireless Microphone (WMIC)

1. System described is for each court system.
2. Receiver Type: UHF FM System with automatic switching diversity reception with XLR type audio output connectors.
3. Indicators: LED signal strength meters for RF and audio levels.
4. Frequency: Coordinate with FCC and local requirements.
5. Antennas: Provide passive directional antennas for the frequency spectrum chosen and locate in the corresponding court.
6. 1-RU Rack mountable 1-ch rack frame.
7. Provide with rack ears.
8. Acceptable product to include:
  - a. Shure: ULXS4 Diversity Receiver (Quantity: 1).
  - b. Shure: ULX2/Beta87A Handheld transmitter (Quantity: 1).

F. Microphone Cables and Accessories

1. Audio Distribution:

- a. For Press Conference.
  - b. 2 input, 8 output.
  - c. Acceptable product:
    - 1) Whirlwind Press Mite (Quantity: 1).
2. Mic Cable:
- a. Whirlwind MK4-30 (Quantity: 6).
  - b. Whirlwind MK4-50 (Quantity: 4).
3. 3-Foot, 1/8"M to 1/8"M (Quantity: 2 for each WPIP location).

## 2.9 LOUDSPEAKERS

### A. Type 1 Ceiling Speaker (surrounds left, center, right):

- 1. Pivoting 1" tweeter and 8" woofer.
- 2. 33Hz - 20kHz.
- 3. 91 dB SPL, one watt, one meter.
- 4. 100W continuous.
- 5. Acceptable product:

- a. SpeakerCraft AIM8 Five.

### B. Type 2 Ceiling Speaker:

- 1. 85Hz - 35kHz.
- 2. 92dB SPL, one watt, one meter.
- 3. 90 degrees conical.
- 4. 260W program with 130W average.
- 5. Provide with VX8 Yoke mount.
- 6. Attach to height ceiling with aircraft cable.
- 7. Allow for +/- 10 degrees aiming during system tuning.
- 8. Finish: paint to match ceiling.
- 9. Acceptable product:

- a. Tannoy VX8.

### C. Type 3 Ceiling Speaker:

- 1. 31Hz - 150Hz frequency range.
- 2. Max SPL, 105dB average, 111dB peak.
- 3. Finish: paint to match ceiling.
- 4. Acceptable product.

- a. Tannoy CMS-110 TB Sub.

### D. Type 4 Ceiling Speaker:

- 1. 34Hz - 18kHz frequency range.
- 2. Max SPL, 118dB average, 124dB peak.

3. Finish: paint to match ceiling.
4. Acceptable product:
  - a. JBL 321C.

E. Type 5 Ceiling Speaker (surround left and right rear):

1. Pivoting 1" tweeter and 8" woofer.
2. 40Hz - 20kHz.
3. 88 dB SPL, one watt, one meter.
4. 100W continuous.
5. Acceptable product:
  - a. SpeakerCraft AIM8 One.

F. Type 6 In-Wall Speaker:

1. 250W.
2. 12" woofer with dual voice coil.
3. 25Hz-500Hz.
4. Includes Bass Power 250 amplifier and AccuTuneBox (SUB).
5. Acceptable product:
  - a. SpeakerCraft Cinema Sub10 System.
  - b. Provide with in-wall mounting kit and cut out.

G. Type 7 Ceiling Speaker:

1. 80Hz-25kHz frequency range.
2. 85 dB SPL, one watt-one meter.
3. 30W continuous.
4. Acceptable product:
  - a. JBL Control 24CT.

H. Type 8 Ceiling Speaker:

I. Finish: paint to match ceiling.

J. Back can and tiling bridge.

K. Acceptable product:

L. Type 9 Ceiling Speaker:

1. 75Hz-20kHz frequency range.
2. 89 dB SPL, one watt-one meter.
3. 150W continuous.
4. Acceptable product:
  - a. JBL Control 26CT.

M. Type 10 Surface Mount Speaker:

1. Coverage pattern: at least 90 degrees horizontal by 50 degrees vertical.
2. Sensitivity: at least 99LF, 113HF dB - SPL, one watt, one meter.
3. Frequency response: 41 Hz to 18 kHz.
4. Configure crossover for passive operation.
5. Transformer: 150 watt, 70 volt.
6. Mount speaker so that front face of speaker is level with bottom edge of steel truss.
7. Orient speakers so that the 90 degree coverage is oriented with the longest dimension of the room.
8. Cabinet color: refer to architect.
9. Acceptable product:

a. JBL AM5215/95 with mounting bracket.

N. Type 11 Surface Mount Speaker:

1. Coverage pattern: Omni-directional.
2. Power Handling: 1600W Program.
3. Frequency response: 42 Hz to 1 kHz.
4. Configure crossover for 35-110Hz operation.
5. Mount speaker so that front face of speaker is level with bottom edge of steel truss.
6. Cabinet color: refer to architect.
7. Acceptable product:

a. JBL ASB6115 with mounting bracket.

O. Type 12 Outdoor Speaker:

1. 100W, two-way.
2. Weather resistant.
3. 4".
4. Finish: color to match surroundings. Refer to architect.
5. Provide with mounting brackets.
6. Acceptable product:

a. JBL N24AWII.

P. Type 13 Outdoor Speaker System:

1. Pendant style.
  2. 70V capable.
- a. Atlas Sound 4".  
b. Community CP6.

2.10 HEARING ASSISTANCE SYSTEM

A. Seating Bowl Transmitter (HOH):

1. System to be used in court seating bowl area and Team Theater.
2. Frequency modulation type with maximum 80 millivolts per meter at 3 meters.
3. Input: balanced bridging, nominal level 10 millivolts to 1 volt, P-P maximum.
4. Displays: LED power indicator and LED VU meter.

5. Frequency response: 50 Hz to 15k Hz.
6. Controls: power on-off and individual mic and line level.
7. Acceptable product:
  - a. Listen Technologies LT 800 with rack mount.
  - b. Phonic Ear PE 550T with AT 575 rack mount kit.

B. Seating Bowl Receivers:

1. Provide unit pricing for additional units.
2. Output level: 125 dB SPL maximum.
3. Gain: 52 dB peak.
4. Provide unit price for additional receivers.
5. Receiver and accessories to include the following components:
  - a. Receiver:
    - 1) Listen Technologies LR 400 (Quantity: 6).
    - 2) Phonic Ear PE 300R-SMB (Quantity: 6).
  - b. Recharger:
    - 1) Listen Technologies LA-202 (Quantity: 1).
    - 2) Phonic Ear PE 300C-S (Quantity: 1).
  - c. Earphone:
    - 1) Listen Technologies single ear bud (Quantity: 12).
    - 2) Phonic Ear PE 300C-S (Quantity: 12).

C. Hearing Assist Antenna (HA):

1. Mount antenna to wall plate.
2. Impedance: 50 ohm with BNC type connector.
3. Acceptable product:
  - a. Listen Technologies LA-107.
  - b. Phonic Ear AT 568.

2.11 VIDEO CONFERENCING

A. Video Conferencing Unit (CODEC):

1. Videoconference system.
2. Transmission speeds 1080P 30 fps @ 1Mbps.
  - a. H.261, H, 263++, H264, P+C / H.239 capable.
    - 1) Control communication RS232.
    - 2) Capable of 16:9 or 4:3 format.
    - 3) Acceptable Product to include:

- a) Polycom HDX-7000 Codec.
- b) Polycom firmware People + Content.
- c) Provide Remote, proprietary cables, power supply.
- d) HDX Microphone Array (MIC).
- e) Premier Plus Service Plan #4870-00262-108.
- f) HDCI Camera Breakout Cable #2457-23521-001.
- g) EagleEye III Camera (CAM) with appropriate length cable and mounting bracket.
- h) Integrate into control system.

## 2.12 VIDEO PROJECTION EQUIPMENT

### A. Team Theater Projector Type 1 (VP<sub>1</sub>):

- 1. 6,000 lumens.
- 2. 10,000:1 contrast ratio.
- 3. Lamp free design, 1-chip DLP.
- 4. Acceptable product:
  - a. Panasonic PT-RW630BU.

### B. Entry Projector Type 2 (VP<sub>2</sub>):

- 1. 20,000 lumens.
- 2. 10,000:1 contrast ratio.
- 3. Four lamp system.
- 4. Compact size.
- 5. Acceptable product:
  - a. Panasonic PT-DZ21KG1.
  - b. With appropriate ET-D75LE series lens.

## 2.13 VIDEO DISPLAY EQUIPMENT - ALTERNATE

### A. LCD or LED Displays and Mounts:

- 1. Provide new displays and mounts specified within. Refer to the television schedule for locations of displays and type of mounts to be provided.
- 2. Coordination of delivery of the displays is part of this contract.
- 3. Moving the displays from a staging area to the physical location is the responsibility of this Integrator.
- 4. Configuration and set-up of the display and remote control is the responsibility of this Integrator.
- 5. Installation and delivery of all accessories (remote control, power cords).
- 6. All Display cables shall be concealed from view.
- 7. Cabling and dressing from the outlet to display to be provided under this scope. This includes any A/V cables (coaxial, HDMI, etc.) and control cabling (IR, RS232, USB).
- 8. It is the intent that the cables, including power, be completely concealed from view. Notify Owner's representative of any situation where cable concealment is questionable such that a solution can be developed.
- 9. Provide covering for mounts to conceal cable where possible.

10. Refer to display schedule at end of document for quantities.

B. Mounting:

1. TV Monitors shall be mounted plumb and level at the operating position in a safe, secure and permanent manner.
  - a. In areas where mounting brackets span blocks of varying depths, provide a "sleeve" to conceal exposed mounting bolt threads.
2. Hardware required to locate the mount and TV monitor at the required position shall be provided.
3. TV Monitors shall be mounted using tamper proof secure hardware.
4. In areas where TVs are located in signage, coordinate mounting with Sign Contractor.
5. In areas where modification of mounting location is required, method must be approved by Owner's representative.
6. Ceiling tile must be replaced with "like and kind" material. Field-verify the type for material to be replaced.
7. Extension columns/poles/masts color must match that of bracket.
8. Extension columns/poles/masts must include escutcheon.
9. Locations to be verified prior to mounting.
10. TVs to conceal outlet locations.

C. Specifications common to each display:

1. 1080 resolution.
2. Consumer grade LCD or LED smart TV display.
3. Screen image size variance from specified: +/- 5%.
4. Inputs:
  - a. 3 HDMI.
  - b. USB.
  - c. ATSC/QAM integrated tuner.
  - d. IR and/or RS232 control (RS232 is preferred).
5. Speakers integrated into unit.
6. Smart TV applications (Ethernet enabled).
7. Black, rectangular bezel (identify look in proposal).
8. Standard VESA mounting.

D. Type A Flat Panel Display (TV<sub>A</sub>)

1. EIA/TIA: 40/42-inch diagonal.
2. Acceptable product:
  - a. LG 42LS5700.
  - b. NEC E423.
  - c. Samsung LED F6300 series.
  - d. Or equal.

E. Type C Flat Panel Display (TV<sub>B</sub>)

1. EIA/TIA: 50/55inch diagonal.

2. Acceptable product:
  - a. LG 50LS5700.
  - b. NEC E554.
  - c. Samsung LED F6300 series.
  - d. Or equal.

F. Type E Flat Panel Display (TV<sub>C</sub>)

1. EIA/TIA: 60/65-inch diagonal.
2. Acceptable product:
  - a. LG 60LN5400.
  - b. NEC E654.
  - c. Samsung LED F6300 series.
  - d. Or equal.

G. Type F Flat Panel Display (TV<sub>D</sub>)

1. EIA/TIA: 75/85-inch diagonal.
2. Acceptable product:
  - a. LG.
  - b. Samsung F6300 series.
  - c. Or equal.

H. Type G Flat Panel Display (TV<sub>E</sub>):

1. EIA/TIA: 103-inch diagonal.
2. Acceptable product:
  - a. LG.
  - b. Panasonic.
  - c. Or equal.

I. Flat Panel Monitor Mounts:

1. Wall mount assembly from 42"-60".
2. Up to 15-degrees tilt.
3. Leveling and lateral shift.
4. Weight load up to 200 lbs.
5. Acceptable Product:
  - a. Chief.
  - b. Peerless.
  - c. Or equivalent.
  - d. Provide with any steel stud mounting accessories.

J. Flat Panel Monitor Mounts:

1. Wall mount assembly from 60"-80".
2. Fixed wall mounts.
3. Weight load up to 250 lbs.

4. Acceptable Product:
  - a. Chief.
  - b. Peerless.
  - c. Or equivalent.
  - d. Provide with any steel stud mounting accessories.

## 2.14 VIDEO SWITCHING AND PROCESSING EQUIPMENT

### A. Audio Video Routing Control Switcher Type 1 (RCS<sub>1</sub>):

1. 8x4 Matrix Switcher.
2. Integrated control processor.
3. Input signal types: (6) HDMI and (2) DTP.
4. Output signal types: (2) HDMI and (2) DTP.
5. Supports resolutions up to and including 4K.
6. EDID format management.
7. HDCP management to allow fast switching between sources.
8. Control communication via Ethernet.
9. Two IR ports.
10. Four relay ports.
11. One RS-232/422/485 ports.
12. Two RS-232 ports.
13. 100 Watts RMS mono @ 70v.
14. 2RU height
15. Acceptable Product:
  - a. Extron DTP CrossPoint 84 IPCP MA 70.
  - b. Crestron.

### B. Audio Video Routing Control Switcher Type 2 (RCS<sub>2</sub>):

1. 8 Input Switcher.
2. Integrated control processor.
3. Input signal types: (4) HDMI and (2) DTP.
4. Output signal types: (2) HDMI and (1) DTP.
5. Supports resolutions up to and including 2K.
6. EDID format management.
7. HDCP management to allow fast switching between sources.
8. Control communication via Ethernet.
9. Two IR ports.
10. Four relay ports.
11. One RS-232/422/485 ports.
12. Two RS-232 ports.
13. 100 Watts RMS mono @ 70v.
14. 2RU height.
15. Acceptable Product:
  - a. Extron DTP IN1608 IPCP MA 70.
  - b. Crestron.

### C. Multi-Window Processor (MWP):

1. 4 Input, 4 window processor.
2. Input signal types: (4) HDMI and (4) RGBHV BNC.
3. Output signal types: (1) HDMI and (1) RGBHV BNC.
4. Supports resolutions up to and including 2K.
5. Control communication via Ethernet.
6. One RS-232/422 port.
7. 2RU height.
8. Acceptable Product:
  - a. Extron DTP MGP 464 Pro DI.

## 2.15 NETWORKING

### A. Ethernet Switch (ETH):

1. IEEE 802.3af power over Ethernet ports.
2. 10/100 Mbps.
3. Acceptable product:
  - a. Cisco.
  - b. HP.
  - c. IBM.

### B. USB Hub (USB):

1. 4 port.
2. 12Mbps data rate.
3. Indicator lights on front.
4. Acceptable product:
  - a. Belkin USB 4-Port Hub.

## 2.16 INTERFACES

### A. Computer Interface Wall and Floor Plate (CIF):

1. Converts HDMI/DVI to SF/UTP (CAT6ScTP) with serial and IR control.
2. Use shielded twisted pair cable as required by manufacturer for optimal performance
3. Independent audio inputs.
4. Installs in a double-gang electrical box.
5. Acceptable Product:
  - a. Extron DTP T UWP 332D.
  - b. Crestron.
    - 1) NOTE: Refer to floor plans for wall and or floor plate quantities and types.
    - 2) Coordinate face plate color with Architect.

### B. Digital Media Receiver (DTP-RX):

1. Type 1:

- a. HDMI to SF/UTP (CAT6ScTP) with serial and IR control.
- b. Use shielded twisted pair cable as required by manufacturer for optimal performance.
- c. Independent audio output.
- d. 1" high metal enclosure compatible with low-profile TV mounts.
- e. Acceptable Product:
  - 1) Extron DTP HDMI 330 RX.
  - 2) Crestron.

a) NOTE: Device and cable to TV to be neatly concealed behind display.

2. Type 2 (Wall Plate):

- a. HDMI to SF/UTP (CAT6ScTP) with serial and IR control.
- b. Use shielded twisted pair cable as required by manufacturer for optimal performance.
- c. Acceptable Product:
  - 1) Extron DTP HDMI 230 RX.

C. Digital Media Transmitter (DTP-TX):

1. HDMI/DVI to SF/UTP (CAT6ScTP) with serial and IR control.
2. Use shielded twisted pair cable as required by manufacturer for optimal performance.
3. Independent audio input.
4. Half rack enclosure.
5. Acceptable Product:
  - a. Extron T USW 333.
  - b. Crestron.

D. Digital Media Distribution Amplifier (DMDA):

1. HDMI to Four Output DTP.
2. 230 ft transmission distance.
3. Audio and control I/O.
4. Acceptable Product:
  - a. Extron DTP HD DA8.

E. Sound Control Panel (SCP):

1. Line level volume control.
2. Acceptable product:
  - a. OWI AMP-MOVC.

F. KVM Extenders (KVM EXT):

1. USB/PS2, Audio, VGA over CAT5.
2. Acceptable product:

- a. Avocent.
- b. Gefen.
- c. MiniComm.
- d. BlackBox.
- e. As approved.

G. KVM Receivers (KVM EXR):

1. Acceptable product:

- a. Avocent.
- b. Gefen.
- c. MiniComm.
- d. BlackBox.
- e. As approved.

2.17 TOUCHSCREEN CONTROL SYSTEM

A. Control Processor (CP):

- 1. Control Processor (CP).
- 2. Two (2) bi-directional RS-232 serial ports.
- 3. One (1) bi-directional RS-232/422/485 serial ports.
- 4. Two (2) IR/serial ports.
- 5. Four (4) relays.
- 6. Ethernet Communications with 3-port switch.
- 7. Provide necessary power supplies and/or power injectors.
- 8. Acceptable Product:
  - a. Extron IPCP Pro 350.
  - b. Crestron.

B. Touchscreen Control Panel (TP<sub>1</sub>):

- 1. Provide flush mounted touch panel in wall.
  - 2. 7" color touch panel.
  - 3. Resolution: 800 x 480.
  - 4. Contrast: 400:1.
  - 5. Display: Active matrix TFT.
  - 6. Memory: SDRAM 512 MB.
  - 7. PoE: IEEE 802.3af class 3.
  - 8. Acceptable product:
    - a. Extron TLP Pro 720M.
    - b. Crestron.
- 1) Coordinate color with Architect.

C. Touchscreen Control Panel (TP<sub>2</sub>):

- 1. 10" color touch panel.
- 2. Resolution: 1024 x 600.

3. Contrast: 400:1.
  4. Display: Active matrix TFT.
  5. Memory: SDRAM 512 MB.
  6. PoE: IEEE 802.3af class 3.
  7. Acceptable product:
    - a. Extron TLP Pro 1000TV.
    - b. Crestron.
- 1) Coordinate color with Architect.

D. Touchscreen Control Panel Back Box:

1. Provide for flush or surface wall mounting.
  2. Acceptable product:
    - a. Extron BB710M (Flush Mount).
    - b. Extron EWB710 (Surface Mount).
    - c. Crestron.
- 1) Coordinate mounting condition with Architect.

E. Touchscreen Control Panel PoE Injector:

1. Provide for each Touchscreen Control Panel (TP).
2. Acceptable product:
  - a. Extron XTP PI 100.
  - b. Crestron.

F. iPad Control Application (TP<sub>3</sub>):

1. Provide for WiFi based control from Owner furnished iPad.
2. Version 2.0.
3. Pro Series control system support.
4. Acceptable product:
  - a. Extron TouchLink for iPad.
  - b. Crestron.

## 2.18 COMPUTERS AND LAPTOPS

A. Video Coaching Computers provided by Owner.

1. Provide connectivity, installation and testing into system.

B. iPads for wireless system control provided by Owner.

1. Provide connectivity, app installation and testing into system.

## 2.19 SOFTWARE

- A. Owner shall retain all rights and non-exclusive ownership to custom software, including original source code. Supply printouts of all source codes as well as back-up copies of uncompiled code on suitable electronic storage medium.
- B. All commercial software used, shall be registered to Owner, in Owner's name. Owner to be supplied with all software documentation including copies of software registration.
- C. All software shall be written with remark statements which document function of subroutines and program requirements.
- D. Deliver final disk copies of the configured software within 30 days after notice to proceed.
- E. Provide one-year of on-site software upgrades from date of substantial completion.
- F. Submit complete software "code" on disk format for approval.
- G. Initial and final software configuration to be included. The cost to configure the software is a part of this contract. Software configuration involves extensive interviews with the Owner. Update software to latest version 60 days prior to system substantial completion. Provide on-site software upgrade service within 30 days of release by manufacturer during the first year following substantial completion.
- H. Provide site licensed commercially available software for control system and control panel both operational and configuration.
- I. The cost to configure the software is a part of this contract.
- J. The cost to interface and control components provided by distributed television installer is part of this contract.
- K. Graphical User Interface ("GUI") and Machine Control
  - 1. The Contractor is to develop the GUI and machine software control. The development is to be done in four phases.
  - 2. During the first phase, development of the GUI panel layouts and machine functions are to be established. Participants of the development are the Contractor and the Owner. This requires multiple meetings with these principles and is an interactive and iterative process.
  - 3. During the second phase, the Contractor produces the initial GUI and machine software control filling the requirements developed during the first phase. This also requires multiple meetings with the Contractor and the Owner and is an interactive and iterative process.
  - 4. Upon completion of the second phase, install the control software within the AV Control Systems and inspect the systems for performance compliance. During this process the Contractor debugs the AV Control Systems software code as required to ensure a properly functioning system. At the end of this phase the Manufacturer is to provide written notification that their product is operating properly and that the functions and configurations established in Phase One and Two are working and have been properly implemented

## 2.20 EQUIPMENT HOUSING & ACCESSORIES

### A. Equipment Rack (ER-1)

1. To be frame and panel type with a minimum 44RU, 31" deep panel space constructed of 16-gauge cold-rolled steel. Racks to have locking rear door mounted on the frame (not the rails). Empty mounting panel spaces to be filled with blank or vent panels, in a finish to match rack. Provide end panels and top panels as required. Provide shelving as required for equipment mounting within racks. Provide rack supports as required. Provide seven rack keys of each type. Rack color to be gloss or flat black. Provide a" lamp in a locally switchable fixture mounted in the top rear of each rack. Include extra set of mounting rails in each rack for rear support of panels or equipment. Verify exact rack space required.
2. Support Equipment
  - a. Blank Panels.
  - b. Vent Panels.
  - c. Miscellaneous equipment shelving.
  - d. Rack screws.
  - e. Power distribution.
  - f. Gooseneck, magnetic, LED rack light.
  - g. Whisper-type cooling fans.
  - h. Wheel base and casters for moving.
3. Racks to be:
  - a. Equipment Room Racks.
    - 1) Middle Atlantic MRK 4431 series, side and top panels.

### B. Equipment Rack (ER-2):

1. Provided for mounting of playback and processing equipment on wall.
2. Unit to pull out and rotate for service.
3. Rack to have 18 units of rack space and 19" of usable depth.
4. Provide with power strips.
5. Provide with locking trim panel.
6. Provide with lockable drawers.
7. Acceptable product:
  - a. Middle Atlantic EWR series

### C. Equipment Rack (ER-3):

1. Provided for mounting of playback and processing equipment.
2. Unit to pull out and rotate for service.
3. Rack to have 40 units of rack space and 20" of usable depth.
4. Provide with power strips.
5. Provide with drawers
6. Acceptable product:
  - a. Middle Atlantic AXS series

D. Equipment Rack (ER-4):

1. Provided for mounting of playback and processing equipment in millwork.
2. Unit to pull out and rotate for service.
3. Rack to have 17 units of rack space and 19" of usable depth.
4. Provide with power strips.
5. Provide with locking trim panel.
6. Provide with lockable drawers.
7. Whisper-type cooling fan and grille.
  - a. NOTE: Vent through rear or toe kick if required and coordinate any vent cover with architect.
8. Acceptable product:
  - a. Middle Atlantic SRSR Series.

E. Audio Cart:

1. 19 inch console rack with pop-up top loaded rack.
2. 9mm plywood construction with PVC exterior.
3. Recessed latches & handles.
4. Heavy-duty zinc plated hardware.
5. Reinforced stackable ball corners.
6. Top rack uses a pop-up ratchet system for transporting flat then elevating to various angles.
7. 4" heavy-duty industrial casters, 2 which are locking.
8. Spring loaded recessed handles on each side for easy lifting to stage or truck.
9. Heavy-duty threaded rack rail.
10. Acceptable product:
  - a. Gator Cases G-Tour 10 X 16 PU.

F. Custom and/or Engraved Panels:

1. Custom panels constructed of 1/8 inch brushed aluminum.
2. Finish: black anodize.
3. Quantity as required.
4. Refer to Plate and Panel details on drawings.
5. Acceptable Product:
  - a. RCI AVD series.
  - b. ProCo.
  - c. Switchcraft

G. Construction back boxes

1. Recess-mounted metal enclosure.
2. Acceptable product:
  - a. Per touch panel manufacturer.
  - b. Per gaming console manufacturer.
  - c. Per subwoofer manufacturer.

H. Cable Management:

1. At conference room tables.
2. Acceptable Product:
  - a. Legrand MRTC.

2.21 POWER CONDITIONING

A. Uninterruptible Power Supply:

1. Provide UPS for control system master units and CPU based equipment located in equipment racks.
2. Acceptable Product:
  - a. APC Back-UPS ES series

B. Power Protection (PWR SURGE):

1. Provide surge protection device to maintain clean power to the following equipment:
  - a. All DSP Units.
  - b. CPU Based processing equipment.
2. Provide product package most suitable for installation method required by equipment and its location.
3. Acceptable products:
  - a. New Frontier Electronics Surge-X SX-1120RT.

C. Rack Lighting and Power Strip (POWER LIGHT):

1. Coordinate outlet receptacles with Electrical Contractor.
2. Nema 20A plug.
3. 20 Amp/2400 Watt rating.
4. Front panel AC voltmeter.
5. Dual front panel pullout dimmable lights.
6. Spike and surge suppression with over-voltage shutdown.
7. 1-U Rack Mountable.
8. Acceptable product:
  - a. Furman PL-Pro C.

D. Sequencing Rack Power Strip (PSEQ):

1. 20 Amp/2400 Watt rating.
2. Multiple sequenced outlets.
3. Front panel AC voltmeter.
4. Spike and surge suppression with over-voltage shutdown.
5. 1-U Rack Mountable.
6. Acceptable product:

- a. Furman PS-Pro Series II.

E. Power Relay (PSREL):

- 1. Relay senses the presence of 120 VAC and closes a SPDT relay.
- 2. Relay contacts are available on a barrier strip.
- 3. Acceptable product:

- a. Furman PS-REL Series II.

## 2.22 POWER SEQUENCING SYSTEM

- A. Provide system to sequentially power or de-power sound system equipment in the Amplifier Rack equipment. This includes equipment such as the program sources, signal processing equipment, and amplifiers.
- B. Initiate power sequencing system from a touch panel control system in the amp rack.
- C. The amplifiers shall be available for power up only after the line level equipment is successfully powered up.
- D. Line level equipment shall disable only after the amplifiers have been successfully disabled.
- E. Audible pops or clicks from the sound system in response to the power sequencing procedure or in the event of a power failure is not acceptable.
- F. Coordinate installation of power sequencing system with Division 26.
- G. Power sequencing equipment must maintain isolated ground system and be listed by a recognized safety testing agency.
- H. Acceptable product manufacturers:
  - 1. Middle Atlantic Products: Reference drawings for Quantities.
    - a. USC-6R Universal Sequencing Controller (PWRSEQ).
    - b. RLM-20IG Power Module (20Amp Isolated Ground).
    - c. Blanks and cable jumpers as required.
    - d. RLM-20-1C Power Module (Standalone Unit).

## 2.23 SYSTEM WIRE

- A. Microphone/Line Level Wire:
  - 1. Provide shielded 22 AWG cable.
  - 2. Cable to be PVC jacketed.
  - 3. Jacket color: black.
  - 4. Acceptable Product:
    - a. Belden 9451.
    - b. Liberty 22-1PEZ.

- c. Belden 88761 (where required).
- d. Liberty 22-2C-PSH-WHT (where required).

B. Video Cable, Intra Rack, Non Plenum:

- 1. Provide RG-59/U type cable.
- 2. Center conductor 23 AWG solid.
- 3. Cable to be PVC or FEP jacketed.
- 4. Acceptable Product:
  - a. Belden 1505A.
  - b. Extron 22-124-XX.
  - c. West Penn 819.

C. Video Cable Non Plenum:

- 1. Provide RG-6/U type cable for cable runs over.
- 2. Center conductor 18 AWG solid.
- 3. Cable to be PVC or FEP jacketed.
- 4. Acceptable Product:
  - a. Belden 1694A.
  - b. Extron 22-098-XX.
  - c. West Penn 6350.

D. Video Cable Plenum:

- 1. Provide RG-6/U type cable.
- 2. Center conductor 18 AWG solid.
- 3. Cable to be PVC or FEP jacketed.
- 4. Acceptable Product:
  - a. Belden 1695A.
  - b. Extron 22-164-XX.
  - c. West Penn 256350.

E. HDMI Cable:

- 1. Provide pre-molded cables in lengths as required.
- 2. Acceptable Product:
  - a. Extron HDMI Ultra Series Cable (6' to 15').
  - b. Extron HDMI Pro Series Cable (25' to 100').

F. DVI Cable:

- 1. Provide pre-molded cables in lengths as required.
- 2. Acceptable Product:
  - a. Extron DVI Cable.

G. Network Twisted Pair Cable:

1. 24 AWG solid.
2. 4 Pair UTP.
3. Acceptable Product:

- a. Belden 1585A.

H. DTP Shielded Twisted Pair Cable:

1. 24 AWG solid.
2. 4 Pair SF/UTP (CAT6ScTP).
3. Acceptable Product:

- a. Extron XTP DTP 24/1000 (Non-Plenum).
- b. Extron XTP DTP 24P/1000 (Plenum).

I. Speaker Level Wire:

1. Provide 14 AWG cable.
2. Cable to be CL3R.
3. Jacket color: gray.
4. Acceptable Product:

- a. West Penn 226.
- b. Belden.

J. Underground Speaker Level Wire:

1. Provide 18 AWG cable.
2. Cable to be CM or CL3 rated.
3. Jacket color: Gray or Black.
4. Acceptable product:

- a. West Penn AQC293.

K. Control Cable:

1. 20 AWG Stranded (7x28).
2. 300V RMS 150 deg C.
3. Acceptable Product:

- a. West Penn.
- b. Belden.
- c. Other Cables:

- 1) As per manufacturers specifications.

## 2.24 CONNECTORS

A. XLR Panel mount Connectors:

1. Provide panel mount XLR connectors with unified metal shell.
2. RF-Protector connectors.

3. Shell Color: Black.
4. Contacts: Silver.
5. Terminations: Solder.
6. Acceptable Product:
  - a. Male Connectors: Neutrik NC\*MD-L-1-BAG Series.
  - b. Female Connectors: Neutrik NC\*FD-L-1-BAG Series.

B. XLR Cable Connectors:

1. Provide XLR cable connectors with die cast shell.
2. No-screw type assembly.
3. Chuck-type strain relief.
4. Shell Color: Black.
5. Contacts: Silver.
6. Terminations: Solder.
7. Acceptable Product:
  - a. Male Connectors: Neutrik NC\*MX-BAG Series.
  - b. Female Connectors: Neutrik NC\*FX-BAG Series.

C. 1/4" Panel mount Connectors:

1. Provide panel mount 1/4" connectors with unified metal shell.
2. Shell Color: Black.
3. Contacts: Silver.
4. Terminations: Solder.
5. Acceptable Product:
  - a. Female Connectors: Neutrik NJ3FP6C-BAG Series.

D. 1/4" Cable Connectors:

1. Provide 1/4" cable connectors with die cast shell.
2. No-screw type assembly.
3. Chuck-type strain relief.
4. Shell Color: Black.
5. Contacts: Nickel.
6. Terminations: Solder.
7. Acceptable Product:
  - a. Male Connectors: Neutrik NP3C-BAG Series.

E. BNC Cable Connectors:

1. Provide cable mount BNC connectors.
2. Contacts: Brass or copper.
3. Terminations: Crimp.
4. Acceptable Product:
  - a. Kings.
  - b. Amp.
  - c. Amphenol.

- d. Canare.
- e. Liberty.

F. BNC panel mount connectors:

- 1. Isolated bulkhead jack, feedthrough.
- 2. 75-ohm metal machined body.
- 3. Acceptable product:

- a. Neutrik NBB75FI.

G. RJ45 Connectors:

- 1. UTP Category 6, 8-pin wiring inserts T568A/B jacks.
- 2. Acceptable products:

- a. Belden PN#AX101320 (color to match plate).

H. RCA Male Cable Connectors:

- 1. Provide RCA cable connectors with die cast shell.
- 2. Shell Color: Silver.
- 3. Contacts: Silver.
- 4. Terminations: Solder.
- 5. Acceptable Product:

- a. Switchcraft 3502 Series.
- b. Liberty.

I. Dual Male SC Connectors:

- 1. Acceptable product:

- a. Belden AX101077.

J. LC Connectors:

- 1. Acceptable product:

- a. Belden AX101982.

K. USB panel mount connectors:

- 1. Reversible gender changer (type A and B).
- 2. Acceptable product:

- a. Neutrik NAUSB.

L. Receptacles:

- 1. Accepted product:

- a. Type XLR-3M:

- 1) Neutrik NC3MD-L-1-B.
- b. Type XLR-3F:
  - 1) Neutrik NC3FD-L-1-B.
- c. Type XLR-5M:
  - 1) Neutrik NC5MD-L-1-B.
- d. Type XLR-6M:
  - 1) Neutrik NC6MD-L-1-B.
- e. Type 1/4inch Phone:
  - 1) Neutrik NJ3FP6C.
- f. Type SPEAKON:
  - 1) Neutrik NL4MP.
- g. Type 1/4 inch Speaker:
  - 1) Switchcraft Z15J.
- h. Type BNC:
  - 1) Canare BCJ-JRU.
- i. Type NCJ:
  - 1) Neutrik NCJ6FI-S.
- j. Type RCA:
  - 1) Switchcraft 3501FR with S-1028 and S-1029 insulating washers.

M. Plugs:

- 1. Accepted product:
  - a. Type XLR-3MP: Neutrik NC3MX-B.
  - b. Type XLR-3FP: Neutrik NC3FX-B.
  - c. Type TRS: Neutrik NP3C-B.
  - d. Type 1/4 inch: Neutrik NP2C-B.

N. Logic Relay

- 1. Configuration: DPDT contacts.
- 2. Control from switch, button, or logic circuits.
- 3. Operate from 24 VDC.
- 4. Acceptable product manufacturers:

- a. Magnecraft.
- b. Potter Brumfield.
- c. Radio Design Labs.

O. Relays and Contactors:

- 1. Relays operating at low voltages to be sealed and include transient suppression devices in parallel with each coil to prevent any relay bounce.
- 2. Mount contactors and relays for AC power in a NEMA 1 enclosure unless otherwise specified.
- 3. Number all relay sockets in rack and on the Record Documents.
- 4. Acceptable products:
  - a. Microphone level audio: Potter & Brumfield KHS17D13-24V.
  - b. Power contactor for line level equipment: Square D LLO series for 20 A circuits and Square D SMO for 30 A circuits.
  - c. Line level & DC routing relay: Potter and Brumfield R10E1-Z2V700.
  - d. Speaker level: Soundolier RLM 24 with RPM series chassis modules.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.
- B. Mount equipment and enclosures plumb and level.
- C. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- D. Verify all locations of video projectors, projection screens, and computer connections in all rooms with Architect.

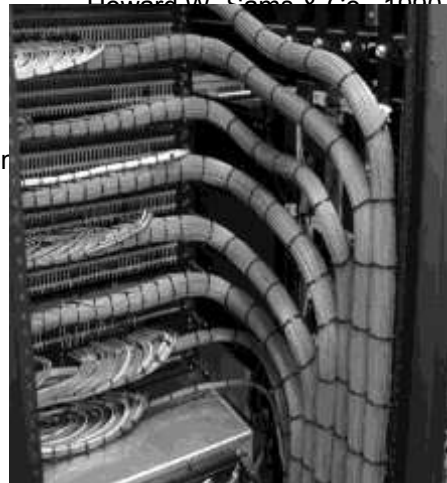
### 3.2 INSTALLATION

- A. Installation of cable and wiring:
  - 1. Cabling and Wiring:
    - a. No cables within public viewing areas shall be visible to the public.
    - b. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
    - c. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
    - d. Provide splice free wiring and cabling from origination to destination.
    - e. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors, where spade lugs are used, crimp properly with ratchet type tool.

- f. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
- g. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.
- h. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.
- i. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommeting.
- j. Execute wiring in strict adherence to:

1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co. 1999.

Appendix II, Recommended Wiring Practices.  
2nd Edition. Indianapolis: Howard W. Sams



2. Equipment

- a. as required herein, and in accordance with s, lace or harness all wire or cable to prevent ctions; no wire or cable shall be supported by wire neatly tied in manageable bundles with
- b. e al
- c. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.
- d. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
- e. Provide plastic cable ties or lacing twine to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
- f. Install with connections completely visible and labeled.
- g. Provide termination resistors, if required, of 5 per cent tolerance; fully visible and not concealed.

B. Installation of connectors, plates & panels:

- 1. Install panel mounted connectors rigidly attached to panels, plumb and level.

2. Custom rack panels shall be 1/8 inch thick aluminum, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.
3. Custom connector plates (speaker, microphone, etc.) are typically stainless steel, unless otherwise noted or specified. However, it is the contractor's responsibility to verify plate finish with the Owner.
4. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
5. Other Plates and Panels may be required to satisfy the requirements of the Work.

C. Installation power and grounding

1. Coordinate final connection of power and ground wiring to housings.
2. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
3. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
4. Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.

D. Installation of Electronic Equipment:

1. Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
2. Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
3. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamicaid labels.
4. Mount equipment plumb and level, firmly and safely held in place.

E. Installation of Equipment Housing:

1. Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks will be fabricated on site and the reasons for the change.
2. Install mounted equipment with black star post type security screws, tamper proof, provide owner with two new star post bits upon completion of project.
3. Provide rear support for housing mounted equipment greater than 15 inches deep.
4. Provide blank panels or vents (as appropriate) to fill unused panel space within the equipment housing. These panels and/or vents are to be black powder coat finish.
5. If Key door locks are required, key each housing type alike.
6. Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, and RF wiring on the right.
7. Do not block access to any front mounted components when mounting product on rear housing rails.
8. Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the conclusion of testing.
9. Provide a light mounted in the top of each full height rack to illuminate the interior for service or maintenance. Lights to be individually switchable and placed so as to provide maximum illumination throughout the rack. Lamps to be at least 75 watt.

10. Provide ventilation adequate to keep temperature within the rack below 85 degrees F. Provide whisper type ventilation fan in each rack if temperature in rack rises above 100 degrees F with power on for five continuous hours. This may also include any hole and/or finish grille on millwork cabinets. Coordinate with Architect.
11. Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.

F. Installation of LCD monitors:

1. Confirm location before mounting
2. Monitors shall be mounted plumb and level at the operating position in a safe, secure and permanent manner and adjusted to fill the screen.
3. All hardware required to locate the mount and monitor at the required position shall be provided.

G. Loudspeaker suspension:

1. Loudspeakers shall be suspended at the operating position in a safe, secure and permanent manner.
2. All speaker enclosures being flown or suspended to have internal mounting brackets to distribute the load to the other faces of the enclosures. Provide internal bracing on cabinets that do not have factory installed bracing.
3. All speaker enclosures to be rigidly mounted to structure with no visible speaker movement.
4. All speaker enclosures to have permanently attached grilles with no company logos or names visible without prior approval by the Owner.
5. Structural support members to have a safety factor of at least 5. Mounting hardware and wire rope to have a safety factor of 8. All fasteners to be graded and certified for use in the intended applications. Overhead suspension hardware shall comply with ASME B30.20 standards and all applicable local building and safety codes.
6. Overhead suspension hardware must be of a type that includes product traceability controls.
7. Rigging, mounting and support systems for loudspeakers shall be designed and sealed by a registered professional engineer licensed to practice in the State of New York. Once the systems are installed, the engineer shall physically inspect the methods and means used to verify compliance with the original design.
8. Paint speakers, supports and related hardware as directed by Architect.

### 3.3 LABELING OF EQUIPMENT

- A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.
- B. Provide logical and legible cable and wiring label permanently affixed for easy identification.
  1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
  2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by contractor. Add cable designation codes to system schematic drawings.

3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

### 3.4 ENGRAVING

- A. Text font: 1/8 inch block sans serif characters unless noted otherwise.
- B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.
- C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.
- D. Equipment label: black with white characters except where indicated.

### 3.5 CONTRACTOR COMMISSIONING

- A. Prior to energizing or testing the System ensure the following:
  1. All products are installed in proper and safe manner according to manufacturer's instructions.
  2. Insulation and shrink tubing are present where required.
  3. Dusts, debris, solder and splatter, etc. is removed.
  4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
  5. Labeling has been provided.
  6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
  7. Products are neat, clean and unmarred and parts securely attached.
  8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.
- B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards.
  1. Electronic devices are properly grounded.
  2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections. Verify each individual component is operating properly.
  3. Verify each individual component's performance meets the manufacturer's published performance for this unit.
  4. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
- C. Speaker Circuit Verification Test:
  1. Measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1 KHz. For constant voltage systems measure the impedance at 250 Hz, 1 KHz and 4 KHz of each line leaving the equipment rack with the line disconnected from the driving source. For band limited devices, use a frequency appropriate for the operating range of the transducer.

2. When documenting the results of these tests, include the calculated impedance based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedance.
3. Include the results of the tests in the Project Record Manual.

D. Speaker Polarity Verification Test:

1. Use an electronic polarity checker, TEF-20, SYSID, SIM II, Smaart, or other similar device to test each reinforcement speaker. All speakers should have the same relative polarity.
2. Follow manufacturer's recommendations in conducting the tests.
3. In a similar manner, check all distributed speakers to ensure they have the same polarity.
4. Include the results of the tests in the Project Record Manual.

E. Audio Signal Paths

1. Verify operation from each source device through all switching, amplification and distribution devices.

F. System Gain Adjustment

1. Adjust each active device to have proper gain structure from the mixer output to the input of the amplifier.
2. With all amplifiers turned off, connect a sine wave or pink noise generator to the input of the mixer.
3. Using a RMS AC voltmeter with a dB scale, adjust the mixer to an output between -10 and 0 dBu. Once the level has been established, it should remain unchanged throughout the test. All equalizers should be set flat for this test.
4. Follow the signal flow from the mixer to each subsequent component. Measure the input level and output level of each device at the point of connection to the device. The input level reading should differ no more than 0.25 dB from the level recorded for the preceding device. Diagnose and correct the wiring or equipment when any readings exceed this range.
5. Adjust the output of each component to achieve the proper output level.
6. Record the output levels of each device in the Project Record Manual.

G. Remote Input Verification Test

1. Using a microphone or portable signal generator, connect to each microphone/line level receptacle throughout the facility.
2. Verify that the receptacle under test appears at the correct input and is operating properly.

H. System Equalization

1. Using a RTA, TEF 20, SYSID, or SMAART, equalize all loudspeaker systems to provide a suitable frequency response as follows:
  - a. Speech Reinforcement Systems: flat response from 125 Hz to 2.5 KHz, with 2 dB roll off above.
  - b. Program Reproduction Systems: flat response from 65 Hz to 8 KHz, with 2 dB roll off above.

2. Verify system gain and amplifier levels.
3. Provide program levels of at least 85 dB and speech reinforcement levels of at least 70 dB in the seating area without objectionable distortion, buzzes, or rattles.
4. Provide hard copy printouts of the spectral response with the test data.

I. RFI and Parasitic Oscillation

1. With systems operating check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.

J. Buzzes, Rattles and other Distortions

1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 KHz and listen carefully for buzzes, rattles and other objectionable distortions.
2. Correct the cause of the defect. If the cause is not from the system. Bring the cause to the attention of the University, indicating cause and suggestive corrective actions.

K. Video Systems Test

1. Projected images and screen must be plumb with respect to ceiling line.
2. Video System Tests. Verify performance of all video equipment, components and systems, as specified herein.
3. Video (signal):
  - a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 55 dB minimum.
  - b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
  - c. Frequency Response: Within plus to minus 0.5 dB to 4.2 MHz.
  - d. Line and Field Tilt: 2% maximum.
  - e. Differential Gain: 2% maximum.
  - f. Differential Phase: 2 degrees maximum.
  - g. Frequency Response: DC to 4.2 MHz within plus or minus 0.5 dB.

L. Video Signal Paths

1. Verify operation from each source device through all switching, amplification and distribution devices.

M. Control Systems

1. Verify operational functions of the control system and all interfaced devices.
2. Verify operational functionality of any wireless user devices.

3.6 FINAL INSPECTION AND TESTING

- A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the team no earlier than two weeks after receipt of the written results.
- B. Provide a minimum of one (1) person for inspection and one (1) person for testing familiar with aspects of the System to assist the Owner.

- C. The process of testing the System may necessitate moving and adjusting certain components.
- D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.
- E. The following procedures will be performed on each System:
  - 1. Inspection of the methods and means employed to incorporate the System within the facility.
  - 2. Verification of proper operation, from controlling devices to controlled devices.
  - 3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
  - 4. Other tests on equipment or systems deemed appropriate.
- F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price.

### 3.7 TEST EQUIPMENT

- A. Ten days prior to start of testing, provide a list to the Owner's Representative of test equipment make, model numbers and calibration dates that will be used.
- B. The following equipment shall be available on site for the entire test period through final system testing.
  - 1. Sound Level Meter: ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
  - 2. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz, 1 dB (long-term average) at 0 dBm output. Stability: 2 dB per day.
  - 3. Dual-trace oscilloscope - 100 MHz bandwidth, 1 mV/cm sensitivity.
  - 4. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 4k Hz. Measurement Range: 1 ohm to 100 kohms.
  - 5. Audio Oscillator: bandwidth 20 Hz to 20k Hz .5 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from -30 dBu to +10 dBu.
  - 6. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
  - 7. NTSC Test generator.
  - 8. Real time analyzer with LED or CRT display. The unit shall meet the filter requirements of ANSI S1.11 Class III for one third octave filters.
  - 9. Video test generator capable of generating signal up to 1600 x 1200.
  - 10. Source material for all playback and recording devices.
  - 11. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

### 3.8 INSTRUCTION OF OWNER PERSONNEL

- A. Provide 20 hours instruction to Owner designated personnel focusing on the use, operation, and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. Team may video record all instruction sessions. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with the Owner.
- B. Provide 12 hours instruction to Owner designated personnel focusing on the use and operation of control system software.
- C. Provide personnel/technical support at three Owner selected special events within the first year of operation.

### 3.9 CLEANUP AND REPAIR

- A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

END OF SECTION 113000

## SECTION 111352 - PROJECTION SCREENS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.
- B. Refer to Instructions to Bidders for substitution of materials and products.

#### 1.2 DESCRIPTION OF WORK

- A. Projection screens required include:
  - 1. Electric Ceiling Mounted Front Projection Screen
- B. Related work specified in other sections
  - 1. Acoustical ceilings.
  - 2. Painting.
  - 3. Electrical wiring, connections, and installation for remote control switches for electrically operated projected screens are specified in Division-16 sections.

#### 1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each model of projection screens required from a single manufacturer as complete units, including all necessary mounting hardware and accessories.
- B. Fire Performance Characteristics: Provide projection screen fabrics identical to those materials which have undergone testing and passed requirements for flame resistance as indicated below:
  - 1. NFPA 701 per small scale test.
  - 2. Federal Standard 191A/5903 for test method. FS GG-S-00172D(1) for flame resistance.
  - 3. Mildew Resistance: Provide mildew resistant screen fabrics as determined by Federal Standard 191A/5760.

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of screen indicated, information to include but not be limited to screen gain, image size, black drop if applicable, and any furnished options if applicable.
- B. Wiring Diagram: Submit manufacturer's wiring diagram for electrically operated units.
- C. Installation: Submit mounting details specific to each screen installation.

- D. Maintenance: Submit manufacturer's maintenance and care instructions.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screens until building is ready to be enclosed, other work within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.
- B. Protect screens from damage during delivery, handling, storage, and installation.

## PART 2 - PRODUCTS

### 2.1 ELECTRIC CEILING MOUNTED FRONT PROJECTION SCREEN (TYPE 1)

- A. General: Provide manufacturer's standard UL-listed and -marked units consisting of case, screen, motor, controls, mounting accessories and other components as required for a complete installation and complying with requirements indicated for screen surface, controls and for case, motor and screen under description of operation and type.
  - 1. Screen Material:
    - a. Comply with the following requirements for type of viewing surface:
      - 1) Completely seamless.
      - 2) Viewing surface - Provide screen surface with a gain of 1.3 unless otherwise indicated.
    - b. Each side of surface equipped with tab-guide cable system to maintain even lateral tension and hold surface flat. Bottom of surface supported and masked by black, extruded aluminum dowel weighted to apply proper vertical tension.
    - c. Edge Treatment: Tab tension. black masking borders.
  - 2. Image Size:
    - a. Size of image as indicated on schedule.
    - b. Provide extra black drop as required to locate image at elevation shown on screen schedule. This extra black drop amount needs to be calculated using the finished ceiling height dimension.
  - 3. Screen Controls:
    - a. Remote control operation of each screen as follows:
    - b. Provide One 3-Position 24 Volt Control Switch.
      - 1) Single Station Control: Low voltage control system for each screen consisting of a single control unit containing transformer for reducing 120 VAC electric power supply to 24 volts, pulse sequence relays, and multi button control stations of number and at locations indicated, with metal device boxes and cover plates for flush wall mounting.

4. Screen Motor:
  - a. Electrically operated 110-120V. AC, 60 Hz. 3-wire motor mounted inside screen roller, instantly reversible, lifetime lubricated with thermal overload protector and electric brake. Preset, accessible limit switches.
5. Screen Housing:
  - a. Units designed and fabricated for recessed installation and complying with the following requirements:
  - b. Roller: Roller is to be 3" diameter metal, mounted on rubber insulated supports.
  - c. Screen Case: Extruded aluminum. Bottom panels form slot for passage of viewing surface, easily removable for access to motor and viewing surface.
6. Acceptable Products:
  - a. Da-Lite Screen Company Tensioned Advantage Electrol w/ Single Motor Low Voltage Control System.
  - b. Draper.

## 2.2 Screen Schedule

Room	Image Size	Type	Quantity	Extra Drop
Team Theater	9'H x 16'W	1	1	Provide for bottom of image 42" A.F.F.

## EXECUTION

### 2.3 INSTALLATION

- A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.
- B. Install ceiling mounted projection screens with screen cases in position and relationship to adjoining work indicated, securely anchored to supporting structure, and in manner which produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when lowered. During screen travel, no objects shall impact or interfere with screen surface.
- C. Test electrically-operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition. Projection screens must be operated within three months of their delivery date from the manufacturer.
- D. Set limit switches to allow image height above the floor as noted in the screen schedule above.

## 2.4 PROTECTION AND CLEANING

- A. Protect projection screens after installation from damage during construction. If despite such protection, damage occurs, remove and replace damaged components or entire unit as required to restore units to their original, undamaged condition. END OF SECTION 111352

## SECTION 114000 – FOODSERVICE SPECIFICATION

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. The work referred to in these documents consists of furnishing all labor and materials required to provide and deliver all equipment hereinafter specified into the building, uncrate, assemble, hang, set in place, level, and completely install, exclusive of final utility connections.
- B. All existing equipment that is specified to be reused in this project, shall be the responsibility of the Kitchen Equipment Contractor who shall remove such equipment from job site, store, repair, refinish, clean, and then relocate in new location, level, assemble and hang as required. All disconnections and/or reconnection of the utilities serving such existing equipment whether is to be reused or not, shall also be the responsibility of General Contractor and/or sub-contractors and not the Kitchen Equipment Contractor.

#### 1.2 GENERAL CONDITIONS

- A. General Conditions of the Contract are hereby made a part of these specifications to the same extent as if bound herein. The General Conditions, including Modifications and Supplementary Conditions contained herein, shall become a part of the Contract and shall apply to all Contractors and Subcontractors.

#### 1.3 DEFINITIONS

- A. All references to the terms "Foodservice Equipment Contractor," "KEC", or "FSEC" in the specifications and drawings shall be defined to mean the Kitchen Equipment Contractor.
- B. All references to the term "Owner" in the specifications and drawings shall be defined to mean the Owner or Owner's designated representative and the Foodservice Equipment Consultant.
- C. All references to the term "Consultant" or "Foodservice Equipment Consultant" in the specifications and drawings shall be defined to mean The Bigelow Companies, Inc., its employees, and authorized representatives and is referred to throughout the contract documents as if singular in number and masculine in gender.
- D. The phrase "The KEC shall" or "by the KEC," as applicable, is understood to be included as a part of each sentence, paragraph, or article of these specifications unless otherwise indicated or specified.
- E. All references to the term "Architect" or "Rossetti" in the specifications and drawings shall be defined to mean Rossetti Architecture, its employees, and authorized representatives and is referred to throughout the contract documents as if singular in number and masculine in gender.

- F. All references to the terms "G.C." in the specifications and drawings shall be defined to mean the General Contractor.

#### 1.4 DESCRIPTION OF WORK

- A. Furnish all material and labor required to provide completely, deliver, and install all kitchen equipment as specified herein and shown on the contract drawings. This work shall be performed in such a manner as to complete the function for which it is designed. This work shall be in strict accordance with the plans and specifications with all dimensions field verified by the KEC prior to the fabrication of any equipment required to be furnished.
- B. Coordinate your work with the respective trades performing preparatory work for installation of equipment under this Contract, including, but not limited to: construction of pits, trenches, receptors, rough-in of supply, waste and vent piping, and electrical connections.
1. Supervise and inspect such preparatory work and determine that openings of adequate size will be provided to permit introduction of this equipment into the building and placing at designated locations.
  2. Comply with all Federal, State, and Municipal regulations which bear on the execution of this work.
  3. Supervise and inspect the services of the respective Mechanical and Electrical Contractors when disconnecting utility services to existing equipment and when reconnecting equipment being relocated and when connecting new equipment being supplied under this Contract.
  4. Secure and pay for all permits, licenses, inspections and tests required by any regulatory agency having jurisdiction. Supply to Owner, through Architect and Consultant, two copies of all certificates of compliance with inspections and tests required by such authorities.
  5. Coordinate the equipment work with the respective trades so that electrical and mechanical components built into the equipment will conform to type, materials, and characteristics of the building components.
  6. Install all heated, heat producing and motor-driven equipment so as to operate efficiently. Provide additional vents, guards, deflectors, and other accessories as needed at no additional cost. Note such additions or modifications on the shop drawings and bring to Architect's and Consultants attention by accompanying letter.
  7. Review field conditions to ensure placement of all motors and compressors have adequate air circulation to allow for peak efficient operation. Notify the General Contractor, Architect and Consultant immediately if placement must be altered to accomplish peak efficiency.
  8. Coordinate and show sizes, utilities, and other requirements as determined by physical inspection for equipment noted as existing to be reused. Include all costs for marking, removing, storing, fully cleaning, redelivering, and installing such equipment. All requirements within the project manual apply to reused equipment except warranty as if KEC furnished including but not limited to code compliance and accessories necessary to conform with the new application.
- C. Related work under this Contract shall not include the following items, unless otherwise shown or specified in the Contract Document:

1. Electrical services including wiring to and final connection of all foodservice equipment.
  2. Water, direct waste piping, gas, steam, and cooling water services to the fixtures including all shut-off valves, traps, and final connections to the fixtures except as otherwise specified.
  3. Exhaust duct work upstream from the exhaust hood collar, connection to the exhaust hood, the complete exhaust, make-up air and ventilation system, all switches, controls, interlocking devices, etc., necessary for complete and proper system operation, unless noted otherwise in item specifications.
  4. Adequate foundation below bases and floors to support the specific equipment when loaded.
  5. Masonry bases for the equipment.
  6. Flooring and quarry tile.
- D. Kitchen Equipment Contractor shall be allowed to quote upon a substitute and/or alternate herein, provided that the Kitchen Equipment Contractor:
1. Provides a list of substitutions and/or alternates on a separate sheet of paper, outlining them as either an addition or a deduction to the specific brand shown in the specifications.
  2. Provide complete construction details and/or brochure cut-sheets for every item the Kitchen Equipment Contractor wishes to substitute.
  3. Kitchen Equipment Contractor shall provide (for each item), on a separate sheet, a "side by side" comparison list that shall include but is not limited to:
    - a. Differences in Utility requirements, including wiring diagrams.
    - b. Differences in Features, such as, but not limited to: size, construction material and method, moving parts, electronic controls, door hinges and opening method, unit capacities, food production rates, introduction of heated and/or refrigerated air, listings with third party agencies, maintenance history and service agencies, etc....
    - c. Differences in performance standards.
  4. Upon request, Kitchen Equipment Contractor shall provide a list of customers, in similar facilities, using the equipment the Kitchen Equipment Contractor wishes to use as an alternate.
  5. Kitchen Equipment Contractor is solely responsible for any and all cost associated with the acceptance of any substitute or alternate piece of equipment.
    - a. Kitchen Equipment Contractor is required to submit a proposal based on the specified equipment herein along with any bid proposing substitutions and/or alternates. The Owner, Architect, and Foodservice Consultant reserve the right to accept or reject such substitute bids or particular items within a substitute bid. Should alternates be used in place of the originally specified equipment, the Kitchen Equipment Contractor shall assume the full cost and responsibility for the accuracy, design integrity, revised drawings, size differences and utility changes that may incur as a result of substituting items. If as a result of such changes, the originally specified item is required to be used after the approval of an alternate; the Kitchen Equipment Contractor shall provide the originally specified unit at no additional cost to the Owner and shall notify the Architect and Foodservice Consultant of the change.

- E. The specifications and drawings are complementary and what is called for by one shall be as binding as if called for by both. Contractor shall examine the plans and specifications to be fully satisfied as to the conditions of the project. No allowance shall be subsequently made to the contractor by reason of error on his part or oversight not called to the attention of the Foodservice Consultant. Any differences between these specification and drawings, including but not limited to, equipment shown on drawings, but not accounted for in the spec., shall be brought to the attention of the Foodservice Consultant. If any differences are not brought to the attention of the Foodservice Consultant, the Kitchen Equipment Contractor shall be responsible for providing all equipment to complete the intention of the drawings and foodservice specification at no additional cost to the Owner or Foodservice Consultant.

#### 1.5 PRODUCT HANDLING

- A. Equipment shall be delivered to the building fully protected, then assembled and set in place. All responsibility shall rest with the KEC for any damage or loss incurred prior to the final acceptance. Such items as may be lost or damaged shall immediately be replaced or repaired to a new condition to the complete satisfaction of and at no additional cost to the Owner.
- B. The KEC shall schedule his deliveries and movements upon the site to prevent delays in other contractor's work and shall coordinate all deliveries and on-site activities with the General Contractor. If required, KEC shall make arrangements to hold equipment in warehouse until delivery can be made to job site. Extra charges resulting from special handling or air shipment shall be paid by the KEC unless delays in ordering are the result of the Owner's actions.

#### 1.6 APPLICABLE CODES AND STANDARDS

- A. Except as otherwise indicated, each item of equipment shall comply with the latest current edition of the following standards as applicable to the manufacture, fabrication, and installation of the work in this section.
  - 1. NSF Standards: Comply with National Sanitation Foundation standards and criteria and provide NSF "Seal of Approval" on each manufactured item and on major items of custom-fabricated work.
  - 2. UL Standards: For electrical components and assemblies, provide either UL labeled products or, where no labeling service is available, provide a complete index of the components used as selected from the UL "Recognized Component Index."
  - 3. ANSI Standards: For gas-burning equipment, comply with ANSI Z21-series standards. Comply with ANSI B57.1 for compressed gas cylinder connections and with applicable standards of the Compressed Gas Association for water connection air gaps and vacuum breakers.
  - 4. AGA: All gas-fired equipment shall be AGA approved, equipped to operate on the type gas available at the job site, and shall contain 100% automatic safety shut-off devices.
  - 5. NFPA Standards: Comply with NFPA Bulletin 96 for exhaust systems and with NFPA 13, 17, and 96 for fire extinguishing systems.
  - 6. ASME Code: Comply with ASME boiler code requirements for steam-generating and steam-heated equipment; provide ASME inspection, stamps, and certification of registration with National Board.
  - 7. National Electrical Code: Comply with NFPA 70 "National Electrical Code" for electrical wiring and devices included with foodservice equipment.
  - 8. Comply with all authorities having jurisdiction over this type of equipment and/or installation.

9. Where specification and/or drawings require mechanical, electrical, or refrigeration work to be performed, such work shall be done in strict conformance to other portions of the Base Building Specifications which sets forth standards for this type of work.
10. City of El Segundo, CA, Building Code.

## 1.7 QUALITY ASSURANCE

- A. Standard Products: Materials, products, and equipment furnished under this contract shall be the standard items of manufacturers regularly engaged in the production of such materials, products, and equipment and shall be of the manufacturer's best quality latest design that complies with the specifications.
- B. Manufacturer's Qualifications: Manufacturers shall be regularly engaged in the production of the items furnished and shall have demonstrated the capability to furnish similar equipment that performs the functions specified or indicated herein.
- C. Contractor's Qualifications: shall be firms regularly engaged in contracting for food service installations. They shall have the technical personnel to handle all phases of the work. They shall be able to demonstrate their financial ability to handle this project to the Owner's satisfaction.
- D. Fabricators' Qualifications: shall be firms regularly engaged in the manufacture of the highest quality of custom built food service equipment and who has a complete factory with personnel and engineering facility to properly draw, detail and manufacture this equipment.

## 1.8 SUBMITTALS

- A. Upon award of Contract, the Kitchen Equipment Contractor shall furnish the Architect, Consultant and Owner with one full sized set of prints of the following drawings, in accordance with the approved project schedule, which shall be made on sheets equal in size and matching the bid set drawing size. CAD-generated computer data is available as an additional expense to the KEC. In the event the KEC chooses to use this data, he accepts all responsibility for its accuracy and will modify the resulting drawings to reflect accurately all current information. Reproduced copies of bid documents will not be accepted for this purpose in any fashion.
  1. All equipment specified for fabrication shall be detailed and fully dimensioned to minimum scale of 3/4" = 1'-0" for plan and elevation views, 1" = 1'-0" for sections and 3"=1'-0" for special details. These drawings will be reviewed and sepia's will be returned for correction. After approval this contractor shall print the number of prints as required for distribution.
  2. Prepare separate one (1) full sized set of electrical and mechanical dimensioned rough-in drawings at 1/4" = 1'-0" scale. These shall be "rough-in" plans not "point of connection" plans, showing exact point of penetration of floors, walls, and ceilings for all services required to operate the equipment that the KEC shall furnish. KEC shall also show exact point of connection to equipment not included in the Kitchen Equipment Contract, for example; existing equipment, soda dispensers, coffee and tea equipment, etc.. These drawings shall also show exact locations of final connection to equipment. Indicate floor drains, floor sink, receptacles, lights, and other special conditions as previously noted in the Foodservice Document Utility Requirement Plan. Include in these plans all utilities for any re-used existing equipment called for in specifications. After approval KEC shall print the number of prints as required for distribution.

3. Dimensioned drawings shall be submitted showing the location and size of all bases, depressions, special height walls, openings in walls for equipment, and critical dimensions, etc. All such drawings shall be drawn to a scale of not less than  $1/4" = 1'-0"$ .
- B. **Manufacturer's Data:** Upon award of the Contract, submit three (3) sets of bound copies of Manufacturers' Illustrations and Technical Data (cutsheets) to the Architect and Consultant for review prior to procurement. All items of Standard Manufacture shall be submitted, including items purchased to be built into fabricated equipment. Each illustration shall be marked to describe accurately the item number and quantity to be furnished as specified, including voltage, phase, load, finish, accessories, etc. The Architect will return one booklet for correction and produce a letter noting status of each item reviewed. Should the KEC require extra sets to be returned to him, the above quantity should be increased accordingly.
- C. **Manufacturers' List:** Submit in writing a list of all manufacturer's representatives of the foodservice equipment, such as convection ovens, ranges, etc., and their authorized service agencies' addresses and telephone numbers.
- D. **Foundation Data:** Data and drawings shall be submitted for each item, if any, requiring special foundations, structures, or supports. Such foundations, structures, or supports will be provided and installed by other appropriate trades in accordance with the drawings and specifications which shall be provided by the KEC and reviewed by the Consultant.
- E. **Operation and Maintenance Manuals:** As project close-out submittal, two (2) bound copies of operation, maintenance, and parts manuals shall be supplied for all equipment items of standard manufacture including standard component assemblies built into all custom-fabricated items. Each manual shall include product data sheets, wiring diagrams, parts list and service agency.
- F. **Review by the Architect, Consultant and Owner** of the drawings and brochures submitted by the KEC does not waive the responsibility of the KEC to furnish each item of equipment in complete compliance with the specifications and contract drawings.
- G. The final number of copies of all submittals shall be as determined by the Architect, Consultant and Owner.
- H. **Warranty: Refrigeration Service Policy** - All self-contained or remote refrigeration systems furnished under this contract shall include start-up, testing and temperature adjustment. Each system shall have a one (1)-year refrigeration service contract providing free service, 24 hours per day, seven days per week, including all parts and labor, refrigerant and mileage
  1. Hermetic or semi-hermetic compressors shall be covered by the manufacturer's factory warranty for an additional four years. All other equipment provided shall include one-year warranty covering parts and labor, plus any extended warranties as normally provided by individual manufacturers. All equipment including refrigeration systems both self-contained and remote shall be warranted by the Kitchen Equipment Contractor on the project for one year as indicated in the preceding sentence. The first day of the first year commences upon the date the equipment is accepted or partial occupancy by the Owner.
- I. **SAMPLES:** Samples of material, products, fabrication methods, and reworking of damaged areas or equipment shall be submitted for review upon request at no additional cost, before proceeding with the work.

## 1.9 JOB CONDITIONS

- A. Visit the job site to field check actual wall dimensions and rough-ins and be responsible for furnishing, fabricating, and installing the equipment in accordance with the available space and utility services as they exist on the job site. Fabricated equipment shall be built to fit out-of-square corners and to fit out-of-plumb walls.
- B. Check all door openings, passageways, elevators, etc., to be sure that the equipment can be conveyed to its proper location within the building and, if necessary, check with the General Contractor regarding the possibility of holding wall erection, placement of doorjambes, windows, etc., for the purpose of moving the equipment to its proper location. Any removal and rebuilding of walls, partitions, doorjambes, etc., necessary to place the equipment or, if caused by incorrect information on the KEC's drawings, shall be done at the expense of the KEC, at no additional cost to the Owner.
- C. Notify the Architect and Consultant of any discrepancies between plans and specifications and actual conditions on the job-site before fabrication of equipment.
- D. Physically check the location and utility size of all "rough-ins" at the job site for compatibility with the equipment being installed before finished floors, walls, and/or ceilings are in place. Should the rough-ins not agree with the previously submitted and approved dimensioned rough-in plans, then this contractor shall have the rough-in moved or notify the architect and consultant of the error.
- E. Ensure equipment accurately fits the space as it exists and conforms to actual field dimensions on the job-site. Any changes required after fabrication has been started shall be made at no additional cost to the Owner.
- F. Include the cost as part of the bid for this work of any special hoisting equipment and operators required.

## 1.10 MISCELLANEOUS

- A. Review all drawings pertaining to the food facilities and food facilities areas, including the utility load information on the foodservice documents. Provide all equipment in accordance with the requirements of these documents (i.e., voltage characteristics, KW loads, special valves, etc.). Provide all necessary appurtenances to accommodate plumbing, electrical, and refrigeration, etc., rough-in as shown on utility load information; for example, an S.R. (single receptacle) connection shown on the plan requires that the appropriate grounded cord and plug be provided to fit the receptacle as part of the equipment item to which the connection will be made.
- B. Where portions of an item pass through masonry, walls, or partitions, provide complete installation of the item, including trim, field welding, dimensions, and coordinate all other work being performed relative to the item being installed.
- C. All equipment, such as pass-through refrigerators and warmers, which pass through a wall where one side is exposed to the public view shall be provided and installed with the operating controls located on the kitchen or working side of the wall. All equipment such as coffee urns, which are located on or in a counter having a pick-up side and a working side, shall be provided and installed with the operating controls facing the working side of the counter.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The equipment and its component parts shall be new and unused unless specified by the consultant as re-using existing equipment. All items of standard manufactured equipment shall be current models at the time of delivery. All parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement, and repair.
- B. Means shall be provided to ensure adequate lubrication for all moving parts. All oil holes, grease fittings, and filler caps shall be accessible without the use of tools.
- C. Plastic nameplates, to identify controls on fabricated equipment and when specified elsewhere, shall be provided of two-ply, 1/16", rigid plastic material which shall be specifically manufactured for engraving such nameplates. The Finished nameplate shall be machine engraved with white letters on a black background and shall have edges beveled on a 45 degree angle. Nameplates shall be attached using adhesive recommended by the manufacturer of the engraving material.
- D. The design of the equipment shall be such as to provide for safe and convenient operation. Covers or other safety devices shall be provided for all items of equipment presenting safety hazards. Such guards or safety devices shall not present substantial interference to the operation of the equipment. All guards shall provide easy access to guarded parts.
- E. Trim shall not be an acceptable substitute for accuracy and neatness. When trim is required and accepted in lieu of rejection of items of equipment, it shall be the KEC's responsibility to provide same at no additional cost to the Owner.
- F. Unless otherwise specified herein, no material lighter than #20 gauge shall be incorporated into the work. All gauges for sheet iron and sheet steel shall be US Standard Gauges and finished equipment gauge thickness shall not vary more than 5% plus or minus from the thickness indicated below.

GAUGE	THICKNESS	GAUGE	THICKNESS
#10	.1406	#16	.0625
#12	.1094	#18	.0500
#14	.0781	#20	.0375

- G. Materials or work described in words which have a well-known and accepted technical or trade meaning shall be held to refer to such accepted meanings.

### 2.2 MATERIALS

- A. Submit a certified copy of the mill analysis of materials if requested by the Architect or Consultant.
- B. Stainless steel sheets shall conform to ASTM A240, Type 304 Condition A, 18-8, having a No. 4 finish. A No. 2B finish shall be acceptable on surfaces of equipment not exposed to view. All sheets shall be uniform throughout in color, finish, and appearance.

- C. Stainless steel tubing and pipe shall be Type 304, 18-8, having a No. 4 finish, and shall conform to either ASTM A213 if seamless or ASTM A249 if welded.
- D. Rolled shapes shall be of the cold-rolled type conforming to ASTM A36.
- E. Galvanizing shall be applied to rolled shapes in conformance with ASTM A123, coating designation G-90, and to sheets in conformance with ASTM A526, coating designation G-90.
- F. Galvanized steel sheets shall be cold-rolled, stretcher leveled, bonderized, and rerolled to ensure a smooth surface.
- G. Casting shall be corrosion-resisting metal containing not less than 30% nickel. All casting shall be rough ground, polished, and buffed to bright luster and free from pit marks, runs, checks, burrs, and other imperfections. In lieu of corrosion-resisting metal castings, die-stamped or cast 18-8 stainless steel will be acceptable.
- H. All millwork materials shall be free from defects impairing strength, durability, or appearance; straight and free from warpage; and of the best grade for their particular function.
- I. Install sealant, wherever required, for sealing backsplashes to walls, cabinet bodies to concrete or tile bases, roll-in refrigerators to floors, or other types of applications.

## 2.3 FINISHES

- A. Paint and coatings shall be of an NSF approved type suitable for use in conjunction with foodservice equipment. Such paint or coatings shall be durable, non-toxic, non-dusting, non-flaking, and mildew resistant; shall comply with all governing regulations; and shall be applied in accordance with the recommendations of the manufacturer.
- B. All exterior, galvanized parts, exposed members of framework, and wrought steel pipe where specified to be painted shall be cleaned, properly primed with rust-inhibiting primer, degreased, and finished with two (2) coats of epoxy-based gray hammertone paint, unless otherwise specified. The epoxy shall be in color to be selected, with sample submitted for approval before application.
- C. Stainless steel, where exposed, shall be polished to a #180 grit, or a No. 4 commercial finish. Where unexposed, finish shall be a No. 2B. The grain of the polishing shall run in the same direction wherever possible. Where surfaces are disturbed by the fabricating process, such surfaces shall be finished to match adjacent undisturbed surfaces.
- D. Galvanized Shelving shall not be painted.
- E. Fabricated equipment shall be spray coated with plastic suitable for protecting the equipment during transport and installation. The coating shall be easily removed after the equipment installation is complete at the work-site or, alternatively, when directed.
- F. Exposed Surfaces on brass, bronze, or steel shall be plated with chromium over nickel in accordance with Federal Specifications WW-P-541, Paragraph 9.5 and Table 9.4, unless otherwise specified.

## 2.4 FABRICATION

- A. All items of fabricated equipment shall be fabricated in the same factory and shall be similar in construction details, materials, methods, and appearance to similar types of items so fabricated under this contract.
- B. Each fabricated item of equipment shall include all necessary reinforcing, bracing, and welding with the proper number and spacing of uprights and cross members for strength. Wherever standard sheet size will permit, the tops of all tables, shelves, exterior panels of cabinet type fixtures, and all doors and drain boards shall be constructed of a single sheet of metal. Except where required to be removable, all flat surfaces shall be secured to vertical and horizontal bracing members by welding or other approved means to eliminate all buckle, warp, rattle, and wobble. All equipment not braced in a rigid manner and which is subject to rattle and wobble shall be unacceptable, and the KEC shall add additional bracing in an approved manner to achieve acceptance.
- C. Suitable pipe slots shall be provided on fabricated equipment, as required, to accommodate service and utility lines and mechanical connections. These slots shall be of proper size and shall be neatly made with turned up edges all around to eliminate cutting or defacing of equipment on the job. Cabinet bases shall be provided with an inner panel duct at the ends or rear of the cabinet allowing adequate space to conceal vertical piping. Such work, when performed at the job-site, shall be of the same quality as similar work performed in the shop.
- D. All exposed surfaces shall be free from bolts and screw heads. When bolts are required, they shall be of the concealed type and be of similar composition as the metal to which they are applied. Where bolt or screw threads on the interior of fixtures are visible or may come into contact with hands or wiping cloths, they shall be capped with stainless steel acorn nuts and stainless steel lock washers.
- E. Where screw threads are not visible or readily accessible, they shall be assembled with stainless steel lock washers and nuts. Wherever bolts or screws are welded to the underside of trim or tops, the reverse side of the weld shall be finished uniformly with the adjoining surfaces. Depressions at these points shall not be acceptable.
- F. Rivets shall not be permitted at any location.
- G. All welding shall be the heliarc method with welding rod of the same composition as the sheet or parts welded. Welds shall be complete, strong, and ductile with excess metal ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of mechanical imperfections such as gas holes, pits, cracks, etc., and shall be continuously welded so that the fixtures shall appear as one piece construction. Butt welds made by spot solder and finished by grinding shall not be acceptable.
  - 1. Spot welds shall have a maximum spacing of three (3) inches. Tack welds shall be of at least 1/4" length of welding material at a maximum space of four (4) inches on center. Weld spacing at the ends of the channel battens shall not exceed two inch centers.
  - 2. In no case shall soldering be considered as a replacement for welding, nor shall any soldering operation be done where dependence is placed on stability and strength of the joint.
  - 3. Fixtures shall be shop fabricated of one piece and shipped to the job-site completely assembled wherever possible. Equipment too large to transport or enter the building as one piece shall be constructed so that field joints can be welded at the job-site.

4. All exposed joints shall be ground flush with adjoining materials and finished to harmonize therewith. Whenever material has been sunk or depressed by welding operation, such depression shall be suitably hammered and panned flush with the adjoining surface and, if necessary, again ground to eliminate low spots. In all cases, the grain of rough grinding shall be removed by successive fine polishing operations.
  5. All unexposed welded joints on under shelving of tables of counters in stainless steel construction shall be suitably coated at the factory with an approved metallic-based paint.
  6. After galvanized steel members have been welded, all welds and areas where galvanizing has been damaged shall have a zinc dust coating applied in conformance with US. Government Military Specification Number MIL-P-26915.
- H. Butt joints and contact joints, wherever they occur, shall be close fitting and shall not require a filler. Wherever break bends occur, they shall be free of undue extrudence and shall not be flaky, scaly, or cracked in appearance of the material, all such marks shall be removed by grinding, polishing, and finishing to the original finish of the metal. Wherever sheared edges occur, they shall be free of burrs, fins, and irregular projections and all be finished to obviate all danger off cutting or laceration when the hand is drawn over them. In no case shall overlapping materials be acceptable where miters or bullnose corners occur.
- I. The grain of polishing shall run in the same direction on all horizontal and on all vertical surfaces of each item of fabricated equipment except in the case where the finish of the horizontal sections of each shall terminate in a mitered edge. Where sinks and adjacent drain boards are equipped with backsplash, the grain of polishing shall be consistent in direction throughout the length of the backsplash and sink compartment.
- J. Component parts, whether fabricated by the KEC or purchased for building into the fabricated equipment, shall conform to the following.
1. Bolts, screws, nuts, and washers shall be of steel, except where brass or stainless steel is fastened, in which case they shall be of brass or stainless steel, respectively. Where dissimilar metals are fastened, bolts, screws, nuts, and washers shall be of higher grade metal. The spacing and extent if bolts and screws shall be as to ensure suitable fastening and prevent buckling of the metals fastened.

## 2.5 MANUFACTURED EQUIPMENT

- A. If any item described in this specification becomes a discontinued item and the manufacturer builds an improved model of the item, the later model shall be provided at no additional cost.
- B. All Manufactured equipment that requires an electric supply shall be UL Listed and shall have the UL Label attached to the equipment.
- C. Dimensions and capacities of manufactured equipment are approximate only and are given to define the size or capacity required as nearly as possible.

## 2.6 ELECTRICAL AND MECHANICAL REQUIREMENTS

- A. Standard UL listed materials, devices, and components shall be selected and installed in accordance with NEMA Standards and Recommendations and as required for safe and efficient use and operation of the foodservice equipment without objectionable noise, vibration, and sanitation problems.

1. Provide recognized commercial grade signals, "on-off" push buttons or switches, and other speed and temperature controls as required for operation of each item, complete with pilot lights and permanent engraved, plastic laminate signs and graphics identifying each item. Provide stainless steel cover plates at controls and signals.
2. Each item requiring electrical power shall be equipped with either a safety disconnect switch (for hard wired connections) or with cord and plug for interruptable connection. Provide NEMA Standard grounding-type plugs, as needed.
3. Furnish all foodservice equipment completely wired internally using wire and conduit suitable for a wet location, including a separate grounding wire. Where an Electrician's services are required, the work shall be done in the KEC's factory or at his expense at the job-site at no additional cost to the Owner. Provide all electrical outlets and receptacles required to be mounted on or in fabricated equipment and interconnect to a suitable terminal box (subpanel, starter, or disconnect switch if so specified) with all wires neatly tagged showing item number, voltage characteristics, and load information. Final connection will be made by the Electrical Contractor.
4. The Electrical Contractor will provide three- or four-wire, grounding-type receptacles for all wall- and floor-mounted outlets to be used for plug-in equipment with characteristics as noted on the drawings. Provide Hubbell Three-wire or four-wire grounding-type connectors and neoprene cords installed on each item of plug-in equipment. Coordinate the work with the Electrical Contractor so that the receptacle provided will match the specific plugs provided as part of the plug-in equipment. Any changes in cords and plugs required in the field due to lack of coordination between the Electrical Contractor and KEC shall be the latter's responsibility. Reduce the length of all cords furnished with the specified equipment to a suitable or appropriate length and so they do not interfere with other equipment or operations.
5. All electrically heated equipment shall be internally wired to a thermostatic control and an "on-off" red indicator light, which shall be mounted in a terminal box on a removable stainless steel access panel.
6. Only rigid steel zinc-coated conduit shall be used. All wiring shall be run concealed where possible.
7. Provide on or for each motor-driven appliance or electrical heating or control unit, a suitable control switch or starter of the proper type and rating and in accordance with Underwriters Code wherever such equipment is not built in. All other line switches, safety cut-outs, control panels, fuse boxes, other control fittings, and connections, when not an integral part of the unit or furnished loose by the equipment manufacturer will be furnished and installed by the Electrical Contractor unless otherwise specified. All electrical controls, switched, or devices provided loose for field installation as a part of the item specified shall be installed in the field by the KEC unless otherwise specified.
8. All equipment furnished under this contract shall be so wired, wound, or constructed so as to conform with the characteristics of electrical and other services at the job-site.
9. Appliances shall be furnished complete with motors, driving mechanism, starters, and controllers, including master switches, timers, cut-off, reversing mechanism, and other electrical equipment if and as applicable. Wiring and connection diagrams shall be furnished with electrically operated machines and for all electrically wired fabricated equipment.
10. Appliances shall be of rigid construction, free from objectionable vibration. Quietness of operation of all foodservice equipment is a requirement. Remove or repair any equipment producing objectionable noise and/or vibration as directed.

11. Motors shall be of the drip-proof, splash-proof, or totally enclosed type, having a continuous duty cycle and ball bearing, except small timing motors which may have sleeve bearings. All motors shall have windings impregnated to resist moisture. Motors located where subject to deposits of dust, lint, or other similar matter from a machine on which installed shall be of the totally enclosed type. Motors shall have ample power to operate the machine for which designated under full load operating conditions without exceeding their nameplate rating. Horsepower requirements on driven equipment shall be determined by the manufacturer based on normal operation at maximum capacity. The nominal rated motor horsepower shall be not less than the horsepower required for normal operation of the equipment at maximum capacity. Insulation shall be NEMA Class B, or better.
  12. Cover plates shall be furnished and installed for all electrical outlets, receptacles, switches, etc., furnished by the KEC and shall match the material and finish of the equipment to which they will be fastened.
  13. All switches, controls, etc., shall be conspicuously labeled as to use with plastic nameplates secured to the adjacent surface as previously specified in Article 2.01-C. Submit a sample for approval.
  14. Where specified for custom fabricated equipment, provide compartment with electrical sub-panel which shall be pre-wired in conduit concealed in cabinet body construction and connected to all electrical components built into of set upon the counter. Electrical sub-panel shall be UL listed, 3-phase, 4-wire circuit breaker type with a ground buss main breaker and individual breakers for each serviced load. All buss shall be copper and the circuit breakers shall be the molded case, bolt-on type with thermomagnetic quick-make, quick-break trip. Multi-pole circuit breakers shall have an internal trip bar. The circuit breakers shall have an interrupting capacity of 10,000 amperes at 120 volts and there shall be a separate breaker for each connected load. Each breaker shall be sized for 125% of the connected load and a minimum of two (2) extra, single pole, 20 amp circuit breakers shall be provided. The loads shall be connected through the breakers in a phased sequence to balance the load on each phase. Main connection to the panel shall be made by the electrical Trade Contractor at the job-site after the equipment is installed.
  15. Where Electrical Equipment Schedules indicate Connection Type as E.C. (Electrical Connection), Kitchen Equipment Contractor to provide electrical disconnecting means. Means may be provided by a cord, plug, and receptacle or wall/equipment mounted disconnect switch. Disconnecting means must have rating equal to or greater than amperage of circuit serving equipment.
- B. Water inlets shall be located above the positive water level where possible to prevent siphoning of liquids into the water supply system. Where conditions shall require a submerged inlet, a suitable type of check valve (except in jurisdictions where check valves are prohibited) and vacuum breaker shall be provided with the fixture to prevent siphoning. Where vacuum breaker piping is through equipment, provide chrome-plated escutcheon plates to cover holes.
1. Provide and install indirect waste lines from equipment which will discharge into floor drains or safe wastes. Extend to a point at least 1" (or as required by local or state code) above the rim of the floor drain, cut bottom on 45-degree angle and secure in position.
  2. All horizontal piping lines shall be run at the highest possible elevation and not less than 6" above the finished floor, through equipment where possible.
  3. No exposed piping in or around fixtures or in other conspicuous places shall show tool marks or more than one thread at the fitting.
  4. All steam operating valves on or in fabricated and purchased foodservice equipment shall be provided with composition hand wheels, which shall remain reasonably cool in during operation.

5. Provide suitable pressure-reducing valves for all equipment with such components that might reasonably be expected to be affected over a period of time by adverse pressure conditions, including but not limited to dishwashers, booster heaters, coffee urns, steam boilers, gas range, convention ovens, etc.
  6. Provide all safety devices that will shut-off gas in case of fire or in the event that the pilot light has been extinguished.
- C. Provide and install complete refrigeration systems; charged, started, and operating properly; including, but not limited to: compressors, condensers, racks, coils, vibration eliminators, sight glasses (moisture indicating type), expansion valves, filters, oil separators, thermostats, defrost time clocks, all controls and control wiring, liquid line dryers, piping, and refrigeration grade copper approved equal silver solder (with as few joints as possible.)
1. Where specifications call for pre-piped lines (i.e., from a fixture to a valve compartment, etc.), provide such work in strict conformance with other sections of the specifications which set forth standards for this type of work or in conformity with the requirements of the Board of Fire Underwriters or ASHRAE Standards, whichever is the greater.
  2. All mechanically refrigerated cold pans shall have a normally closed liquid line electric solenoid valve installed before the expansion valve and wired to a silent-type toggle switch complete with an "on-off" red indicator light and both mounted in a terminal box on a removable access panel. This switch shall be fed by a separate control circuit and shall not be wired into the compressor circuit so that it shall stop the flow of refrigerant to the cold pan and not turn off the compressor. The compressor shall then pump down and turn off through the action of the pressure control.
  3. Each refrigeration item specification is written to provide minimum specifications and scope of work. All refrigeration equipment shall be designed and installed to maintain the following general temperatures unless otherwise specified.
- |               |                    |                       |
|---------------|--------------------|-----------------------|
| Type          | Refrigerators      | Freezers              |
| Walk-in       | 35 deg F/1.7 deg C | -10 deg F/-23.3 deg C |
| Reach-in      | 35 deg F/1.7 deg C | -10 deg F/-23.3 deg C |
| Under counter | 35 deg F/1.7 deg C | -10 deg F/-23.3 deg C |
| Cold Pans     |                    | 0 deg F/-17.8 deg C   |
| Work Rooms    |                    | 50 deg F/ 10 deg C    |
4. Provide (including payment if subcontracted) all electrical and refrigeration components needed by the completed systems and complete (or have completed by the respective trades) all connections of and to said components.
  5. An evaporator coil defrost system shall be provided and installed by the KEC on all walk-ins refrigerator and freezer rooms where the refrigeration systems are designed to operate at room temperature of less than 35 degrees. Fan guards shall be supplied and shall be OSHA approved.
  6. Verify the requirements of and provide any or all additional refrigeration specially(s) or component (s) required or recommended by the manufacturer for proper operation under the specific operating conditions and location of each system specified.
  7. Verify and provide manufacturer's certification (or certification by manufacturer's authorized agent) that the equipment selection hereinafter specified for each refrigeration system is properly sized and shall meet the operating requirements set fourth for each system regarding maintaining specified operating temperature, hours of compressor running time, and system pressures and velocities as recommended by the equipment manufacturer (s).
  8. All refrigeration systems shall be installed and wired in strict conformance with the manufacturer's instructions and recommendations.

9. Hang the blower coils per manufacturer's recommendation at the location as shown on the drawings. Unit shall be mounted sloping such that the drain pans are completely pitched to the drain lines. The coils shall be hung using nylon bolts or other approved non-conductive, non-corrosive fasteners. Coils shall be installed 4" from the interior walk-in ceiling. The KEC shall furnish No. 12 gauge galvanized steel fish plates of suitable size and shape on the exterior ceiling of the walk-in to spread the weight of the coils adequately. The coils shall be connected to the condensing unit and the installation shall constitute a complete working system capable of maintaining the interior temperatures specified regardless of the heavy usage the walk-in units may receive.
10. Furnish and install a minimum of 1" O. D copper tubing drain line from each coil outlet to a point 1" above the floor drain. Drain lines shall be trapped immediately above the floor drain. The freezer drain line shall be wrapped with a continuous electrified heater tape and satisfactorily insulated, which shall be furnished as part of the refrigeration system contract.
11. Refrigeration tubing shall be Type L, ACR nitrogen filled, hard drawn degreased, sealed copper and shall be installed with horizontal runs slopped 1" per 20 feet toward the condensing units. All refrigerant piping shall be properly supported by adjustable hangers spaced and adjusted to the drop required. The evaporator housing shall protect the refrigerant piping against damage. Where vertical runs of more than 5'-0" occur in the suction line, the risers shall be trapped at the bottom. Piping is to be installed so that refrigerant or oil cannot drain back into the coils from the suction line.
12. All suction and refrigerant lines shall be installed with minimum 1/2" Armstrong Armaflex or equal cellular type insulation. Metal pipe sleeves shall be provided where piping passes through a wall, ceiling, or floor. Space around the tubing shall be filled with mastic insulating compound. All insulation that is outdoors and exposed shall be covered completely with plastic sleeving and secured and sealed in place. Install a permanent suction line filter in each compressor suction line with pressure fitting ahead of the filter to facilitate checking of pressure drop through the filter.
13. Furnish and completely install a thermostat to control the refrigeration temperatures for each individual compartment. The Electrical Contractor shall interconnect the blower coils with the condensing unit.
14. The condensing units shall be factory assembled, piped and tested and shall be mounted on a welded steel rack. Units shall include a semi-hermetic motor compressor with built in thermal overload, suction and discharge stop valves, oil sight glass and suction and discharge line vibration isolators as required. Each condensing unit shall have a factory mounted, pre-wired control panel/disconnect switch complete with circuit breakers, contactors, and time clocks as required. The Electrical Contractor shall provide and install the main power to each disconnect (s). Electrical Contractor shall also interwire power from the freezer condensing unit to the freezer blower coil. Control and thermostat wiring shall be the responsibility of the KEC contract, not the responsibility of the Electrical Contractor.
15. The KEC shall be responsible during check out and initial operation to make sure that:
  - a. All controls are properly adjusted, including refrigeration circuits, room air temperature controls, etc.
  - b. All condensers carry an overload protector.
  - c. That a competent service mechanic is available during the first eight (8) hours of operation.
  - d. That all switches, starters, and controls are identified as to function.

16. The refrigeration systems shall be furnished with a one-year refrigeration service contract, covering all parts and labor, with service available seven days per week, 24 hours a day. Continuation of the service contract after the first year shall be at the option of the Owner. The refrigeration system shall be warranted for one year and the compressors shall carry the manufacturer's extended five-year warranty.
17. Furnish four (4) copies of complete remote refrigeration system control wiring and piping diagrams. One (1) copy shall be framed in Plexiglas and mounted at the compressor location.
18. Unless otherwise specified, all thermometers for walk-in units will be furnished with suitable length armored capillary tubes to allow the sensing bulb to be installed in the incoming air stream to the blower coil with all runs fastened to the walk-in walls to prevent it from damage. This identical requirement applies to alarm systems when specified.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Begin installing the equipment at the time the building is ready to receive the equipment.
- B. Provide a competent foreman or supervisor for erection of equipment and to coordinate with other trades regarding connections, installation, and inspection. The KEC shall also coordinate his delivery schedule with the General Contractor to ensure adequate openings in the building to receive the equipment.
- C. KEC to set each item of non-mobile and non-portable equipment securely in place, level, and adjust to correct height. Where required, anchor equipment to supporting substrate or to floor and wall for use without shifting and dislocation. Where equipment is indicated to be anchored to floor, provide legs with adjustable flange foot. Conceal anchorage where possible. Adjust countertops and other work surfaces to level tolerance of 1/16" maximum offset.
- D. All refrigeration work where applicable to this Contract shall be accomplished in an approved manner, using first quality fittings, controls, valves, etc. Refrigeration items shall be started up, tested, adjusted, and turned over to the Owner in first class condition and left operating in accordance with the manufacturer's specifications. Refrigeration lines and hook-up shall be by the KEC.
- E. All equipment that rests on masonry bases shall be set level onto a bed of silicone rubber sealant, and securely affixed to the base.
- F. All equipment that butts to a wall or against other equipment shall be sealed with silicone rubber sealant. Trim strips or other items requiring fasteners shall be set in a bed of silicone rubber sealant and fastened with suitable stainless steel fasteners 48" or less on centers. Prior to the application of sealant, all surfaces shall be thoroughly cleaned and degreased. The adhesive sealant shall be one part mildew resistant silicone in either clear or an approved color.
- G. Install and interconnect, when necessary, all electrical controls, switches, or other units which are separately furnished for field installation in or on equipment provided, unless otherwise specified.
- H. Every precaution against injuries to persons or damage to property shall be taken by the KEC at his own expense.

- I. Store all apparatus, materials, supplies, and equipment in an orderly fashion at the job-site so as not to interfere unduly with the progress of his work or of any other Contractor (s).
- J. Do not place or allow to be placed upon the work or any part thereof such loads as are inconsistent with the safety of that portion of the work.
- K. All cutting, fitting, or patching required during installation shall be accomplished by the KEC, at his own expense, so as to make the work conform to the plans and specifications. The KEC shall not cut or otherwise alter, except with the consent of the General Contractor, the work of any other Contractor.

### 3.2 START-UP AND TESTING

- A. Supply a factory authorized service agent who shall start up all equipment, test, and make adjustments as necessary, resulting in each item of equipment performing in accordance with the manufacturer's specifications. Test each item of equipment for balance and adjusted for pressure, voltage and similar considerations. Check for proper functioning of controls and safety devices. Kitchen Equipment Contractor shall provide written confirmation of the service agent's visit and testing of equipment. Service agent shall be required to leave a tag in a visible location on each piece of equipment, that notifies the Owner on who to call for future service requirements.
- B. All gas-fired equipment shall be checked by local gas company as to calibration, air adjustment, etc., and adjustments made as required. Do not operate steam lines until they have been cleaned and treated for sanitation. The KEC shall arrange and coordinate such visit.
- C. After each piece of equipment has been started-up and tested by an authorized service agent; the Kitchen Equipment Contractor shall schedule a demonstration of equipment for the Owner's personnel.

### 3.3 CLEAN-UP

- A. After completion of the installation, remove protective coverings, clean up, lubricate, and adjust where necessary all items of equipment and turn them over to the Owner in first-class condition.
  - 1. Where stainless steel surfaces are disturbed by the installation of fabricating process, such surfaces shall be and finished to match adjoining undisturbed surfaces.
  - 2. At the completion of the installation work, all stainless steel finishes shall be gone over with a portable polishing machine and buffed to perfect surface. All painted surfaces shall be carefully gone over and retouched as required.
- B. Frequently clean up all refuse, rubbish, scrap materials, and debris caused by the operations, to the end that at all times the site of work shall present a neat, orderly, and workmanlike appearance.
- C. Before final payment remove all surplus materials, false work, temporary structures, including foundations thereof and debris of every nature resulting from his operations, and shall put the site in a neat, orderly, and broom-clean condition for Owner's sanitizing procedures prior to use.

### 3.4 OPERATION INSTRUCTIONS AND WARRANTIES

- A. Arrange for demonstrations and instructions for operating the equipment as requested. Schedule training with Owners representative; provide at least 7-day notice to Owners representative of training date. Furnish to the Consultant, for Owner use instructions and service manuals for all items of equipment that are mechanically operated or that require periodic service, in accordance with Article 1.08E, herein. Furnish to the Owner, certificate (s) of warranty for all items of equipment provided, in accordance with Article 1.08H, herein.

## PART 4 - EQUIPMENT SPECIFICATIONS

### 4.1 EQUIPMENT SPECIFICATIONS

- A. All items listed on the contract drawings under the heading "Foodservice Equipment Schedule" shall be furnished in strict accordance with the foregoing specifications and with the following detailed item specifications.
- B. Kitchen Equipment Contractor to provide accessories, features, and options indicated for to the specified item. Utilities as shown on utility schedule are as required per the following specified equipment. Insure that utilities requirements for approved selected equipment as listed as acceptable alternate or otherwise approved substitution per instruction included in other section of the General Specifications are provided accurately on rough-in drawings. Coordinate with all trades mechanical and electrical requirements for all approved equipment. All approved equipment must comply with all dimensional constraints.
- C. Provide rough-in drawings for all foodservice areas including future and NIKEC equipment.
- D. Provide matching exterior finish and material (aluminum or stainless steel) trim strips and enclosure panels as required to adjacent walls and ceilings for all walk-in coolers, freezers and exhaust ventilators.
- E. Approved exhaust ventilators must equal specified pre-engineered ventilator requirements, including but not limited to , CFM air volume, duct connections, static pressure, etc. Refer to item B above.
- F. Kitchen Equipment Contractor to provide PRV (Pressure Reducing Valves) for foodservice equipment between rough-in utility location and point of connection to kitchen foodservice equipment as required. KEC shall provide Back Flow preventor valves if required.
- G. KEC shall ensure all walk-in cooler/freezer or step-in cooler/freezer refrigeration systems are provided with R404a refrigerant and/or shall conform to all current laws and use an ozone safe refrigerant, and where refrigeration systems are located above walk-in/step-in within ceiling space, refrigeration condenser must be plenum rated.
- H. KEC shall ensure that all custom fabricated work tables, work counters, shelves and sinks other than millwork items are to be applied with 1/16" thick coat of sound deadening material secured to underside.
- I. KEC shall ensure that all compartment sink units are to have cantilevered drain boards, except as shown in Elevation and/or where drain boards exceed 36" in length.

J. All quantities shall be as shown on the foodservice plans.

ITEM 2.028 - ICED TEA BREWER (1 REQ'D)

SIS No: \*B098

Bunn-O-Matic Model ITCB-DV-0000

35700.0000 ITCB-DV Infusion Series® Tea/Coffee Brewer, dual voltage, 3 or 5 gallon capacity single brewer, 29" trunk with overlays, full/half batch switches, BrewWISE® intelligence with pre-infusion & pulse brew, Energy-saver mode, English/Spanish alphanumeric & advertising display, brew counter, brews into BUNN tea dispensers brews into TD4, TD4T, TDS-3, TDS-3.5, TDO-4, TDO-5, TDO-N-3.5 & TDO-N-4 (sold separately) & 1.9 to 3.8 litre airpots, 120v, 120/208v, 120/240v/60/1-ph, 1700/2650/3500 watts, 14.0/13.0/15.0 amps, UL, NSF  
N.I.K.E.C. (BY PURVEYOR)

ITEM 4.082 - RESTAURANT RANGE, GAS, GRIDDLE TOP (1 REQ'D)

SIS No: \*B098

Southbend Model 436A-3T

Ultimate Restaurant Range, gas, 36" griddle, thermostatic controls, standing pilot, (1) convection oven with battery spark ignition, includes (3) racks, 22-1/2" flue riser with shelf, stainless steel front, sides, shelf & 6" adjustable legs, 96,000 BTU, CSA, NSF1 ea Standard one year limited warranty (range)

1 EA NOTE: 22.5" high flue riser, with heavy duty shelf, standard

1 EA Natural Gas

1 EA 115v/60/1-ph, 5.9 amps, 6'cord & plug, per oven

1 EA Casters, 2 locking & 2 standard, in lieu of legs

1 EA Standard two year limited warranty (broiler/cheesemelter)

1 EA 3/4" quick disconnect with 5' hose

1 EA Model 1176867 Restraining device kit

ITEM 4.084 - RESTAURANT RANGE, GAS, CHARBROILER TOP (1 REQ'D)

SIS No: \*B098

Southbend Model 436C-3C

Ultimate Restaurant Range, gas, 36" charbroiler, (1) cabinet base, 22-1/2" flue riser with heavy duty shelf, stainless steel front, sides and shelf, 6" adjustable legs, 96,000 BTU, CSA, NSF

1 EA Standard one year limited warranty (range)

1 EA NOTE: 22.5" high flue riser, with heavy duty shelf, standard

1 EA Natural Gas

1 EA Open cabinet base without doors is standard

1 EA Casters, 2 locking & 2 standard, in lieu of legs

1 EA 3/4" quick disconnect with 5' hose

1 EA Model 1176867 Restraining device kit

ITEM 4.088 - RESTAURANT RANGE, GAS, 6-BURNER TOP (1 REQ'D)

SIS No: \*B098

Southbend Model 4361A

Ultimate Restaurant Range, gas, 36", (6) non-clog burners with standard grates, convection oven base, standing pilot, 22-1/2" flue riser with heavy duty shelf, stainless steel front, sides and shelf, 6" adjustable legs, 230,000 BTU, CSA, NSF

1 EA Standard one year limited warranty (range)

1 EA NOTE: 22.5" high flue riser, with heavy duty shelf, standard

1 EA Natural Gas

1 EA 115v/60/1-ph, 5.9 amps, 6'cord & plug, per oven

1 EA Casters, 2 locking & 2 standard, in lieu of legs

1 EA 3/4" quick disconnect with 5' hose

1 EA Model 1176867 Restraining device kit

1 EA Provide Model P36-RAD Platinum Compact Radiant Broiler Sectional Mount, Gas, 36", dual valve

control, counter balanced rack system, stainless steel front & sides, 40,000 BTU with all mounts and interconnections as needed.

ITEM 4.174 - COOKING SYSTEM, INDUCTION HEAT (1 REQ'D)

SIS No: \*B098

Spring USA Model ICB234-26

MAX Induction Cooking System, built-in, (2) 2600 watt ranges, (1) AF350 induction air filter, black smoke-glass tempered cook top, digital LED power/temp display, cook/temp indicator lights, integrated power management system, individual SmartScan® controls, stainless steel, 208/220v/50• 60/1• ph, 27 amps, 5.55 kW, NEMA 14• 50P, FCC, cETLus, UL Sanitation, NSF

1 EA Model PWP Premium Warranty Program is Available (Contact the Spring USA Corporate Office for Terms & Costs)

ITEM 6.005 - CAN OPENER, MANUAL (1 REQ'D)

SIS No: \*B098

Nemco Model 56050-1

CanPRO® Can Opener, compact, permanent, cuts from the side, along the lid's outer seam, gearless drive, holds up to #10 cans, stainless steel & aluminum nickel-plated construction, NSF

ITEM 6.009 - FOOD PROCESSOR (1 REQ'D)

SIS No: \*B098

Robot Coupe Model R301 ULTRA B

D Series Cutter/Mixer, 3-1/2 qt. stainless steel bowl with handle and see-thru lid, "S" blade with smooth edges, on/off and pulse switch, single speed, 1725 RPM, 120v/60/1-ph, 9 amps, 1-1/2 HP, ETL electrical and sanitation, cETL

1 EA 1 year parts & labor warranty

1 EA Model R255 Plate Rack, fits R101 series, R2 series, R301 series, R401, R402V, R4N, R6N, R6VN, CL50D, CL50D Ultra, CL52D, CL55D, CL60D

ITEM 6.017 - SLICER, FOOD (1 REQ'D)

SIS No: \*B098

Globe Model 3975N

Premium Slicer, automatic, 9• speed, 20 to 60 strokes per minute, 13" diameter hardened steel alloy knife, gear-driven knife system, PreciseEdge knife, no-drip base with Marine edge, 2° angled drip groove on slice table, knife ring guard with removable deflector, knife cover interlock, and dual gear slice-thickness adjustment, carriage angle 45°, 12" long food chute carriage, lift lever, no voltage release, laminated wall chart included, stainless steel construction, 1/2 HP, 115v/60/1• ph, 7.0amps, ETLus, NSF/ANSI 8• 2010 (made in USA)

1 EA 1 year labor warranty from date of original installation (not to exceed 18 months from factory shipment)

1 EA 2 year parts warranty (excludes wear/expendable parts)

1 EA 15 year drive gears warranty (see Warranty Sheet for complete details)

ITEM 6.020 - MIXER, COUNTER, 20 QT (1 REQ'D)

SIS No: \*B098

Globe Model SP20

Planetary Mixer, 20 qt., bench model, 3 fixed-speed, #12 hub, includes: removable stainless steel bowl guard with built-in ingredient chute, 20 qt. stainless steel bowl, aluminum spiral dough hook, stainless steel whip & aluminum beater, cast iron body & bowl lift, gear driven high torque transmission, digital controls with 60 minute timer, non-slip rubber feet, 6 ft cord & plug, 1/2 HP, 115v/60/1-ph, 6 amps, NEMA 5-15P, NSF, cETLus

ITEM 10.011 - COMPUTER (1 REQ'D)

SIS No: \*B098

N.I.K.E.C. (BY OPERATOR)

ITEM 10.013 - DESK WITH CHAIR (1 REQ'D)

SIS No: \*B098

N.I.K.E.C. (BY OPERATOR)

ITEM 10.031 - TRASH CAN (WITH DOLLY) (2 REQ'D)

SIS No: \*B098

Continental Refrigerator Model 1RE-SS

BRUTE® Container, without lid, 55 gallon, 26-1/2"D x 33"H, round, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray

1 EA BRUTE® Container Lid, 26-3/4"D x 2"H, heavy duty plastic, gray

1 EA BRUTE® Dolly, 18-1/4"D x 6-5/8"H, heavy duty 3" casters, 250 lb. capacity, for 2620, 2632, 2643, 2655 black

ITEM 12.081 - REACH-IN REFRIGERATOR (2 REQ'D)

SIS No: \*B098

Continental Refrigerator Model 1RE-SS

Wide Refrigerator, reach-in, 28-1/2" wide one-section, self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, wide full-height solid doors, exterior dial-type thermometer, electric condensate evaporator, 5" casters, 1/4 hp

1 EA Standard warranty (for the United States & Canada Only): 3 year parts and labor

1 EA 115v/60/1, 6.9 amps, NEMA 5-15P, standard

1 EA Refrigerator: Self-Contained refrigeration, 1/4 hp, standard

1 EA Compressor warranty: 5 year compressor (self-contained units only)

1 EA Door hinged on right, standard

1 EA 5" Casters, standard

ITEM 12.082 - REACH-IN FREEZER (1 REQ'D)

SIS No: \*B098

Continental Refrigerator Model 2FE-SS

Wide Freezer, reach-in, 57" wide two-section, self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, wide full-height solid doors, exterior dial-type thermometer, electric condensate evaporator, 5" casters, 1/2 hp

1 EA Standard warranty (for the United States & Canada Only): 3 year parts and labor

1 EA 115v/60/1, 10.0 amps, NEMA 5-15P, standard

1 EA Freezer: Self-Contained refrigeration, 1/2 hp, standard

1 EA Compressor warranty: 5 year compressor (self-contained units only)

1 EA Left Door hinged on left & right door hinged on right, standard

1 EA 5" Casters, standard

ITEM 12.083 - REACH-IN REFRIGERATOR (1 REQ'D)

SIS No: \*B098

Continental Refrigerator Model 2RE-SS

Wide Refrigerator, reach-in, 57" wide two-section, self-contained refrigeration, stainless steel exterior & interior, standard depth cabinet, wide full-height doors, with exterior dial-type thermometer, electric condensate evaporator, 5" casters, 1/3 hp

1 EA Standard warranty (for the United States & Canada Only): 3 year parts and labor

1 EA 115v/60/1, 6.5 amps, NEMA 5-15P, standard

1 EA Freezer: Self-Contained refrigeration, 1/3 hp, standard

1 EA Compressor warranty: 5 year compressor (self-contained units only)

1 EA Left Door hinged on left & right door hinged on right, standard

1 EA 5" Casters, standard

ITEM 12.120 - RESIDENTIAL REFRIGERATOR/FREEZER (2 REQ'D)

SIS No: \*B098

Sub Zero Model BI-36UG/S

\*Stainless Steel finish needs to be verified with Architect.

ITEM 13.096 - WALL MOUNTED POT SINK SYSTEM (1 REQ'D)

SIS No: \*B098

Metro Model POT SINK SYSTEM

Smart Wall Custom Assembly See FS200 for installation details

2 EA SmartWall G3 Wall Track, 40", 12 gauge steel, Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protection; includes hardware to join the track to another

4 EA SmartWall G3 Upright, 30", Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protection, slots for grids/shelf supports at 1-1/2" increments; 17 slots total; sold by the piece

8 EA SmartWall G3 Shelf Support, single, for 14" deep shelf, Metroseal 3 epoxy with Microban antimicrobial product protection, actual dimensions (DxWxH 16-9/16" x 1-1/2" x 8-3/16"); compatible with Super Erecta® wire and solid shelves, MetroMax Q, and MetroMax i; two required per shelf

1 EA SmartWall G3 Wire Grid, 18" x 36", Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protection; brackets not included

4 EA Super Erecta® Shelf, wire, 14" W, 36" L, plastic split sleeves are included in each carton, Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protection, NSF

5 EA SmartWall G3 Large Utensil Holder, 10-3/8"W x 10-1/2"D, Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protectionepoxy finish

5 EA SmartWall G3 Small Utensil Holder, 10-3/8"W x 4-3/8"D, Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protection

2 EA SmartWall G3 Storage Basket, 13-3/8"W x 5"D x 7"H, Metroseal 3 epoxy coated corrosion-resistant finish with Microban®antimicrobial protection

1 EA SmartWall G3 Light-Duty Grid Shelf, 18-1/2"W x 9"D, Metroseal 3 epoxy coated corrosion-resistant finish with Microban® antimicrobial protection

ITEM 13.141 - SHELVING UNIT, WIRE 5-TIER, 30" X 24" (1 REQ'D)

SIS No: \*B098

Eagle Group Model S5-74-2430E

Starter Shelving Units, (5) 24"W x 30"L wire shelves with patented QuadTruss® design, (4) 74" post, EAGLEgard® green epoxy finish with MICROGARD® antimicrobial protection, NSF. Provide Casters with Unit.

ITEM 13.143 - SHELVING UNIT, WIRE 4-TIER, 42" X 24" (7 REQ'D)

SIS No: \*B098

Eagle Group Model S5-74-2442E

Starter Shelving Units, (5) 24"W x 42"L wire shelves with patented QuadTruss® design, (4) 74" post, EAGLEgard® green epoxy finish with MICROGARD® antimicrobial protection, NSF Provide Casters with Unit.

ITEM 14.001 - DROP-IN SINK (1 REQ'D)

SIS No: \*B098

John Boos Model PB-DISINK101405

Drop-In Sink, one compartment, 10"W x 14" front to back x 5"deep bowl, 16/300 stainless steel, (faucet not included)

1 EA Model PBF-4DM-5GLF Sink Mixing Faucet, with 5" goose neck spout, deck mounted, 4" centers,

with 1/2" NPT (LOW LEAD)

- 1 ST Model PB-WR ADA Wrist Blades, stainless steel, (1 pair), Use with Heavy Duty Faucets ONLY
- 1 EA Model PB-PT1.5 P-Trap, 1-1/2" & tail pipe

ITEM 14.002 - SINK, HAND, WALL MOUNT (2 REQ'D)

SIS No: \*B098

John Boos Model PBHS-W-1410

Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep, all stainless steel construction (faucet NOT included)

- 1 EA Model PBF-4SM-5GLF Sink Mixing Faucet, with 5" goose neck spout, splash mounted, 4" centers, with 1/2" NPT (LOW LEAD FAUCET)
- 1 ST Model PB-WR ADA Wrist Blades, stainless steel, (1 pair), Use with Heavy Duty Faucets ONLY
- 1 EA Model PB-PT1.5 P-Trap, 1-1/2" & tail pipe
- 1 EA Model 0410C Hand sink, left & right side splash

ITEM 14.008 - SOAP DISPENSER (3 REQ'D)

SIS No: \*B098

San Jamar Model S890TBK

Soap and Hand Sanitizer Dispenser, wall mount, bulk or bag-in-box, 4-3/4"L x 4-3/4"W x 10-1/2"H, translucent black pearl

ITEM 14.009 - PAPER TOWEL DISPENSER (3 REQ'D)

SIS No: \*B098

San Jamar Model T1400TBK

Smart System Classic Towel Dispenser, with IQ Sensor, 17"L x 12" x 1/4"W x 10"D, wall mount, with lock, holds (1) 8" wide roll; 8.5" diameter and 4" stub roll, touchless, (3) selectable paper lengths and dispensing delays, Infinity® System, automatic transfer, replaceable drive module, self-adjusting sensing field, durable break-resistant plastic, requires 4 D-cell batteries or AC Adapter (not included), translucent black pearl

ITEM 14.014 - SINK, SCULLERY, 3-COMPARTMENTS (1 REQ'D)

SIS No: \*B098

John Boos Model 3PB18244-2D18

Pro-Bowl Sink, (3) 18"W x 24" front-to-back x 14" deep compartments, (2) 18" drainboards, 10"H boxed backsplash with 45° top & 2" return, (2) sets faucet holes, 16/300 stainless steel, 1-5/8" OD stainless steel legs with 1-1/4" OD adjustable side & front bracing, fully welded front apron & adjustable stainless steel feet, NSF

- 1 EA Model PBF-10-SLF Sink Mixing Faucet, with 10" swing nozzle, wall mounted, 8" centers, with 1/2" NPT (LOW LEAD FAUCET)
- 1 ST Model PB-WR ADA Wrist Blades, stainless steel, (1 pair), Use with Heavy Duty Faucets ONLY
- 3 EA Model PB-LWR-1 Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, 2" drain outlet, includes: basket strainer
- 1 EA Model PB-LWB Lever waste support arm bracket

ITEM 15.025 - STAINLESS STEEL WORK TABLE - 48" (2 REQ'D)

SIS No: \*B098

John Boos Model ST6-3048SSK

Work Table, 48"W x 30"D, 16/300 stainless steel flat top with Stallion safety edge front & back, 90° turn-down on sides, 18 gauge stainless steel adjustable undershelf, stainless steel legs & bullet feet, NSF, KD

- 4 EA Model 0209S-4 Modification to leg height, (4) leg table, 34"H overall
- 4 EA Model DP2015-S30 Drawer, for 30"D work tables, 15"W x 20"D x 5" deep, stainless steel construction, poly friction slides, NSF, for stainless steel table tops only
- 4 ST Model CAS01-R Casters, 5", heavy duty, locking, for 1-5/8" Diameter legs (set of 4)

ITEM 15.058 - WORK TABLE WITH SINK(S) (1 REQ'D)

SIS No: \*B098

John Boos Model EPT6R5-3096SSK-L

Work Table, 96"W x 30"D, 16/300 stainless steel top with 5" clip-down riser, 16 x 20 x 12 left sink bowl with 4" deck mount faucet & 10" spout, stainless steel legs & adjustable undershelf, 1" stainless steel adjustable bullet feet, NSF, KD

1 EA Model PB-LWR-1 Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, 2" drain outlet, includes: basket strainer

ITEM 17.081 - DISHWASHER, UNDERCOUNTER (1 REQ'D)

SIS No: \*B098

Hobart Model LXEH-2

LXe Dishwasher, undercounter, 23-15/16"W x 23-9/16"D x 32-1/2"H, high temperature sanitizing, (32) racks/hr, fresh water rinse, .74 gal/rack, delime notification, auto chemical priming, service diagnostics, detergent & rinse aid pump, 120/208-240(3W)/60/1-ph, 30.5 amps, cULus, NSF, ENERGY STAR®

1 EA Standard warranty - 1-Year parts, labor & travel time during normal working hours

1 EA Extended warranty - 1-Year parts and labor performed during the normal business hours of the local service office (net)

1 EA Model CORD-PWRKIT-LXEH Power cord kit, for 120/208-240(3w)/60/1 voltage

1 EA Model COVER-TRIM-LXE Trim Cover

1 EA Model WTRHAM-ARREST Water hammer arrestor kit

1 EA Model DWT-LXE Drain water tempering kit for LXe

1 EA On-site DWT installation by local Hobart Service Office (this price is available only if the local Hobart Service Office completes the installation of the dishwasher within a 50 mile radius and during normal business hours). Price is available only with machine purchase (if purchased separately local installation rates will apply)

ITEM 21.016 - EXHAUST VENTILATOR WITH MAKE UP AIR - 10'6" X 76"

(1 REQ'D)

SIS No: \*B098

Avtec Model AXWP-10'6" X 76"

Exhaust Ventilator - with makeup air

Entire hood shall be constructed of 18 gauge, type 304, stainless steel all polished to a #4 finish and shall be as shown on drawing and shall consist of removable grease extractor modules, exhaust & supply duct collars, fire damper in supply collar, collection trough and hanger brackets. Exhaust hood shall be of all welded construction and liquid tight with all exposed welds ground smooth, flush and polished to the original metal finish. All interior seams sealed with high temperature silver silicone. The exhaust hood shall be constructed to comply with NSF, NFPA-96 and U.L-710 where such listings apply. Hood shall be supplied with NSF approved Model # Energy Aire high velocity modular grease extractors extending the full length of the extraction area. The grease extractors shall form a barrier between the cooking equipment and the throat of exhaust duct. The exhaust hood shall be fitted with a grease collection trough pitched to the outside end(s) of hood and equipped with stainless steel grease receptacles recessed into hood body.

The interior of the hood shall be supplied with pre-wired U.L. incandescent light fixtures designed for 100 watt light bulbs and vapor proof globes (bulbs by others). Light fixtures shall be pre-wired in a concealed manner on top of hood to a built-in control panel on hood. Control located as shown on the foodservice plans. Control panel shall consist of two switches, one for the lights and one to control the roof-top fan system. Hood item to include toggle switches only, motor starters and/or fire system interlocks are by other trades. Exhaust hood shall be equipped with hanger rods and cast steel brackets to secure exhaust hood to the building structure above. Seismic brackets if required by code, are the responsibility of others. Kitchen Equipment Contractor shall furnish and install 18 gauge stainless steel closure channels from the top of the hood to the finished ceiling on the front and ends if required by ceiling height. Panels mounted in a concealed manner. The exhaust hood shall incorporate a supply air make up system consisting of

duct collar, plenum, and perforated stainless steel air diffuser along full face. All parts of the exhaust hood shall be guaranteed against defective material and/or workmanship for a period of one (1) year from the date of startup. Provide stainless steel enclosure with lift off doors on the end of the hood (if shown on the foodservice plans) for fire suppression systems components.

Provide Automatic Exhaust Fan Interlock System, installed and wired to comply with IMC2006 Chapter 5 section 507.2.1.1. System to include: Thermal sensors mounted in the capture area, directly in front of each exhaust collar(s). Thermal sensors are designed to energize the fan switch in the event the temperature inside the capture plenum of the hood exceeds 110 degree F. The temperature sensor is to be factory wired to a terminal strip and control panel located in a junction box on top of the hood. The control panel is to be equipped with a delay timer to prevent the exhaust fan from cycling on/off the sensor when the exhaust fan switch is de-activated. The delay timer is to be pre-set at the factory in order to keep the exhaust fan operating for a maximum of 15 minutes after the exhaust fan is de-activated. The control panel is to allow designed to allow an infinite number of sensors to be wired through one panel.

Kitchen Equipment Contractor shall inter-connect the Fire Protection System Item #21.056, to this unit. Provide 18 Gauge Stainless steel Wall flashing from bottom rear of hood to 6" above finished floor.

ITEM 21.056 - FIRE PROTECTION SYSTEM (1 REQ'D)

SIS No: \*B098

Avtec Model R-102

Fire Suppression System - R102

Unit shall be a U.L. listed wet chemical fire suppression system. Unit shall consist of all hood, plenum, duct collar and surface protection piping and nozzles, agent tank, automan release, remote manual pull station, and thermal detectors. Unit shall be complete with all switches, interfaces and mechanical gas valves required for installation.

Components shall be installed into an integral S.S. enclosure mounted to the exhaust hood if shown on the foodservice plans, or components shall be installed as shown on the foodservice plans and interconnected to the exhaust hood as needed.

Electrical Contractor to provide conduit and junction box in wall for remote manual pull station for fire protection system. Electrical Contractor to connect to microswitch on wet chemical fire protection system and extend conduit and wire in a concealed manner to fuel and power shut-off devices for all appliances located under the Shut-off devices furnished by the KEC and installed by Plumbing and/or Electrical Contractor.

ITEM 25.501 - SERVICE COUNTER (1 REQ'D)

SIS No: \*B098

Custom Model CUSTOM

SERVICE COUNTER

N.I.K.E.C. (BY BASE BUILDING)

ITEM 25.502 - SERVICE COUNTER (1 REQ'D)

SIS No: \*B098

Custom Model CUSTOM

SERVICE COUNTER

N.I.K.E.C. (BY BASE BUILDING)

PART 5 - PRODUCT IDENTIFICATION AND ITEMIZED PRICES

- A. Prior to the award of this contract by the Owner, the KEC shall submit for approval a list of all items of kitchen equipment to be used in this work. This list shall be submitted on the Equipment Subcontractor's letterhead and shall indicate the manufacturer, model number and the price for each item installed in place.

- B. The summation of all itemized prices shall be equal to the actual amount of the Kitchen Equipment Sub-Contract (excluding the General Contractor's fee and/or profit). It is to be understood and agreed that the Owner may add a greater number of any given item or items to the contract or delete any given item or items, each at the itemized price listed and under the terms of the General Conditions and Bid Proposal.
- C. The Kitchen Equipment Sub-Contractor submitting this proposal is:

NAME:

ADDRESS:

PRIME CONTACT:

PHONE #:

FAX #:

and agrees to furnish all the labor and materials for shipping of this Kitchen and Foodservice Equipment for the total sum of:

\_\_\_\_\_ Dollars  
(\$ \_\_\_\_\_ .00)

The itemized list when submitted for approval shall be used in the fulfillment of this contract and from which no deviation will be made without the consent of the Owner once Owner's approval has been given.

END OF SECTION 114000

## SECTION 116500—SCORING DISPLAY SYSTEMS

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Work under this Contract includes all installation labor, materials, tools, transportation services, supervision, coordination, etc., necessary to complete the design/build installation of the Scoring Display Systems, as described in these specifications and illustrated on the associated drawings. The systems shall be called the "Scoring Display Systems" and the installer the "Scoring Display System Installer".
- B. The work specified herein is performance based. This requires the Installer to provide all subsequent design and engineering, which is not included within the Contract Documents, to meet the requirements of this Performance Specification. The drawings included with this specification convey system concepts. The plans do not necessarily show complete and accurate building details. The Installer is responsible for making field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems.
- C. Work includes a number of separate scoring/advertising/naming displays. Drawings should be considered to be conceptual in nature, illustrating the features and appearance of the system. The Scoreboard Installer shall assume full responsibility for final structural engineering, mechanical requirements as well as construction information and coordination required in accordance with the Installer's final design of elements being provided under this contract.
- D. The Scoring Systems include supply and installation of the following major items:
  - 1. Four (4) basketball main scoring displays
  - 2. Four (4) shot clocks and LED goal scoring strips
  - 3. Secondary steel for attachments to building are in this installer's scope of work.
  - 4. Scoring control components, including software.
  - 5. Low voltage control system for all displays, and any illumination for advertising panels, etc. to be included as part of this contract to allow control of lighting and displays from that location.
  - 6. All electrical distribution/load centers, etc., to each display system from each installation point from isolator or disconnect as shown on electrical drawings
  - 7. Option pricing.
  - 8. Operations and maintenance training.
  - 9. Scoring feeds in data to the TV Truck parking pedestals
- E. The Contract also includes:
  - 1. Provision of final engineering, development of final design drawings and submission to the Owner and Architect for approval.
  - 2. Submission of all information required by public agencies.
  - 3. All necessary construction and sign permits.
  - 4. Registered Engineers' stamp on drawings and calculations required.
  - 5. Verification of dimensions and conditions at the job site.
  - 6. Coordination with other contractors and trades.

7. Preparation of submittal information.
  8. Installation and all anchorages and attachments in accordance with the contract documents, manufacturer's recommendations, and all applicable code requirements.
  9. Initial tests and adjustments, written report, and documentation.
  10. Instruction of operating personnel; provision of manuals.
  11. Maintenance services; warranty.
  12. Provision of court/floor protection if using any crane or mechanical lift when installing and servicing displays.
- F. The Contract Documents are complementary and are intended to include or imply all items required for the proper execution and completion of the work. Any item of work required by the Specifications or other portion of the Contract Documents, but not shown on the drawings, or shown on the drawings but not required in the Specification, shall be provided without extra charge as if shown or mentioned in both.

## 1.2 REFERENCES

- A. American Iron and Steel Institute (AISI).
- B. American National Safety Institute (ANSI).
- C. American Society of Mechanical Engineers (ASME).
- D. American Society of Testing and Materials (ASTM).
- E. National Electrical Manufacturer's Association (NEMA).
- F. Occupational Safety and Health Administration (OHSA).
- G. Underwriters Laboratories (UL).
- H. United States Institute of Theatre Technology (USITT).
- I. Entertainment Services and Technology Association (ESTA).
- J. Standard for Electric Signs, UL-48, 13th Edition.
- K. Standard for Control Centers for Changing Message Type Signs, UL-1433, 1st Edition.
- L. Federal Communications Commission Regulation Part 15.
- M. National Electric Code (NEC).

## 1.3 DESCRIPTION OF WORK

- A. Connect (provide all required cabling and transmission electronics) Scoreboards to court control locations as indicated on drawings. Control components will be portable with the capability of connecting to the courtside locations.

- B. Work includes (2) two main basketball scoring displays for each of the main practice courts and supplemental scoring displays for the side courts. These displays will be fixed digit LED scoring technology with options for advertising/naming displays and necessary computer controlled scoring systems. Scoring Systems consist of:
1. Secondary structure and supplemental steel to attach displays and enclosures to building's walls as located on the drawings.
  2. Coordination with Construction Manager, Structural Engineer and Architect as to final scoreboard design and locations.
  3. Fixed Digit game-in-progress displays:
    - a. LED colors: as directed by Owner.
    - b. Display assembly color: as directed by Owner.
  4. Option for advertising/naming panels with four color copy (artwork provided by Owner).
  5. Wired scoring controllers.
- C. LED shot clocks.
- D. LED goal scoring strips.
- E. Data output, compatible with character generators (e.g. XPression, Chyron) as well as ability to provide feed to regional sports networks scoring displays (aka Fox box). Provide data output at the following locations:
1. TV truck pedestals – Three separate feeds.
- F. Low voltage, signal raceway/conduit from the courtside control locations to the scoring display locations and to the scoring equipment rack location will be provided by the project. Any additional conduit/raceway required for a code compliant, complete installation (no bare cabling is allowed in locations exposed to public view) is to be included in this scope of work.
- G. Supply complete dimensions, clearance requirements, mounting locations and requirements, and total and point load structural loading data.
- H. Provide fixture data for any illuminated displays. Provide manufacturer's minimum operation life expectancies for any light bulbs and illumination devices.
- I. Provide all ventilation and climate control equipment, including shop drawings, dimensions, clearance requirements, unit weights and noise data.
- J. Structure and Enclosure:
1. Design, document, furnish and install all required structure, enclosures and support for scoreboard and displays. All supplemental steel, girts and framing required to provide a complete enclosure shall be furnished and designed in accordance with the project Miscellaneous Metals Specification Section, but provided under this contract. Attachment and structure shall also be provided for any siding enclosure, border trim panels, face closeout, bezel, etc. Contractor shall submit drawings and calculations showing all structural attachments between display and structure for review by the project Structural Engineer. Submittals shall be in accordance with the provisions in this specification as well as related specification sections.

2. Contractor is responsible for touch up and repairs of welds, paint and finishes where work attaches to structure. Coordinate with Owner to maintain all product warranties where attaching to other trades such as Paint, Roofing, Expansion Joints, etc.
  3. Color of all exposed structure, enclosures, close-out panels, etc. to be determined during the submittal process. Submit color samples to Owner for approval.
    - a. NOTE: Identify costs associated with changing structure, display or assembly color at time of proposal.
  - K. Supply complete assemblies (supplemental structure, enclosure, and finish) for displays to attach to building's walls as appropriate, including structural engineer (registered in the jurisdiction of the project) stamped calculations.
  - L. Control Equipment
    1. Connections between displays and control equipment and any physically separate control position locations shall be included in this installer's scope of work.
    2. All control equipment for scoring and clock displays to have the ability to be connected at courtside locations.
    3. Scoring software and controller functions/overlays are required for the following sports:
      - a. Basketball.
      - b. Volleyball.
    4. Displays to be able to be independently turned on and off from the courtside locations. Displays to have individual on/off control include:
      - a. Scoring Displays.
      - b. Any ad panel illumination.
  - M. Display and scoring cable runs to be composed of a minimum of 2 discrete bundles.
  - N. Coordinate with Owner's Testing and Inspection Agency to provide access for testing of welds and attachments in accordance with the project General Conditions and overall project requirements and specifications. All testing criteria shall be as indicated in the project General Conditions and overall project requirements and specifications.
  - O. Supply and install processors and/or controllers in a rack located in the court storage area of both practice courts and not within display enclosures.
- 1.4 RESPONSIBILITY AND RELATED WORK
- A. Supply accessories and minor equipment items needed for complete systems, even if not specifically mentioned herein or on the drawings, without claim for additional payment.
  - B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Scoring System Installer to supply systems in full working order. Notify the Owner's Representative of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings will be provided without claim for additional payment.

- C. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner.
- D. If a conflict develops between the contract documents and the appropriate codes and is reported to the Owner's Representative prior to bid opening, the Owner's Representative will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.
- E. Electrical
  - 1. Power is provided at locations shown on electrical drawings. The Installer shall be responsible for termination and distribution electrical power from the transformers and panel boards to the equipment as required (including load center, breakers, step down transformers, etc.). This will include necessary distribution boards, conduit and cabling as required for a complete installation.
  - 2. A ground point will be provided for each display. The Installer shall be responsible for connecting existing/Owner provided ground point to all equipment in accordance with NEC code, local codes and standards specified herein.
  - 3. Refer to electrical single line diagrams for minimum short ratings of all required equipment.
- F. Coordinate work with other trades to avoid causing delays in construction schedule.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: At least 5 years experience in the production of specified products or as approved by the Owner.
- B. Installer's Qualifications information to be provided with Bid Response. Firm experienced in the installation of systems similar in complexity to those required for this project; and meet the following:
  - 1. At least five years experience with equipment and systems of the specified types.
  - 2. Experience with at least two comparable scale new construction projects within the last three years.
  - 3. Maintain a fully staffed and equipped service facility.
  - 4. With the bid return, the potential Installer shall demonstrate that he has:
    - a. Adequate plant and equipment to complete the work.
    - b. Scoring software appropriate for NBA, NBA-D, NCAA Division 1 basketball games.
    - c. Adequate staff with commensurate technical experience.
    - d. Suitable financial status to meet the obligations of the work.
    - e. References from three (3) or more users of similar display and software control systems provided by Installer.
    - f. List of subcontractors intended to do the work.
    - g. Provide with bid, the name and relevant experience of the proposed project manager. Also provide the name and qualifications of the site superintendent.
- C. With proposal, provide listing with appropriate explanation regarding the status of Manufacturer's or Installer's resolved or unresolved legal disputes within the last six calendar years.

1. With proposal, provide listing with appropriate explanation regarding any projects within the last 3 years, where the Installer or Manufacturer has failed to meet construction schedules, due Installer or Manufacturer's cause.

## 1.6 SUBMITTALS

- A. Submit all shop drawings and submittals in accordance with project requirements. Quantities listed herein are the minimum required of this contractor.
- B. Shop drawings and submittal data shall contain sufficient information to describe the Work to be performed. Drawings shall be executed at an appropriate scale. Refer to Division 1 for submittal requirements. Submit all Shop Drawing information at one time. Information shall include but not necessarily be limited to:
  1. Elevation and Sections of all displays along with enclosure/structure fabrication drawings.
  2. Any internally illuminated Advertising Panel detailed drawings.
  3. Finishes of all exposed housings.
  4. Wiring diagrams. Complete, detailed wiring diagrams for all systems, based on the contract documents but including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring in conduit.
  5. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.
  6. A material list of all equipment to be furnished, arranged in specification order. This list shall be followed by catalog data sheets, arranged in specification order, of all equipment to be furnished. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol. This submittal must be submitted in its entirety.
  7. Floor Plan drawings showing exact locations of devices and equipment.
  8. Floor Plan drawings showing exact power requirements and conduit routing for each system with the location of all junction boxes.
  9. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Indicate welded connections using standard AWS welding symbols.
  10. Submit a letter of certification prepared by a professional Structural Engineer(s) (registered in the State of California) employed by the fabricator certifying the following:
    - a. The aforementioned Engineer is fully experienced in the design of structural steel (primary or secondary) and signage.
    - b. All shop drawings (including all supports, connections and components) shall be prepared under the direction of the aforementioned engineer(s), in compliance with the Contract Document requirements and applicable building codes. His seal and signature shall appear on all shop drawings. The aforementioned shop drawings shall include sufficient information to enable the Architect to confirm that design loads, support points and tie backs are in compliance with the Architect's design criteria.
    - c. This certification letter must be received by the Architect and Owner prior to the submission of the Shop Drawings for the metal stairs and railings, and shall bear the seal and signature of the aforementioned engineer.
  11. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, design loads, support points and tie backs.

12. The design shall be in accordance with the aesthetic design intent of the project with the Architect having final authority in reference to aesthetic matters.
13. All design calculations (which shall bear the seal and signature of the aforementioned engineer) indicating compliance with the requirements of the design criteria and appropriate codes shall be provided to the Architect prior to fabrication for record purposes.
14. The calculations provided to the Architect at project completion shall be forwarded to the Owner as part of "Project Closeout".
15. Proposed cable labeling technique.
16. Samples as required in various specification paragraphs.
17. Power consumption at 50%, 75% and 100% illumination levels (all lighting elements energized) for each display.
18. Drawings of initial proposal for pre-programmed displays.
19. Description of QA/QC procedure.

C. Training and Event Attendance Submittals:

1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
2. Following discussions with Owner, formally submit a Training and Event Attendance submittal 2-4 weeks prior to first training. Submittal shall:
  - a. Include a separate page/entry for every training session.
  - b. Indicate date, time, and approximate length of training session.
  - c. Indicate person(s) conducting training.
  - d. Indicate whether training will be video recorded.
  - e. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
  - f. Include signature and title lines for:
    - 1) Owner acknowledging and accepting training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
    - 2) Countersigning by trainer indicating that training actually occurred.
    - 3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
    - 4) Owner's representative attending training at the end of the session shall initial that:
      - a) Training Occurred.
      - b) Training Materials were provided and left with owner
      - c) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
      - d) Training was generally sufficient for the proposed curriculum.
  - g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.).

3. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.
- D. Final Inspection Notification Report. Two copies of a typed, neatly prepared checkout report for each piece of equipment and the entire system shall be prepared and submitted; it shall include:
1. A complete listing of every piece of equipment including serial number, the date it was tested and by whom, the results and date re-tested (if failure occurred during any previous tests).
  2. The final report shall indicate that every device tested successfully.
  3. A performance test report indicating that the system meets all of the Installer testing requirements of Part III.
- E. Contract closeout submittals:
1. Keep a complete set of drawings on the job, note any changes made during installation, and submit 1 corrected set of reproducible drawings showing Work as installed.
  2. Submit the following data for review, prepared as indicated, at least one week prior to acceptance testing (exceptions noted):
    - a. System Reference Manual: Furnish 3 copies, in 3 ring binders, sized to hold the material plus 50% excess, with clear vinyl pockets on cover and spine for project title. Provide tabular dividers with permanent legends for the following sections:
      - 1) System Operation and Instructions. Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity. This procedure should describe the operation of all system capabilities. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
      - 2) A list of all equipment, indicating manufacturer, model, serial number, and equipment location (i.e.; rack/room number). Update following acceptance testing, if changed.
      - 3) Manufacturer's Instruction Manuals for all items of equipment, incorporating or followed by manufacturer's warranty statements.
        - a) Where manufacturer registration is required, register warranty in Owner's name, and at an address determined by Owner. Provide copy of registration.
        - b) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
      - 4) A list of settings, if applicable, of all semi-fixed controls. Update following acceptance testing.
      - 5) Photographically reproduced schematic wiring diagrams of the scoreboard and advertising display low and high voltage systems, based on the as-built documentation, at a reduced scale easy to handle but fully legible. Blue-line (or similar diazo process) prints are not acceptable.

- 6) Maintenance Instructions, including Installer's maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products. Instructions shall include recommendations for products and cleaning, washing and painting of all video, auxiliary, and advertising boards for a period of 10 years as deemed necessary by the Owner or tenant.
  - 7) A legend of acronyms and abbreviations must accompany all documentation.
  - 8) Any other pertinent data generated during the Project or required for future service.
- b. In titled ring binders sized for material below, plus 50% excess; 3 copies:
- 1) Manufacturer's Service Manuals and parts lists for all equipment. Photocopies are not acceptable. For custom circuits or modifications, complete schematics and parts lists.
  - 2) As-built wiring diagrams and system block diagrams showing nominal input and output levels. (Submit within two weeks after Acceptance Testing.)
  - 3) Duplicate copies of reduced-scale wiring diagrams.
- c. Photographically reproduced as-built wiring diagrams and overall building wiring diagrams, at a reduced scale easy to handle but fully legible. Blueline (or similar diazo process) prints are not acceptable. Mounted behind clear acetate and located with the equipment racks.

F. Submittal format:

1. Provide a unique control number in consecutive order (e.g. 11650-001)
2. Provide a complete table of contents with the following information:
  - a. Project title and number.
  - b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
3. Date of submission.
4. Referenced addendum or change order number as applicable.
5. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
6. Index by manufacturer and model or part number unless specified otherwise herein.
7. Each submission page stamped with Contractor's certification stamp, initialed or signed certifying:
  - a. Review, approval and acceptance of submission.
  - b. Certification of product compliance to specification.
  - c. Verification product may be incorporated within the work.
8. Arrange product data list in specification order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer's data sheets, arranged in the same order. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.

9. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'-0". Provide one reproducible transparency and two bound blueline prints of which the processed transparency will be returned to Contractor, additional prints will not be reviewed or returned.
10. Bind Project Record Manual in titled three ring D style binders sized for 150 per cent of the required material. Maximum size: three inch spline. Use multiple volumes if necessary.

G. Resubmission Requirements:

1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate any changes that have been made other than those requested.

1.7 PROJECT CONDITIONS

- A. Verify all conditions on the jobsite applicable to this work. Notify Owner's Representative in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The drawings diagrammatically show cables, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Owner's Representative for approval, showing how the work may be installed.
- C. This installer is responsible for all additional electrical (high and low voltage), structural, mechanical and plumbing work for completed systems.

1.8 ACCEPTANCE TESTING

- A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Owner's Representative or Owner's Consultant.
- B. Provide one person familiar with all aspects of the system to assist the Owner's Representative or Owner during acceptance testing. One of the available individuals must have specialized knowledge of the control system.
- C. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.
- D. Final Acceptance shall occur after the displays have functioned without failure for two games/events (as defined by the Owner).
  1. Failure shall be defined as a failure of the display, or a portion of the display, to meet the project performance specifications for a length of time greater than one minute due to electronic, electrical, mechanical, structural, or other failure of the display. Failure due to owner's operators, spectators, or force majeure will not be considered event failure; failure due to installer's operators will be considered a failure.

## 1.9 DISPLAY AND SCORING SYSTEMS SOFTWARE LICENSE

### A. Introduction

1. All proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor shall agree that 3rd party (e.g. manufacturer's) proprietary software provided with the system shall be subject to this agreement.
3. Contractor and owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

### B. License Grant and Ownership

1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the owner.
2. Except as expressly set forth in this paragraph, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

### C. Copies, Modification and Use

1. Source code shall be available to owner for a period of not less than 15 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right in owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

5. During the life of the system (defined as a period of not less than 10 years and not more than 15 years), the Contractor shall provide software updates in accordance with all necessary support requirements to maintain the system. This shall include a commitment to provide appropriate patches, fixes, and interface updates as necessary to maintain the operability and security of the system at a level commensurate with the original system.
  - a. In the event that computer and or processor hard ware refinements and updates are necessary to support software updates 7 years after substantial completion, said hardware will be provided to owner at the agreed upon terms for change orders of the original contract.
  - b. Labor shall be in accordance with change order rates of the original contract, as adjusted for inflation in accordance with project General Conditions.
6. All hardware supplied shall support software updates for a period of not less than 7 years following substantial completion.

#### 1.10 WARRANTY/MAINTENANCE

- A. Warrant labor and materials for (2) two years following the date of the first event, or Final Acceptance by Owner, whichever is later. This is to be from the date of acceptance of the equipment.
- B. System to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or materials within the Warranty period without charge.
  1. A defect as it applies to a pixel shall be at any point that the pixel fails to be able to meet the performance requirements of this specification.
- C. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.
- D. Within the warranty period, answer service calls within 8 hours, and correct the problem within twenty four hours. Provide local representation with service personnel available upon call within 3 hours prior to an event and throughout the time of the event.
- E. Register all manufacturer's warranties in Owner's name.
- F. Maintain spare parts inventory on-site as listed in this specification from end of initial warranty period through year 5 of display life. Within 72 hours of notification that spare part has been used, that part (excluding bulbs) shall be replaced by the service representative/manufacturer.
- G. During the 20,000 hour nominal LED display lifetime, the Owner may have certified brightness and measurements made on scoreboard(s) according to the acceptance procedure to verify that the board is operating within specifications. If the board is not capable of meeting specifications, provide price perform the necessary repair and component replacement to bring the system to operational parameters. This new work shall be warranted for 20,000 hours effective from the original Owner acceptance date.
- H. Preventative inspections and cleaning:

1. Preventative inspections shall occur 30 days before the beginning of the second and third seasons (one of the inspections will be occurring immediately preceding the expiration of the 2 year warranty period).
2. As part of the inspection, clean or wash display if needed.

#### 1.11 OPTIONS, ALLOWANCES AND UNIT PRICING

- A. Option 11 65 00 – A. Cost to provide one static, unlit, ad panel with four color copy to the top or bottom of each main court display.
- B. Option 11 65 00 – B. Cost to provide vinyl team name lettering in lieu of base bid electronic team and player name lettering. Indicate deduct amount.
- C. Option 11 65 00 – C. Cost to provide wireless controllers in lieu of base bid wired controllers at each court location. Coordinate location of antennae, coordinate frequencies of controllers for optimal operation without disrupting operation of other frequencies in use in the area.
- D. Voluntary alternate/option. If there is a procedure or task that is adding significant cost to each bidder's proposal, then identify the item and the savings for eliminating the item.

### PART 2 - PRODUCTS

#### 2.1 SPECIFIED PRODUCTS AND MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed as a standard of quality. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer's specifications. Verify performance as required. Where two or more acceptable products are listed, the Installer may use either at his option. Invitation to bid does not necessary imply that vendor has met all qualification requirements.
- B. Suppliers invited to bid are done so with no implication or certification that their proposed products meet the technical requirements of this specification. Potential vendors are invited to prepare prices for more than one display type meeting these specifications. Suppliers invited to bid include:
  1. Scoring Fixed Digit Displays:
    - a. Daktronics.
    - b. OES.
    - c. Trans Lux.
    - d. Nevco.
    - e. White Way.
    - f. As approved by Owner.
  2. Scoring Equipment:
    - a. Daktronics.
    - b. OES.
    - c. As approved by Owner.

- C. Other qualified manufacturers will be considered subject to approval of technical data, samples, and results of independent testing laboratory tests (if necessary to verify performance) of proposed equipment, submitted in accordance with project requirements.
  - 1. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
  - 2. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.
- D. All equipment supplied shall be new and meet the latest published specifications of that product. In the event that the product is enhanced, or improved, supply the newer product at no additional cost.
  - 1. If product is discontinued or becomes obsolete due to continuing product development, replace it with manufacturers' current equivalent at time of installation at no additional cost.
  - 2. If product is discontinued or becomes obsolete due to technology change, substitution will be based on fair market value of accepted and proposed products, upon approval of substitution by Owner's Representative.
- E. While service contract costs form the basis for alternates, the annual costs for a parts-only service contract cannot exceed 6.5% of the base bid price for this section of work. The specifics of the parts only costs are outlined in the description of the service contract.
- F. Manufacturer's name, logo, or representation shall not be visible to the public.
- G. All materials shall fully comply with Underwriters Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.

## 2.2 PHYSICAL DESIGN CRITERIA

- A. General: Engineer systems to the most stringent applicable code.
- B. Seismic Loads: Subject to the Building Official's approval, seismic design shall be under the Building Code in use at the time of the construction of the display.
- C. Wind Loads (if applicable): A minimum design pressure as dictated by the Project's code (positive or negative) shall be applied to all signage and display surfaces. This also applies to the entire Scoreboard Enclosure. Corner pressures and attachment loads shall be as determined through local Building Code and by applying the project specific criteria. (All attachments, connections and members shall also be capable of withstanding all seismic forces in accordance with the local Building Code.)
- D. Minimum thicknesses, gauges and standards:
  - 1. All sheet metal shall have a minimum thickness of 18 gauge.
  - 2. Structural steel members shall have a minimum flange, web or wall thickness of 1/4 inch.
  - 3. Where similar connections and members are used in other areas of the facility, every effort shall be made to detail and furnish members in a consistent and uniform manner.
- E. Enclosure and structure:

1. All display enclosures, all additional structure, lighting, power distribution, convenience outlets, and other items for installation, operation, maintenance, and repair is this contractor's responsibility.
2. Installer to submit complete drawings showing the connection of the Installer supplied equipment to the building structure at each different condition.
3. Installer to submit design calculations, bearing structural engineer's stamp for review. Review will be for design intent only and shall not be construed as approving the design analysis.
4. The scoreboard structure, supports, attachment and anchoring members, mounting hardware shall be provided in accordance with engineering standards and governing codes.
5. Exposed steel and coatings to be in accordance with project paint and coating specifications.
6. Enclosure.
  - a. Enclosure to be shop fabricated, anodized aluminum. Color to be determined with Owner. Construction to comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other industry standard practice.
  - b. Form exposed sheet metal work without excessive "oil-canning", buckling and tool marks with exposed edges folded back to form hem. Finish to comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations. For components which are assembled or welded in factory, apply finish after completion of fabrication.
  - c. Electrolytic protection shall be provided wherever differing metals come into contact.
  - d. Trim shall be coordinated to be identical in appearance to adjacent advertising panels (whether provided herein, or by others).
  - e. Finishes shall match adjacent existing elements, unless otherwise indicated.
  - f. All welds shall be cleaned, primed and painted.
  - g. Cabinet depth of adjacent scoring and advertising/naming rights displays shall be within 1" (+/-). Notify Owner when variance is greater.

F. Modules and displays to be serviced from front.

G. Electrical

1. Provide complete power and branch circuit distribution within the enclosure from the existing demarcation point as shown on electrical drawing.
  - a. Power Distribution: All panel boards or load centers provided with lighting units for power distribution to displays loads shall incorporate main breakers.
2. Conceal conduit and distribution.
3. Provide lockable load center, breaker panels, and disconnects. Provide minimum of 4 keys per lock.
4. All materials shall fully comply with Underwriters' Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.

H. Ventilation

1. Provide natural or forced ventilation as required for operation of all components.
2. Provide all necessary dust and dirt filtration for the ventilation system.
3. Filters shall be easily removable and changeable.

4. NC level attributed to this ventilation shall be no more than NC 40 at nearest seat.

I. Service Requirements

1. All screws and nuts that are required to be removed for access to displays shall incorporate captive screw and nut type designs.
2. A minimum of one of any specialized or custom tool required for maintenance of the display; including any specialized/custom ladder, bosun's chair, or scaffolding required to service displays for maintenance and repair.

- J. Provide primary and backup connection from each display to control system locations.

## 2.3 FIXED DIGIT SCORING DISPLAYS

A. Main Court Scoreboard

1. Ability to display game in progress information.
2. Ability to display overall team scores, game time, period and possession information
3. Time expiration horn
4. Scoreboard Display requirements:

a. Team Indicators

- 1) Monochrome LED lamp matrix; 8 character (minimum).
- 2) Minimum font height 8 inches.
- 3) 25mm maximum resolution.

b. Clock and Score Digits

- 1) 7 segment bar digits with lens monochrome LED.
- 2) Minimum digit height 10 inches.

c. Period possession Information, fouls, T.O.L.

1) Digits

- a) 7 segment bar digits with lens monochrome LED.
- b) Minimum digit height 7 inches.

5. Standard of Quality:

- a. Daktronics BB- 2125.
- b. OES.

6. NOTE: Assembly color to be determined in submittal process.

## 2.4 GAME IN PROGRESS/STATISTICAL INFORMATION CONTROLLERS

A. General Configuration

1. On/Off control.

2. Brightness Control.
3. Dedicated wired scoring/clock/statistics (time/clock, score, etc.) control consoles for use court side. Provide for each scoreboard plus 2 spares.
4. Game scoring and clock functions to be controlled, when necessary, from dedicated (non-desktop computer based) control console.
5. One controller to be capable of controlling multiple displays.
6. Statistics module shall support:
  - a. Basketball.
  - b. Volleyball .
7. All control system software and messages shall be stored in non-volatile (disk) format.
8. Back-up computing and redundancy:
  - a. All game scoring functions (e.g. scoring computers, control panels, etc.) shall be completely backed-up with redundant equipment (not necessarily full-time, on-line).
9. Overlays/Inserts.
10. Battery back up.
11. Carrying case.

## 2.5 PLAY CLOCKS, SHOT CLOCKS, GOAL LIGHTS AND CONTROLLERS

### A. Single Sided Shot Clocks:

1. Ability to display 1/10 of a second.
2. Display requirements:
  - a. Game Time:
    - 1) Seven segment bar digits.
    - 2) Minimum height 7".
  - b. Shot Clock Time:
    - 1) Seven segment bar digits.
    - 2) Minimum height 13".
3. Mount to Owner supplied basketball goal assembly backboards.
4. Two sets of two, (top of goal only) for practice courts.
5. Conceal wiring and distribution units in assembly.
6. Standard of quality:
  - a. Daktronics 2130.
  - b. OES.
  - c. As approved.

### B. Portable shot clocks for use should installed shot clocks fail.

1. Clocks to have identical features and size as large goal mounted clocks, but need not be translucent. Provide cabling to control point to clock with "quick disconnect" terminations.

2. Provide legs or base for clock cabinet to maintain stability when set on floor. Solution must allow for clock to fall over when hit by a player. Provide handle on enclosure for transport.
3. Technology: monochrome LED— Color as directed by Owner.
4. 100% Solid state drivers.
5. A minimum of two levels of brightness: 50% to 65% and 100%.
6. Electrical and control cabling connections to be made with "quick disconnect" hardware to facilitate removal and replacement of damaged display. Portable equipment to assume use of different AC power source (extension cords are acceptable) and portable data distributor in the event of electronic equipment/connector failure of permanently mounted clocks. Signal cabling to wall J-box is assumed to be used in portable clock deployment scenario.
7. The Standard for portable shot/game clocks shall be:
  - a. Daktronics TI-2115'
  - b. OES equivalent'
  - c. As approved'

C. Shot Clock Accessories

1. Light Strips'
2. Lines perimeter of backboard'
3. Programmable'
4. Standard of quality:
  - a. Daktronics BB-2135'
  - b. OES'
  - c. As approved'

D. Locker Room/Back of House Game Clocks

1. Technical Standards:
  - a. Displays provided in locker rooms and select other locations as listed above to allow team members and officials to view game clock at all times. Coordinate location with Owner/Owner's Representative.
  - b. Clock enclosure to allow flush mounting (rather than surface mount) in wall. Should site conditions prevent flush mounting, provide surface mount enclosures at direction of Owners Representative.
  - c. Display may be LED, incandescent lamp or other directly illuminated source. LCD displays are not acceptable. Control cable to each display to be home run to controller interconnect junction box.
  - d. Digit sizes to be no less than 4 inches high.
  - e. 100 percent Solid state drivers.
  - f. A minimum of two levels of brightness: 50 percent to 65 percent and 100 percent.
  - g. Electrical and control cabling connections to be made with "quick disconnect" hardware to facilitate removal and replacement or removal of display.
2. Quantity:
  - a. Coordinate final locations with Owner.
3. The Standard for clocks shall be:

- a. Daktronics TI-2028/TI-2013.
- b. OES.
- c. As Approved.

E. Time Expiration Horn

- 1. Provide single driver horn instrument for audible signaling of time expiration. Initiations of horn to be able to be automatically linked to game clock, as well as manually triggered or stopped.

2.6 SCORING DISPLAY SUPPORT EQUIPMENT (IF REQUIRED)

- A. Equipment Rack to match those being used for the video production equipment and be frame and panel type constructed of 16-gauge cold-rolled steel. - to have locking rear door mounted on the frame (not the rails). Coordinate location and equipment/cabling in racks with Owner and video production system installer. Empty mounting panel spaces to be filled with blank or vent panels, in a finish to match rack. Provide end panels and top panels as required. Provide shelving as required for equipment mounting within racks. Provide rack supports as required. Provide seven rack keys of each type. Rack color to be gloss or flat black. Provide a magnetically attached, demountable, 60-watt fluorescent or LED lamp in a locally switchable fixture mounted in the top rear of each rack. Include extra set of mounting rails in each rack for rear support of panels or equipment. Verify exact rack space required.

1. Support Equipment:

- a. Blank Panels.
- b. Vent Panels.
- c. Miscellaneous equipment shelving.
- d. Rack screws—Middle Atlantic HS.
- e. Power distribution.
- f. Rack light.
- g. Seismic bracing and bases for attachment of racks to structure as required by code.

2. Display System Racks to be:

a. Racks:

- 1) Middle Atlantic WR-44-32.
- 2) With side and top panels.
- 3) Located in Broadcast Interconnect Room.

2.7 CONTROL CABLING

- A. Installation shall include all required and operationally necessary low voltage control and/or fiber optic cabling for all scoring displays from Scoreboard Control location to each display assembly as appropriate.
- B. All cable whether fiber optic or copper will be run in conduit/cable tray from the Scoreboard Control location at courtside locations to the equipment rack and to each scoring element. Provide a single spare for each transceiver (line driver) type used by the scoring system.

- C. Provide back-up to any cabling sufficient to maintain game in progress clock functions/displays. Provide one spare cable of each type to each display. It is not acceptable to use spare pairs within the same cable.
  - 1. Include electronics, patch panels, and/or jackfields required at Scoreboard and courtside locations to accept and easily switch to backup cabling without changing cables at the rear of equipment.
- D. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. All equipment and materials shall be new. Take care during installation to prevent scratches, dents, chips, etc.
- B. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least three. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- C. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommets.
- D. AC Power and Grounding
  - 1. Adhere to all local and national electrical codes and standards.
  - 2. Label power distribution equipment (e.g. breaker panels, disconnects, and load centers) as to what portion of what module is being served by that device or which advertising panel (e.g. breaker).
- E. All engraving shall be 1/8" block sans serif characters unless noted otherwise. On dark panels or push buttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored push buttons, letters shall be black.
- F. Equipment and Cable Labeling
  - 1. Provide engraved lamicoid labels on the front and rear of active equipment mounted in racks. Mount labels in a neat, plumb and permanent manner. Embossed labels are not acceptable. Equipment labels to have at least three lines of engraving with the first line listing the general name of the device. The second line to include the schematic reference of the device. The bottom line to indicate what other devices or areas this equipment controls.
  - 2. Provide an engraved label over each user-operated control that describes the function or purpose of the control. Label size to be adjusted to fit available space.
  - 3. Engraved labels to have 1/8" high characters minimum. Labels to be black with white characters except where indicated.

4. Cables, and wiring to be logically, legibly and permanently labeled for easy identification. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style label. Hand-written or self-laminating type labels are not acceptable.
5. Wiring designations to be an alphanumeric code that is unique for each cable. Locate the cable designation at the start and end of each cable run and within 3" of the point of termination or connection. For cable runs that have intermediate splice points, the cable shall have the same designation throughout with an additional suffix to indicate each segment of the run. Actual cable designation assignments to be determined by Installer. Add cable designation codes to system schematic drawings included with Project Record Drawings.
6. Label each terminal strip with a unique identification code in addition to a numerical label for each terminal. Show terminal strip codes on system schematic drawings included with Project Record Drawings.
7. Provide adhesive labels on the rear of equipment where cables attach to indicate the designation of the cable connected at that point. Neatly lace vertical and horizontal wiring inside rack with lacing bars. Horizontal wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Neatly bundle excess AC power cable from rack mounted equipment with plastic cable ties. Rack wiring to be bundled with plastic cable ties or lacing twine. Electrical tape and adhesive backed cable tie anchors are not acceptable. Flush cut cable ties as to prevent sharp, jagged edges.
8. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.

### 3.2 INSTALLER TESTS AND ADJUSTMENTS

- A. Verify the following before actual tests and adjustments on the system:
  1. Electronic devices are properly grounded.
  2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
  3. Insulation and shrink tubing are present where required.
  4. Dust, debris, solder splatter, etc. is removed.
  5. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
- B. Preparation for Acceptance, prior to final inspection:
  1. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.
  2. All systems, equipment and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
  3. All materials shall be neat, clean and unmarred and parts securely attached.
  4. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. shall be replaced or properly repaired, and debris cleaned up and discarded.
  5. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed.
  6. All as built documentation, record drawings, operations and maintenance manuals, and test data must be presented prior to or during acceptance as determined by Owner's representative.
  7. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed.

8. Verify each individual component is operating properly.
9. Verify each individual component's performance meets the manufacturer's published performance for this unit.
10. Verify proper operation from controlling devices to controlled devices.
11. Verify proper adjustment, balance and alignment of equipment for optimum quality and to meet the manufacturer's published specifications.
12. Establish and mark normal settings for each level control, and appropriately record these settings within the "System Operation and Maintenance Manual."
13. Verify that all communications and networking services are installed and in proper working condition (Ethernet, IP addressing).

### 3.3 TEST EQUIPMENT

- A. Provide test equipment and complete, installed control system for final acceptance testing. Test equipment to be available for the entire period through final system acceptance. Prior to start of testing, provide a list to the Owner's Consultant of test equipment make and model numbers that will be used.

1. Multimeter: Measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10 ma to 10A.

### 3.4 ACCEPTANCE

- A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owner's Consultant.
- B. Acceptance testing will include operation of each major system and any other components deemed necessary. Installer will assist in this testing and provide any test equipment required specified herein. Installer shall provide at least 1 technician available for the entire testing period (day and/or night), to assist in tests, adjustments, and final modifications. Tools and material required to make any necessary repairs, corrections, or adjustments shall be furnished by the Installer. Testing process is estimated to take a one day for all.
- C. The following procedures will be performed on each System:
1. Control functions shall be checked for proper operation, from controlling devices to controlled devices.
  2. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each adjustable control with small white, adhesive dots, and record these settings, in the "System Operation and Maintenance Manual."
    - a. For physical controls, normal settings shall be marked with small white, adhesive dots.
    - b. For software controls, "screen shots" of the relevant menus, pages or dialog boxes shall be made. Additionally software presets shall be recorded to "disc" permitting full recall.
  3. Installed and loose equipment will be inventoried for correct quantity.
  4. Any other test on any piece of equipment or system deemed appropriate.
  5. Verification of pixel functionality.

- D. In the event the need for further adjustment or work becomes evident during setup and/or acceptance testing, the Installer will continue his work until the system is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Installer will pay for additional time and expenses of the Owner's Representative.
- E. The Owner's Consultant's fees and costs involved in acceptance testing are not the responsibility of the Scoring System Installer, except as described in Part 3 of this specification.
- F. Final acceptance will follow the successful control system operation at the completion of the first two practices or other events as defined by Owner.
  - a. Tests to be performed in accordance with manufacturer's installation and service manual on displays installed at the site. Tests on display elements or modules prior to installation are not acceptable.
  - b. Test report shall include full documentation on test procedure, instruments employed (including model number and serial number) and copy of instrument calibration certification.

### 3.5 DEMONSTRATIONS

- A. Provide 2 hours total instruction to Owner designated personnel on the use and operation of the Systems, scheduled by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative and Owner. At direction of Owner or tenant, a portion of training time may be deferred to end of first regular season as follow-up sessions to enhance operator's ability to maximize performance of system.
- B. Training Schedules
  - 1. Training should be assumed to take place on the project site, unless agreed to by the Owner.
  - 2. Training should be scheduled to be non-overlapping, unless agreed to by the Owner.
  - 3. Actual training schedule shall be by agreement with Owner.
  - 4. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time.
- C. The following is a general idea of the training "curriculum":
  - 1. A general familiarization of the devices.
  - 2. An explanation of how the device interfaces to the rest of the system (including data connections; timing requirements and the like).
  - 3. General training on operating the device.
  - 4. Specific training on device operation (e.g. entering statistics; how to access data retrieval sources; how to create repeatable formats and layouts, changing fonts, loading new fonts).
  - 5. Basic and specific troubleshooting.
  - 6. Maintenance procedures.

END OF SECTION 116500

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 116623 - GYMNASIUM EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Basketball equipment.
2. Exercise equipment.
3. Safety pads.

B. Related Requirements:

1. Section 096466 "Wood Athletic Flooring" for game lines and markers.

#### 1.2 DEFINITIONS

- A. FIBA: Federation Internationale de Basketball Amateur (The International Basketball Federation).

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
3. Include transport and storage accessories for removable equipment.

C. Samples: For each exposed product and for each item and color specified.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

B. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.

- C. Qualification Data: For Installer.
- D. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

#### 1.8 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Basketball backboard failures including glass breakage.
    - b. Faulty operation of basketball backstops.
  - 2. Overhead-Supported and Wall-Mounted Backstops Warranty Period: 10 years from date of Substantial Completion.
  - 3. Portable Backstops Warranty Period: Ten year limited warranty on frame, two year on telescopic brace, and two years on the foot pedestals.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain each type of gymnasium equipment from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

### 2.3 BASKETBALL EQUIPMENT

- A. General: Provide equipment complying with requirements in FIBA's "Basketball Rule Book."
- B. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
- C. Provide manufacturer's recommended connections complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.
- D. Portable Backstops:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Spalding Equipment; Spalding Spring Portable 10'8" Extension, 401-990.
  - 2. Frame:
    - a. The base of the frame shall consist of structural steel tubing, comprising of 3"x5", 2"x5", round tubing, and formed heavy gauge steel parts welded together to form a box section. The base weldment supports 2 structural steel arms consisting of 3"x5", 3"x3", 2-1/8" Dom, and steel parts welded together. Hinges consist of 1-1/2" ground and polished pins with bronze bushings on all pivot points. The unit shall have a boom weldment consisting of structural steel tubing, comprising of 5"x5", formed sheet metal, and steel parts welded together. The boom shall have an extension of 10'8" from the front base pad to the front of the backboard glass. The unit will come preassembled with 2000lbs. of ballast weight. The total weight of assembled unit when in the playing position is approximately 3700lbs. Ballast shall be contained within a polished aluminum tread plate cover.
  - 3. Wheels:
    - a. The front shall be provided with 2 heavy-duty swivel casters each with one 6"x2" poly wheel rated at 900lbs. The rear of the base shall have double 6"x2" poly wheels each side rated at 1800lbs. Each unit shall come with an automatic lifting mechanism attached to the front casters for ease of set-up.
  - 4. Anchors:

- a. Each unit shall come equipped with ribbed brass floor inserts and two heavy-duty drop pins for locating the baskets, Rear anchor and brass cover plate, and adjustable chain links to anchor the unit to the floor.
5. Folding:
  - a. The unit shall operate with 7 Chrome Silicon springs to assist in raising and lowering. The unit shall come with a positive lock at the 8', 9', and 10' playing positions and can be adjusted to meet several heights in between. A spring cover shall be included and shall be covered to match the padding.
6. Padding:
  - a. All front padding shall be a minimum of 4" thick P1895 covered with 24oz. Naugahyde and is removable. All base side padding shall be a minimum of 2" thick P1895 covered with 24oz. Naugahyde and is removable. Color as selected.
7. Finish:
  - a. The unit shall be finished with a baked on electro-static powder-coat standard color white.
8. Rim and Backboard attachment:
  - a. Super Glass Pro Backboard. The rim and backboard shall be attached to the unit as a direct mount which completely eliminate stress on the glass backboard during play. The rim will mount through spacers and bolt directly to the backboard structure and to the front of the portable to insure that there is no contact between the mounting bolts, rim, and the glass backboard. A V-Brace support is supplied to further support the backboard during play.
9. Backboard: GB1sb glass backboard with border and target measures 42" x 72". Twenty year warranty.
10. Goal: SD180sb Vision with 180-degree breakaway action. Seven year warranty on breakaway mechanism and ring.
- E. Overhead-Supported Backstops:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Spalding Equipment; Single Mast Ceiling-Suspended Backstops, 1017 Forward Fold, Rear Braced.
  2. Folding Type: Provide manufacturer's standard assembly for forward-folding, rear-braced backstop, with hardware and fittings to permit folding.
  3. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
    - a. Center-Mast Frame: Welded with side sway bracing.
    - b. Finish: Manufacturer's standard polyester powder-coat finish. Black.
- F. Wall-Mounted Backstops: Complete assembly extending from wall, including support framing to building structure, bracing, cables, support chains, pulleys, fittings, hardware, pipe anchors, equipment pads, and fasteners.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Spalding Equipment; Wall-Braced Stationary Backstop.
  2. Stationary Type: Provide manufacturer's standard assembly for stationary backstop.
  3. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
    - a. Finish: Manufacturer's standard polyester powder-coat finish. Black
  4. Extension: 36 inches.
- G. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.
1. Retractor Device: Manufacturer's standard device designed to retract both support and safety cables, chains, and straps away from play of the basketball when backstop is in playing position; one per folding backstop.
- H. Backstop Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
  3. Motor Electrical Characteristics:
    - a. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
    - b. Horsepower: 3/4 hp.
    - c. Phase: Single.
  4. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.
    - a. Group Key Switch Control Stations: One switch per each backstop.
    - b. Keys: Provide two keys per station.
    - c. Control Station Enclosure: Provide prime-painted metal enclosure with key access with two sets of keys per enclosure.
  5. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.
- I. Basketball Backboards:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Spalding Equipment; SuperGlass Prosb Backboard.
  2. Shape and Size:
    - a. Rectangular, 72 by 42 inches width by height.

3. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
    - a. Glass: Not less than 1/2-inch- thick, transparent tempered glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass and framing system manufactured to comply with FIBA Level 1 or Level 2 requirement that glass does not split off if broken. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.
      - 1) Standard Mount: Provide steel corner reinforcement with mounting slots for mounting backboard frame to backstop at standard mounting centers. Provide center-strut frame reinforcement.
      - 2) Direct Mount: Designed for mounting backboard frame to center mast of backstop to maximize relief of stresses on backboard frame and glass.
      - 3) Rim-Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.
    - b. Steel: Single-piece, steel face sheet, not less than 0.1046-inch nominal thickness, with 1-1/2-inch deep, roll-edged perimeter flange and with steel-reinforced, welded frame welded to back side of backboard; with mounting slots for mounting backboard frame to backboard support framing at standard mounting centers.
  4. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced rules.
  5. Finish: Manufacturer's standard factory-applied, white background.
- J. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern 5 inches o.c. horizontally and 4 inches o.c. vertically for goal attachment.
1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
  2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.
- K. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Spalding Equipment; Slam-Dunk Precision 180sb Goal.
  2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
  3. Breakaway Characteristics: Positive-lock movable breakaway design, with manufacturer's standard breakaway mechanism including preset pressure release, set to release at 230-lb load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.
  4. Field Adjustment: Provide rim that is field-adjustable for rebound elasticity without being removed from the backboard.
  5. Mount: Rear.

6. Net Attachment: No-tie loops for attaching net to rim without tying.
  7. Finish: Manufacturer's standard finish.
- L. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:
1. Competition Cord: Antiwhip, made from white nylon cord not less than 120-gm thread and not more than 144-gm thread.
- M. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules.
1. Attachment: Manufacturer's standard.
  2. Color: As selected by Architect from manufacturer's full range.

## 2.4 SAFETY PADS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Draper, Inc.; GREENGUARD Wall Protection Pads or comparable product by one of the following:
1. AALCO Manufacturing.
  2. ADP Lemco.
  3. IPI by Bison.
  4. Jaypro Sports LLC.
  5. Performance Sports Systems.
  6. Porter Athletic Equipment Company.
  7. Spalding Equipment.
- B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 450 or less.
- C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, not less than 14-oz./sq. yd and treated with fungicide for mildew resistance; with surface-burning characteristics indicated, and lined with fire-retardant liner.
- D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
1. Backer Board: Not less than 3/8-inch-thick fire-retardant-treated plywood or 7/16 inch-thick Oriented Strand Board.
  2. Fire-Resistive Fill: Multiple-impact-resistant foam not less than 2-inch-thick, fire-resistive neoprene; 6.0-lb/cu. ft. density.
  3. Size: Each panel section, as indicated.
  4. Number of Modular Panel Sections: As indicated.
  5. Installation Method: Concealed mounting Z-clips top and bottom.

- 6. Fabric Covering Color: As selected by Architect from manufacturer's full range for one color.
- E. Corner Wall Safety Pads: Wall corner pad consisting of not less than 1-1/4-inch- thick, multiple-impact-resistant, closed-cell, polyethylene-foam filler, covered on both sides and all edges by fabric covering with backer board and manufacturer's standard anchorage to wall.
  - 1. Length: Each pad matching length of wall safety pads.
  - 2. Fabric Covering Color: Match color of wall safety pads for one color.
- F. Cut-out Trim: Provide manufacturer's standard flanged cut-out trim kits for fitting pads around switches, receptacles, and other obstructions.
  - 1. Color: Black.

## 2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.
  - 1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
  - 2. Cast Aluminum: ASTM B 179.
  - 3. Flat Sheet: ASTM B 209.
- B. Steel: Comply with the following:
  - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
  - 3. Steel Sheet: ASTM A 1011/A 1011M.
- C. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.
- D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and hangars.
- E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.
- F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.
- G. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.
- H. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
  - 1. Verify critical dimensions.
  - 2. Examine supporting structure, subfloors, and footings below finished floor.
  - 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.
- C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
  - 1. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
- D. Wall and Corner Safety Pads: Mount with bottom edge at 4 inches above finished floor.
- E. Cut-out Trim: Limit cuts in face of padding from trim unit's corner-to-corner outside dimensions. Install with ends of cuts concealed behind trim flange.
- F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.
- G. Connections: Connect electric operators to building electrical system.
- H. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by Owner, and store units in location indicated on Drawings.

### 3.3 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

### 3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

## SECTION 116653 - GYMNASIUM DIVIDERS

### 1.1 PRODUCTS

- A. Base Bid: See Section 102239 Folding Panel Partitions.
- B. Alternate 1: Basis of Design Manufacturer/Product: Nickerson; Arena Curtain System.
  - 1. Divider System: Electrically operated, roll-up dividers with safety lock.
  - 2. Divider Curtains:
    - a. Curtain, Solid: Manufacturer's standard opaque fabric.
    - b. Flame-Resistance Ratings: Passes NFPA 701.
- C. Alternate 2: Basis of Design Manufacturer/Product: Performance Solutions; Curtain Divider System.
  - 1. Divider System: Remotely stored, electrically lifted, walk-draw dividers with safety lock.
  - 2. Divider Curtains:
    - a. Curtain, Solid: Manufacturer's standard opaque drapes.
    - b. Flame-Resistance Ratings: Passes NFPA 701.
- D. Alternate 3: Basis of Design Manufacturer/Product: Draper; Roll-up Gym Divider Curtain.
  - 1. Divider System: Electrically operated, roll-up dividers with safety lock.
  - 2. Divider Curtains:
    - a. Upper Curtain, Mesh: Vinyl coated.
    - b. Lower Curtain, Solid: Vinyl-coated fabric.
    - c. Flame-Resistance Ratings: Passes NFPA 701.

END OF SECTION 116653

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 122413 - ROLLER WINDOW SHADES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

#### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

## 2.2 WC-01, MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc.; MechoShade Mecho/5 or comparable product by one of the following:
  - 1. BTX Window Automation, Inc.
  - 2. DFB Sales.
  - 3. Draper Inc.
  - 4. Hunter Douglas Contract.
  - 5. Lutron Electronics Co., Inc.
  - 6. OEM Shades Inc.
  - 7. Silent Gliss USA, Inc.
  - 8. SM Automatic, Inc.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
  - 1. Bead Chains: Manufacturer's standard.
    - a. Loop Length: Full length of roller shade.

- b. Limit Stops: Provide upper and lower ball stops.
  - c. Chain-Retainer Type: Chain tensioner, jamb mounted or sill mounted.
- 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
  - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  - 1. Roller Drive-End Location: Right side of interior face of shade.
  - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Shadebands:
  - 1. Shadeband Material: Light-filtering fabric.
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
    - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
  - 1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
    - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
  - 2. Endcap Covers: To cover exposed endcaps.
  - 3. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
    - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
    - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
  - 4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

## 2.3 WC-04, MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc.; ElectroShade Electro/1 or comparable product by one of the following:
1. BTX Window Automation, Inc.
  2. DFB Sales.
  3. Draper Inc.
  4. Hunter Douglas Contract.
  5. Lutron Electronics Co., Inc.
  6. OEM Shades Inc.
  7. Silent Gliss USA, Inc.
  8. SM Automatic, Inc.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    - a. Individual Switch Control Station: Maintained-contact, wall-switch-operated control station with open, close, and center off functions.
      - 1) Switch Positions: Three.
      - 2) Switch Style: Rocker.
    - b. Color: As selected by Architect from manufacturer's full range.
  3. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of interior face of shade.
  2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
1. Shadeband Material: Light-filtering fabric.

2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
  - a. Type: Enclosed in sealed pocket of shadeband material.
  - b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
  - a. Shape: L-shaped.
  - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
  - a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.
3. Endcap Covers: To cover exposed endcaps.
4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
  - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 6 inches.
  - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  1. Source: Roller shade manufacturer.
  2. Type: Woven PVC-coated fiberglass or PVC-coated polyester.
  3. Orientation on Shadeband: Up the bolt.
  4. Openness Factor: 3 percent.
  5. Color: As selected by Architect from manufacturer's full range.

2.5 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
  2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Roller Shade Locations: As indicated on Drawings.

#### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

#### 3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes plastic-laminate countertops.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in plastic-laminate countertops.
  - 2. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Verification:
  - 1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
  - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
  - 3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
  - 4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
  - 5. Product Data: For installation adhesives, indicating VOC content.
  - 6. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
  - 7. Qualification Data: For Installer.
- B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Fabricator of products.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

### PART 2 - PRODUCTS

#### 2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
  - 1. Provide labels from AWI certification program indicating that countertops, including installation, comply with requirements of grades specified.
  - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

E. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - a. Abet Laminati, Inc.
  - b. Formica Corporation.
  - c. Lamin-Art, Inc.
  - d. Panolam Industries International, Inc.
  - e. Wilsonart International; Div. of Premark International, Inc.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations.
2. Edge Treatment: Same as laminate cladding on horizontal surfaces.

G. Core Material: Particleboard or medium-density fiberboard.

H. Core Material at Sinks: exterior-grade plywood.

I. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

## 2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Composite Wood Products: Products shall be made without urea formaldehyde.
2. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
3. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
4. Particleboard: ANSI A208.1, Grade M-2.
5. Softwood Plywood: DOC PS 1.

## 2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 2-inc OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc.

## 2.4 MISCELLANEOUS MATERIALS

- A. Adhesives: Do not use adhesives that contain urea formaldehyde.
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- C. Installation Adhesive:
  1. Adhesives shall have a VOC content of 70 g/L or less.
  2. Plastic Seam Filler: Plastic seam and repair filler in color to match plastic laminate.
  3. Product: Seamfil, Kampel Enterprises, Inc.
- D. Colored Caulk: Acrylic latex caulk in color to match plastic laminate.
  1. Product: Colorflex, Kampel Enterprises, Inc.

## 2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
  1. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  2. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  1. Seal edges of openings in countertops with a coat of varnish.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
  - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
  - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623.13

## SECTION 123640 - STONE COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes stone countertops.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each stone accessory and manufactured product.
- B. Shop Drawings:
  - 1. Include plans, sections, details, and attachments to other work.
  - 2. Show locations and details of joints.
  - 3. Show direction of veining, grain, or other directional pattern.
- C. Samples for Verification: For each stone type indicated, in sets of Samples not less than 12 inches square.
  - 1. Include two or more Samples in each set and show the full range of variations in appearance characteristics expected in the completed Work.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
  - 2. Product Data: For adhesives, indicating VOC content.
  - 3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
- B. Qualification Data: For fabricator.
- C. Material Test Reports:
  - 1. Stone Test Reports: For stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, according to referenced ASTM standards. Base reports on testing done within previous three years.
  - 2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For stone countertops to include in maintenance manuals. Include product data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate stone countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of stone countertops.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
  - 1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
  - 2. Store stone on wood A-frames or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

#### 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication and indicate measurements on Shop Drawings.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
  - 1. For stone types that include same list of varieties and sources, provide same variety from same source for each.

#### 2.2 STONE-01, MARBLE

- A. Regional Materials: Stone shall be fabricated within 500 miles of Project site from materials that have been extracted, harvested, or recovered within 500 miles of Project site.
- B. Description: Uniform, fine- to medium-grained, black stone with veining.

- C. Varieties and Sources: Subject to compliance with requirements, provide product indicated or comparable product acceptable to the Architect.
- D. Cut stone from contiguous, matched slabs in which natural markings occur.
- E. Finish: Polished.
- F. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

## 2.3 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

- A. General: Use only adhesives formulated for stone and ceramic tile and that are recommended by their manufacturer for the application indicated.
  - 1. Adhesives shall have a VOC content of 65 g/L or less.
- B. Water-Cleanable Epoxy Adhesive: ANSI A118.3.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Boiardi Products; a QEP company.
    - b. Bonstone Materials Corporation.
    - c. Bostik, Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. Jamo Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Parex USA, Inc.
    - j. Prospec; Bonsal American; a division of Oldcastle Architectural Products Group.
    - k. Summitville Tiles, Inc.
    - l. TEC, Specialty Construction Brands, Inc.; an H. B. Fuller company.
- C. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Boiardi Products; a QEP company.
    - b. Bostik, Inc.
    - c. C-Cure.
    - d. Custom Building Products.
    - e. Jamo Inc.
    - f. Laticrete International, Inc.
    - g. MAPEI Corporation.
    - h. Parex USA, Inc.
    - i. Prospec; Bonsal American; a division of Oldcastle Architectural Products Group.
    - j. Summitville Tiles, Inc.
    - k. TEC, Specialty Construction Brands, Inc.; an H. B. Fuller company.

- D. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and that will not stain the stone it is applied to.
  - 1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
  - 2. Color: Clear.
- E. Stone Joint Splines: Stainless-steel or brass washers approximately 1 inch in diameter and of thickness to fit snugly in saw-cut kerf in edge of stone units.
- F. Plywood Subtops: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- G. Stone Cleaner: Specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
- H. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bostik, Inc.
    - b. Custom Building Products.
    - c. Hillyard, Inc.
    - d. HMK Stone Care System.
    - e. Miracle Sealants Company.
    - f. Stone Care International Inc.
    - g. Summitville Tiles, Inc.

## 2.4 STONE FABRICATION, GENERAL

- A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that may impair structural integrity, function, or appearance.
  - 1. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by Architect.
- B. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.
- C. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated.
  - 1. Clean sawed backs of stones to remove rust stains and iron particles.
  - 2. Dress joints straight and at right angle to face unless otherwise indicated.
  - 3. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
  - 4. Provide openings, reveals, and similar features as needed to accommodate adjacent work.

5. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased unless otherwise indicated.
  6. Finish exposed faces of stone to comply with requirements indicated for finish of each stone type required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.
- D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

## 2.5 STONE COUNTERTOPS

- A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual VII."
- B. Nominal Thickness: Provide thickness indicated. Gage backs to provide units of identical thickness.
- C. Edge Detail: As indicated.
- D. Splashes: Provide 3/4-inch- thick backsplashes and end splashes unless otherwise indicated.
1. Height: As indicated.
  2. Top-Edge Detail: Straight, slightly eased at corner.
- E. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.
1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long may result, unless unavoidable.
  2. Joint Type: Grouted, 1/16 inch in width.
  3. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints]. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
- F. Cutouts and Holes:
1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
  2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
  3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive stone countertops and conditions under which stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone countertops.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone countertops.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by stone countertop Installer for anchoring stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.
- B. Before installing stone countertops, clean dirty or stained stone surfaces by removing soil, stains, and foreign materials. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives and rinse with clear water. Allow stone to dry before installing.

### 3.3 CONSTRUCTION TOLERANCES

- A. Variation from Level: Do not exceed 1/8 inch in 96 inches, 1/4 inch maximum.
- B. Variation in Joint Width: Do not vary joint thickness more than one-fourth of nominal joint width.
- C. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch difference between planes of adjacent units.
- D. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch difference between edges of adjacent units, where edge line continues across joint.

### 3.4 INSTALLATION OF COUNTERTOPS

- A. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- B. Install countertops over subtops with full spread of water-cleanable epoxy adhesive.
- C. Do not cut stone in field unless otherwise indicated. If stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.

- D. Set stone to comply with requirements indicated. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure stone countertops in place.
- E. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  - 1. Install metal splines in kerfs in stone edges at joints. Fill kerfs with stone adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Space joints with 1/16-inch gap for filling with grout. Use temporary shims to ensure uniform spacing.
  - 1. Install metal splines in kerfs in stone edges at joints. Fill kerfs with setting adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. Install backsplashes and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch gap between countertop and splashes for filling with sealant. Use temporary shims to ensure uniform spacing.
- I. Grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.

### 3.5 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
- B. Remove and replace stone countertops of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
  - 2. Defective countertops.
  - 3. Defective joints, including misaligned joints.
  - 4. Interior stone countertops and joints not matching approved Samples and mockups.
  - 5. Interior stone countertops not complying with other requirements indicated.
- C. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.

- D. Clean stone countertops no fewer than six days after completion of installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that may damage stone.
- E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 123640

## SECTION 123661 - SIMULATED STONE COUNTERTOPS

### 1.1 SUSTAINABILITY REQUIREMENTS

#### A. LEED 2009 NC:

1. Recycled content.
2. Certified wood.
3. Low-emitting composite wood.

### 1.2 SOLID-SURFACE-MATERIAL COUNTERTOPS

#### A. Front: Straight, slightly eased edge.

#### B. Backsplash and Endsplash: Eased edge.

#### C. Countertops: 3/4-inch- (19-mm-) thick, solid surface material.

#### D. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. FSC certified, with chain of custody certificate, or 100% post-consumer wood waste, with Manufacturer's certificate.
2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
  - a. Agrifiber particleboard is not acceptable.
3. Softwood Plywood: DOC PS 1, medium-density overlay

END OF SECTION 123661

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 123663 - SOLID SURFACING COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material sinks.

B. Related Requirements:

1. Division 22 for non-integral sinks and plumbing fittings.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Product Data: For adhesives, indicating VOC content.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

B. Qualification Data: For fabricator.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

## 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

## 1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

## PART 2 - PRODUCTS

### 2.1 SS, SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
  - 1. Product: Provide product indicated.
  - 2. Type: Provide Standard type unless Special Purpose type is indicated.
  - 3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
  - 4. Colors and Patterns: As indicated.
- B. Composite Wood Products: Products shall be made without urea formaldehyde.
- C. Particleboard: ANSI A208.1, Grade M-2.
- D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

### 2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Premium.
- B. Configuration:
  - 1. Front: Straight, slightly eased at top.
  - 2. Backsplash: Straight, slightly eased at corner.
  - 3. End Splash: Matching backsplash.

- C. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch- thick, solid surface material.
- E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.
  - 2. Install integral sink bowls in countertops in the shop.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:
  - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
  - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
  - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## 2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
  - 1. Adhesives shall have a VOC content of [70] <Insert value> g/L or less.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
  - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123663

## SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Resilient entrance mats.
  - 2. Recessed frames.
- B. COORDINATION
- C. Coordinate size and location of recesses in concrete to receive floor mats and frames.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
- B. Shop Drawings:
  - 1. Items penetrating floor mats and frames, including door control devices.
  - 2. Perimeter floor frames.
  - 3. Samples: For the following products, in manufacturer's standard sizes:
  - 4. Floor Mat: Assembled sections of floor mat.
  - 5. Frame Members: Sample of each type and color.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

#### 2.2 WOM-01, RESILIENT ENTRANCE MATS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product acceptable to the Architect.

1. Carpet-Type Mats: 100% regenerated polyamide BCF carpet bonded to flexible vinyl backing to form mats 9 mm thick with nonraveling edges.
2. Colors, Textures, and Patterns: As indicated.

## 2.3 FRAMES

- A. Recessed Frames: Manufacturer's standard extrusion.
  1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
    - a. Color: Mill finish.

## 2.4 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

## 2.5 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
  1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

## 2.6 ALUMINUM FINISHES

- A. Mill finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
  - 1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
  - 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
  - 3. Delay setting mats until construction traffic has ended.

### 3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

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## SECTION 124816 - ENTRANCE FLOOR GRILLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes recessed floor grilles and frames.

#### 1.2 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor grilles and frames.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for entrance floor grilles and foot grilles.
- B. Shop Drawings:
  - 1. Items penetrating floor grilles and frames, including door control devices.
  - 2. Divisions between grille sections.
  - 3. Perimeter floor moldings.
- C. Samples: For the following products, in manufacturer's standard sizes:
  - 1. Floor Grille: Assembled section of floor grille.
  - 2. Frame Members: Sample of each type and color.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor grilles and frames to include in maintenance manuals.

#### 1.5 FIELD CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide C/S Group; Gridline G6 or a comparable product by one of the following:

1. Arden Architectural Specialties, Inc.
2. Balco, Inc.
3. Cactus Mat Mfg. Co.
4. Crowder, K. N. Manufacturing, Inc.
5. J. L. Industries, Inc.
6. Kadee Industries, Inc.
7. Mats Inc.
8. Pawling Corporation; Architectural Products Division.
9. Reese Enterprises, Inc.

## 2.2 ENTRANCE FLOOR GRILLES, GENERAL

- A. Structural Performance: Provide floor grilles and frames capable of withstanding the following loads and stresses:
1. Uniform floor load of 300 lbf/sq. ft.
  2. Wheel load of 5000 lb per wheel.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

## 2.3 FLOOR GRILLES

- A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.
- B. Stainless-Steel Floor Grille: Type 304.
1. Surface Treads: 0.090-by-0.172-inch wire with 0.145-inch- wide openings between wires.
  2. Support Rods: Spaced 1 inch o.c., welded to each wire.
  3. Mat Grating: 5/8 inch deep.
  4. Pit Grating: 1-1/8 inches deep.
  5. Stainless-Steel Finish: Mill.
  6. Grille Size: As indicated.

## 2.4 FRAMES

- A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

## 2.5 SUPPORT SYSTEM

- A. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.

## 2.6 MATERIALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- B. Stainless-Steel Angles: ASTM A 276 or ASTM A 479/A 479M, corrosion resistant, Type 304.

## 2.7 FABRICATION

- A. Shop fabricate floor grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.
- B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

## 2.8 STAINLESS-STEEL FINISHES

- A. Mill finish.
- B. Directional Satin Finish: No. 4.
  - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of floor grilles and frames.
- B. Examine roughing-in for drainage piping systems to verify actual locations of piping connections before floor grille and frame and drain pan installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install recessed floor grilles and frames to comply with manufacturer's written instructions at locations indicated and with top of floor grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set floor-grille tops at height for most effective cleaning action. Coordinate top of floor-grille surfaces with doors that swing across grilles to provide clearance under door.

### 3.3 PROTECTION

- A. After completing frame installations, provide temporary filler of plywood or fiberboard in floor-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124816

## SECTION 124853 – CUSTOM AREA RUGS

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Custom Fabricated Area Rugs.

### 1.2 SUSTAINABILITY REQUIREMENTS

- A. LEED 2009 NC:
  - 1. Low-emitting flooring.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Shop Drawings:
  - 1. Graphics: Scale drawing indicating colors.
- C. Samples: 12 inches by 12 inches.

### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For area rugs to include in maintenance manuals.

### 1.5 FABRICATION

- A. Area Rugs Physical Properties: As indicated in the Materials Manual and on the Drawings.
- B. Size: As indicated on the Drawings.

END OF SECTION 124853

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## SECTION 126100 - FIXED AUDIENCE SEATING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes fixed audience seating with the following:
  - 1. Standard mounting.
  - 2. Molded-plastic chairs with upholstered inserts.
  - 3. Power and data service to individual seat locations.
- B. Owner-Furnished Material: Upholstery fabric.

#### 1.2 DEFINITIONS

- A. Pan: An exposed, supporting seat bottom made of steel.
- B. Shell: An exposed, supporting seat bottom or back made of materials other than steel.
- C. Tablet Arm: A flat surface attached to a chair that has the primary function to support tasks such as writing and short-term reference-material handling.

#### 1.3 COORDINATION

- A. Coordinate layout and installation of electrical wiring and devices with seating layout to ensure that floor junction boxes for electrical devices are accurately located to allow connection without exposed conduit.
- B. Coordinate layout and installation of diffuser pedestals with HVAC work and with properties of diffuser pedestals to ensure alignment, proper air diffusion, and correct seat locations.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of components, and finishes for fixed audience seating.
  - 2. Include electrical characteristics of electrical components, devices, and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Seating Layout: Show seating layout, aisle widths, aisle-end alignment or stepping, row-lettering and chair-numbering scheme, chair widths, and chair spacing in each row.
  - 2. Accessories: Show locations and features of accessories, including tablet arms, electrical devices, and accessibility provisions.
  - 3. Wiring Diagrams: For power, signal, and control wiring.

- C. Samples for Initial Selection: For each type of exposed color, finish, texture, and pattern indicated.
  - 1. Include Samples of accessories involving color and finish selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Chair Unit: Full-size unit of each type and combination of finishes.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
  - 2. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fixed audience seating to include in operation and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Maintenance of self-rising seat mechanisms, folding armrests, and other operating components.
    - b. Adjustment of self-rising seat mechanisms to align seats.
    - c. Maintenance of electrical components, devices, and accessories.
    - d. Methods for maintaining upholstery fabric.
    - e. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Chair Seats and Backs: 5 percent of quantity installed for each type and size of chair seat and back.
  - 2. Tablet Arms: 5 percent of quantity installed for each type and size of tablet arm; left- and right-hand mounted.
  - 3. Armrests: 5 percent of quantity installed for each type of armrest.
  - 4. Power Receptacles: 5 percent of quantity installed.
  - 5. Data Ports: 5 percent of quantity installed.
  - 6. Chair Seat Hinges: 5 percent of quantity installed.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including standards, and pedestals.
    - b. Faulty operation of self-rising seat mechanism.
    - c. Faulty operation of electrical components.
    - d. Wear and deterioration of fabric and stitching beyond normal use.
    - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Periods: As follows, from date of Substantial Completion.
    - a. Structural: 10 years.
    - b. Operating Mechanisms: Five years.
    - c. Electrical Components: Five years.
    - d. Plastic, Wood, and Paint Components: Three years.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.
  - 1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics of Upholstered Chairs:
  - 1. Fabric: Class 1 according to DOC CS 191-1953 or 16 CFR 1610, tested according to California Technical Bulletin 117.
  - 2. Padding: Comply with California Technical Bulletin 117.
  - 3. Full-Scale Fire Test: Comply with California Technical Bulletin 133.
- B. Strength and Durability Performance: Chairs and components shall pass testing according to BIFMA X5.4.

## 2.3 FIXED AUDIENCE SEATING

- A. Fixed Audience Seating: Assembly-space seating in permanent arrangement as shown on Drawings.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Irwin Seating Company; Signature Model with Ergo Seat Assembly or comparable product by one of the following:
    - a. American Seating Company.
    - b. Clarin Seating.
    - c. Ducharme Seating International Inc.
    - d. GreyStone International, Inc.
    - e. Hussey Seating Company.
    - f. Interkal LLC.
    - g. KI, Inc.
    - h. Preferred Seating Co. Inc.
    - i. Seating Concepts LLC.
    - j. SERIES LLC.
    - k. Sitmatic.
    - l. Theatre Solutions, Inc.
    - m. Track Seating; a division of Track Corporation.
- B. Chair Mounting Standards: Floor attached of the following material:
  - 1. Cast Iron: One-piece castings with integral mounting points and attachment anchoring points for seat pivots, backs, and armrests.
  - 2. End Panels:
  - 3. Material: Cast iron with integral cast logo.
    - a. Cast-Metal Design: As indicated.
  - 4. Fabric Upholstered Chairs:
  - 5. Back:
    - a. Padding Thickness: 3 inches.
    - b. Outer Back Surface: Molded plastic, with concealed fasteners.
    - c. Top Corners: Rounded.
  - 6. Seat: Two part, top and bottom construction and as follows:
    - a. Top Padding Thickness: Minimum 3 inches at front and rear edges.
    - b. Seat Bottom: Molded-plastic shell.
- C. Plastic Chairs: Molded plastic and as follows:
  - 1. Back: Smooth surface with rounded top corners.
  - 2. Seat: Smooth surface.
  - 3. Chair Width: Vary chair widths to optimize sightlines and row lengths, with minimum chair width as shown.
- D. Back Height: 44 inches high.

E. Back Pitch: Fixed.

1. Chair Seat Hinges: Self-lubricating, with noiseless self-rising seat mechanism passing ASTM F 851, positive internal stops cushioned with rubber or neoprene, and requiring no maintenance.
2. Self-Rising Seat Mechanism: Spring actuated, full fold.
3. Armrests: Upholstered with rounded edges, integral cup holder, and concealed mounting.
4. Power and Data Service Package: Manufacturer's standard service to each seat position, including terminal devices and wiring with 18 inches of extra length and as follows:
5. Power Receptacles: 120 V with wiring and duplex receptacle.
6. Data Ports: Data-port terminal with wiring and receptacle jack.
7. Location: Manufacturer's standard location.

F. Tablet Arms: Manufacturer's oversize, foldaway tablet arm with plastic-laminate writing surface over medium-density fiberboard or plywood core and with rounded, matching PVC edges.

1. Mounting: Right-hand mounted unless otherwise indicated.
2. Fold-Away Mechanism: Cast-iron or steel hinge and swivel mechanism that give positive support in open position and semiautomatic return to stored position below arm block and parallel to chair.

G. Accessible Seating:

1. Provide rollaway chair for each wheelchair space unless otherwise indicated.
2. Provide chairs with folding armrest on aisle side in locations indicated, but not less than five percent of aisle seats, dispersed through the audience seating area. Identify these seats with a sign or marker. Provide chairs with retractable arm at 5 percent of aisle seats.

H. Row-Letter and Chair-Number Plates: Manufacturer's standard.

1. Material: Aluminum with black embossed characters.
2. Location: As indicated on Drawings.
3. Attachment: Manufacturer's standard method.

## 2.4 MATERIALS AND FINISHES

A. Molded Plastic: High-density polyethylene or polypropylene, blow or injection molded, with surface that is mar and dent resistant.

1. Provide with UV inhibitors to retard fading.
2. Color and Texture: As selected by Architect from manufacturer's full range.

B. Fabric: Manufacturer's standard 100 percent nylon or 100 percent polyolefin with flame-retardant treatment.

1. Weight: As selected by Architect from manufacturer's full range.
2. Color and Pattern: As selected by Architect from manufacturer's full range.

C. Upholstery Padding: Flexible, cellular, molded or slab polyurethane foam.

- D. Metal Finish: Finish exposed metal parts with manufacturer's standard minimum 1.5-mil- thick, polyester baked-on powder coating.

- 1. Color: As selected by Architect from manufacturer's full range.

## 2.5 FABRICATION

- A. Floor Attachments: Fabricate to conform to floor slope so that standards and pedestals are plumb and chairs are maintained at same angular relationship to vertical throughout Project.
- B. Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Verify that electrical connections are properly located.
- C. Verify that HVAC air-distribution locations are correct.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install seating in locations indicated and fasten securely to substrates according to manufacturer's written installation instructions.
  - 1. Install fixed audience seating with each chair capable of complying with performance requirements without failure or other conditions that might impair the chair's usefulness.
  - 2. Install standards plumb.
  - 3. Install seating so moving components operate smoothly and quietly.
- B. Install seating with end standards aligned or stepped as indicated from first to last row and with backs and seats varied in width and spacing to optimize sightlines.
- C. Install riser-mounted standards and attachments to maintain uniform chair heights above floor.
- D. Install chairs in curved rows at a constant radius.
- E. Install wiring conductors and cables concealed in components of seating and accessible for servicing.
  - 1. Connect electrical service at junction-box locations according to Division 26.

2. Connect voice and data communication service at junction-box locations according to Division 27.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  1. Inspect components, assemblies, and equipment, including connections, to verify proper, complete, and sturdy installation according to manufacturer's written instructions and product specifications.
  2. Verify that seats return to correct and uniform at-rest position.
  3. Test power receptacles as specified in Section 262726 "Wiring Devices" when power is activated.
  4. Test data ports when data connection is activated.
- B. Fixed audience seating will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust chair backs so that they are at proper angles and aligned with each other in uniform rows.
- B. Adjust hardware and moving parts to function smoothly so they operate easily. Lubricate bearings and sliding parts as recommended in writing by manufacturer.
- C. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
- D. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
- E. Replace damaged and malfunctioning components that cannot be acceptably repaired.
- F. Replace upholstery fabric damaged during installation or work of other trades.

END OF SECTION 126100

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Los Angeles, CA  
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## SECTION 126600 - TELESCOPING STANDS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Manually operated telescoping stands.
  - 2. Electrically operated telescoping stands.

#### 1.2 DEFINITIONS

- A. Forward Folding: Wall- or floor-attached bleachers that open in the forward direction by moving the front row away from the stack to the fully extended position.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.
  - 2. Include load capacities, assembly characteristics, and furnished accessories.
  - 3. Include electrical characteristics of electrical components, devices, and accessories.
- B. Shop Drawings: For telescoping stands in both stacked and extended positions.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include load capacities.
  - 3. Show seating layout, aisle widths, row-lettering and seat-numbering scheme, and wheelchair accessibility provisions.
  - 4. Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
  - 5. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed product and for each color and texture required.
  - 1. Include Samples of accessories involving color and finish selection.
- D. Seat Unit: Full-size unit of each type.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
5. Qualification Data: For Installer.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For telescoping stands to include in operation and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Procedures for conducting periodic inspections.
    - b. Precautions for cleaning materials and methods that could be detrimental to telescoping-stand finishes and performance.
    - c. Methods for maintaining upholstery fabric.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 FIELD CONDITIONS

- A. Finished Spaces: Do not deliver or install telescoping stands until finishes in spaces to receive them are complete, including suspended ceilings, floors, and painting.
- B. Field Measurements: Indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Telescoping stands shall withstand the effects of gravity loads, operational loads, and other loads and stresses according to ICC 300.
- B. Fire-Test-Response Characteristics of Upholstered Chairs: Comply with California Technical Bulletin 117.
- C. Accessibility Standard: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

### 2.2 TELESCOPING STANDS

- A. System Description: Operable system of multiple-tiered seating on interconnected folding platforms that close for storage, without being dismantled, into a nested stack. Telescoping-stand units permit opening and closing of adjacent, individual and multiple rows, and close with vertical faces of platforms in the same vertical plane.
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Telescoping-Stands Standard: ICC 300.
- B. Recessed Telescoping Stands: Forward-folding system, in which the bleachers open in the forward direction by moving the front row away from the stack to the fully extended position and the rear of bleacher understructure permanently attaches to building construction so that closed stands are recessed in opening.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Irwin Telescopic Seating Company; Model 4500 with Integra Seating and Panelam Deck or comparable product by one of the following:
  - 2. Hussey Seating Company.
    - a. Interkal LLC.
    - b. Kodiak Industries Ltd.
    - c. Royal Stewart Ltd.
  - 3. Row Spacing: 33 inches.
  - 4. Row Rise: As indicated on Drawings.
  - 5. Seat Type: Chairs.
  - 6. Elevated Front Row: Height indicated on Drawings.
  - 7. Operation: Electrically operated, with integral power unit.
  - 8. Electrical Characteristics for Each Seating Section:
    - a. Horsepower: As required.
    - b. Electrical Controls:
    - c. Control Devices: Wall-attached control system.
    - d. Limit Switches: Automatically stop power system when telescoping stands reach fully opened or closed positions.

- e. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 feet, mounted under telescoping seating for audio and visual warning during integral power operation.
- f. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

## 2.3 COMPONENTS

- A. Chairs: Rotating from upright, locked position to folded-down position that allows supporting platform to telescope for storage. In upright position, seats fold up to allow passage of persons within row.
  - 1. Operation: Automatic.
  - 2. Chair Width: As indicated on Drawings.
  - 3. Seat Height: Not less than 17 inches or more than 18 inches.
  - 4. Seats: Molded plastic with padded upholstery insert.
    - a. Color: As selected by Architect from manufacturer's full range.
  - 5. Backs: Molded plastic with padded upholstery insert.
    - a. Color: As selected by Architect from manufacturer's full range.
  - 6. Armrests: Molded plastic with cup holder.
    - a. Color: As selected by Architect from manufacturer's full range.
- B. Deck: Manufacturer's standard laminated panel of high density polyethylene overlay permanently bonded to tongue-and-groove, 5-ply structural plywood.
  - 1. Finish: Manufacturer's standard.
    - a. Color: As selected by Architect from manufacturer's standard colors.
- C. Risers: Steel sheet with manufacturer's standard, rust-inhibiting coating or hot-dip galvanized finish.
- D. Safety Rails: Steel, finished with manufacturer's standard powder coat system.
  - 1. Self-storing mid-aisle handrails located at centerline of each aisle with seating on both sides.
  - 2. End rails (guards) that are telescoping and self-storing.
  - 3. Back rails (guards) along rear of units where required by ICC 300.
  - 4. Removable front rails (guards) along front of units where required by ICC 300.
  - 5. Removable rails around accessible seating cutouts and truncations.
  - 6. Removable, programming-support front rails to allow seating in upper rows while lower rows remain in the stored position.
  - 7. Color: Black.
- E. Understructure: Structural steel.
  - 1. Finish: Manufacturer's standard rust-inhibiting finish.

2. Color: Manufacturer's standard.

F. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.

1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but no fewer than four per column or less than 4 inches in diameter and 1-1/2 inch wide.

G. Control Devices:

1. Wall Attached: Manufacturer's standard control station, located within full view of each stand and its movement area.

H. Fasteners: Vibration proof, in manufacturer's standard size and material.

## 2.4 ACCESSORIES

A. Steps:

1. Slip-resistant, abrasive tread surfaces at aisles.
2. Intermediate aisle steps, fully enclosed, at each aisle.
3. Transitional top step, fully enclosed, at each aisle where last row of telescoping stands is adjacent to a cross aisle.
4. Removable front steps, fully enclosed, at each aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.

B. Portable Stairs: Portable access-stair units equipped with handrails, with no fewer than four full-swiveling, nonmarring wheels and a locking mechanism to prevent movement during use.

C. Ramps: Portable access-ramp units, slope to comply with requirements of accessibility standard, equipped with handrails, with no fewer than four full-swiveling, nonmarring wheels and a locking mechanism to prevent movement during use.

D. Closure Panels and Void Fillers:

1. Aisle closures at foot level that produce flush vertical face at aisles when system is stored.
2. Gap fillers for closing openings between stand units or between stand units and adjoining construction.

E. Signage:

1. Row letters at each row end.
2. Seat numbers on each chair.
3. Accessibility signs at each accessible space.

## 2.5 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- C. Composite Wood Products: Products shall be made without urea formaldehyde.
- D. Lumber: Kiln dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B & B finish (B and better) grade-of-finish requirements.
- E. Plywood: PS 1 as standard with manufacturer.
- F. Molded Plastic: High-density polyethylene; blow or injection molded, color-pigmented, textured, impact-resistant, with integral reinforcing ribs for attachment and anchoring points. Provide with UV inhibitors to retard fading.

## 2.6 FABRICATION

- A. Fabricate telescoping stands to operate easily without special tools or separate fasteners unless otherwise indicated.
- B. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.
- C. Form exposed work with flat, flush surfaces, level and true in line.
- D. Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair their usefulness.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install telescoping stands according to ICC 300 and manufacturer's written instructions.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Perform the following tests and inspections:
  - 1. ICC 300 Inspection: Inspect installed telescoping stands to verify that construction, installation, and operation are according to ICC 300 requirements.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Telescoping stands will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

#### 3.4 ADJUSTING

- A. Adjust backrests so that they are at proper angles and aligned with each other in uniform rows.
- B. Adjust hardware and moving parts to function smoothly, and lubricate, test, and adjust each telescoping stand unit to operate according to manufacturer's written instructions.
- C. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up factory-applied finishes or replace components as required to restore damaged or soiled areas.
- D. Replace upholstery fabric damaged during installation or work of other trades.

#### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect, adjust, operate, and maintain telescoping stands.

END OF SECTION 126600

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 131723 - THERAPEUTIC TREATMENT POOLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This section includes the furnishing of the following:
- B. Related items provided by this contract:

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of therapy pool system component.
- B. Shop Drawings: Indicate components by others.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For products to include in operation and maintenance manuals.

#### 1.4 WARRANTY

- A. Provide manufacturer's warranties in writing per the following schedule.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Provide the following:
- B. Basis of Specifications for therapy pool: specifications are modeled around HydroWorx pools with the following features: 14'-0" long x 7'-6" wide treatment area, varying water depths from 3'-0" to 5', additional means of varying water depth approximately 10" via the HydroWorx control system which transfers water to a external holding tank to adapt the water level to the patient/ athletes needs, intergrated / flush mounted into the pool floor system powered variable speed direct electric drive underwater treadmill specifically driven w/out hydraulics, two (2) Badu resistance jets with adjustable flow nozzels allowing for directional and flow rate adjustments as well as an attachable massage hose, pool mounted digital control system, commercial filtration system, heater with variable controlled water temperature, computer documentation software, hand-held remote control, removable stainless steel support bars, stairway handrail, cameras for underwater viewing, camera switching device, monitor, digital video recorder, additional resistance side jet, additional attachable massage hose, and accessories as indicated herein. The fully executed pool order form must be an included addendum to the bid package to identify all options selected and scopes of work.

## 2.2 MATERIALS

- A. Pre-manufactured hydrotherapy pool components: manufacturer's standard, prefabricated, system with items as listed below.
- B. Pool shell: manufacturer's standard acrylic (fiberglass reinforced) pool shell with textured non-slip surface. Required dimensions are 14'-0" long x 7'-6" wide x 5' 4" high.
- C. Powered variable speed direct electric-drive treadmill (i.e. specifically driven w/out hydraulics). The treadmill device is to be intergrate / flush mounted in the pool (i.e. specifically not a drop in treadmill that will limit usable space within the pool area). Speed ranges from 0 to 7.5 mph in .2 increments. Swim currents or laminar flows are not to be accepted as adequate replacements for this integratd flush mounted treadmill feature.
- D. Varying water depth feature: The pool provides varying water depth sections from 3' -0" to 5' of water depth as well as an additional means of varying water depth in all areas of the pool approximately 10" via the HydroWorx control system which transfers water via (2) 2 HP transfer pumps to a external holding tank to adapt the water level to the patient/ athletes needs.
- E. Maintenance system shall include 200 sq. ft. filter and cartridge, 3/4 HP maintenance pump, brominator, one (1) NSF skimmer, and water chemistry testing kit.
- F. 11 kW electric heater
- G. Badu jets shall be adjustable / directional and multi-functional jets formed of thermoplastic co-extrusion of PVC so as not to cause corrosive action with the pool tank. The Badu Jet system shall be powered by a 4 HP Speck pump motor and include two (2) front resistance/therapy jets, one (1) 5' attachable therapy hose for deep tissue massage. Laminar flow or paddle wheel systems are not to be accepted as adequate replacements for the adjustable multi-directional jet system.
- H. Additional resistance and massage side BADU jet. Badu jet shall be adjustable / directional and multi-functional jets formed of thermoplastic co-extrusion of PVC so as not to cause corrosive action with the pool tank. The Badu Side Jet system shall be powered by a 2 HP Speck pump motor and include one (1) resistance/therapy jet, one (1) 5' attachable therapy hose for deep tissue massage. Laminar flow or paddle wheel systems are not to be accepted as adequate replacements for the adjustable multi-directional jet system.
- I. Computer documentation: HydroWorx owns the proprietary rights to the software that is written exclusively for HydroWorx. The control system, which was custom designed, utilizes fully integrated compontents. This system is based around an industry standard PLC (Programmable Logic Controller) which monitors pool conditions through various sensors. The PLC also communicates with the operator/trainer via the infrared remote control, the pool control pendant, and the HydroWorx software running on a personal computer. The software monitors the pool functions, treadmill speed, floor depth, and jet power and then uses this information to display and store information in a patient database for future reference and progress reports.
- J. Pool electronic patient monitoring systems shall include a computer, monitor, keyboard, mouse, and surge protector, and appropriate software and licensing agreements for this product.
- K. Control system shall include water-resistant remote control unit, which can control jet action, treadmill speed adjustment, vertical lift and lowering of floor, and patient session time.

- L. Additional controls shall include control of water temperature, chemical feeding system controls, and all other pertinent controls for a complete working system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of therapy pools.
- B. Examine roughing-in for electrical systems to verify actual locations of electrical connections before installation.
- C. Examine walls, floors, and ceilings for suitable conditions where pool is to be installed.

### 3.2 INSTALLATION

- A. Installation by general contractor and appropriate subcontractors. Refer to "Related items done by other contracts" in this section.
- B. Install pool level and plumb, according to manufacturer's written instructions and drawings.
- C. HydroWorx has no scope of work and is not present onsite for the delivery, setting and installation of the pool equipment.
- D. General contractor completes the HydroWorx Site Analysis Checklist and return it to the HydroWorx project management department for review. Customer in-service training cannot be scheduled until this is completed. Contact the HydroWorx project management department to schedule phone assistance to aid in completing the site analysis checklist.
- E. Owner Training: A HydroWorx representative will make (1) non-prevailing wage / non-union trip to perform the customer training. The customers authorized representative, pool maintenance and medical staff must be present to go through the system maintenance technical training and operational overview performed by the HydroWorx representative. The customers authorized representative is required to sign the pool systems startup documents to accept ownership and begin the warranty period.
- F. The general contractor and their CCIP Administrator are responsible for including HydroWorx field representatives in any project required CCIP insurance obligations as well as all associated costs and administrative requirements.
- G. Upon completion of the owner training the pool will be turned over to the owner, at which time the water must be tested daily to confirm proper water chemistry. The pool is typically left up and running and the timing of the customer training should be sequenced to make this feasible.

### 3.3 DEMONSTRATION

- A. Start-up services: engage a manufacturer's authorized representative to provide start-up services and to demonstrate and train owner's medical and maintenance personnel as specified below.
1. Provide shop pre-fabricated, aquatic therapy pool systems. The unit shall include; 14'-0" long x 7'-6" wide treatment area, varying water depths from 3'- 0" to 5', additional means of varying water depth approximately 10" via the HydroWorx control system which transfers water to a external holding tank to adapt the water level to the patient/ athletes needs, intergrated / flush mounted into the pool floor system powered variable speed direct electric drive underwater treadmill specifically driven w/out hydraulics, two (2) Badu resistance jets with adjustable flow nozzels allowing for directional and flow rate adjustments as well as an attachable massage hose, pool mounted digital control system, commercial filtration system, heater with variable controlled water temperature, computer documentation software, hand-held remote control, removable stainless steel support bars, stairway handrail, cameras for underwater viewing, camera switching device, monitor, digital video recorder, additional resistance side jet, additional attachable massage hose, and accessories as indicated.
  2. Design consultation.
  3. Manufacturer's standard installation guide with standard drawings including standard electrical and standard plumbing schematics.
  4. Provide operations manual in electronic format and product data in electronic format for all components of the pool.
  5. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  6. Include full building plan, elevations, sections, details.
  7. Include details of components. Indicate location and size of each field connection.
  8. Include diagrams for service connections and power, signal, and control wiring.
  9. All therapy pool components including controls, pumps, jets, and treadmill unit shall be fully warranted by manufacturer for a period of one (1) year. The HydroWorx Limited Warranty Document must be an included addendum to the bid package to identify specific warranty terms and conditions.
  10. Pool shell and treadmill frame shall be fully warranted by manufacturer for a period of five (5) years against structural failure. The HydroWorx Limited Warranty Document must be an included addendum to the bid package to identify specific warranty terms and conditions.
  11. Installation contractor and all subcontractors shall provide a one (1) year limited warranty against defects in material, installation, and workmanship.
  12. HydroWorx International, Inc.; HydroWorx Plunge Series Pool.
  13. HydroWorx International, Inc.; HydroWorx Thermal Plunge Series Pool.
  14. HydroWorx International, Inc.; HydroWorx 500 Series.
  15. Do not proceed with installation until unsatisfactory conditions have been corrected.
  16. During the preparation of the support structure the manufacturer's representative shall be available by phone.
  17. In-service training (product introduction/protocols) will take place following the installation completion and will be coordinated according to a mutually agreeable schedule between the customer and the HydroWorx sales representative. This training cannot be scheduled until HydroWorx receives the completed site analysis checklist form from the general contractor.

18. Train owner's maintenance personnel and medical staff on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
19. Review data in the operation and maintenance manuals.

#### 3.4 PROTECTION

- A. To be provided by the general contractor.
- B. General contractor is to clean pool, poolroom, mechanical level, and associated controls completely prior to contract closeout and turnover to owner.

END OF SECTION 131723

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Lakers Practice Facility  
Los Angeles, CA  
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## SECTION 131733 – WHIRLPOOL TUBS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Stationary whirlpools.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each stationary whirlpool.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of appliance.
- B. Field quality-control reports.
- C. Sample Warranties: For manufacturers' special warranties.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each stationary whirlpool to include in operation and maintenance manuals.

#### 1.5 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace stationary whirlpool or components that fail in materials or workmanship within specified warranty period except as qualified below:
1. Warranty Period: Two years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain [residential appliances from single source] [and] [each type of residential appliance from single manufacturer].

## 2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in [the DOJ's 2010 ADA Standards for Accessible Design] [the ABA standards of the Federal agency having jurisdiction] [and] [ICC A117.1] <Insert requirement>.

## 2.3 STATIONARY WHIRLPOOLS

### A. 15 Gallon Stationary Whirlpool:

- 1. Basis-of-Design Product: Provide Whitehall Manufacturing, A Division of Acorn Engineering Company; E Series 15 Gallon Stationary Whirlpool E-15-S.
  - a. Size: 25"L x 13"W x 15"D.
  - b. Whirlpool shall be fabricated from heavy gauge, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall be polished to satin finish.
  - c. Tank shall have a reinforced rim and shall be fitted with a stainless steel skirt flush to the floor line. Bottom of tank shall be a seamless, rounded coved design to minimize bacteria build up.
  - d. Provide a 2" combination drain and overflow, and a filler spout.
  - e. Provide a turbine assembly with raising and lowering device which functions both as agitator and emptying device, permits adjustment of desired height, direction of water agitation, and can be locked into place.
  - f. Turbine assembly shall be UL listed 1/2 HP jet pump motor with automatic thermal overload protector, and lifetime-sealed bearings.
  - g. Provide a thermometer with a stem retainer to prevent rattle when whirlpool is in operation.
  - h. Electric Requirements:
    - 1) Amps: 8.
    - 2) Volts: 115.
    - 3) Hertz: 60.
    - 4) GFI Receptacle.

### B. 60 Gallon Stationary Whirlpool:

- 1. Basis-of-Design Product: Provide Whitehall Manufacturing, A Division of Acorn Engineering Company; H Series 60 Gallon Stationary Whirlpool H-60-S.
  - a. Size: 36"L x 20"W x 28"D.
  - b. Whirlpool shall be fabricated from heavy gauge, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall be polished to satin finish.
  - c. Tank shall have a reinforced rim and shall be fitted with a stainless steel skirt flush to the floor line. Bottom of tank shall be a seamless, rounded coved design to minimize bacteria build up.
  - d. Provide a 2" combination drain and overflow, and a filler spout.

- e. Provide a turbine assembly with raising and lowering device which functions both as agitator and emptying device, permits adjustment of desired height, direction of water agitation, and can be locked into place.
- f. Turbine assembly shall be UL listed 1/2 HP jet pump motor with automatic thermal overload protector, and lifetime-sealed bearings.
- g. Provide a 3" dial thermometer with a stem retainer to prevent rattle when whirlpool is in operation.
- h. Electric Requirements:
  - 1) Amps: 8.
  - 2) Volts: 115.
  - 3) Hertz: 60.
  - 4) GFI Receptacle.

C. Hydrotherapy Table with Seats:

- 1. Basis-of-Design Product: Provide Whitehall Manufacturing, A Division of Acorn Engineering Company; CTS3 Combination Table with Seats.
  - a. The top and lower seat have a vinyl upholstered padded seat. The frame is constructed from solid hardwood. The legs are solid oak with a urethane finish. Floor levelers are provided.

2.4 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of stationary whirlpools.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install stationary whirlpool according to manufacturer's written instructions.

- B. Built-in Equipment: Securely anchor units with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform visual, mechanical, and electrical inspection and testing for each stationary whirlpool according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
  - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After installation, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. A stationary whirlpool will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 131733

## SECTION 132416 - SAUNAS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Modular saunas with convection heaters.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, sauna heater rated capacities, vapor retarder data, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Indicate dimensions, required clearances, method of field assembly, and location and size of each field connection.
3. Include locations of sauna heater, lighting, and controls.
4. Samples: For each exposed wood member, full board width by 12 inches long.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

#### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sauna heaters to include in operation and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install saunas until building is enclosed, wet-work in spaces is complete and dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

## 1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of sauna heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of heating element, controls, and safety mechanisms.
    - b. Deterioration or corrosion of metals or metal finishes.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MODULAR SAUNAS WITH CONVECTION HEATERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Amerec Sauna and Steam; Signature Series, Pacific, or a comparable product by one of the following:
  - 1. Airmist, Inc.
  - 2. Am-Finn Sauna Co.
  - 3. Apex Sauna and Steam.
  - 4. Baltic Leisure.
  - 5. Finlandia Sauna Products, Inc.
  - 6. Finnleo.
  - 7. Nordic Sauna.
  - 8. Saunacore.
  - 9. Steamist; Div. of Steamaster Co., Inc.
- B. Modular Saunas with Convection Heaters: Freestanding, demountable, panelized system complete with manufacturer's standard framing, insulation, and vapor retarders; designed for use with convection heater. Include the following:
  - 1. Door of style and construction indicated.
  - 2. Exterior Wall Finish: Same wood species and grade as interior paneling.
  - 3. Bench.
  - 4. Removable flooring.

### 2.2 HEATERS AND CONTROLS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Convection Heater: Manufacturer's standard electric convection unit with stainless-steel elements, stainless-steel interior, stainless-steel exterior, and wire protective top grill. Provide heat-tested, shatter-resistant igneous rocks that are in direct contact with and completely cover heating-unit coils.
  - 1. Capacity: Determined by manufacturer for sauna size indicated.
  - 2. Mounting: Floor mounted with integral floor stand or legs.
- C. Digital Controls: Manufacturer's standard system designed for remote wall mounting, with touchpad controls, digital display, thermostat, and the following features:
  - 1. Mounting: Recessed.
  - 2. Heater switch.
  - 3. Light switch.
  - 4. Heat-indicator light.
  - 5. Adjustable temperature control.
  - 6. Programmable time and temperature for heater startup and shutdown.
  - 7. Preset temperature lock.

## 2.3 COMPONENTS

- A. All-Glass Doors: Manufacturer's standard prehung door assembly of 8-mm-thick, clear, tempered float glass; mounted on 2-inch-thick western red cedar jambs and head.
  - 1. Size: 36 by 80 inches.
- B. Door Hardware: Provide 1-1/2 pairs of brass butt hinges, one ball catch, and two wood door pulls of same wood species as interior paneling for each door.
- C. Window: Curved glass units made from clear, tempered float glass. Provide jamb and casing of same wood species as interior paneling.
- D. Benches: Fabricate from S4S, 2-by-2-inch-nominal wood, spaced not more than 1/2 inch apart and supported by 2-by-4-inch-nominal wood framing; of same wood species as interior paneling.
- E. Base and Trim: Same wood species and grade as interior paneling.
- F. Flooring: Manufacturer's standard removable 1-by-4-inch-nominal wood duckboards, of same species and grade as interior paneling, spaced not more than 1/2 inch apart and mounted on preservative-pressure-treated wood sleepers.

## 2.4 MATERIALS

- A. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- B. Interior Paneling: 1-by-4-inch-nominal, V-joint, tongue-and-groove wood boards; sanded smooth; kiln dried to no more than 12 percent moisture content.

1. Wood Species and Grades: Lumber of grades indicated according to DOC PS 20 and the provisions of the grading agency indicated.
  - a. Western Red Cedar: WCLIB or WWPA; Clear Heart.
- C. Softwood Plywood: DOC PS 1.
- D. Hardwood Plywood: HPVA HP-1, containing no urea formaldehyde.
- E. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type I (transparent glass, flat), Quality Q3 (glazing select), Class 1 (clear); manufactured by horizontal (roller-hearth) process, with exposed edges seamed before tempering.
  1. Safety Glazing Labeling: Permanently mark glazing with certification label of the SGCC, the manufacturer, or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- F. Fasteners: Stainless steel or hot-dip galvanized.

## 2.5 ACCESSORIES

- A. Provide the following accessories. Provide wood accessories of same wood species as interior paneling unless otherwise indicated.
  1. Wood guardrail for heater, of dimensions required by listing.
  2. Wood-slat backrest for each bench.
  3. Thermometer, 4-inch diameter, with chrome casing.
  4. Wood light valance with low-voltage light fixture.
  5. Wall-mounted light fixture, rated for damp locations; brushed satin aluminum with white glass globe.
  6. Copper bucket with wood handle, 1-gal. capacity, with wood-handled copper ladle.
  7. Wood clothes hanger with four pegs.

## 2.6 FABRICATION

- A. Fabricate saunas to dimensions, profiles, and details indicated. Sand boards smooth and ease edges to a radius of not less than 1/16 inch.
- B. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, vents, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- C. Nail or screw and glue bench components together from bottom side.
- D. Countersink or conceal all metal fasteners.
- E. Secure glass in wood frames with removable stops.

- F. Flush mount junction boxes for heater, control panel, and light fixtures, with concealed connecting electrical conduit in modular sauna panels.
- G. Modular Saunas: Complete fabrication of modular sauna panels, including assembly and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation.
  - 1. Trial fit panels at fabrication shop. Install dowels, screws, bolted connectors, cam locks, and other fastening devices that can be removed after trial fitting. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
  - 2. Accessible Modular Saunas: Fabricate framing and panels to eliminate thresholds and permit accessible entry.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates for suitable conditions where saunas are to be installed.
- B. Examine roughing-in for electrical systems to verify actual locations of electrical connections before heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Condition paneling to average prevailing humidity conditions in installation areas before installation.

#### 3.3 INSTALLATION OF MODULAR SAUNAS

- A. Complete field assembly with joining methods recommended in writing by manufacturer.
- B. Set saunas level, plumb, and securely in place. Anchor as required for secure installation.

#### 3.4 ADJUSTING

- A. Adjust sauna door to close securely without binding. Adjust door to operate at room temperature and at sauna operating temperature.

END OF SECTION 132416

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 132426 - STEAM ROOMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Steam generators and control.
- B. Doors for site constructed rooms.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A company with not less than 20 years of experience in manufacturing components of the type required for this project.
- B. Regulatory Requirements: Provide only ASME certified low-pressure vessels and UL listed equipment and controls.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Product: Provide Amerec Steam Boiler; Helo Commercial Steam Boiler and T100B touch screen control package.

#### 2.2 STEAM GENERATORS AND CONTROLS

- A. Steam Boiler:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Control Package: External control system including programmable temperature and time displays, light switch, and temperature read out in Celsius or Fahrenheit
  - 5. Steam Boiler: All steel construction with powder coat finish and stainless steel feet.

6. Size as recommended by manufacturer based on volume of room and type of construction materials employed.
7. Provide Cool Flush Auto Drain System that ensures the unit is flushed and drained daily.
8. Provide 24-hour, 7-day timer, to turn the generator on and off at a specific time each day of the week.
9. Provide high temperature alert alarm, to set off audible alarm at a specific temperature and interrupt power to the unit when that temperature setting is exceeded.
10. Room "over-temperature shut down" turns boiler elements off and blinks indicators to show alarm.
11. Indicator lights with integral diagnostics.
12. Digital Timers for on/off operation and Auto-drain programming.
13. Low Water Cut-Off, where required by code.
14. Clear, Anodized Aluminum Door and Frame.
15. Size: 36 by x 84 inches, for 40 by 86 inches finished opening.
16. Hinge and Lock Stiles: 2 inches wide.
17. Top Rails: 2-1/2 inches wide.
18. Bottom Rails: 10 inches wide.
19. Glazing: 1" insulated glass.
20. Provide hinges to suit application.
21. Closer, mounted outside of steam room.
22. Weatherstripping on jambs and head and vinyl sweep on bottom, providing vapor-tight seal when closed.

- B. Provide all other items needed to provide complete functional installation.

## 2.3 DOORS FOR SITE-CONSTRUCTED STEAM ROOMS

- A. Doors:

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that rough-ins for all utilities are properly sized and in correct locations.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 INSTALLATION

- A. Install steam room components in strict accordance with manufacturer's instructions and approved shop drawings.
- B. Install insulation and vapor barrier in accordance with requirements of specifications.

- C. Steam Generators and Accessories: Install and connect steam generators, steam outlets, controls, and temperature sensors. Coordinate with work of mechanical and electrical sections, and connect to utilities.

### 3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION 132426

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## SECTION 132436 – CRYOTHERAPY ROOM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Modular whole-body quad chamber.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Indicate dimensions, required clearances, method of field assembly, and location and size of each field connection.

#### 1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For whole-body quad chamber to include in operation and maintenance manuals.

#### 1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not install whole-body quad chamber until building is enclosed, wet-work in spaces is complete and dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

#### 1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of whole-body quad chamber that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Faulty operation of refrigeration engine, condenser, controls, and safety mechanisms.
  - b. Deterioration or corrosion of metals or metal finishes.

2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 WHOLE-BODY QUAD CHAMBER

- A. Basis-of-Design Product: Subject to compliance with requirements, provide US Cryotherapy; Whole-Body Quad treatment chamber, or a comparable product acceptable to the Architect.
- B. Product Features:
  1. 4 Person Capacity.
  2. Room 1: Pre-chamber at -76° F.
  3. Room 2: Main therapy chamber at -166° F.
  4. Cryotherapy specific software.
  5. Remote control access and monitoring for maintenance.
  6. Surveillance video from inside the chamber.
  7. Intercom inside the chamber.
  8. Music inside the chamber.
  9. Visual contact at all time.
- C. Components:
  1. Cryochamber.
  2. Control desk.
  3. Timer feature.
  4. Remote access programming.
- D. Equipment:
  1. Control panel with I pod dock.
  2. Timer.
  3. Internal speakers.
  4. Surveillance video from inside the chamber.
  5. Intercom inside the chamber.
- E. Remote Mounted Equipment:
  1. Electronic control cabinet.
  2. Refrigerating engine.
  3. Condenser, air cooled.
- F. Interior Wall and Ceiling: Manufacturer's standard insulated construction.
  1. Dimensions: 14 feet wide, 8 feet deep, 8 foot 6-inches, clear interior height.
- G. Doors: Glazed aluminum entry door, tempered insulating glass, aluminum frame.
- H. Monitoring: Remote control access and monitoring for maintenance.
- I. Electrical Requirement: 3 Phase, 400V, 50/60 HZ, 80 amp, dedicated circuit, with shutoff.

## 2.2 FABRICATION

- A. Whole-Body Quad Chamber: Complete fabrication of whole-body quad chamber, including assembly and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation.
  - 1. Trial fit panels at fabrication shop. Install dowels, screws, bolted connectors, cam locks, and other fastening devices that can be removed after trial fitting. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for suitable conditions where whole-body quad chamber is to be installed.
- B. Examine roughing-in for electrical systems to verify actual locations of electrical connections before whole-body quad chamber installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF WHOLE-BODY QUAD CHAMBER

- A. Complete field assembly with joining methods recommended in writing by manufacturer.
- B. Set whole-body quad chamber level, plumb, and securely in place. Anchor as required for secure installation.

### 3.3 ADJUSTING

- A. Adjust whole-body quad chamber door to close securely without binding. Adjust door to operate at room temperature and at whole-body quad chamber operating temperature.

END OF SECTION 132436

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## SECTION 142400 - HYDRAULIC ELEVATORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes hydraulic passenger and service elevators.
- B. Related Requirements:
  - 1. Section 015000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
  - 2. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
  - 3. Section 055000 "Metal Fabrications" for the following:
    - a. Attachment plates and angle brackets for supporting guide-rail brackets.
    - b. Hoist beams.
    - c. Structural-steel shapes for subsills.
    - d. Pit ladders.
    - e. Section 096813 "Tile Carpeting" for finish flooring in elevator cars.
  - 4. Section 096543 "Linoleum Flooring" for finish flooring in elevator cars.
  - 5. Section 271500 "Communications Horizontal Cabling" for telephone service for elevators and for Internet connection to elevator controllers for remote monitoring of elevator performance if required.
  - 6. Division 28 for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
  - 7. DEFINITIONS
- C. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- D. Service Elevator: A passenger elevator that is also used to carry freight.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.
  - 2. Include detailed layout of car-control station.

3. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- D. Sample Warranty: For special warranty.

### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
  1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

## 1.7 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Furnish well casing and coordinate delivery with related excavation work.
- C. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

## 1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
  - 2. Warranty Period: 1 year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Otis Elevator Co; HydroFit Low Rise Holeless or comparable product by one of the following:
  - 1. American Crescent Elevator Mfg., Corp.
  - 2. Fujitec America, Inc.
  - 3. KONE Inc.
  - 4. Minnesota Elevator, Inc.
  - 5. Mowrey Elevator Co.
  - 6. Schindler Elevator Corp.
  - 7. Schumacher Elevator Co.
  - 8. ThyssenKrupp Elevator.

- B. Source Limitations: Obtain elevators from single manufacturer.
  - 1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator seismic requirements in ASME A17.1/CSA B44.
  - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
  - 2. Project Seismic Design Category: D.
  - 3. Elevator Component Importance Factor: 1.0.
  - 4. Design earthquake spectral response acceleration short period (Sds) for Project is 1.091.
  - 5. Provide earthquake equipment required by ASME A17.1/CSA B44.
  - 6. Provide seismic switch required by ASCE/SEI 7.

## 2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

## 2.4 PASSENGER ELEVATOR

- A. Passenger Elevator Number: #1, Main Entry.
- B. Cylinder Type: Holeless, telescoping, beside the car.
- C. Rated Load: 3500 lb.
- D. Rated Speed: 100 fpm.
- E. Operation System: Single elevator.
- F. Auxiliary Operations:
  - 1. Battery-powered lowering.
  - 2. Automatic dispatching of loaded car.
  - 3. Nuisance call cancel.

4. Security Features: Card-reader operation and Accommodations for CCTV camera.

G. Car Enclosures: Enameled steel with removable wall panels.

1. Inside Width: 80 inches.
2. Inside Depth: 65 inches.
3. Inside Height: 93 inches.
4. Front Walls (Return Panels): Stainless steel.
5. Side and Rear Wall Panels: Stainless steel vertical.
6. Doors: Stainless steel.
7. Ceiling: Stainless steel.
8. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish, at sides and rear of car.
9. Floor: Prepared to receive tile as indicated on finish plans.

H. Hoistway Entrances:

1. Width: 42 inches.
2. Height: 96 inches.
3. Type: Single-speed side opening.
4. Frames: Stainless steel.
5. Doors: Stainless steel.

I. Hall Fixtures: Stainless steel.

J. Additional Requirements:

1. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel.
2. Provide hooks for protective pads in service car and one complete set of full-height protective pads.

## 2.5 SERVICE ELEVATOR

A. Service Elevator Number: #2 Exhibition/Loading area.

B. Cylinder Type: Holeless, telescoping, beside the car.

C. Rated Load: 3500 lb.

D. Rated Speed: 100 fpm.

E. Operation System: Single elevator.

F. Auxiliary Operations:

1. Battery-powered lowering.
2. Automatic dispatching of loaded car.
3. Nuisance call cancel.

G. Security Features: Card-reader operation, and accommodations for CCTV camera.

H. Dual car-control stations.

I. Car Enclosures: Enameled steel with removable wall panels and ceiling hatch.

1. Inside Width: 80 inches.
2. Inside Depth: 65 inches.
3. Inside Height: 93 inches.
4. Front Walls (Return Panels): Stainless steel.
5. Side and Rear Wall Panels: Stainless steel vertical.
6. Doors: Stainless steel.
7. Ceiling: As indicated on the Drawings.
8. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish, at sides and rear of car.
9. Floor: Prepared to receive tile as indicated on finish plans.

J. Hoistway Entrances:

1. Width: 42 inches.
2. Height: 96 inches.
3. Type: Single-speed side opening.
4. Frames: Stainless steel.
5. Doors: Stainless steel.

K. Hall Fixtures: Stainless steel.

1. Additional Requirements:
  - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel.
  - b. Provide hooks for protective pads in service car and one complete set of full-height protective pads.

## 2.6 SYSTEMS AND COMPONENTS

A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts.
2. Motor shall have wye-delta or solid-state starting.
3. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.

B. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

1. Cylinder units shall be connected with dielectric couplings.
2. Hydraulic Fluid: Elevator manufacturer's standard fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

- C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- D. Car Frame and Platform: Welded or bolted steel units.
- E. Guides: Roller guides, Polymer-coated, nonlubricated sliding guides, or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car frame.

## 2.7 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations:
  - 1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
  - 2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors start closing.
  - 3. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
  - 4. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
  - 5. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are re-energized before car doors open.
- C. Security Features: Security features shall not affect emergency firefighters' service.
  - 1. Card-Reader Operation: System uses card readers at car-control stations and hall push-button stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space for card reader in car.
    - a. Security access system equipment is specified in Division 28.

## 2.8 DOOR-REOPENING DEVICES

- A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

## 2.9 CAR ENCLOSURES

- A. General: Provide enameled- or powder-coated-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.
1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
  2. Materials and Finishes: Manufacturer's standards, but not less than the following:
  3. Subfloor for Carpet: Exterior, underlayment-grade plywood, not less than 5/8-inch nominal thickness.
  4. Subfloor for Tile: Exterior, C-C Plugged grade plywood, not less than 7/8-inch nominal thickness.
  5. Floor Finish: Specified in Division 09.
  6. Stainless-Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless-steel sheet.
  7. Fabricate car with recesses and cutouts for signal equipment.
  8. Fabricate car door frame integrally with front wall of car.
  9. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
  10. Sight Guards: Provide sight guards on car doors.
  11. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
  12. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
  13. Metal Ceiling: Flush panels, with incandescent downlights in the center of or four low-voltage downlights in each panel.

## 2.10 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
1. Fire-Protection Rating: As indicated.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Stainless-Steel Frames: Formed from stainless-steel sheet.
  2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.

3. Sight Guards: Provide sight guards on doors matching door edges.
4. Sills: Extruded or machined aluminum, with grooved surface, 1/4 inch thick.
5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

## 2.11 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed or semirecessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
  1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
  2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide hall push-button station at each landing as indicated.
  1. Provide units with flat faceplate for mounting with body of unit recessed in wall or jamb-mounted units.
  2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
  3. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Division 28.
- G. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide one of the following:
  1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
  2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
  3. Units mounted in both jambs of entrance frame.
  4. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

5. At manufacturer's option, audible signals may be placed on cars.

- H. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

## 2.12 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- D. Stainless-Steel Bars: ASTM A 276, Type 304.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Install piping above the floor, where possible. Install underground piping in casing.
  - 1. Lubricate operating parts of systems as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
  - 1. Place hall lanterns where shown.
  - 2. Mount hall lanterns at a minimum of 72 inches above finished floor.

### 3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

### 3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each elevator used for construction purposes:
  - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
  - 2. Provide strippable protective film on entrance and car doors and frames.
  - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
  - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
  - 5. Do not load elevators beyond their rated weight capacity.
  - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevators.
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

### 3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 3 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  1. Perform maintenance during normal working hours.
  2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 142400

## SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Common work results for requirements specifically applicable to Division 21.
- B. Requirements of Division 01 Specifications, General Provisions of the Contract and General and Supplementary Conditions apply to this Division.

#### 1.2 REFERENCES

- A. ANSI: American National Standards Institute.
- B. ASME: American Society for Mechanical Engineers.
- C. ASTM: American Society for Testing and Materials.
- D. AWWA: American Water Works Association.
- E. FM: Factory Mutual.
- F. IRI: Industrial Risk Insurers.
- G. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
- H. NEMA: National Electrical Manufacturers' Association.
- I. NFPA: National Fire Protection Association.
- J. UL: Underwriters' Laboratories, Inc.

#### 1.3 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Include Products as specified in the individual sections of Division 21.
- C. Submit shop drawing and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- D. Prepare shop drawings completely independent of the Engineer of Record's CADD files. Should the Contractor or Vendor wish to use the Engineer of Record's CADD files as the basis for developing their shop drawings, a release form, obtainable from the Engineer or Architect, must be signed.
- E. Submit copies of shop drawings in accordance with Division 01, including:

1. Concrete pads and foundations including anchor bolt and sleeve locations.
2. Fire protection systems.
3. Assist in the preparation of coordinated room layouts as specified in Section 230500.

F. Brochures: Submit manufacturer's product data and brochures including:

1. Complete descriptions.
2. Illustrations.
3. Rating data, accessories, dimensional data, and applicable options and features marked for the specific items scheduled on drawings and specified herein.
4. Capacities stated in the terms specified.
5. Performance curves for fire pumps and jockey pumps.

#### 1.4 REGULATORY REQUIREMENTS

A. Perform work specified in Division 21, in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.

1. NFPA 13: Sprinkler System Installation.
2. 2013 California adopted Building Codes and Fire Code with ties to the International Fire Code and Amendments.
3. NFPA 101: Life Safety Code.
4. ANSI Handicapped Code-A117.1.
5. U.L. Fire Resistance Index.
6. ASTM E814-08B: Standard Test Method for Fire Tests of Penetration Firestop Systems.
7. IBC: International Building Code, with Mechanical and Plumbing Codes.
8. NFPA 101B: Standard on Means of Egress for Buildings and Structures (1999).
9. Special regulations, supplement, and amendments of the State and/or local authorities having jurisdiction.

#### 1.5 PROJECT/SITE CONDITIONS

- A. Layouts indicated on drawings are diagrammatical and intended to show relative positions and arrangement of piping and equipment. Coordinate work with other trades and with measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings. Provide necessary rises, drops, and offsets to fit in the available space unless prevented by Project conditions.
- B. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.
- C. Place anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.
- D. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner and all affected trades.
- E. Determine sizes and verify locations of existing utilities on or near site.

- F. Keep roads clear of materials and debris.
- G. Visit site and be informed of conditions under which Work must be performed.
- H. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or, as applicable, means of access using wall or ceiling access doors.
- I. Install piping to leave sufficient space for AHJ inspection of rated wall construction.

#### 1.6 FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required to perform Division 21 work.

#### 1.7 COORDINATION DRAWINGS

- A. Prior to commencement of installation, assist in preparation of coordination drawings for work under this Division, as specified in Division 01. Fully cooperate with persons coordinating and performing work under other Divisions.
- B. Drawings shall not be formally submitted but shall be kept on site for reference. Notify Architect of conflicts that cannot be resolved.

#### 1.8 COMPLETENESS OF WORK

- A. The Contract Documents depict fire suppression systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout the Division 21 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

#### 1.9 REFERENCE STANDARDS AND DEFINITIONS

- A. Comply with provisions of Division 01.

#### 1.10 PRODUCT SUBSTITUTIONS

- A. Comply with provisions of Division 01.

#### 1.11 RECORD DRAWINGS

- A. Provide record drawings that illustrate the work of Division 21 as finally constructed.

- B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.
- C. Deliver record drawings in a form suitable for re-production to Architect within 30 days of Substantial Completion.

#### 1.12 OWNING AND OPERATING MANUALS

- A. Comply with the requirements of Division 01, but provide a minimum of three sets.
- B. Manuals shall include clear and comprehensive instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.
- C. Copies of reviewed submittals on furnished equipment shall be included.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT SUPPORTS

- A. Structural steel for supports: ASTM A36.
  - 1. Use galvanized members installed areas of high humidity or condensation, and outside.
  - 2. Furnish other members with shop coat of red primer.
  - 3. Retouch primer after field welding.

#### 2.2 FLASHINGS AND COUNTERFLASHINGS

- A. Furnish materials and coordinate installation for flashing and counterflashing roof penetrations for pipe and drains.
- B. Materials:
  - 1. Sheetmetal: 24 gauge minimum ASTM A525, Class G90.
  - 2. Sheet lead: 3 pounds per square foot.
  - 3. Stainless steel: Minimum 20 gauge.
  - 4. Sheet copper: 24 OZ/SF.

#### 2.3 WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
- B. Size: 24"x24" minimum, as indicated, or as required to allow inspection, service and removal of items served.

- C. 14 gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.
- D. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.
- E. Prime painted or rust inhibitive paint finish.
- F. UL labeled when in fire-rated construction, 1-1/2 hour rating.
- G. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are valves, and equipment needing periodic or replacement maintenance.
- H. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
- I. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers.
  - 1. For masonry and drywall construction: Milcor Style M.
  - 2. For plastered masonry walls and ceiling: Milcor Style K.
  - 3. For ceramic tile or glazed structural tile: Use stainless steel panels.

## 2.4 SLEEVES

- A. Materials
  - 1. Concrete floors, concrete and masonry walls: 18-gauge galvanized sheetmetal.
  - 2. Drywall partitions: 18 gauge galvanized steel sheet metal.
- B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2". Provide larger annular space if required by firestopping product installation instructions.
- C. Sleeves supporting riser piping 4" and larger shall have three 6" long reinforcing rods welded radially at 120 degree spacing to the sleeve and shall be installed with the rods embedded in the concrete slab.

## PART 3 - EXECUTION

### 3.1 EXCAVATING AND BACKFILLING

- A. Contractor shall review Division 33 and shall perform excavation and backfilling in accordance with the most stringent requirements. Contractor shall request clarification before proceeding if there are conflicting instructions.
- B. Contract Documents show the approximate location of underground utilities known to exist in the area of construction. Contractor shall determine the exact location of utilities.

1. Uncover existing utilities which require new connections before trenching in the vicinity of indicated utility connection. Contact local authority responsible for locating all existing utilities. Do not perform any excavation until the presence and location of existing utilities has been determined.
  2. Clear all vegetation and other objectionable material from the area required for the excavation and backfill operations. Disposal of material removed by the clearing operation shall be approved by the Owner's Representative.
- C. Provide trenching, excavating, and backfilling necessary for performance of work indicated in Contract Documents.
- D. Excavate to depths indicated on the drawings or as necessary to permit the installation of pipe, bedding, backfill, structures or appurtenances. Provide a firm, undisturbed, uniform surface in the bottom of trenches. Where excavation exceeds the required depth, bring the excavation to proper grade through the use of an approved incompressible backfill material. Store excavated material and dispose of surplus excavated material.
1. Excavate trench to sufficient depth to permit a minimum of 36" of cover over the top of the pipe unless otherwise required by pipe elevations indicated on the Drawings. The trench width shall be 18" plus the diameter of the pipe and/or the largest bell.
- E. Trenching and excavation shall be unclassified. No extra will be paid in the event that rock is encountered.
1. Should rock excavation be required, use only experienced personnel for blasting.
  2. Exercise extreme care when blasting with signals of danger given before firing any charge.
  3. Conform to and obey all public authority regulations for the protection of life and property.
- F. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition and to meet applicable codes.
- G. Provide a minimum of 6" of No. 67 crushed stone or clean sand bedding, or equal, in the bottom of the trench to maintain the required grade and continuous support of the bottom quadrant of the pipe.
- H. Upon completion of excavation, and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with min. 6" pipe bedding. Pipe bedding shall be select material deposited in the trench, and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Material for pipe bedding shall comply with local codes. In absence of local code requirements the bedding shall be bank sand or select back fill material approved by the Architect. Any material used shall pass a 1/4 inch screen.
- I. Clean and inspect pipe for defects before lowering into trench for assembly. Install pipe in accordance with provisions of Contract Documents and with the recommendations of the pipe manufacturer.
1. Ensure pipe is of proper strength and classification for specified service. Discard damaged or defective pipe discovered during pipe laying operations.
  2. Maintain alignment and grade during layout operation. Use acceptable method for maintaining grade and alignment to produce desired results.

J. Where crushed stone backfill is required, use No. 67 stone, clean sand or equal.

1. After bedding has been shaped and the pipe assembled, place crushed stone carefully around the pipe and to a point 12" above the pipe. Backfill above this point shall be as described below:
  - a. Backfill areas of vehicular traffic shall consist entirely of crushed stone and compacted crusher run material.
  - b. Backfill for shoulders of roadways, sidewalk, and slab on grade structures shall consist entirely of crushed stone.
  - c. Backfill areas not subject to vehicular traffic may consist of suitable excavated material as described above.
2. Where crushed stone is not required, suitable excavated material may be utilized. This includes fine, dry earth or a mixture of earth and shot rock. Rocks larger than 6" in any dimension may not be included in any portion of the backfill material.
3. Trenches shall be backfilled only after piping has been inspected, tested, and approved by the Architect. All backfill material shall be placed in the trench either by hand or by approved mechanical methods. The compaction of backfill material shall be accompanied by tamping, with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Architect. Backfill completely around pipe, including 18" above the pipe, with suitable bank sand, tamped in 4" layers under, around, and over pipe. Water down backfill as required. The remainder of the backfill shall be select backfill material tamped at intervals of no more than 12" depths. All materials to be used as selected material backfill shall be approved by the Architect. If, in the opinion of the Architect, the excavated material does not meet the requirements of selected material, the Contractor shall be required to screen the material prior to its use as selected material backfill. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than six inches in its longest dimension. No wood, vegetable matter or other material which, in the opinion of the Architect, is unsuitable shall be included in the backfill. The upper 24" of backfill may be water jetted, if desired. Backfill shall be brought up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation.

### 3.2 CUTTING AND PATCHING

- A. Repair or replace damage caused by cutting or installation of work specified in Division 21.
- B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

### 3.3 FLASHING AND COUNTERFLASHING

- A. Counterflash pipes where penetration of roofs and outside walls occur.

### 3.4 DELIVERY, STORAGE, AND PROTECTION

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where deliver in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.
- B. Store items in a clean, dry place, and protect from damage. Equipment may not be staged or stored outdoors unless intended for outdoor use.
- C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.
- D. Keep dirt and debris out of pipes.
- E. Repair, restore, and replace damaged items.

### 3.5 SLEEVES

- A. Floors: Sleeve all pipe penetrations. Extend sleeve 1-1/2" above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.
- B. Masonry or concrete walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.
- C. Drywall partitions: Sleeve all penetrations of piping in systems over 160 deg F.
- D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.
- E. Install piping and sleeves in strict accordance with applicable U.L. floor or partition assembly instructions. Coordinate with Division 07 Firestop manufacturer's installation instructions.
- F. Penetrations not sleeved or firestopped:
  - 1. Seal voids between pipe and partition. Seals shall be airtight.

### 3.6 CLEANING FIRE SUPPRESSION SYSTEMS

- A. General Cleanup:
  - 1. As work proceeds throughout the construction schedule, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition. See Division 01 of specifications for further requirements.
  - 2. Seepage, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems shall be repaired without cost to the Owner.

B. Factory Finishes:

1. Clean items with factory finishes. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula. If finishes are badly damaged or if there are many damaged, scratched or bare places, refinish the entire item.

END OF SECTION 210500

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 210520 - FIRE EXTINGUISHERS, FIRE VALVES AND CABINETS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Provide fire suppression/protection components, fire extinguishers, valves and cabinets, as indicated on the drawings and as herein specified.

#### 1.2 RELATED WORK

- A. Section 078413: Penetration Fire Stopping.
- B. Section 099100: Painting.
- C. Section 210500: Common Work Results for Fire-Suppression.
- D. Section 210553: Identification for Fire-Suppression Piping and Equipment.
- E. Section 211313: Fire Suppression Sprinkler Systems.
- F. Division 26: Electrical.

#### 1.3 INSTALLER QUALIFICATIONS

#### 1.4 QUALITY ASSURANCE

- A. Underwriters Laboratories (U.L.) listed and Factory Mutual (F.M.) approved material.
- B. Comply with local fire department standards for hose threads, operating nuts and accessories for hydrants and siamese connections.

#### 1.5 SUBMITTALS

- A. Submit product data for review. Include the following manufacturer's product data with shop drawings:
  - 1. Valves.
  - 2. Siamese Connection.
- B. Submit product to Owner's Insuring Agency and AHJ for approval.

#### 1.6 APPLICABLE CODES (LATEST ADOPTED ADDITION)

- A. NFPA 1, Fire Code.

- B. NFPA 10: Standard for Portable Fire Extinguishers.
- C. NFPA 13: Sprinkler System Installation.
- D. NFPA-101 Life Safety Code.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. The Fire Extinguishers & Cabinets shall be specified by the Architect.

## PART 3 - EXECUTION

### 3.1 COORDINATION

- A. Coordinate installation to avoid interference with other systems.
- B. Provide power and interlock wiring under Division 26.

END OF SECTION 210520

## SECTION 210548 - VIBRATION AND SEISMIC CONTROLS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment support bases.
- B. Vibration isolators.
- C. Seismic snubber assemblies.
- D. Seismic restraints for suspended components and equipment.

#### 1.2 RELATED REQUIREMENTS

- A. Section 014533 - Code-Required Special Inspections.
- B. Section 033000 - Cast-in-Place Concrete.

#### 1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.
- B. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide; 2011.
- C. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013.

#### 1.4 SUBMITTALS

- A. Submit product data and drawings for review in accordance with the requirements of Division 01.
- B. Product Data:
  - 1. Provide manufacturer's product literature documenting compliance with Part 2 Products.
  - 2. Include seismic rating documentation for each restraint component accounting for horizontal, vertical, and combined loads.
- C. Shop Drawings:
  - 1. Provide schedule of vibration isolator type with location and load on each.
  - 2. Fully dimensioned fabrication drawings and installation details for housekeeping pads, bases, member sizes, attachments, and supported equipment.

3. Include auxiliary motor slide bases and rails, base weights, concrete weights, equipment static loads, and support points.
4. Include selections from prescriptive design tables that indicate compliance with the applicable building code.
5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
6. Include the calculations that indicate compliance with the applicable building code for seismic controls and the manufacturer's requirements.
7. Include the seal of the Professional Structural Engineer registered in the Texas, on the drawings and calculations which at a minimum include the following:
  - a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
  - b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
    - 1) Basis for Certification: Indicate whether certification is based on actual testing of assembled components, on calculations, or on historic data.
    - 2) Indicate equipment is sufficiently durable to resist design forces and or remain functional after the seismic event.
  - c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
  - d. Detailed description of the equipment anchorage devices on which the certifications are based.
- D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

## 1.5 QUALITY ASSURANCE

- A. Perform design and installation in accordance with applicable codes.
- B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in Texas.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum \_\_\_\_ years of experience.
- E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section. See Section 014533 for additional requirements.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. AFCON: [www.afcon.org](http://www.afcon.org).
- B. PHD Manufacturing, Inc: [www.PHD-mfg.com](http://www.PHD-mfg.com).
- C. TOLCO: [www.tolco.com](http://www.tolco.com).
- D. Mason Industries.
- E. Amber Booth.
- F. Vibration Eliminator Company.
- G. Substitutions: See Section 016000 - Product Requirements.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General:
  - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
  - 2. Steel springs to function without undue stress or overloading.
  - 3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
  - 4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
  - 5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

### 2.3 EQUIPMENT SUPPORT BASES

- A. Structural Bases:
  - 1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
  - 2. Frames: Square, rectangular or T-shaped.
  - 3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
  - 4. Applications: Adjustable motor slide rails for centrifugal fans.
- B. Concrete Inertia Bases:
  - 1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running in both directions in a single layer.
  - 2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
  - 3. Mass: Minimum of 1.5 times weight of isolated equipment.

4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
5. Concrete: Filled on site with minimum 3000 psi concrete.

## 2.4 VIBRATION ISOLATORS

### A. Non-Seismic Type:

1. All Elastomeric-Fiber Glass Pads:
  - a. Configuration: Flat or molded.
  - b. Thickness: 0.25 inch minimum.
  - c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
2. Elastomeric Mounts:
  - a. Material: Oil, ozone, and oxidant resistant compounds.
  - b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
3. Steel Springs:
  - a. Assembly: Freestanding, laterally stable without housing.
  - b. Leveling Device: Rigidly connected to equipment or frame.
4. Restrained Steel Springs:
  - a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
  - b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
5. Elastomeric Hangers:
  - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
  - b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
6. Spring Hanger:
  - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
  - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
7. Combination Elastomeric Spring Hanger:
  - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
  - b. Bottom Opening: Sized to allow plus minus 15 degrees rod misalignment.

8. Thrust Restraints:

- a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
- b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.

B. Seismic Type:

- 1. Products to be listed in accordance with the requirements of NFPA 13.
- 2. Coil Springs Consisting of Single Elements:
  - a. Housing: Manufactured from cast iron material.
  - b. Ductile Material: Designed and rated for seismic applications.
  - c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
  - d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
  - e. Resilient Pad: Located in series with spring.
  - f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
  - g. Finish: Suitable for the application.
- 3. All Directional Elastomeric:
  - a. Material: Molded from oil, ozone, and oxidant resistant compounds.
  - b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.
  - c. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
  - d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.
  - e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

## 2.5 SEISMIC SNUBBER ASSEMBLIES

A. Products to be listed in accordance with the requirements of NFPA 13.

B. All Directional External:

- 1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
- 2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
- 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
- 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

C. Lateral External:

1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

D. Omni Directional External:

1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inches thick cushions any impact and prevents metal to metal contact.

E. Horizontal Single Axis External:

1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

## 2.6 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Products to be listed in accordance with the requirements of NFPA 13.

B. Cable Restraints:

1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.
3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
4. Connections:
  - a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
  - b. Internally brace clevis hanger bracket cross bolt to prevent deformation.

5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:

1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Comply with the requirements of NFPA 13.
- C. Bases:
  1. Set steel bases for one inch clearance between housekeeping pad and base.
  2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
  3. Adjust equipment level.
- D. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
  1. Up to 4 Inches Pipe Size: First three points of support.
  2. 5 to 8 Inches Pipe Size: First four points of support.
  3. 10 inches Pipe Size and Over: First six points of support.
  4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

#### 3.2 INSTALLATION - SEISMIC

- A. Comply with the following:

1. Install in accordance with manufacturer's instructions.
  2. ASCE 7.
  3. FEMA E-74.
  4. NFPA 13.
- B. Provide end of line restraint.
- C. Seismic Snubbers:
1. Install on all isolated equipment.
  2. Provide minimum of four seismic snubbers located close to isolators.
  3. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance.
  4. Snub all other equipment between 0.15 inch and 0.25 inch clearance.
- D. Piping:
1. Provide seismic bracing.
  2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
  3. Provide flexible connections between floor mounted equipment and suspended piping; between unbraced piping and restrained suspended items; as required for thermal movement; at building separations and seismic joints; and wherever relative differential movements could damage pipe in an earthquake.
  4. Brace every run 5.0 feet or more in length with two transverse and one longitudinal bracing locations.
  5. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):
    - a. Provide transverse bracing at spacing not more than 40.0 feet on center.
    - b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.
  6. Pipes and Connections Constructed of Non Ductile Materials (listed plastic pipe):
    - a. Provide transverse bracing at spacing not more than 20.0 feet on center.
    - b. Provide longitudinal bracing at spacing not more than 40.0 feet on center.
  7. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.
  8. Piping Explicitly Exempt from Seismic Bracing Requirements:
    - a. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
    - b. Install piping such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
    - c. Provide swing restraints as required to control potential impact due to limited space between subject components.
  9. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.
  10. Re-use of Existing Hangers:

- a. Re-using existing hangers at locations of seismic bracing are to be judged on a case-by-case basis by the registered project design professional.
  - b. Unless otherwise shown on the drawings, it is assumed all hangers supporting new piping, located at a seismic brace, will be new.
- E. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:
  - 1. Install equipment anchorage items designed to resist seismic design force in any direction.
  - 2. Install vibration and seismic controls designed to include base and isolator requirements.
  - 3. Provide flexible connections between equipment and interconnected piping.
  - 4. Provide isolators and restraints designed for amplified code forces and with demonstrated ability to resist required forces including gravity, operational and seismic forces.
  - 5. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.
  - 6. Where concrete floor thickness is less than required for expansion anchor installation, install through bolt in lieu of expansion anchor.
- F. Wall mounted Mechanical Equipment:
  - 1. Provide support and bracing to resist seismic design force in any direction.
  - 2. Install backing plates or blocking as required to deliver load to primary wall framing members.
  - 3. Anchoring to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads is not permitted.

### 3.3 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect isolated equipment after installation and submit report. Include static deflections.
- C. Perform testing and inspections of the installation in accordance with Section 014533.

END OF SECTION 210548

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Identification of fire suppression piping and equipment.

### PART 2 - PRODUCTS

#### 2.1 NAMEPLATES AND TAGS

- A. Acceptable manufacturers: Seton Nameplate Corporation, Marking Services Inc. or equal.
- B. Rigid plastic, "Setonite" or Bakelite with engraved lettering, minimum 1/2" high.
- C. Brass tags, at least 1-1/2" inches in diameter, with alpha-numeric I.D., permanently stamped black filled letters showing the service, and black filled numbers showing the valve or equipment number.

#### 2.2 PIPE MARKERS

- A. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, performed to fit around pipe or pipe covering.
- B. Plastic Tape Markers: flexible vinyl film tape with pressure sensitive adhesive and printed marking.

#### 2.3 PAINT

- A. Acceptable manufacturers: Sherwin-Williams, Porter, or equal.
- B. Coordinate paint and preparation materials with requirements of Section 099100.

### PART 3 - EXECUTION

#### 3.1 PIPE IDENTIFICATION AND PAINTING

- A. Identify all piping as specified herein painted under Section 099100.
- B. Paint piping as specified in this section and as specified in Section 099100.

1. Paint all exposed fire protection piping in its entirety including stairways, fan rooms, central plant, mechanical equipment rooms, etc. Paint piping "Fire Protection Red" unless otherwise specified in Division 09.

### 3.2 NAMEPLATES AND TAGS

- A. Use names, numbers and abbreviations appearing in schedules on Contract Drawings.
- B. Provide nameplates, located in a conspicuous location directly on the equipment. Provide nameplates for all following equipment including, but not limited to:
  1. Starters.
  2. Pumps.
  3. Controller panels.
- C. Name Tag Fasteners: Commercial quality, rust resisting nuts and bolts with backwashers, self-tapping screws, or rivets. If equipment surface does not allow for direct attachment, use copper or brass rings to attach tags.
- D. Valve Tags
  1. Each valve shall be identified with a brass tag. The tag shall contain an alpha-numeric I.D. which shall include floor-level and building section as part of the I.D. Coordinate format of identification tags with Division 23 for consistent valve numbering.
  2. Include a valve schedule in project close-out documents.
  3. Securely fasten tags to valves with a brass "S" hook or chain.

END OF SECTION 210553

## SECTION 211313 - FIRE SUPPRESSION SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Provide materials and labor required to completely execute the sprinkler and fire protection work for this project, as indicated on the drawings and as herein specified.
- B. Scope of work:
  - 1. Hydraulic design of sprinkler system.
  - 2. Shop drawings.
  - 3. Alarm check valves and accessories.
  - 4. Interior pipe, fittings, and valves.
  - 5. Hangers, supports and sleeves.
  - 6. Sprinkler heads and extra sprinkler cabinet.
  - 7. Testing and flushing.

#### 1.2 RELATED WORK

- A. Division 01: Seismic Requirements.
- B. Section 078413: Penetration Fire Stopping.
- C. Section 099100: Painting.
- D. Section 210500: Common Work Results for Fire Suppression.
- E. Section 210520: Fire Extinguishers and Cabinets.
- F. Division 26: Electrical.

#### 1.3 INSTALLER QUALIFICATIONS

- A. Comply with local and state licensure requirements for installation of fire protection systems.

#### 1.4 DESIGN REQUIREMENTS

- A. Design 100% hydraulically calculated automatic sprinkler system as applicable in accordance with Owner's insuring agency guidelines, NFPA 13, and state and local code requirements.
- B. Design system to serve entire project unless otherwise indicated on drawings.
- C. Design system with sprinkler zones as indicated on drawings. Pipe/mains sizes indicated on drawing shall not be reduced without engineer of record approval.

D. Base design on the following criteria:

1. Light hazard occupancy in all areas except as noted herein or shown on drawings: 0.10 GPM/SF over 1500 sq ft.
2. Ordinary hazard occupancy for mechanical equipment rooms, storage rooms, and other areas indicated on drawings: .15 GPM/SF over 2000 sq ft.
3. Minimum excess pressure of 10 psi including required hose stream allowance and sprinkler requirements.
4. Maximum pipe velocity of 20 feet/second or as limited by insuring agent.
5. Hose stream allowance based on occupancy classification of remote area in addition to sprinkler demand. In penthouses, design system for 150 GPM hose allowance, or as required by Owner's insuring agency, in addition to sprinkler demand.
6. A minimum of 18 inches clearance between bottom of sprinkler deflector and top of storage shelving.
7. Sprinkler system in elevator equipment room and bottom of hoistway shall be a wet pipe system.
  - a. Sprinkler head is not required at top of shaft.
  - b. Sidewall sprinkler heads shall be installed at bottom of each hoistway, not more than 2 feet above the floor of the pit.
  - c. Location of sidewall head shall not interfere with elevator toe guard.
  - d. 212 degree sprinkler head shall be required.
  - e. A supervised, indicating control valve located outside of hoistway and equipment room shall be in an accessible location.
  - f. f. Sprinkler riser shall run outside of hoistway.
  - g. Install system per ASME, ANSI A 17.1 safety code.
  - h. See Division 26 for installation of smoke and heat detectors in hoistway and equipment room for elevator recall and shunt trip prior to discharge of water.
8. Include a 3/4" ball drip for all types of fire department connections. Route discharge to outside of building.
9. Base design on results of a flow test, not more than six months old, to determine the adequacy of the water supply. Submit flow test results with sprinkler system drawings and calculations.
10. Include dry pendant type sprinkler heads located within cooler and freezer boxes with recess seat located within a conditioned space.
11. Use standard coverage sprinkler heads. Extended coverage heads shall not be used.

1.5 QUALITY ASSURANCE

- A. Underwriters Laboratories (U.L.) listed and Factory Mutual (F.M.) approved material.
- B. The automatic sprinkler system installer shall provide a permanently attached nameplate located at the controlling riser, indicating the location and the discharge densities over designed areas of discharge including gallons per minute and residual pressure, and hose stream demand supplied by the sprinkler piping.

1.6 SUBMITTALS AND SHOP DRAWINGS

- A. Submit drawings and calculations to State, Local Fire Marshal and to Owner's Insuring Agent for approval.

- B. After receiving approval from State, Local Fire Marshal and Owner's Insuring Agent, submit shop drawings and calculations for review prior to start of installation. Submitted shop drawings shall bear State, Local Fire Marshal's and Owner's Insuring Agent approval stamp.
- C. Include the following manufacturer's product data with shop drawings:
  - 1. Sprinkler Heads.
  - 2. Valves.
  - 3. Pipe and fittings.
  - 4. Hangers.
  - 5. Water flow, pressure and tamper switches.
- D. Submit shop drawing and submittals to Owner's Insuring Agency for approval.

#### 1.7 APPLICABLE CODES (LATEST ADOPTED ADDITION)

- A. NFPA 13: Sprinkler System Installation (2002).
- B. NFPA-101: Life Safety Code.

#### 1.8 PROJECT CLOSE-OUT DOCUMENTS

- A. Include sprinkler as constructed drawings in project close-out documents.
- B. Comply with requirements specified in Division 01.

### PART 2 - PRODUCTS

#### 2.1 VALVES

- A. Acceptable Manufacturers: Nibco, Crane, Stockham, Grinnell, Mueller, Watts, Hersey, Febco, Ames. Nibco model numbers are used to establish required level of product quality.
- B. Outside system valves:
  - 1. Double detector check valves: Shall be specified by the civil engineer.
  - 2. Gate valves: All exterior valve and PIV shall be specified by the civil engineer.
- C. Interior valves:
  - 1. Alarm check valve: Gem Model F20, F200, or F2001 with F211 retard chamber, divided seat ring, rubber-faced clapper, U.L. listed and F.M. approved.
  - 2. Check valves:
    - a. All check valves on discharge side of fire pump shall be non-slam type.
    - b. Nibco No. F-908-W, U.L. Listed and F.M. approved, bolted bonnet, horizontal swing, renewable seat and disc, 175 lb. wwp.
    - c. Nibco No. KW-900-W, U.L. Listed, F.M. approved, wafer style, rubber seat, spring actuated, 175 lb wwp.

3. Gate valves:
  - a. Nibco F-607-OTS, U.L.-F.M. approved flanged pattern outside screw and yoke, 175 psi WP. 2" and smaller shall be O.S.&Y., iron body, flanged.
4. Butterfly valves:
  - a. Nibco WD3510-8 or LD3510-8, wafer or lug style, U.L. Listed, F.M. approved, 250 lb wwp, lug style 200 psi wwp dead end rated, internal tamper switch.
5. Globe and Angle Valves (Drains and Flow Regulation):
  - a. 175 PSI minimum working pressure. 2" and smaller: bronze, renewable composition disc, screwed. 2-1/2" and larger: iron body, bronze mounted, renewable composition disc, flanged.
6. Ball valves:
  - a. Nibco No. KT-505-8 or G-505-8, threaded or grooved, U.L. listed, F.M. approved, bronze body, three piece, internal tamper switches, 300 psi wwp.

## 2.2 PIPE AND FITTINGS

### A. Interior Pipe and Fittings:

1. Schedule 40 ASTM-135, electric-resistance welded steel pipe for piping 2 inch and smaller.
2. Schedule 10 ASTM-135, electric-resistance welded steel pipe suitable for roll grooving for piping 2-1/2 inch and larger.
3. Sprinkler piping and fitting shall be galvanized for dry pipe system, piping exposed to weather and in corrosive environment.
4. Fittings:
  - a. Mechanical couplings: Roll or cut groove rigid type by Victaulic, Central Grooved, or Anvil.
  - b. Class 125 in accordance with ANSI B16.4 or Class 250 in accordance with ANSI B16.3 cast iron sprinkler fittings - screwed, flanged, or grooved-end.
  - c. All fittings shall be by the same manufacturer.

### B. Drain Piping:

1. Schedule 40, A106 or A120, galvanized pipe.
2. Fittings: Class 250 malleable iron, screwed with galvanized coating.

## 2.3 HANGERS AND SUPPORTS

- A. Acceptable manufacturers: Anvil, Bline, Viking, Reliable Empire, Fee and Mason. Grinnell model numbers are used to establish level of product quality.
- B. Provide U.L. Listed and F.M. approved hangers.

C. Hangers:

1. Anvil #260 MSS, Type 1 for pipe 2" through 12".
2. Anvil Figure #104, Type 6, adjustable split ring for pipe less than 2".
3. Anvil #69 for pipe 1/2" through 2".

D. Clamps:

1. Riser Clamps: Anvil #261, MSS Type 8, at floor slab penetrations to support risers.
2. C-Clamps: Anvil #92 with retainer clip, MSS Type 23.
3. Malleable Beam Clamps: Anvil Figure #218, MSS Type 30.

E. Inserts:

1. Concrete insert: Anvil Figure #281, MSS Type 18, universal concrete insert, adequately sized and correctly positioned to support full load.
2. Lightweight concrete: Anvil #285.
3. Continuous Concrete Insert: Anvil Powerstrut #PS-349, pregalvanized.
4. Power Insert: HILTI HDI expansion anchor. Use in conjunction with all thread rods.
5. Power inserts shall not be used in post tension construction unless approved by Structural Engineer.

## 2.4 SPRINKLER HEADS

- A. Acceptable Manufacturers: Reliable Sprinkler Company, Automatic Sprinkler Company, Viking, Tyco Fire Products.
- B. Slip-type escutcheons will not be accepted.
- C. Sprinkler heads shall be U.L. Listed and F.M. approved. Concealed type quick response sprinkler head may be U.L. listed only.
- D. Provide quick response sprinkler head throughout smoke compartments. Provide quick response heads in all light hazard areas.
- E. Brass U-Right: Tyco TY-FRB, bulb type, 1/2" orifice, upright. Quick response Tyco TY-FRB.
- F. Chrome Pendent: Tyco TY-FRB, bulb type, 1/2" orifice, pendent. Quick response Tyco TY-FRB.
- G. Horizontal Sidewall: Tyco TY-FRL, solder type, 1/2" orifice. Quick response Tyco TY-FRL 1/2" solder, Tyco TY-FRB 1/2" bulb type.
- H. Concealed: Tyco RF2, bulb type, 1/2" orifice. Quick response bulb type, 1/2" orifice.
- I. Semi-Recessed: TY-FRL solder type; TY-FRB bulb 1/2" orifice.
- J. Dry Pendent: Tyco DS1 (standard coverage), bulb type, 1/2" orifice; Tyco DS2 extended coverage. (Also available DSC-concealed.)
- K. Provide polyester coated heads in corrosive environments and exterior over hangs.

- L. Provide one sprinkler cabinet with 24 extra sprinkler heads and sprinkler wrench for emergency use. Locate cabinet in maintenance area. Provide a minimum of two extra sprinkler heads of each type sprinkler head used for the project. Add an extra sprinkler cabinet if necessary to house the spare heads.

## 2.5 SWITCHES

- A. Provide tamper switches for all fire/sprinkler system control valves unless noted otherwise.
- B. Flow switch: Notifier Model No. WFD-6 vane type flow switch with pneumatic retard adjustable from 0 to 90 seconds, complete with double pole, double throw micro feature.
- C. Tamper switch: Notifier Model No. SGV for 4" and larger, Potter-Roemer Model No. OSYSU-A2 for pipe size less than 4", tamper switch double pole, double throw micro feature for 1/2-inch to 12-inch valves.

## 2.6 WATER FLOW ALARMS

- A. Connect water flow alarms to alarm check valves with bell located on outside of building. Provide other flow switches as shown on drawings and connect to fire alarm system.
- B. Drain valves: Provide drain valves as required by NFPA 13.

## 2.7 INSPECTORS TEST ASSEMBLY

- A. Cabinet: Potter-Reamer #1812-C white baked enamel, minimum 6-1/2" deep, steel box with full acrylic panel.
- B. Test module: Victaulic "Test Master" Style 718, threaded, with combination sight glass and 1/2" orifice.
- C. Finish: Paint exterior cabinet frame to match wall surface.

## PART 3 - EXECUTION

### 3.1 COORDINATION

- A. Coordinate installation to avoid interference with other systems.
- B. Provide power and interlock wiring under Division 26.

### 3.2 PIPE INSTALLATION

- A. Flush the fire service mains before connecting to sprinkler branch piping system.

- B. Exterior underground piping shall be buried with a permanent, bright colored, continuous printed plastic tape. Tape shall be intended for direct burial and buried directly above fire protection main. Tape shall be 6" wide, 4 mils thick. Tape shall be printed with proper identification of service located below.
- C. Install sprinkler pipe a minimum of 12" above top of ceiling to allow for removal of ceiling tile and lighting fixtures and for access to equipment above the ceiling.
- D. Support vertical pipe risers at 12' maximum distance or at least once at each floor.
- E. Use hanger types as specified in Part 2 above. This shall overrule hanger types outlined in NFPA 13.
- F. Hanger spacing shall be in accordance with NFPA 13.
- G. Provide hangers on all arm outs of 12" or more.
- H. Seal penetrations of fire rated walls and floors in accordance with U.L. Fire Resistance Index for Through-Penetration Firestop Systems. Coordinate requirements with Division 07.
- I. Provide trapeze type hangers where necessary to support pipe when structural steel is not directly above for support.

### 3.3 SPRINKLERS

- A. Install sprinkler heads and required piping in areas such as concealed spaces, kitchen hoods, dietary freezer and chill boxes and other special areas and spaces as required by NFPA 13, NFPA 101, and IBC.
- B. Provide drain valves, pipes and test connections as required by NFPA 13. Pipe drain lines and test connections to outside building or as shown and detailed on Drawings. Originate test lines from most hydraulically remote point of each sprinkler zone.
- C. Install sprinkler heads centerline of corridors and locate in the center of the ceiling tiles. Install sprinkler heads in other designated spaces in the center of the ceiling tiles and symmetrically locate with other heads within the ceiling. Do not install sprinkler heads in other locations any closer than six inches to any ceiling grid or wall.
- D. Provide head guards on heads below 7'-6" above floor or walkway and where heads may be subject to damage.
- E. When exposed sprinkler piping is painted the installed sprinkler heads shall be bagged and banded to protect the sprinkler heads. Do not use tape for bagging the sprinkler heads. If tape or paint gets on the sprinkler head, the sprinkler head will lose its listing and shall be replaced.
- F. Refer to Architectural reflected ceiling plans for exact head locations.

END OF SECTION 211313

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

SMITH SECKMAN REID INC  
2995 SIDCO DR  
NASHVILLE, TN 37204

HYDRAULIC CALCULATIONS FOR  
LOS ANGELES LAKERS HEADQUARTERS

DATE: DEC 4, 2015

-DESIGN DATA-

REMOTE AREA LOCATION: NORTHEAST CORNER OF OPEN COURT

OCCUPANCY CLASSIFICATION: LIGHT HAZARD

DENSITY: 0.10 gpm/ 1500 sq. ft.

AREA OF APPLICATION: 1500 sq. ft.

COVERAGE PER SPRINKLER: 225 sq. ft. MAX

TYPE OF SPRINKLERS CALCULATED: BRASS UPRIGHT

NUMBER OF SPRINKLERS CALCULATED: 10

HOSE-STREAM DEMAND: 100 gpm

TOTAL WATER REQUIRED (INCLUDING HOSE): 345 gpm

FLOW AND PRESSURE (AT SOURCE): 245 gpm @ 78 psi

TYPE OF SYSTEM: AUTOMATIC WET SPRINKLERS

WATER SUPPLY

Source: FIRE HYDRANT Test Date: 10-28-15 Test By: EL SEGUNDO FD

Location: MARIPOSA BY FIRE STATION

Static: 78 psi Residual: 72 psi Flow: 1267 gpm

Source Elevation Relative to Finished Floor Level: -46 ft.

NAME OF DESIGNER: RANDY NICHOLSON, ROCKY GOODMAN

AUTHORITY HAVING JURISDICTION: LOCAL FIRE MARSHAL

NOTES:

Calculations performed by HASS under license # 1610061910 ,  
granted by HRS SYSTEMS, INC.

(Notes continue after pipe calculations results.)

(Notes continue after pipe calculations results.)

DATE: 12/4/2015HOLSON\DESKTOP\LAKERS HQ SPRK CALC\LAKERS HQ SPRK CALC.SDF

JOB TITLE: LAKERS HQ SPRK CALC

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	78.0	72.0	1267.0	77.5	344.5	67.9

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	344.5 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	244.5 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
1	145.0	K= 5.60	13.7	20.7
2	145.0	K= 5.60	16.1	22.5
3	145.0	K= 5.60	19.1	24.5
4	145.0	K= 5.60	22.6	26.6
5	145.0	K= 5.60	24.7	27.9
6	145.0	K= 5.60	13.8	20.8
7	145.0	K= 5.60	16.1	22.5
8	145.0	K= 5.60	19.1	24.5
9	145.0	K= 5.60	22.7	26.7
10	145.0	K= 5.60	24.8	27.9
A	145.0	- - - -	28.7	- - -
B	145.0	- - - -	28.8	- - -
C	145.0	- - - -	32.0	- - -
D	134.0	- - - -	37.2	- - -
E	134.0	- - - -	41.3	- - -
F	116.0	- - - -	49.7	- - -
TOR	116.0	- - - -	52.4	- - -
BOR	106.5	- - - -	57.2	- - -
F1	106.5	- - - -	57.7	- - -
F2	105.0	- - - -	58.8	- - -
U1	100.0	- - - -	61.0	- - -
U2	100.0	- - - -	61.0	- - -
DCV1	95.0	- - - -	63.3	- - -
DCV2	95.0	- - - -	69.3	- - -
E1	95.0	- - - -	69.4	- - -
E2	95.0	- - - -	69.4	- - -
E3	95.0	- - - -	69.5	- - -
SOURCE	99.0	SOURCE	67.9	244.5

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JOB TITLE: LAKERS HQ SPRK CALC

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	VEL (FPS)	DIA (IN)	LENGTH	PRESS.	SUM.
	NODES	(FT)	(K)	(PSI)	(GPM)			HW (C)	(FT)		(PSI)
	Pipe: 1					20.7		1.049 PL	15.00	PF	2.4
2		145.0	5.6	16.1	22.5	7.7		120 FTG	E	PE	0.0
1		145.0	5.6	13.7	20.7			0.139 TL	17.00	PV	
	Pipe: 2					43.2		1.380 PL	15.00	PF	3.0
3		145.0	5.6	19.1	24.5	9.3		120 FTG	T	PE	0.0
2		145.0	5.6	16.1	22.5			0.142 TL	21.00	PV	
	Pipe: 3					67.7		1.610 PL	15.00	PF	3.5
4		145.0	5.6	22.6	26.6	10.7		120 FTG	T	PE	0.0
3		145.0	5.6	19.1	24.5			0.154 TL	23.00	PV	
	Pipe: 4					94.3		2.067 PL	15.00	PF	2.1
5		145.0	5.6	24.7	27.9	9.0		120 FTG	T	PE	0.0
4		145.0	5.6	22.6	26.6			0.084 TL	25.00	PV	
	Pipe: 5					122.2		2.067 PL	9.00	PF	3.9
A		145.0	0.0	28.7	0.0	11.7		120 FTG	2T	PE	0.0
5		145.0	5.6	24.7	27.9			0.136 TL	29.00	PV	
	Pipe: 6					20.8		1.049 PL	15.00	PF	2.4
7		145.0	5.6	16.1	22.5	7.7		120 FTG	E	PE	0.0
6		145.0	5.6	13.8	20.8			0.140 TL	17.00	PV	
	Pipe: 7					43.3		1.380 PL	15.00	PF	3.0
8		145.0	5.6	19.1	24.5	9.3		120 FTG	T	PE	0.0
7		145.0	5.6	16.1	22.5			0.143 TL	21.00	PV	
	Pipe: 8					67.8		1.610 PL	15.00	PF	3.6
9		145.0	5.6	22.7	26.7	10.7		120 FTG	T	PE	0.0
8		145.0	5.6	19.1	24.5			0.154 TL	23.00	PV	
	Pipe: 9					94.5		2.067 PL	15.00	PF	2.1
10		145.0	5.6	24.8	27.9	9.0		120 FTG	T	PE	0.0
9		145.0	5.6	22.7	26.7			0.085 TL	25.00	PV	
	Pipe: 10					122.3		2.067 PL	9.00	PF	4.0
B		145.0	0.0	28.8	0.0	11.7		120 FTG	2T	PE	0.0
10		145.0	5.6	24.8	27.9			0.136 TL	29.00	PV	
	Pipe: A					122.2		4.026 PL	15.00	PF	0.1
B		145.0	0.0	28.8	0.0	3.1		120 FTG	----	PE	0.0
A		145.0	0.0	28.7	0.0			0.005 TL	15.00	PV	
	Pipe: B					244.5		4.026 PL	159.00	PF	3.2
C		145.0	0.0	32.0	0.0	6.2		120 FTG	E	PE	0.0
B		145.0	0.0	28.8	0.0			0.019 TL	169.00	PV	

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JOB TITLE: LAKERS HQ SPRK CALC

PIPE TAG						Q (GPM)	DIA (IN)	LENGTH	PRESS.	
END	ELEV.	NOZ.	PT	DISC.	VEL (FPS)	HW (C)		(FT)	SUM.	
NODES	(FT)	(K)	(PSI)	(GPM)		FL/FT			(PSI)	
Pipe: C										
D	134.0	0.0	37.2	0.0	244.5 6.2	4.026 120	PL FTG	11.00 E	PF PE	0.4 -4.8
C	145.0	0.0	32.0	0.0		0.019	TL	21.00	PV	
Pipe: D										
E	134.0	0.0	41.3	0.0	244.5 6.2	4.026 120	PL FTG	159.00 4ET	PF PE	4.2 0.0
D	134.0	0.0	37.2	0.0		0.019	TL	219.00	PV	
Pipe: E										
F	116.0	0.0	49.7	0.0	244.5 6.2	4.026 120	PL FTG	18.00 E	PF PE	0.5 -7.8
E	134.0	0.0	41.3	0.0		0.019	TL	28.00	PV	
Pipe: F										
TOR	116.0	0.0	52.4	0.0	244.5 6.2	4.026 120	PL FTG	95.00 5E	PF PE	2.8 0.0
F	116.0	0.0	49.7	0.0		0.019	TL	145.00	PV	
Pipe: TOR										
BOR	106.5	0.0	57.2	0.0	244.5 6.2	4.026 120	PL FTG	10.00 TG	PF PE	0.6 -4.1
TOR	116.0	0.0	52.4	0.0		0.019	TL	32.00	PV	
Pipe: BOR										
F1	106.5	0.0	57.7	0.0	244.5 6.2	4.026 120	PL FTG	8.00 T	PF PE	0.5 0.0
BOR	106.5	0.0	57.2	0.0		0.019	TL	28.00	PV	
Pipe: F1										
F2	105.0	0.0	58.8	0.0	244.5 6.2	4.026 120	PL FTG	1.50 GA	PF PE	0.4 -0.6
F1	106.5	0.0	57.7	0.0		0.019	TL	23.50	PV	
Pipe: F2										
U1	100.0	0.0	61.0	0.0	244.5 2.5	6.280 140	PL FTG	5.00 E	PF PE	0.0 -2.2
F2	105.0	0.0	58.8	0.0		0.002	TL	27.00	PV	
Pipe: U1										
U2	100.0	0.0	61.0	0.0	244.5 2.5	6.280 140	PL FTG	12.00 ----	PF PE	0.0 0.0
U1	100.0	0.0	61.0	0.0		0.002	TL	12.00	PV	
Pipe: U2										
DCV1	95.0	0.0	63.3	0.0	244.5 1.4	8.390 140	PL FTG	155.00 3E	PF PE	0.1 -2.2
U2	100.0	0.0	61.0	0.0		0.000	TL	248.00	PV	
Pipe: DCV1										
DCV2	95.0	0.0	69.3	0.0	FIXED PRESSURE LOSS DEVICE					
DCV1	95.0	0.0	63.3	0.0	6.0 psi, 244.5 gpm					
Pipe: DCV2										
E1	95.0	0.0	69.4	0.0	244.5 1.4	8.390 140	PL FTG	72.00 2ETG	PF PE	0.1 0.0
DCV2	95.0	0.0	69.3	0.0		0.000	TL	200.00	PV	
Pipe: E1										
E2	95.0	0.0	69.4	0.0	244.5 0.7	11.938 100	PL FTG	58.00 T	PF PE	0.0 0.0
E1	95.0	0.0	69.4	0.0		0.000	TL	100.82	PV	

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PIPE TAG					Q (GPM)	DIA (IN)	LENGTH	PRESS.	
END	ELEV.	NOZ.	PT	DISC.	VEL (FPS)	HW (C)	(FT)	SUM.	
NODES	(FT)	(K)	(PSI)	(GPM)		FL/FT		(PSI)	
Pipe: E2					244.5	11.938	PL 428.00	PF	0.1
E3	95.0	0.0	69.5	0.0	0.7	100	FTG T	PE	0.0
E2	95.0	0.0	69.4	0.0		0.000	TL 470.82	PV	
Pipe: E3					244.5	6.065	PL 28.00	PF	0.1
SOURCE	99.0	SRCE	67.9	(N/A)	2.7	100	FTG EG	PE	1.7
E3	95.0	0.0	69.5	0.0		0.004	TL 40.13	PV	

NOTES (HASS):

- Calculations were performed by the HASS 8.5 computer program under license no. 1610061910 granted by  
HRS Systems, Inc.  
208 Southside Square  
Petersburg, TN 37144  
(931) 659-9760
- The system has been calculated to provide an average imbalance at each node of 0.003 gpm and a maximum imbalance at any node of 0.085 gpm.
- Total pressure at each node is used in balancing the system. Maximum water velocity is 11.7 ft/sec at pipe 10.
- Items listed in bold print on the cover sheet  
  
are automatically transferred from the calculation report.
- Available pressure at source node SOURCE under full flow conditions is 77.38 psi compared to the minimum required pressure of 20.00 psi.
- PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

PAGE: A MATERIAL: S40 HWC: 120

Diameter	Equivalent Fitting Lengths in Feet								
(in)	E	T	L	C	B	G	A	D	N
	Ell	Tee	LngEll	ChkVlv	BfyVlv	GatVlv	AlmChk	DPVlv	NPTee
1.049	2.00	5.00	2.00	5.00	6.00	1.00	10.00	2.00	5.00
1.380	3.00	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
1.610	4.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00
2.067	5.00	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00
4.026	10.00	20.00	6.00	22.00	12.00	2.00	20.00	20.00	20.00
6.065	14.00	30.00	9.00	32.00	10.00	3.00	28.00	28.00	30.00
11.938	27.00	60.00	18.00	65.00	21.00	6.00	45.00	45.00	60.00

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PAGE: D MATERIAL: DIRON HWC: 140

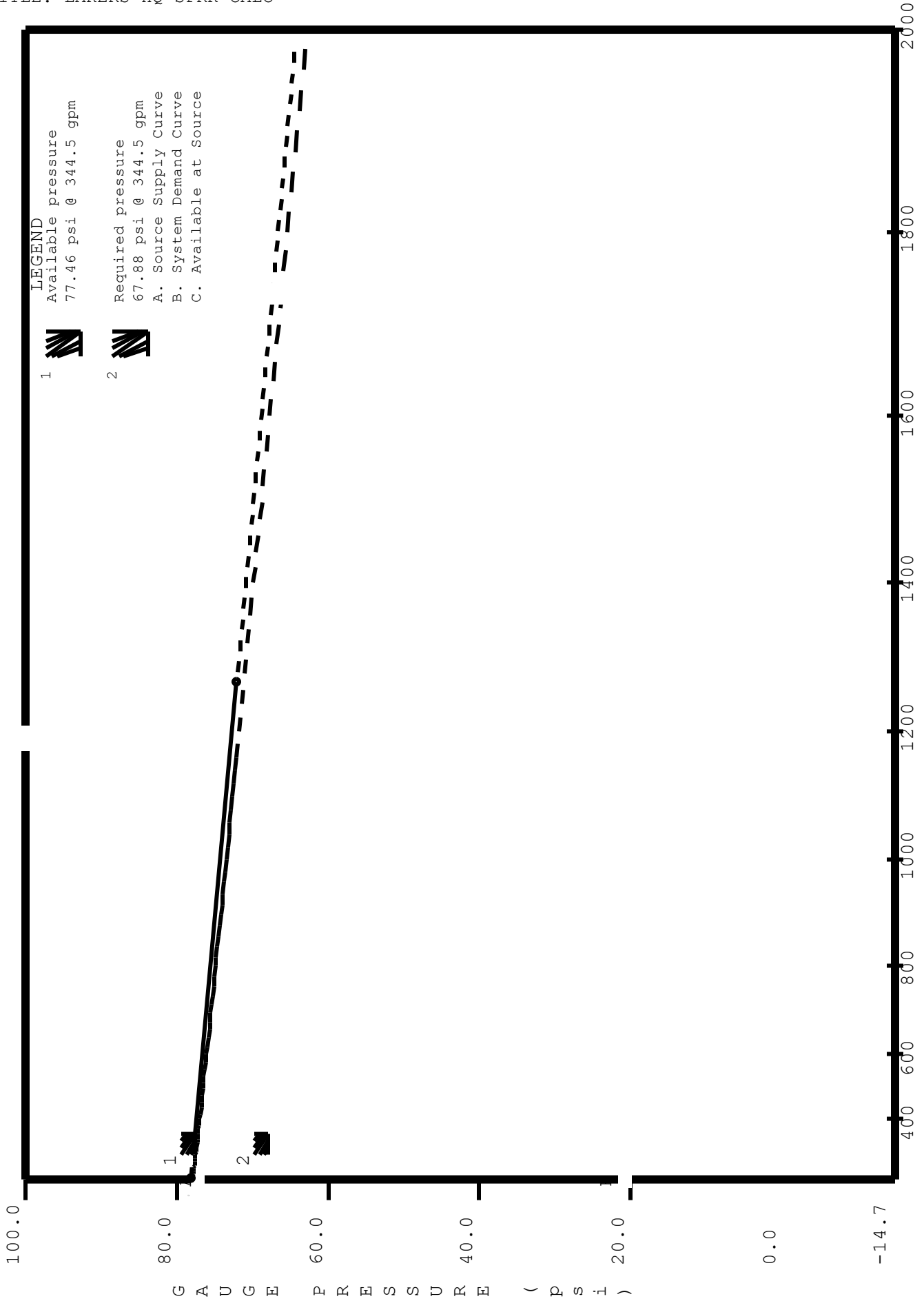
Diameter (in)	Equivalent Fitting Lengths in Feet						
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	N NPTee
6.280	22.00	47.00	14.00	51.00	16.00	5.00	47.00
8.390	31.00	59.00	22.00	76.00	20.00	7.00	59.00

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JOB TITLE: LAKERS HQ SPRK CALC

WATER SUPPLY ANALYSIS

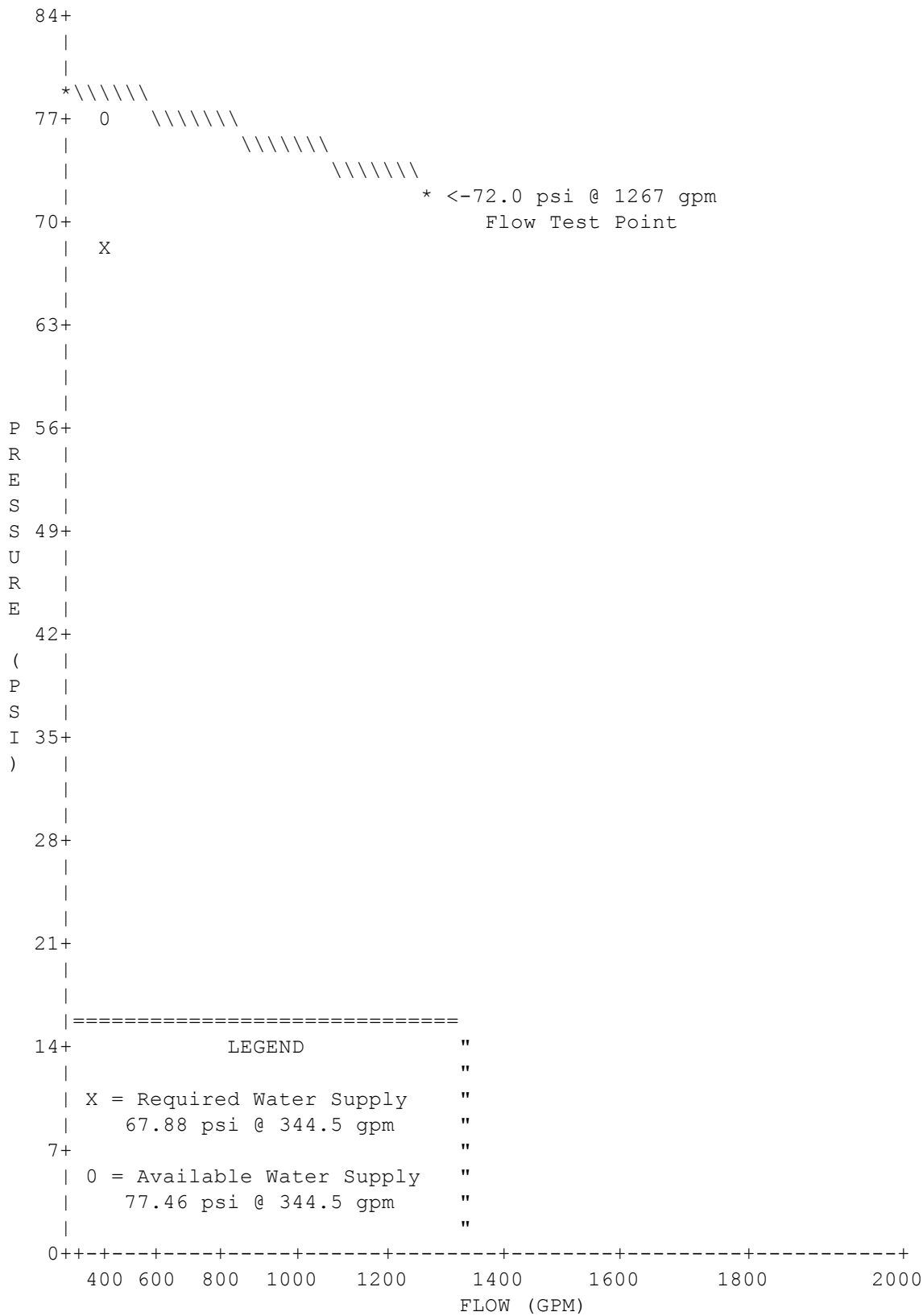
Static: 78.00 psi Resid: 72.00 psi Flow: 1267.0 gpm



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JOB TITLE: LAKERS HQ SPRK CALC

WATER SUPPLY CURVE



## SECTION 211319 - PRE-ACTION SPRINKLER SYSTEM

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Contractor shall install Double Interlock Supervised Pre-action System using a deluge valve controlled by a normally closed solenoid power to open valve release system.
- B. System shall be installed in accordance with drawing and specifications, however, no requirements or NFPA 13 shall be violated. Material and labor necessary to fully comply with drawings and specifications and with rules, regulations, ordinances shall be furnished by the Contractor.
- C. Scope of Work:
  - 1. Hydraulic design of sprinkler system
  - 2. Shop drawings
  - 3. Riser assembly
  - 4. Air compressor
  - 5. Release control panel
  - 6. Smoke/heat detectors

#### 1.2 RELATED WORK

- A. Division 01: Seismic Requirements
- B. Section 07 84 46: Fire-Resistive Joint Systems
- C. Section 09 91 00: Painting
- D. Section 21 05 00: Common Work Results for Fire Suppression
- E. Division 26: Electrical

#### 1.3 INSTALLER QUALIFICATIONS

- A. Comply with local and state licensure requirements for installation of fire protection system.

#### 1.4 DESIGN REQUIREMENTS

- A. Not more than 1000 closed sprinklers shall be controlled by any one pre-action valve, or maximum 750 gallon system capacity.
- B. Sprinkler piping and detection devices shall be automatically supervised when there are more than 20 sprinklers on the system.
- C. Automatic sprinklers on pre-action system installed in the pendent position shall use a return bend pipe arrangement and be located in a heated area. Provide approved dry pendent type if installed in an area subject to freezing.
- D. Sprinkler piping shall be galvanized for dry pipe system.
- E. Design 100% hydraulically calculated, pre-action sprinkler system in accordance with Owner's insuring agency guidelines, NFPA 13, state and local code requirements.

- F. Design system to serve area as noted on Drawings.
- G. Refer to Section 21 13 13 for design density of sprinkler head in light and ordinary hazard occupancies.
- H. Maximum pipe velocity of 20 feet/second.
- I. System air pressure shall be restored to normal in 30 minutes or less.
- J. Provide accelerator when system capacity exceeds 500 gallons.
- K. System shall be designed for water to reach the most remote sprinkler head within 60 seconds.
- L. Base design on results of flow test, not more than six months old, and wet pipe sprinkler design, to determine the adequacy of water supply and pressure of the pre-action system.

## 1.5 QUALITY ASSURANCE

- A. Underwriters Laboratories (U.L.) listed and Factory Mutual (F.M.) approved material.
- B. Comply with local fire department standards for hose threads, operating nuts and accessories for hydrants and siamese connections.
- C. The automatic sprinkler system installer shall provide a permanently attached nameplate located at the controlling alarm, indicating the location and the discharge densities over designed areas of discharge including gallons per minute and residual pressure, and hose stream demand supplied by the sprinkler piping.

## 1.6 SUBMITTALS AND SHOP DRAWINGS

- A. Prepare complete detailed working drawings and calculations for fire protection system.
- B. Submit drawings and calculations to State Fire Marshal and to Owner's Insuring Agent for approval.
- C. After receiving approval from State and Local Fire Marshall and Owner's Insuring Agent, submit shop drawings and calculations for review prior to start of installation.
- D. Submitted shop drawings shall bear state or local fire marshal's and Owner's insuring agents approval stamp.
- E. Submit system components as specified in Section 21 13 13.

## 1.7 APPLICABLE CODES (LATEST ADOPTED EDITION)

- A. NFPA 13: Sprinkler System Installation

## PART 2 - PRODUCTS

### 2.1 COMPONENTS

- A. Deluge valve with standard trim, main OS&Y valve with tamper switch on main riser. Check valve with tamper switch on main riser. Check valve with drain on main riser located as shown on drawings. A pre-package cabinet unit would be preferred for this application.

- B. Pre-action shall contain:
  - 1. Pressure gauge
  - 2. Check valve
  - 3. Water flow alarm trim
  - 4. System air supply trim
  - 5. Release trim
  - 6. Accelerator
  - 7. Contractor shall size and provide air compressor as required for the pre-action sprinkler system.
  - 8. For electrical requirements and specifications see Division 26.
  - 9. Contractor shall provide a 24V approved listed control panel with backup power.
- C. Release control panel:
  - 1. Single area,
  - 2. Energize to operate releasing devices for solenoid valve.
  - 3. Other supervisorable components:
    - a. Remote trouble alarms
    - b. Remote water flow alarms
    - c. Remote fire alarm
    - d. Battery power back-up with 90 hour minimum supply. Provide battery charger cabinet with dual rate and automatic switching.
    - e. Building 24 volt back-up power (emergency).
    - f. Air pressure alarm for sprinkler piping supervision.
- D. See electrical drawing and specification for electrical requirements for pre-action sprinkler system.
- E. See Section 21 13 13 for the following:
  - 1. Valves
  - 2. Piping and fittings
  - 3. Hangers and supports
  - 4. Sprinkler heads
  - 5. Switches
  - 6. Pipe Installation

## PART 3 - EXECUTION

### 3.1 COORDINATION

- A. Sprinkler contractor shall coordinate installation of mains and sprinkler heads with all other disciplines.
- B. Coordination sprinkler heads with signs, diffusers and smoke or detecting system equipment.

### 3.2 INSTALLATION

- A. Provide and install system as located as shown on contract drawings.
- B. All work shall meet N.F.P.A. and state and local code requirements.
- C. Contractor shall provide Owner with technical data sheets, operation and maintenance instructions booklet. Provide one booklet at main riser pre-action sprinkler riser.

END OF SECTION 211319

## SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Common work results for requirements specifically applicable to Division 22.
- B. Requirements of Division 01 Specifications, General Provisions of the Contract and General and Supplementary Conditions apply to this Division.

#### 1.2 REFERENCES

- A. AGA: American Gas Association.
- B. ANSI: American National Standards Institute.
- C. ASME: American Society for Mechanical Engineers.
- D. ASTM: American Society for Testing and Materials.
- E. AWWA: American Water Works Association.
- F. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
- G. NEMA: National Electrical Manufacturers' Association.
- H. NFPA: National Fire Protection Association.
- I. UL: Underwriters' Laboratories, Inc.

#### 1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 01 including required number of copies.
- B. Include Products as specified in the individual sections of Division 22.
- C. Group submittals to include complete information of related systems, products, and accessories in a single submittal.
- D. Prepare shop drawings completely independent of the Engineer of Record's CADD files. Should the Contractor or Vendor wish to use the Engineer of Record's CADD files as the basis for developing their shop drawings, a release form, obtainable from the Engineer or Architect, must be signed.

- E. Assist in the preparation of coordinated room layouts as specified in Division 01 and Section 230500. Include coordination of concrete pads and foundations including anchor bolt and sleeve locations.
- F. Submit copies of shop drawings in accordance with Division 01, for plumbing equipment and piping systems.
- G. Brochures: Submit manufacturer's product data and brochures including:
  - 1. Complete descriptions.
  - 2. Illustrations.
  - 3. Rating data, accessories, dimensional data, and applicable options and features marked for the specific items scheduled on drawings and specified herein.
  - 4. Capacities stated in the terms specified.
  - 5. Performance and rating data for plumbing equipment and performance curves for pumps.

#### 1.4 QUALITY ASSURANCE

- A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.
  - 1. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

#### 1.5 REGULATORY REQUIREMENTS

- A. Perform Work specified in Division 22 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.
  - 1. NFPA 54: National Fuel and Gas Code.
  - 2. NFPA 101: Life Safety Code.
  - 3. ANSI Handicapped Code-A117.1.
  - 4. U.L. Fire Resistance Index.
  - 5. ASTM E814-08B: Standard Test Method for Fire Tests of Penetration Firestop Systems.
  - 6. 2013 California Building Code, with Mechanical and Plumbing Codes.
  - 7. 2013 California adopted building codes with amendments and any supplement of the State and/or local authorities having jurisdiction.
- B. Comply with the applicable edition date of each regulation as adopted by the authorities having jurisdiction.

## 1.6 PROJECT/SITE CONDITIONS

- A. Layouts indicated on drawings are diagrammatical and intended to show relative positions and arrangement of piping and equipment. Coordinate work with other trades and with measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings. Provide necessary rises, drops, and offsets to fit in the available space unless prevented by Project conditions.
- B. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.
- C. Place anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.
- D. Determine sizes and verify locations of existing utilities on or near site.
- E. Keep roads and other spaces clear of materials and debris.
- F. Visit site and be informed of conditions under which Work must be performed.
- G. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or, as applicable, means of access using duct, wall, or ceiling access doors.
- H. Install piping to leave sufficient space for AHJ inspection of wall construction. Coordinate pipe routing with other trades including but not limited to Divisions 21, 23, 26 and 28.

## 1.7 FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required to perform Division 22 work.

## 1.8 COORDINATION DRAWINGS

- A. Prior to commencement of installation, assist in preparation of coordination drawings for work under this Division, as specified in Division 01. Fully cooperate with persons coordinating and performing work under other Divisions.
- B. Drawings shall not be formally submitted but shall be kept on site for reference. Notify Architect of conflicts that cannot be resolved.

## 1.9 COMPLETENESS OF WORK

- A. The Contract Documents depict plumbing systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

- B. Catalog numbers referenced throughout the Division 22 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

#### 1.10 REFERENCE STANDARDS AND DEFINITIONS

- A. Comply with provisions of Division 01.

#### 1.11 PRODUCT SUBSTITUTIONS

- A. Comply with provisions of Division 01.

#### 1.12 RECORD DRAWINGS

- A. Provide record drawings that illustrate the work of Division 22 as finally constructed. Deliver record drawings to the Architect in a form suitable for production.
- B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.
- C. Deliver record drawings to Architect within 30 days of Substantial Completion.

#### 1.13 OWNING AND OPERATING MANUALS

- A. Comply with the requirements of Division 01, but provide a minimum of three sets.
- B. Manuals shall include clear and comprehensive instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.
- C. Copies of reviewed submittals on furnished shall be included.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT SUPPORTS

- A. Structural steel for supports: ASTM A36.
  - 1. Use galvanized members installed in areas of high humidity or condensation, and outside.
  - 2. Furnish other members with shop coat of red primer.
  - 3. Retouch primer after field welding.

## 2.2 FLASHINGS AND COUNTERFLASHINGS

- A. Furnish materials and coordinate installation for flashing and counterflashing roof penetrations for vents, pipe, drains, and ducts.
- B. Materials:
  - 1. Sheetmetal: 24-gauge minimum ASTM A525, Class G90.
  - 2. Sheet lead: 3 pounds per square foot.
  - 3. Stainless steel: Minimum 20 gauge.
  - 4. Sheet copper: 24 OZ/SF.
  - 5. Vent Stack Fitting: Josam 1830 or Jay R. Smith 1750.

## 2.3 WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
- B. Size: 24"x24" minimum, as indicated, or as required to allow inspection, service and removal of items served.
- C. 14-gauge minimum sheet metal for doors, 16-gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.
- D. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.
- E. Prime painted or rust inhibitive paint finish.
- F. UL labeled when in fire-rated construction, 1-1/2 hour rating.
- G. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are valves, and equipment needing periodic or replacement maintenance.
- H. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
- I. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers.
  - 1. For masonry and drywall construction: Milcor Style M.
  - 2. For plastered masonry walls and ceiling: Milcor Style K.
  - 3. For ceramic tile or glazed structural tile: Use stainless steel panels.

## 2.4 PIPE ENCLOSURES

- A. For exposed vertical piping in kitchen: 18 gauge stainless steel (type 302) with No. 4 finish.
  - 1. Extend from 2" above ceiling to equipment or island partition.
  - 2. Size covers to contain number of pipes served.

- B. Minimize number of covers by enclosing maximum number of pipes in each drop.
- C. Anchor to equipment or partition.
- D. Fasten seams and joints with stainless steel pop rivets.
- E. Provide 1-1/2" ceiling flange as closure.

## 2.5 SLEEVES

- A. Materials
  - 1. Concrete floors, concrete and masonry walls: 18 gauge galvanized sheetmetal.
  - 2. Drywall partitions: 18 gauge galvanized steel sheet metal.
- B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2". Provide larger annular space if required by firestopping product installation instructions.
- C. Sleeves supporting riser piping 4" and larger shall have three 6" long reinforcing rods welded radially at 120 degree spacing to the sleeve and shall be installed with the rods embedded in the concrete slab.

## PART 3 - EXECUTION

### 3.1 EXCAVATING AND BACKFILLING

- A. Contractor shall review Division 33 and shall perform excavation and backfilling in accordance with the most stringent requirements. Contractor shall request clarification before proceeding if there are conflicting instructions.
- B. Contract Documents show the approximate location of underground utilities known to exist in the area of construction. Contractor shall determine the exact location of utilities.
  - 1. Locate and uncover existing utilities which require new connections before trenching in the vicinity of indicated utility connection.
  - 2. Clear all vegetation and other objectionable material from the area required for the excavation and backfill operations. Disposal of material removed by the clearing operation shall be approved by the Owner's Representative.
- C. Provide trenching, excavating, and backfilling necessary for performance of work indicated in Contract Documents.
- D. Excavate to depths indicated on the drawings or as necessary to permit the installation of pipe, bedding, backfill, structures or appurtenances. Provide a firm, undisturbed, uniform surface in the bottom of trenches. Where excavation exceeds the required depth, bring the excavation to proper grade through the use of an approved incompressible backfill material. Store excavated material and dispose of surplus excavated material.

1. Excavate trench to sufficient depth to permit a minimum of 36" of cover over the top of the pipe unless otherwise required by pipe elevations indicated on the Drawings. The trench width shall be 18" plus the diameter of the pipe and/or the largest bell.
- E. Trenching and excavation shall be unclassified. No extra will be paid in the event that rock is encountered.
  1. Should rock excavation be required, use only experienced personnel for blasting.
  2. Exercise extreme care when blasting with signals of danger given before firing any charge.
  3. Conform to and obey all public authority regulations for the protection of life and property.
- F. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition and to meet applicable codes.
- G. Provide a minimum of 6" of No. 67 crushed stone or clean sand bedding, or equal, in the bottom of the trench to maintain the required grade and continuous support of the bottom quadrant of the pipe. On bell and spigot piping, dig bell holes so bottom of bells do not support pipe.
- H. Upon completion of excavation, and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with min. 6" pipe bedding. Pipe bedding shall be select material deposited in the trench, and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Material for pipe bedding shall comply with local codes. In absence of local code requirements the bedding shall be bank sand or select back fill material approved by the Architect. Any material used shall pass a 1/4-inch screen.
- I. Clean and inspect pipe for defects before lowering into trench for assembly. Install pipe in accordance with provisions of Contract Documents and with the recommendations of the pipe manufacturer.
  1. Ensure pipe is of proper strength and classification for specified service. Discard damaged or defective pipe discovered during pipe laying operations.
  2. Maintain alignment and grade during layout operation. Use acceptable method for maintaining grade and alignment to produce desired results.
- J. Where crushed stone backfill is required, use No. 67 stone, clean sand or equal.
  1. After bedding has been shaped and the pipe assembled, place crushed stone carefully around the pipe and to a point 12" above the pipe. Backfill above this point shall be as described below:
    - a. Backfill areas of vehicular traffic shall consist entirely of crushed stone and compacted crusher run material.
    - b. Backfill for shoulders of roadways, sidewalk, and slab on grade structures shall consist entirely of crushed stone.
    - c. Backfill areas not subject to vehicular traffic may consist of suitable excavated material as described above.
  2. Where crushed stone is not required, suitable excavated material may be utilized. This includes fine, dry earth or a mixture of earth and shot rock. Rocks larger than 6" in any dimension may not be included in any portion of the backfill material.

3. Trenches shall be backfilled only after piping has been inspected, tested, and approved by the Architect. All backfill material shall be placed in the trench either by hand or by approved mechanical methods. The compaction of backfill material shall be accompanied by tamping, with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Architect. Backfill completely around pipe, including 18" above the pipe, with suitable bank sand, tamped in 4" layers under, around, and over pipe. Water down backfill as required. The remainder of the backfill shall be select backfill material tamped at intervals of no more than 12" depths. All materials to be used as selected material backfill shall be approved by the Architect. If, in the opinion of the Architect, the excavated material does not meet the requirements of selected material, the Contractor shall be required to screen the material prior to its use as selected material backfill. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than six inches in its longest dimension. No wood, vegetable matter, or other material which, in the opinion of the Architect, is unsuitable shall be included in the backfill. The upper 24" of backfill may be water jetted, if desired. Backfill shall be brought up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation.

### 3.2 CUTTING AND PATCHING

- A. Repair or replace damage caused by cutting or installation of work specified in Division 22.
- B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

### 3.3 FLASHING AND COUNTERFLASHING

- A. Counterflash pipes where penetration of roofs and outside walls occur.

### 3.4 CONNECTION TO EQUIPMENT FURNISHED BY OWNER

- A. Connect or install equipment shown on plumbing drawings that requires plumbing connections.
- B. Provide piping, shutoff valves, unions, and other piping appurtenances required for a complete installation. Provide steam strainers, steam traps, and pressure reducing valves in steam lines. Provide backflow preventers and/or pressure reducing valves where required by the equipment design or local code. All components shall be line size unless noted otherwise.

### 3.5 DELIVERY, STORAGE, AND PROTECTION

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where delivery in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.
- B. Store items in a clean, dry place, and protect from damage. Plumbing equipment may not be staged or stored outdoors unless intended for outdoor use.

- C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.
- D. Protect plumbing fixtures and brass or chromium plated trim, valves and piping from damage. Cover fixtures during work of finishing trades.
- E. Keep dirt and debris out of pipes and ducts.
- F. Repair, restore, and replace damaged items.
- G. Cover factory finished equipment during work of finished trades.

### 3.6 SLEEVES

- A. Floors: Sleeve all pipe penetrations. Extend sleeve 1-1/2" above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.
- B. Masonry or concrete walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.
- C. Drywall partitions: Sleeve all penetrations of piping in systems over 160 deg F.
- D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.
- E. Install piping, insulation and sleeves in strict accordance with applicable U.L. Fire Resistance Index assembly and with firestop manufacturer's installation instructions for floor or partition penetrations. Coordinate with Division 07.
- F. Penetrations not sleeved or firestopped:
  - 1. Seal voids between pipe and partition. Seals shall be airtight.

### 3.7 CLEANING PLUMBING SYSTEMS

- A. General Cleanup:
  - 1. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Architect. See Division 01 of specifications for further requirements.
  - 2. See page, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.
- B. Factory Finishes:
  - 1. Clean items with factory finishes. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula. If finishes are badly damaged or if there are many damaged, scratched or bare places, refinish the entire item.
- C. Domestic Water System:

1. Flush system progressively by opening building operable valves, faucets and hose bibs and permitting flow to continue from each unit until water runs clear.
2. Sterilize system in accordance with requirements of State Department of Public Health by the following method or other methods acceptable to authority having jurisdiction.
3. Introduce chlorine or a solution of calcium or sodium hypochlorite. Fill lines slowly and apply sterilizing agent at a rate of 50 ppm of chlorine as determined by residual chlorine tests at ends of lines. Open and close all valves while system is being chlorinated.
4. After sterilizing agent has been applied and left standing for 24 hours, test for residual chlorine at ends of lines. If test indicates there is less than 25 ppm, repeat sterilizing process.
5. After system has been standing 24 hours and test indicates at least 25 ppm of residual chlorine, flush out system until all traces of chemical used are removed.
6. Have local health department check and approve system before connecting it to existing water system.

### 3.8 SYSTEMS TESTING

- A. Test all systems and equipment installed to demonstrate proper operation.
- B. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.
- C. Correct and retest work found defective when tested.
- D. Make repairs to piping systems with new materials. Peening, doping, or caulking of joints or holes will not be acceptable.
- E. Domestic Water Piping: Test hot and cold water piping systems upon completion of rough-in, before fixtures are connected, at a hydrostatic pressure of 125 psig or 150% of working pressure whichever is greater for a period of two hours.
- F. Drainage and vent system:
  1. Test plug opening to permit system to be filled with water, and subject system to 10 foot head of water pressure. System shall hold water for 30 minutes with a drop in water level in a 4 inch diameter standpipe, and without visible leakage.
  2. If system is tested in sections, a minimum head of 10 feet shall apply.

END OF SECTION 220500

## SECTION 220523 - VALVES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 221116: Domestic Water Piping.

#### 1.2 QUALITY ASSURANCE

- A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.
  - 1. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.
- B. Valve bodies, shells, and seats: Factory tested.
- C. Bronze body valves:
  - 1. Materials for pressure containing parts: ASTM B-62 (less than 200 psi), B-61 (200 psi and above).
  - 2. Design, workmanship, testing: MSS-SP-80.
- D. Butterfly valves:
  - 1. Face-to-face and end-to-end dimensions: MSS-SP-67.
- E. Pressure Reducing Valves:
  - 1. Pressure reducing valves 2" and less to have bronze body construction meeting ASSE Standard B356, ANSI A112.26.2.
  - 2. Pressure reducing valves 2-1/2" and up to be cast iron construction, ASTM A126 Class B. Valve to be epoxy coated inside and outside. Unit to have low flow bronze bypass valve.
- F. Valve stems: ASTM B584-78, Class 13C (cast silicon brass), ASTM B-371-79, Alloy A (rolled silicon brass), or other material equally resistant to dezincification.
- G. Pressure castings: Free of impregnating materials.
- H. Valve name or trademark and working pressure stamped or cast into body.
- I. Standard for 200 PSI and 300 PSI valves with metallic seats: ASTM B61-76.

### 1.3 SUBMITTALS

- A. Submit product data for review. Valves used or indicated to be used in domestic potable water systems must be lead free in accordance with the Reduction of Lead in Drinking Water Act effective January 4, 2014.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Bronze body valves: Nibco, Apollo, Stockham, Milwaukee, Dezurik or Kennedy.
- B. Butterfly valves: Nibco, Apollo, Stockham, Crane, Mueller or Dezurik.
- C. Ball valves: Nibco, Apollo, Watts, Milwaukee, Jamesbury or Hammond.
- D. Pressure Reducing Valves: Watts, Apollo, Nibco.

### 2.2 MATERIALS

- A. Nibco Figure numbers are indicated below unless noted otherwise:
- B. Check Valves:
  - 1. Domestic Water:
    - a. 2" and less, Figure T-413-Y-LF, or S-413-Y-LF, threaded or solder, Class 150.
    - b. 2-1/2" and up: Iron body, bronze disc, stainless steel spring, flanged, Class 125, Lead Free, globe style, F-910-LF.
- C. Ball Valves
  - 1. Domestic Water
    - a. 2" and less, Figure T585-80-LF or S-585-80-LF, 2-piece, full port, 600 psi, WOG, PTFE seats.
    - b. 2-1/2" and up, Watts G4000-FDA-Lead Free-200 psi, 2 piece, full port, cast iron, flanged, heat fused epoxy coating, stainless steel ball and stem, PTFE seat, Class 125 meeting MSS-SP-72-92 or equal.
- D. Butterfly Valves - 2-1/2" And Up:
  - 1. Domestic Water: Figure LD-2000, lug type, 200 psi, Class 125, EPDM liner, and aluminum bronze disc, meeting AWWA C504-88.
  - 2. Butterfly valves rated bubble tight for dead end service at full pressure in both directions without the need for downstream blind flange.
  - 3. Provide hand wheel and closed housing worm gear on valves 8 inches and larger. Provide clamp lock hand lever operators on valves less than 8 inches.

- E. Pressure Reducing Valve:

1. 2" and less, Watts Series U5 or 223 Lead Free with integral or attached strainer. 300 psi inlet pressure and bronze body construction.
  2. 2-1/2" and up, Watts ACV 115E Lead Free automatic control valves with a 263 reducing valve. 400 psi inlet pressure with stainless steel seats. Cast iron body with epoxy coating inside and outside.
- F. Valve connections: Two inches and smaller - threaded; 2-1/2 inches and larger - flanged.
- G. Provide chain operators for gate valves, butterfly valves, and plug cocks located in mechanical rooms as required by plumbing plans or where valves are mounted above 7'-0" A.F.F.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Furnish and install valves in each piping connection at each piece of plumbing equipment to allow equipment to be isolated from piping systems.
- B. Furnish and install valves in all piping systems to isolate each floor or main section of the building. Install sufficient number of valves to minimize the portion of the system which must be shut down for service or maintenance purposes.
- C. Furnish and install valves above each group of plumbing fixtures.
- D. Install valves in water piping systems so ordinary maintenance work can be performed on the equipment that the valves isolate, without having to drain the system beyond the valve.
- E. All valves above drywall access panels shall be located within one foot of access panels including valves located above ceilings.
- F. Locate valves so as to be easily accessible by maintenance personnel.
- G. Pressure reducing valves shall be installed on equipment as required per manufacturer's recommendation and on main lines serving any facility when the static pressure exceeds 80 psi as required by the State or Local Plumbing Code.
- H. Coordinate with Section 230593 for test and balance requirements.

END OF SECTION 220523

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 220529 - HANGERS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 221116: Domestic Water Piping,
- B. Section 221316: Sanitary Waste and Vent Piping,
- C. Section 220700: Plumbing Insulation,

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Anvil, Carpenter and Patterson, Fee and Mason, B-Line, Viking, Reliable, and Michigan. Anvil numbers are used for reference.

#### 2.2 HANGERS

- A. Anvil Figure #260 MSS Type 1, clevis hangers for:
  - 1. Non-insulated steel and galvanized piping 2" through 24" diameter,
  - 2. Non-insulated cast iron pipe,
  - 3. Non-insulated PVC piping,
- B. Anvil Figure #260 clevis hangers with Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption.
  - 1. All insulated piping,
- C. Anvil Figure CT-69, MSS Type 10 with adjustable wrought tubing ring hanger, copper plated for:
  - 1. Non-insulated copper tubing with no longitudinal movement,
- D. Anvil Figure #CT-121, MSS Type 8, riser clamps (at floor penetrations) to support:
  - 1. Copper pipe risers,

- E. Anvil Figure #261, MSS Type 8, riser clamps (at floor slab penetrations) to support:
  - 1. Steel pipe risers,
  - 2. PVC pipe risers,
- F. Anvil Powerstrut Trapeze Hangers: Where three or more lines of pipe run parallel, support them with trapeze hangers.
- G. Water piping supports within walls to be by Caddy, Holdrite, Sioux Chief or approved equivalent. Support vertical drops and piping at fixture supplies in wall. Hanger material to be suitable for piping material installed. Piping supports shall be installed per manufacturer's recommendations.

## 2.3 INSERTS

- A. Concrete Insert: Anvil Figure #281, MSS Type 18, universal concrete inserts, adequately sized and correctly positioned to support full load operating systems.
- B. Concrete Insert, Wedge Type: Anvil Figure #281, 1/4" to 7/8",
- C. Lightweight Concrete Insert: Anvil Figure #285,
- D. Continuous Concrete Insert: Anvil Powerstrut Figure #PS-349 pre-galvanized,

## 2.4 EXPANSION ANCHORS

- A. Hilti Kwik-bolt, zinc-plated, metal expansion anchor.
- B. Anchor to meet U.L., ICBO-4627 and FM listings.

## 2.5 CLAMPS

- A. C-Clamps: Anvil Figure #92, MSS Type 23.
  - 1. Use these for attaching hangers to steel beams. Do not weld hanger rods to structural steel members.
- B. Malleable Beam Clamps: Anvil Figure #218, MSS Type 30: Use these for attaching hangers to bar joists.

## PART 3 - EXECUTION

### 3.1 PIPE HANGERS

- A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight or stresses from vibration and swaying of pipe. Support pipe risers at regular intervals in pipe shafts at least once at each floor level or a maximum of 12'-0" apart. Do not use perforated metal, strap iron, or band iron. Do not make offsets in hangers.

- B. Maximum allowable spacing of pipe hangers is listed below. Space hangers and brackets at closer intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging or swaying of pipe.
- C. COPPER PIPE - Water
  - 1. 1/4" to 1-1/4" - 5'0" O.C.
  - 2. 2" to 2-1/2" - 8'0" O.C.
  - 3. 3" and above - 10'0" O.C.
- D. CAST IRON PIPE
  - 1. Space hangers not to exceed 10 feet on centers. Provide minimum of two hangers per section within 18" of joint on barrel and at change of direction and branch connection. Install hanger and supports per CISPI 301-09.
- E. PVC PIPE
  - 1. 3/4" to 3" - 4' O.C.
  - 2. 4" and above - 4' O.C.
- F. SWAY BRACING
  - 1. Provide sway bracing and additional supports to meet the seismic bracing requirements.

END OF SECTION 220529

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Los Angeles, CA  
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## SECTION 220548 - VIBRATION AND SEISMIC CONTROLS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment support bases and isolation.
- B. Equipment vibration isolators.
- C. Seismic snubber assemblies.
- D. Seismic restraints for suspended components and equipment.
- E. Piping isolation.

#### 1.2 RELATED REQUIREMENTS

- A. Section 014533 - Code-Required Special Inspections: Statement of Special Inspections; additional requirements for code-required special inspections.
- B. Section 033000 - Cast-in-Place Concrete.

#### 1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.
- B. ASHRAE (HVAC) - ASHRAE Handbook - HVAC Applications; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2011.
- C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide; 2011.
- G. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.
- H. SMACNA 1981 - Seismic Duct Restraint Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

#### 1.4 SUBMITTALS

- A. Submit product data and drawings for review in accordance with the requirements of Division 01.
- B. Product Data:
  - 1. Provide manufacturer's product literature documenting compliance with Part 2 Products.
  - 2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.
- C. Shop Drawings:
  - 1. Provide schedule of vibration isolator type with location and load on each.
  - 2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
  - 3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
  - 4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
  - 5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
  - 6. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
  - 7. Include the seal of the Professional Engineer registered in the State of California in which the Project is located, on the drawings and calculations which at a minimum include the following:
    - a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
    - b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
      - 1) Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.
      - 2) Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.
    - c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
    - d. Detailed description of the equipment anchorage devices on which the certifications are based.
    - e. Statement of Special Inspections: Prepared by the registered design professional in responsible charge.
      - 1) See Section 014533 for additional requirements.
- D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

## 1.5 QUALITY ASSURANCE

- A. Perform design and installation in accordance with applicable codes.
- B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in Texas.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
  - 1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum \_\_\_\_ years of experience.
- E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
  - 1. See Section 014533 for additional requirements.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Kinetics Noise Control, Inc: [www.kineticsnoise.com](http://www.kineticsnoise.com).
- B. Mason Industries: [www.mason-ind.com](http://www.mason-ind.com).
- C. Vibration Eliminator Company, Inc: [www.veco-ny.com](http://www.veco-ny.com).
- D. Vibration Mountings & Controls, Inc.
- E. Korfund Company.
- F. Amber Booth.
- G. Furnish vibration isolators by a single manufacturer.
- H. Substitutions: Not permitted.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General:
  - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
  - 2. Steel springs to function without undue stress or overloading.
  - 3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.

4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

## 2.3 EQUIPMENT SUPPORT BASES

### A. Type 14 - Structural Bases:

1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
2. Frames: Square, rectangular or T-shaped.
3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
4. Applications: Adjustable motor slide rails for centrifugal pumps.
5. Mason KSL.

### B. Type 10 - Concrete Inertia Bases:

1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
3. Mass: Minimum of 1.5 times weight of isolated equipment.
4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
5. Concrete: Filled on site with minimum 3000 psi concrete.
6. Applications: Adjustable motor slide rails for centrifugal pumps.
7. Mason BMK.

## 2.4 VIBRATION ISOLATORS

### A. Non-Seismic Type:

#### 1. Type 1 - All Elastomeric-Fiber Glass Pads:

- a. Configuration: Flat or molded.
- b. Thickness: 0.25 inch minimum.
- c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with 16 ga. load plate providing evenly distributed load over pad surface.
- d. Mason Super "W" pad.

#### 2. Type 2 - Elastomeric Mounts:

- a. Material: Oil, ozone, and oxidant resistant compounds.
- b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
- c. Mason BR.

#### 3. Type 3 - Steel Springs:

- a. Assembly: Freestanding, laterally stable without housing, 1/4" neoprene non-skid pad.
  - b. Leveling Device: Rigidly connected to equipment or frame, spring diameter no less than 0.8 of compressed height at rated load, minimal additional travel to solid equal to 50% of rated deflection.
  - c. Mason SLF.
4. Type 4 - Restrained Steel Springs:
  - a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction, internal isolation pad.
  - b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
  - c. Mason SLR.
5. Type 13A - Elastomeric Hangers:
  - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
  - b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
  - c. Mason 30.
6. Type 13 - Spring Hanger:
  - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
  - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
  - c. Mason HS.
7. Type 6 - Combination Elastomeric-Spring Hanger:
  - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
  - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
  - c. Mason 30N.
8. Type 16 - Thrust Restraints:
  - a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
  - b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.
  - c. Mason WBI or WBD.
9. Type 12 - Flexible stainless steel braided hose connectors:
  - a. 1/2" to 1-1/2": 12" long.
  - b. 2" to 4": 18" long.
  - c. 6" to 10": 24" long.
  - d. 12" to 16": 32" long.
  - e. Mason BBS.

10. Type 15 - Flexible rubber pipe connections, peroxide cured EPDM with Kevlar tire cored reinforcement, raised face rubber flanges with encased solid steel rings.
  - a. 14" diameter and below: Mason SFDEJ twin sphere with reinforcing ring; minimum pressure rating of 250 psi at 170 degrees F and 215 psi at 250 degrees F.
  - b. 16" diameter and above: Mason SFEJ single sphere; minimum pressure rating of 180 psi at 170 degrees F and 150 psi at 250 degrees F.
  - c. Control rods: Mason CR with 1/2" thick Neoprene washer bushings.

B. Seismic Type:

1. Coil Springs Consisting of Single Elements:

- a. Housing: Manufactured from cast iron material.
- b. Ductile Material: Designed and rated for seismic applications.
- c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
- d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
- e. Resilient Pad: Located in series with spring.
- f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
- g. Finish: Suitable for the application.

2. All Directional Elastomeric:

- a. Material: Molded from oil, ozone, and oxidant resistant compounds.
- b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.
- c. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
- d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.
- e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

## 2.5 SEISMIC SNUBBER ASSEMBLIES

A. Comply with:

1. ASHRAE Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.

B. All Directional External:

1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.

3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

C. Lateral External:

1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

D. Omni Directional External:

1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

E. Horizontal Single Axis External:

1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

## 2.6 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Comply with:

1. ASHRAE Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.

5. FEMA E-74.

B. Cable Restraints:

1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.
3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
4. Connections:
  - a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
  - b. Internally brace clevis hanger bracket cross bolt to prevent deformation.
5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:

1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

## PART 3 - EXECUTION

### 3.1 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Bases:
  1. Set steel bases for one inch clearance between housekeeping pad and base.
  2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
  3. Adjust equipment level.
- C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
  1. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- D. Support piping connections to equipment mounted on isolators using isolators or Type 6 resilient hangers for scheduled distance.

1. Up to 4 Inches Pipe Size: First three points of support.
2. 5 to 8 Inches Pipe Size: First four points of support.
3. 10 inches Pipe Size and Over: First six points of support.
4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

E. Provide Type 12 flexible connections at the following locations:

1. Medical vacuum lines within 50 pipe diameters each side of vacuum pump.
2. Medical air lines within 50 pipe diameters each side of compressors.

### 3.2 INSTALLATION - SEISMIC

A. Comply with:

1. ASHRAE Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.

B. Seismic Snubbers:

1. Provide on all isolated equipment, piping and ductwork.
2. Provide minimum of four seismic snubbers located close to isolators.
3. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance.
4. Snub all other equipment between 0.15 inch and 0.25 inch clearance.

C. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:

1. Install equipment anchorage items designed to resist seismic design force in any direction.
2. Install vibration and seismic controls designed to include base and isolator requirements.
3. Provide flexible connections between equipment and interconnected piping.
4. Provide isolators and restraints designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational and seismic forces.
5. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.
6. Where concrete floor thickness is less than required for expansion anchor installation,
7. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws or other mechanical fasteners, install supplemental framing or blocking to transfer loads to structural elements.

D. Suspended Plumbing Equipment:

1. Provide supports and bracing to resist seismic design force in any direction.
2. Provide flexible connections between equipment and interconnected piping.

3. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.
4. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

E. Wall mounted Plumbing Equipment:

1. Provide support and bracing to resist seismic design force in any direction.
2. Install backing plates or blocking as required to deliver load to primary wall framing members.
3. Anchoring to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads is not permitted.

F. Piping:

1. Provide seismic bracing in accordance ASCE 7.
2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
3. Provide flexible connections between floor mounted equipment and suspended piping; between unbraced piping and restrained suspended items; as required for thermal movement; at building separations and seismic joints; and wherever relative differential movements could damage pipe in an earthquake.
4. Brace resiliently supported pipe with cable bracing or alternate means designed to prevent transmission of vibrations and noise to the structure.
5. Brace every run 5.0 feet or more in length with two transverse and one longitudinal bracing locations.
6. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):
  - a. Provide transverse bracing at spacing not more than 40.0 feet on center.
  - b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.
7. Pipes and Connections Constructed of Non Ductile Materials (cast iron, no-hub, plastic or non-UL listed grooved coupling pipe):
  - a. Provide transverse bracing at spacing not more than 20.0 feet on center.
  - b. Provide longitudinal bracing at spacing not more than 40.0 feet on center.
8. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.
9. Piping Explicitly Exempt from Seismic Bracing Requirements:
  - a. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
  - b. Install piping consistent with ASCE 7, such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
  - c. Provide swing restraints as required to control potential impact due to limited space between subject components.

10. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.
11. Re-use of Existing Hangers:
  - a. Re-using existing hangers at locations of seismic bracing are to be judged on a case-by-case basis by the registered project design professional.
  - b. Unless otherwise shown on the drawings, it is assumed all hangers supporting new piping, located at a seismic brace, will be new.

G. Tanks:

1. Install tank anchorage, tank legs and/or supporting structure designed to resist design force.
2. Provide flexible connections between tank and interconnected piping.

3.3 FIELD QUALITY CONTROL

- A. Inspect isolated equipment after installation and submit report. Include static deflections.
- B. Perform testing and inspections of the installation in accordance with Section 014533.

3.4 SCHEDULES

- A. Pipe Isolation Schedule. Use Type 6 vibration isolation on the following piping sizes and locations.
  1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
  2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
  3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.
  4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.
  5. 6 Inch Pipe Size: Isolate 60 diameters from equipment.
  6. 8 Inch Pipe Size: Isolate 60 diameters from equipment.
  7. 10 Inch Pipe Size: Isolate 54 diameters from equipment.
  8. 12 Inch Pipe Size: Isolate 50 diameters from equipment.
- B. Equipment Isolation Schedule. Use the isolator and restraint types listed above on the following applications:
  1. Plumbing Pumps
    - a. Slab on grade: Type 15.
    - b. Upper floors: Type 3, 10, 15.
  2. Hot water recirculation pumps.
    - a. Suspended: Type 6.

END OF SECTION 220548

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 220553 - IDENTIFICATION OF PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Identification of plumbing piping and equipment as specified herein.

#### 1.2 RELATED WORK

- A. Division 01: Cutting and Patching.
- B. Division 01: Seismic Requirements.
- C. Division 01: Shop Drawings, Product Data, and Samples.
- D. Division 01: Storage and Protection.

### PART 2 - PRODUCTS

#### 2.1 NAMEPLATES AND TAGS

- A. Acceptable manufacturers: Seton Nameplate Corporation, Marking Services Inc. or equal.
- B. Rigid plastic, "Setonite" or Bakelite with engraved lettering, minimum 1/2" high.
- C. Brass tags, at least 1-1/2" inches in diameter, with alpha-numeric I.D., permanently stamped black filled letters showing the service, and black filled numbers showing the valve or equipment number. At substantial completion, a schedule of all valves shall be submitted to the Architect and Owner's Representative.

#### 2.2 PIPE MARKERS

- A. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.
- B. Plastic Tape Markers: flexible vinyl film tape with pressure sensitive adhesive and printed marking.

#### 2.3 PIPE IDENTIFICATION AND PAINTING

- A. Identify all piping as specified herein painted under Division 09.
- B. Pipe Identification:

1. Identify piping by stenciling or tagging (to denote contents and direction of flow) on piping at no more than 25 foot intervals at valves, and at least once in each separate space through which the pipe passes. Colors shall conform to ASME 13.1.
  2. Stenciling shall be a minimum of 2" high letters.
- C. Buried piping does not require identification marking, unless noted otherwise in specifications.
- D. All piping in central plant and mechanical rooms shall be labeled to identify contents and direction of flow.

## 2.4 EQUIPMENT AND APPARATUS IDENTIFICATION

- A. Acceptable Manufacturers: Seton Name Plate Corporation or equal.
- B. Nameplates: Rigid plastic, "Setonite" or Bakelite, with engraved lettering (indicating names and numbers of mechanical apparatus), a minimum of 1/2" high. Fill engraved lettering with a permanent coloring material which contrasts with color of tag material to allow for easy reading.
- C. Use names, numbers and abbreviations appearing in schedules on Contract Drawings.
- D. Where stenciling is used to identify large pieces of equipment, stenciling shall be in a conspicuous place visible from control panel area and of at least one (1) inch letters and/or numbers. Large pieces of equipment may be stenciled with an oil based enamel or semi-gloss latex.
- E. Provide nameplates, located in a conspicuous location directly on the equipment or apparatus, for mechanical equipment including, but not limited to:
1. Starters.
  2. Pumps.
  3. Control panels.
  4. Plumbing equipment.
- F. Name Tag Fasteners: Commercial quality, rust resisting nuts and bolts with backwashers, self-tapping screws, or rivets. If equipment surface does not allow for direct attachment, use copper or brass rings to attach tags.
- G. Valve Tags
1. Each valve shall be identified with a brass tag. The tag shall contain an alpha-numeric I.D. which shall include floor level and building section as part of the I.D.
  2. A valve schedule shall be provided to Architect and Owner's Representative. Mount valve schedule under glass and mount as directed by Owner's Representative.
  3. Securely fasten tags to valves with a brass "S" hook or chain.

END OF SECTION 220553

## SECTION 220700 - PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. Exposed - Equipment and piping in areas which will be visible without removing ceilings or opening access panels.
- B. Concealed - Installed above ceiling, in walls or chases.
- C. Outdoors - Exposed to the weather or ambient conditions.
- D. Underground - Buried.

#### 1.2 CERTIFICATION/QUALITY ASSURANCE

- A. Insulation, adhesives, coatings, sealers, tapes, shall have a flame spread rating of 25 or less and smoke development of 50 or less in accordance with ASTM E-84 and UL 723
- B. Materials shall meet the requirements of NFPA 90-A.

#### 1.3 SUBMITTALS

- A. Submit manufacturer's product data and installation procedures for review.

### PART 2 - PRODUCTS

#### 2.1 PIPE AND EQUIPMENT INSULATION

- A. Materials for Pipe and Equipment: Provide factory premolded insulation for pipe, pipe fittings, and valves.
- B. Fitting insulation: Same thickness and material as adjoining pipe insulation.
- C. Flexible Tubular Elastomeric:
  - 1. Provide fire-retardant closed-cell slip-on flexible type; minimum "R" value of 2.57
  - 2. Acceptable manufacturers: Armacell; Nomaco K-Flex
  - 3. Use on the following services:
    - a. Moisture condensate drains - 1/2" thick
- D. Fiberglass Pipe Insulation:

1. Acceptable manufacturers: Johns-Manville "Micro-Lok 850"; CertainTeed; Knauf; Owens Corning. Foster Jacket: ASJ fiberglass reinforced kraft paper with aluminum foil; minimum R value of 3.7.
2. Use on the following services:
  - a. Domestic hot water supply piping less than 1" to be 1" thick. Domestic hot water supply piping 1" and larger to be 1-1/2" thick
  - b. Domestic hot water recirculation piping less than 1" to be 1" thick. Domestic hot water recirculation piping 1" and larger to be 1-1/2" thick.
  - c. Horizontal rain water leaders and roof drain bodies - 1" thick
  - d. Drain bodies, traps and horizontal drain lines receiving cold condensate - 1/2" thick

## 2.2 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

- A. For all services, use premolded insulation for pipe fittings, elbows, tees, butterfly valves, and couplings 2-1/2" and larger. Finish shall be as specified under Products above or as specified below. PVC fitting covers with fiberglass inserts may be used on piping fittings elbows and valves 2" and less for the following services:
  1. Domestic Hot Water.
  2. Domestic Hot Water Recirc.
- B. For piping installed above grade exposed-to-the-weather outside the building, cover straight pipe insulation with 0.016" thick aluminum jacket equivalent to Childers and cover fittings with factory formed covers equivalent to Elljacs.
- C. For flexible tubular elastomeric pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of fire retardant self-extinguishing vinyl lacquer type highly flexible coating equivalent to Armacell "Armaflex Finish", custom color blended to match surrounding surfaces.

## PART 3 - EXECUTION

### 3.1 INSTALLATION - GENERAL

- A. Deliver and store insulation materials in manufacturer's containers and kept free from dirt, water, chemical and mechanical damage.
- B. Complete piping pressure testing prior to applying insulation.
- C. Apply insulation in workmanlike manner by experienced and qualified workmen.
- D. Surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.
- E. Adhesives, cements and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.

- F. Stop duct coverings, including jacket and insulation, at fire penetrations of fire or smoke rated partitions, floors above grade and roofs. "Fan-out" or extend jacketed insulation at least 2" beyond angle frames of fire dampers and secure to wall. Maintain vapor barrier.

### 3.2 INSTALLATION OF PIPE AND EQUIPMENT COVERING

- A. Where glass fiber or flexible tubular elastomeric insulation is used on piping sized 2" and larger, insert a section of foamglass or calcium silicate insulation, at hanger or support points, between pipe and metal shield for full length of shield, to prevent crushing of insulation. Where insulation passes through pipe hangers and across trapeze supports, 12" long metal saddles shall be used. Insulation thickness to be same as adjoining glass fiber insulation. On cold pipe, vapor barrier should be carried through the hanger and sealed. Saddles shall be used where rigid foamglass inserts are not acceptable.

END OF SECTION 220700

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 220800 - COMMISSIONING OF PLUMBING SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Commissioning is a systematic process of ensuring that the building systems perform according to the design intent.
- B. Refer to Section 019100 Commissioning Requirements.

#### 1.2 RELATED DOCUMENTATION

- A. Contract drawings, Division 0, Conditions of the Contract, and Division 1, General Requirements, apply to the Work of this Section.

#### 1.3 RELATED SECTIONS

- A. Section 013510 Green Building Certification Management
- B. Form - Product Substitution
- C. Section 013300 Submittal Procedures
- D. Section 019100 Commissioning Requirements.

#### 1.4 SYSTEM TO BE COMMISSIONED

- A. Plumbing Systems
  - 1. Domestic Hot Water Heaters
  - 2. Circulation Pumps

### PART 2 - PRODUCTS

- 2.1 Refer to Section 019100 Commissioning Requirements.

### PART 3 - EXECUTION

- 3.1 Refer to Section 019100 Commissioning Requirements.

END OF SECTION 220800

## SECTION 221116 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Piping and pipe fittings for domestic cold, hot and re-circulating water piping.

#### 1.2 RELATED WORK

- A. Section 220500: Common Work Results for Plumbing.

#### 1.3 SUBMITTALS

- A. Submit product data for review on piping and fittings. Submittal data shall include:
  - 1. Manufacturer of pipe.
  - 2. Tests or listings by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
  - 3. Product data for pipe and fittings to be used on each piping system.
  - 4. Solder and brazing product data and installation procedures for copper pipe.

#### 1.4 QUALITY ASSURANCE

- A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.
  - 1. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

### PART 2 - PRODUCTS

#### 2.1 COPPER PIPE

- A. Conform to ASTM B-88 specification for wrought seamless copper.
- B. Type L, hard for:
  - 1. Domestic cold water piping.
  - 2. Domestic hot water.
  - 3. Domestic hot water re-circulating piping.
- C. Use Type K, rolled, soft for: Piping installed under floor slabs.

## 2.2 COPPER PIPE FITTINGS

- A. Sweat type, wrought copper, ASTM B62, with dimensions conforming to ANSI B16.22 and sweep patterns for copper tubing.
- B. Mechanical Couplings: Roll groove rigid type by Victaulic, Gruvlok or Anvil.
- C. Mechanical joints: Domestic cold and hot water piping 4" and larger may be joined with rolled grooved copper fittings and valves by Victaulic or Anvil, copper pipe grooved systems. Gaskets shall be rated for not less than 220 degrees. Joints, materials, and gaskets for grooved systems shall be approved for use in potable water systems.
- D. Grooved copper system:
  - 1. Victaulic Style 607 or Style 641 rolled grooved copper fittings for domestic cold water and domestic hot water for sizes 4" and larger.
- E. Dielectric Connections:
  - 1. Provide at junction of copper pipe and equipment with steel piping systems.
  - 2. Central, Dielectric insulating unions, and insulating flange unions, as manufactured by Central Plastic Company, or CTS Fabrication USA (1-1/2" thru 8").
  - 3. Provide copper solder joint to plated female iron pipe for sizes 1/2" through 2".
  - 4. Provide insulating flange unions, malleable female iron pipe thread to copper solder joint flange unions for sizes 2-1/2" through 4".
  - 5. Brass fittings and valves may not be used for dielectric union locations.
- F. Unions: Brass ground joint, 250 lb. working pressure.
- G. Nipples: Brass.

## 2.3 ROLL GROOVE JOINT FOR COPPER

- A. Copper tube shall conform to ASTM B-88. Types K and L may be used in conjunction with the Gruvlok, Victaulic, or equivalent roll grooved fittings. Gruvlok model number are used below.
- B. Grooved copper fittings shall be Gruvlok Wrot Copper fittings per ASTM B-75 and ANSI B-16.22, alloy C12200 copper. Wrot Copper fittings size 2" - 8" diameter fittings. Copper fittings are 99.9% lead free. Intended for usage with Gruvlok series 7400 Ridgelite couplings, and series 7012 flange adapters. Couplings and Wrot Copper Fittings are NSF, Plumbing Code approved and UL/ULC listed.
- C. Copper tube system couplings shall be Gruvlok Fig. 7400 Ridgelite and Fig. 7012 coupling flange adapters. The Grade "E" EPDM gasket for the Gruvlok Copper Method covers a service temperature range from -40 degrees F to +190 degrees F. Use "Gruvlok Xtreme Lubricant" only. Coupling working pressure is 300 psig maximum.
- D. All Gruvlok coupling gaskets except DRI-SEAL must be lubricated with approved lubricant as provided by Gruvlok. Gruvlok Xtreme Lubricant is strongly recommended below -20 degrees F, and above 180 degrees F and systems subject to continuous cycle temperature changes. Standard and other specific Gruvlok lubricants can be used on DRI-SEAL Fire Protection gaskets and other applications as recommended by Gruvlok.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Clean inside of pipe before installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.
- B. Install pipe so that it does not interfere with opening of doors or apparatus, access to equipment, or to electrical equipment.
- C. Do not install pipes in such a way that they will apply torque to pumps. After pumps have been installed and pumps have been operated, recheck and realign pumps if necessary.
- D. Run pipes in straight lines and square with building. Install risers plumb. Make offsets only where indicated and where necessary.
- E. Install branch connections using separate tee or lateral fittings for each branch. Do not combine branches into "bullhead tee" arrangement.
- F. Do not install water pipes in electric rooms, tele/data rooms, transformer rooms, audio/visual rooms or elevator equipment rooms. Fire protection piping runouts serving only these rooms shall be installed in these rooms.
- G. Do not install piping above electrical equipment such as starters, variable frequency drives, motor control centers, or disconnects. Maintain code required clearance above, below and to sides of electrical equipment.
- H. Provide flanges or unions throughout the pipe systems at all equipment. Make provisions for servicing and removal of equipment without dismantling piping.
- I. Piping Expansion:
  - 1. Install piping to allow thermal expansion and contraction without injury to piping, equipment or structure.
    - a. Use loops or expansion joints where necessary and where detailed.
    - b. Provide pipe guides.
- J. Branch Lines:
  - 1. Where possible branch lines shall come off top of mains to prevent sediment, welding slag, or pipe deburrs from entering the branch lines and causing valve leakage or failure.

### 3.2 PIPE JOINTING

- A. Preparing Pipe Ends:
  - 1. Machine cut pipe ends square.
  - 2. Ream pipe ends, after cutting, to full diameter.
- B. Soldered and Brazed Joints:

1. Make Type L copper pipe joints with suitable flux and 95/5, lead free solder.
2. Make Type K copper pipe joints with silver (BAg series) brazing filler material with flux or copper-phos (BCup series) brazing filler material without flux per the recommendations of the Copper Development Association.
3. Domestic cold and hot water piping 4" and larger shall be brazed. Copper to copper joints shall be brazed using a copper-phosphorus or copper-phosphorus-silver brazing filler metal (BCup Series) without flux. Dissimilar metals such as copper and bronze or brass shall be brazed using an appropriate flux with a silver (BAg Series) brazing filler metal.
  - a. In lieu of brazing, domestic cold and hot water piping 4" and larger may be joined with rolled grooved copper fittings and valves by Victaulic or Anvil, copper pipe grooved systems.

C. Bracing Joints:

1. Provide braces and bridle rods as required to reinforce joints.
2. If mechanical couplings are used, then prepare pipe ends and make joints in accordance with pipe coupling manufacturer's printed instructions.
3. Where large pipes underground are subject to shock because of sudden changes in liquid flow rate, provide concrete "kicker" blocks at joints, fittings, and changes of pipe direction. Provide "kicker" blocks in accordance with applicable pipe industry trade or research organization recommendations.
  - a. For example, for ductile iron pipe follow recommendations of Ductile Iron Pipe Research Association.

3.3 ESCUTCHEONS

- A. Provide chrome plated escutcheons where uninsulated pipes penetrate walls or ceilings of finished spaces.

3.4 STRAINERS

- A. Install strainers so the strainer basket can be removed without spilling water on motors and electrical equipment.

3.5 AIR VENTING

- A. Provide manually operated air vents at high points in vertical risers to eliminate air from systems.
- B. Use ball valves for manual air vents.

3.6 VALVE ACCESS

- A. Locate ceiling/wall access panels at shut-off and control valves for proper access and operation. Furnish and install access doors in accordance with Section 220500 and other Divisions as applicable.

### 3.7 TESTING

- A. Before piping is concealed or insulated, recheck it for leaks.
- B. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Preening, caulking, and doping are not permitted.

END OF SECTION 221116

## SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. This section includes requirements for:
  - 1. Backflow preventers.
  - 2. Shock arrestors.
  - 3. Trap primers.
  - 4. Domestic water service connection.
  - 5. Inline automatic flow controller.
  - 6. Thermometers and pressure gauges.

#### 1.2 RELATED WORK

- A. Section 220500: Common Work Results for Plumbing.
- B. Section 220523: Valves for Plumbing Piping.
- C. Section 220700: Plumbing Insulation.

#### 1.3 QUALITY ASSURANCE

- A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.
  - 1. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

#### 1.4 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are indicated in subsequent paragraphs.

## 2.2 BACKFLOW PREVENTERS

- A. Acceptable manufacturers:
  - 1. Beeco.
  - 2. Apollo.
  - 3. Febco.
  - 4. Cla-Val.
  - 5. Ames.
  - 6. Watts.
  - 7. Wilkins Regulator Company.
- B. Provide completely automatic unit, fitted with tight closing shut-off valves and test cocks at each end.
- C. Construct such that all parts are replaceable without removing unit from line.
- D. Total pressure drop through complete backflow preventer does not exceed 12 PSI at rated flow.
- E. Provide per local requirements and dimensions as detailed on drawings.
- F. Backflow preventers shall meet the following standards: (Apollo Figure numbers are used for reference.)
  - 1. Atmospheric vacuum breaker - Apollo 38-200 series, ASSE 1001-2008.
  - 2. Hose-connected vacuum breakers - Apollo 38-414, ASSE 1011-2004.
  - 3. Back siphonage vacuum breakers - Apollo 4A-500-04F, ASSE 1056-2013.
  - 4. Reduced pressure principle backflow preventers - Apollo 4ALF-200 Series, ASSE 1013-2011.
  - 5. Double check valve assembly - Apollo 4ALF-100 Series, ASSE 1015-2011.
  - 6. Pressure type vacuum breaker - ASSE-1020-2004.

## 2.3 SHOCK ARRESTORS

- A. Acceptable manufacturers:
  - 1. Josam.
  - 2. Wade.
  - 3. Jay R. Smith.
  - 4. Precision Products.
  - 5. Zurn.
  - 6. Sioux Chief.
- B. Arrestor shall be piston type, polycarbonate with two EPDM O-rings, lubricated with FDA-approved Dow Corning #111 silicone compound in Type L or K copper body, suitable for 200 psig minimum pressure at 200 degrees F.
- C. Arrestor shall be ANSI/ASSE 1010 Certified and be maintenance free with no access panel required.

## 2.4 THERMOMETERS AND PRESSURE GAUGES

- A. Acceptable manufacturers: Terice, Winters, Dwyer or approved equal.
- B. Thermometers shall have a 9" aluminum case with 3.5" or 6" stem, fully adjustable, organic filled (non-mercury), +/- 1% accuracy, lead free brass or stainless steel thermowell, dual scale, 30 degrees F to 200 degrees F range.
- C. Pressure gauges shall have a 4" white aluminum dial with type 304 SS case, lead free brass socket, glycerin filled with accuracy of +/- 1.5 % of full scale to 150 degrees F; dry type to 200 degrees F. Install with lead free gauge cock.

## 2.5 INLINE AUTOMATIC FLOW CONTROLLER

- A. Provide automatic flow controllers at re-circulating branches and at re-circulating pump as scheduled and detailed on Drawings.
- B. Acceptable manufacturers: FDI, Inc. Model ICCS.
- C. Body: Series 300 Stainless steel.
- D. Union Nut: Nickel plated brass.
- E. Flow Cartridge: Series 300 Stainless Steel wear surfaces.
  - 1. Accuracy: Flow rate +/-5% over 95% of the control range.
  - 2. Certification: NSF/ANSI 61-G certified by NSF for potable water applications.
- F. Temperature rating: 180 degree F. Tested and approved for commercial hot water applications.
- G. Pressure rating: 400 PSI static pressure.
- H. Provide portable meter kit including the following accessories:
  - 1. Hoses, fittings and adapters as required for connection to pressure/temperature ports.
  - 2. 6" diameter face, 270 degree arc, beryllium diaphragm gauge.
  - 3. Provide with carrying case, calibration instructions and capacity curves.

## PART 3 - EXECUTION

### 3.1 INSTALLATION AND TESTING

- A. Backflow Preventers
  - 1. Pipe relief through fixed air gap and discharge to sewer.
  - 2. Install adjacent to wall and/or floor utilizing stand-off brackets, angle frame, and/or concrete piers.
  - 3. Test unit for leaks and pressure drop. Clean and/or replace soiled strainer media.
  - 4. Provide dual parallel reduced pressure backflow preventers on the main domestic water entrance to the facility.

5. Provide a reduced pressure backflow preventer on the domestic cold water serving carbonators at soda machines.
6. Provide backflow prevention vacuum breaker on any water line feeding any piece of equipment which could cause back siphonage such as mechanical equipment, trap primer lines, etc.

B. Shock Arrestors:

1. Install shock arrestors at each quick closing valve, solenoid type valve, and flush valve. Size shock arrestors in accordance with manufacturer's instructions.
2. Install shock arrestors within five feet of valve, provide wall access panel as required.
3. Test and certify shock arrestors by Plumbing and Drainage Institute in accordance with ANSI/ASSE 1010.

C. Inline Automatic Flow Controllers

1. Install in accordance with manufacturer's instructions and in accordance with details on Drawings.

END OF SECTION 221119

## SECTION 221123 - DOMESTIC WATER PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Division 26: Electrical.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 HOT WATER RE-CIRCULATING PUMP

- A. Acceptable manufacturers: Taco, Aurora, or Bell and Gossett
  - 1. Model number, capacity, accessories, and electrical characteristics as scheduled on drawings.
- B. Provide in-the-line pump, all bronze construction, flange connections, hardened steel shafts, bronze sheathed, diamond bared, sleeve bearings, bronze impellers, and mechanical seals.
- C. Provide flexible coupled motor, supported from pump casing and manual motor starter complete with thermal overload protection.
- D. Provide test ports at unit to verify flow through pumps.
- E. Provide operating and maintenance instructions.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Verify location and clearance requirements.
- B. Install in accordance with manufacturer's recommendations.

#### 3.2 START-UP AND TEST

- A. Start-up pump, verify integrity of connection and electrical phasing.

- B. Test pumps in operation under design load conditions.
- C. Coordinate with section 230593 for test and balance requirements.

END OF SECTION 221123

## SECTION 221316 - STORM AND SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

- A. RELATED WORK
- B. Section 220500: Common Work Results for Plumbing.
- C. Section 220529: Hangers for Plumbing Piping.
- D. Section 221319: Sanitary Waste Piping Specialties.
- E. Section 232000: HVAC Piping for Condensate Drain Piping.

#### 1.2 SUBMITTALS

- A. Submit product data for review on piping and fittings. Submittal data shall include:
  - 1. Manufacturer of pipe.
  - 2. Tests or listing by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
  - 3. Product data for pipe and fittings to be used on each piping system.

#### 1.3 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 CAST IRON PIPE AND FITTINGS

- A. Conform to ASTM A-74, A-888, and CISPI 301 and CISPI 310.
  - 1. Pipe and fittings shall be marked with the collective trademark of Cast Iron Soil Pipe Institute and be listed by NSF International.
- B. Standard weight pipe with drainage fittings for:
  - 1. Sanitary waste, vent, and drainage pipe 2" and larger above ground.
  - 2. Building storm drains.
  - 3. Rainwater conductors inside building.
  - 4. Drain lines under buildings, and under exterior concrete or other paving. Extend cast iron piping at least 5 feet outside of building.
- C. Joints in Cast Iron Pipe:
  - 1. Below grade: Bell and spigot with neoprene compression gaskets.

2. Above grade: No-Hub using stainless couplings, meeting CISPI 310-90. Provide 4-band, heavy duty couplings for piping 2" through 10" and 6-band heavy duty couplings for piping 12" and larger. Couplings shall comply with ASTM C 1540/ FM-1680 rated no hub bands for all cast iron piping material above slab on-grade.

## 2.2 PVC PIPE AND FITTINGS

- A. Polyvinyl chloride sewer pipe and fittings (4" to 15" diameters) shall be as manufactured by Charlotte or equal.
- B. PVC pipe, fittings, cement, and joint cleaner for entire project shall be supplied by a single manufacturer.
- C. PVC Schedule 40, Type I, DWV, ASTM D-2665, 1120, 160 PSI at 73 degrees F. Solvent cement shall meet ASTM No. D-2564 for (PVC-DWV) plastic and pipe fittings. If permitted by governing code authority, may be used for:
  1. Air handling unit condensate drains above grade only if room is not used as return air plenum.
  2. Inside gravity, under floor slab sanitary and storm waste drainage systems, with waste temperatures below 140 degrees F.
  3. Condensate drains from rooftop units shall be UV resistant where exposed.
- D. CPVC Schedule 80, ASTM D-2846, 230 psi at 73 degrees F. Solvent cement shall meet ASTM No. F-493 for chlorinated polyvinyl chloride (CPVC) plastic pipe and fittings. If permitted by governing code authority, may be used for:
  1. Inside gravity, under floor slab sanitary waste drainage systems, where temperature of waste discharged into drainage system exceeds 140 degrees F.
  2. Under floor conduit for steam condensate drainage piping below slabs.
- E. Fittings:
  1. Permanently identify each fitting in accordance with MSS-SP-2241, and with manufacturer's trademark.
  2. Include certification with submittal data that fittings and flanges meet applicable requirements.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. PVC Joints:
  1. Make joints in accordance with cement manufacturer's printed instructions.
- B. Cast Iron Pipe Joints:
  1. Install compression gaskets and No-Hub bands in accordance with CISPI installation methods and manufacturer's instructions.

C. Grading Pipes for Drainage:

1. Uniformly place storm drainage pipes and footing drain pipes at elevations and slopes indicated. If no elevations or slopes are indicated, slope pipes at not less than 1/8" per foot.
2. Uniformly place sanitary sewer pipes at elevations and slopes required by the local codes.

D. Bracing Joints:

1. Provide braces and bridle rods as required to reinforce joints.
2. If mechanical lock type couplings are used, then prepare pipe ends and make joints in accordance with pipe coupling manufacturer's printed instructions.
3. Where large pipes underground are subject to shock because of sudden changes in liquid flow rate, provide concrete "kicker" blocks at joints, fittings, and changes of pipe direction. Provide "kicker" blocks in accordance with applicable pipe industry trade or research organization recommendations.
4. PVC storm water piping shall be limited to 12" when penetrating any rated floor slab, due to fire penetration requirements.
5. Clean inside of pipe before installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.
6. Do not install piping above electrical equipment such as starters, variable frequency drives, motor control centers, or disconnects. Maintain code required clearance above, below and to sides of electrical equipment.
7. Run pipes in straight lines and square with building. Install risers plumb. Make offsets only where indicated and where necessary.
8. Piping passing through or under grade beams or through foundation walls shall be provided with a Schedule 40 steel pipe sleeve two sizes greater than the piping passing through the sleeve.

END OF SECTION 221316

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. This section includes requirements for:
  - 1. Cleanouts.
  - 2. Grease interceptors.
  - 3. Trap primers.
  - 4. Manholes.
  - 5. Catch basins.
  - 6. Sanitary sewer service connection.

#### 1.2 RELATED WORK

- A. Section 220500: Common Work Results for Plumbing.

#### 1.3 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are indicated in subsequent paragraphs.

#### 2.2 CLEANOUTS

- A. Acceptable manufacturers:
  - 1. Jay R. Smith (Jay R. Smith model numbers are used below).
  - 2. Josam.
  - 3. Wade.
  - 4. Zurn.
  - 5. Sioux Chief.
  - 6. Watts.
- B. Exterior: 4250 Series heavy duty cast iron cleanout housing with internal cleanout body and plug.
- C. Finished concrete floor: 4031-PB cast iron body with round adjustable polished nickel bronze top, ABS plug and carpet marker where required.

- D. Ceramic tile: 4919 PB Series, cast iron body, polished nickel bronze top, 1/2" terrazzo recess and closure plug.
- E. Vinyl tile floor: 4151PB Series, cast iron body, round nickel bronze top, 1/8" tile recess and closure plug.
- F. Wall: 4422, cast iron caulking ferrule with stainless round access cover and screws.
- G. Access covers: Minimum size 12" x 12" located for access to valves, shock absorbers, trap primers, wall cleanouts, etc.
- H. Furnish cleanouts occurring in waterproof floors with clamping devices.

## 2.3 GREASE INTERCEPTOR

- A. Precast - Exterior
  - 1. Provide exterior grease interceptors constructed of reinforced concrete and of minimum capacity, location and detail as shown on drawings.
  - 2. Grease traps subject to vehicle loads shall be rated for traffic duty.
- B. Grease traps subject to vehicle loads shall be rated for traffic duty.

## 2.4 TRAP PRIMERS

- A. Acceptable manufacturers:
  - 1. Josam.
  - 2. Zurn.
  - 3. Wade.
  - 4. Jay R. Smith.
  - 5. Precision Plumbing Products.
  - 6. MIFAB.
- B. Provide trap primer of brass construction, with removable operating parts, and integral vacuum breaker.

## 2.5 CATCH BASINS

- A. Provide catch basins as manufactured Neenah Foundry.
- B. Provide frame, gratings, concrete, masonry, etc., to construct catch basins.
- C. Catch basins may be built-in place masonry or pre-constructed concrete as detailed on drawings.

## 2.6 AIR ADMITTANCE VALVES

- A. An air admittance valve shall be acceptable as a vent termination for any individual vent, common vent, circuit vent, loop vent and island fixture vent that is provided to prevent siphonage of a fixture trap. An air admittance valve can be used as an alternative to extending a vent through the roof (or sidewall) to the open atmosphere.
- B. Acceptable Manufacturers:
  - 1. Studor, Inc. or equivalent.

## PART 3 - EXECUTION

### 3.1 INSTALLATION AND TESTING

- A. Cleanouts
  - 1. Provide line size cleanouts up to 4"; 4" cleanout for lines larger than 4".
  - 2. Locate cleanouts at all changes in direction greater than 45 degrees and in straight runs as shown 100 feet outside the building on drawing or spaced not greater than required by applicable Plumbing Code.
  - 3. Extend inaccessible cleanouts up through floor and/or wall to provide easy accessibility.
- B. Grease Interceptors
  - 1. Locate for easy access and cleaning.
  - 2. Obtain approval from local and state health department.
  - 3. Unit shall meet local code requirements.
- C. Trap Primers
  - 1. Install primers in accessible location or as shown on drawings.
  - 2. Trap primers shall be Plumbing and Drainage Institute approved.
- D. Catch Basins
  - 1. Install such that frame and grating elevation is minimum 1" lower than surrounding grade in non-paved areas.
  - 2. Install such that frame and cover elevation is 1" higher than surrounding grade in non-paved areas.
  - 3. Slope bottom of basin to drain outlet.
  - 4. Construct catch basins per detail on drawings.
- E. Air Admittance Valves
  - 1. Install air admittance valves in accessible locations. Provide access panels when required for access to valve. Install only where standard fixture vent system cannot be installed. Air admittance valves shall be limited to non-standard venting.

END OF SECTION 221319

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## SECTION 221329 - SANITARY WASTE PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Division 26: Electrical.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 SANITARY WASTE PUMP, SUBMERSIBLE

- A. Acceptable manufacturers: Liberty, Weil, Chicago, PACO, Goulds, or Swaby.
- B. Model number, capacity, accessories, and electrical characteristics scheduled on drawings.
- C. Provide duplex non-clog pumps, close coupled, bronze impeller, totally submersible type complete with mechanical seals to prevent moisture from reaching electrical components.
- D. Provide control by Float or Pressure Switches encapsulated in PVC or Polypropylene, control panel complete with high water alarm, disconnect and starter.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Verify location and clearance requirements.
- B. Install in accordance with manufacturer's recommendations.

#### 3.2 START-UP AND TEST

- A. Start-up pump, verify integrity of connection, electrical phasing.
- B. Test pumps in operation under design load conditions.

END OF SECTION 221329

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## SECTION 221429 - SUMP PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Division 26: Electrical.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 SUMP PUMP, SUBMERSIBLE

- A. Acceptable manufacturers: Weil, Chicago, Worthington, Federal, Goulds, Zoeller, or Swaby.
- B. Provide pump 1/3 horsepower motor, 115-volt, single phase, all bronze and complete with grounded power cord for connection to receptacle.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Verify location and clearance requirements.
- B. Install in accordance with manufacturer's recommendations.

#### 3.2 START-UP AND TEST

- A. Start-up pump, verify integrity of connection, electrical phasing.
- B. Test pumps in operation under design load conditions.

END OF SECTION 221429

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## SECTION 223436 - WATER HEATER, GAS FIRED BOILER WITH STORAGE TANK

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 220523: Valves for Plumbing Piping.
- B. Section 220700: Plumbing Insulation.
- C. Section 221116: Domestic Water Piping.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Lochinvar.
- B. A. O. Smith.

#### 2.2 EQUIPMENT

- A. Water containing section shall be of copper, fin-tube construction employing solid copper tubes having extruded integral fins and bronze headers. The entire heat exchanger shall carry a 5 year limited warranty against failure caused by defective workmanship or material.
- B. The water heater shall bear the ASME stamp and shall be National Board listed for 150 PSI working pressure. Water heater shall be AGA listed or UL listed and shall be test certified.
- C. The unit will have the capability of being vented directly "through the wall" or of being vented into a conventional stack. Water heater shall be fully approved for installation either indoors or outdoors.
- D. Standard operation controls and equipment shall include a automatic ignition device, operating aquastat, electric high-limit, automatic main gas valve, main gas pressure regulator capable of accepting 14" W.C. gas supply pressure, master switch with pilot light, ASME relief valve and temperature gauges.
- E. The entire unit shall be factory assembled, pre-wired and tested, and shall include a properly sized bronze, circulating pump. Water heater shall meet the energy efficiency requirements of ASHRAE 90.1 (latest adopted version).

## 2.3 STORAGE TANK

- A. Tank shall be complete with storage and overall dimensions as scheduled. The tank supplier shall guarantee the tank to deliver 80% of tank capacity without a drop in outlet temperature.
- B. The tank shall be built in accordance with ASME construction requirements and so labeled, with a Working Pressure of 150 P.S.I. The tank lining shall be copper lining 3 lb. min., copper clad or silica cement with ten year guarantee. Provide a 12"x16" manhole on tanks 30" diameter and larger.
- C. Provide factory supplied ASME temperature and pressure relief valve.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Furnish factory or manufacturer's service representative to verify system installation and operation.
- B. Verify location and clearance requirements.
- C. Install in accordance with manufacturer's recommendations and Contract Drawings.
- D. Install vent line to atmosphere as shown on Drawings.
- E. Insulate water connections as specified in Section 220700.
- F. Clean and test equipment in accordance with Section 220500.

END OF SECTION 223436

## SECTION 224000 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with provisions of Section 220500.
- B. Provide plumbing fixtures, trim and related items such as supplies, traps, drains, cleanouts, water closet flanges, bolts, seats and covers, fixture supports and other accessory items.
- C. Coordinate fixture requirements by reviewing architectural, structural, and equipment drawings. Install fixtures in accordance with Contract Drawings and manufacturer's rough-in drawings.

#### 1.2 RELATED WORK

- A. Section 221319: Sanitary Waste Piping Specialties.
- B. Section 221116: Domestic Water Piping.

#### 1.3 CODES AND STANDARDS

- A. Perform work in accordance with applicable codes and standards enforced by local authorities.
- B. All barrier free fixtures shall be installed in accordance with the Americans with Disabilities Act (ADA) Rules and Regulations.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Fixtures: Kohler, American Standard, Toto, Gerber, Zurn, Sloan.
- B. Fixture stops, supplies, faucets, mixing valves, shock absorbers or any devices in the drinking water supply shall be lead free per the "Safe Drinking Water Act."
- C. Brass Trim: McGuire, Engineered Brass Company, Kohler, Cambridge Brass, ProFlo.
- D. Roof Drains, Hydrant, Floor Drains, Shock Absorbers, Carriers and P-Traps: Jay R. Smith, Zurn, Wade, Josam, Watts, MIFAB.

- E. Diaphragm Flush Valves: Sloan Royal, Zurn Z6000AV-HET-PL with low force handles for ADA compliance.
- F. Sensor type flush valves shall have a battery override manual flush valve actuator.
- G. Toilet Seats: Bemis, Church, Kohler.
- H. Faucets: T&S Brass, Delta HDF, Water Saver, Chicago Faucet Company, Kohler, Zurn, Symmons, Moen, Speakman.
- I. Stainless Steel Sinks: Elkay, Just, Kohler.
- J. Mixing Valves: Leonard, Lawler, Powers, Speakman, Watts, Symmons, Bradley, Apollo.
- K. Shower Valves (thermostatic and/or pressure balancing type): Symmons, Leonard, Powers, Lawler, Speakman.
- L. Flow Control Devices: Dole Flow Controls Company. All lavatory faucets shall have flow restrictors or aerators to limit the flow to 0.4 GPM. All required flows are listed on the fixture schedule.
- M. Pre-fabricated insulation on water lines and p-trap under barrier free lavatories and sinks: Trap Wrap TrueBro, Inc., Handi Lav-Guard, McGuire Pro-wrap, Plumberex-Handishield, Zurn, and Pro-Flo trap wrap.
- N. Shower heads, faucets and flush valves shall meet local and state code requirements for water conservation on low consumption fixtures. Provide integral stop-checks for all shower and tub valves.
- O. Provide fixtures and trim as a complete unit as required in the individual "P" numbers listed below.

## 2.2 MATERIALS

- A. Wall Hung Lavatories: Furnish complete with wall mounting brackets when installed on CMU walls.
- B. Countertop Sinks: Furnished complete with mounting rings where required.
- C. Fixture Color: White unless specified otherwise.
- D. Faucets and Flush Valves: Provide either integral or attached supply stops with nipples.
- E. Provide mixing valves per ASSE or CSA Standards as required by the local adopted code. Mixing valves used in drinking water shall be lead free. Mixing valves shall be used to supply tempered water to public hand-washing facilities and shall conform to ASSE 1070 or CSA B125.3.
- F. Clamping Device: Provide for drains installed in slabs above grade.
- G. Trap Primer: Provide connections for floor drain as shown on drawings.

- H. Caulking: General Electric silicon sanitary sealant or equal. Color to match fixture color.
- I. Provide Zurn ZR-1231 floor mounted carrier for wall hung lavatories.
- J. Provide FRT wood or metal backing at wall fixtures and fixture trim connections so piping and connecting faucets and valves are rigid to wall.
- K. Provide shower and floor drain water proofing membrane for non-prefabricated shower and floor drains located above slab on grade.
- L. Showers and tubs shall have non-slip walking surface.
- M. All fixtures and fittings relating to drinking water shall meet the requirement of ANSI/NSF 61, Section 9. Any faucet for drinking water shall be certified by U.L. to the ANSI/NSF 61, Section 9 Standards.
- N. Prefabricated insulation kit for lavatory and sink supplies, trap and drain piping shall be Truebro Model 103 (white) or equal.

## 2.3 PLUMBING FIXTURES

### A. P-1C WATER CLOSET (FLOOR MOUNTED- FLUSH VALVE - PHOTO SENSOR - 1.28 GPF)

- 1. Fixture: Zurn Z5655-BWL white elongated bowl with 12-inch rough-in.
- 2. Valve: Sloan 111-1.28-SFSM, 1.28 gallon per flush with true manual override.
- 3. Seat: Zurn Z5956SS-EL, white open front.
- 4. Carrier: Zurn ZN1203-N4 or ZN1204-N4; provide carriers for minimum wall thickness.
- 5. Mounting: 15-1/2 inches from finish floor to top of rim.

### B. P-1D WATER CLOSET (FLOOR MOUNTED- FLUSH VALVE - PHOTO SENSOR - BARRIER FREE - 1.28 GPF)

- 1. Fixture: Zurn Z5665-BWL, white elongated bowl with 12-inch rough-in.
- 2. Valve: Sloan 111-1.28-SFSM, 1.28 gallon per flush with true manual override.
- 3. Seat: Zurn Z5956SS-EL, white open front.
- 4. Carrier: Zurn ZN1203-N4 or ZN1204-N4, fixture carriers for minimum wall size.
- 5. Mounting: 17 inches from finished floor to top of rim.

### C. P-1E WATER CLOSET (FLOOR MOUNTED - TANK TYPE)

- 1. Fixture: Toto MS654114MF one piece white elongated bowl, comfort height, 1.6 & 0.9 gallons per flush.
- 2. Trim: Zurn Z8801CR-8873-12-PC supply pipe with wheel stop. Two bolt caps included.
- 3. Seat: Zurn Z5956SS-EL white open front.

### D. P-2C URINAL (WALL HUNG - FLUSH VALVE - PHOTO SENSOR - PINT PPF)

- 1. Fixture: American Standard 6590.001 0.125 gallon per flush urinal.
- 2. Flush Valve: Sloan 186-0.125 HEU SFSM, 0.125 gallon per flush sensor flush valve with true manual override.
- 3. Carrier: Zurn #Z1222.
- 4. Mounting: 24 inches from finish floor to flood rim.

- E. P-2D URINAL (WALL HUNG - FLUSH VALVE - PHOTO SENSOR - BARRIER FREE - PINT PPF)
1. Fixture: American Standard 6590.001, 0.125 gallon per flush urinal.
  2. Flush Valve: Sloan 186-0.125 HEU SFSM, 0.125 gallon per flush sensor flush valve with true manual override.
  3. Carrier: Zurn #Z1222.
  4. Mounting: 17 inches from finish floor to flood rim.
- a. P-3A SHOWER (TILE WALLS AND FLOOR)
5. Fixture: Tile walls and floor with accessories furnished under Division 08 and 09
  6. Trim: Delta T17261 Compel chrome plated single lever valve and shower head. Mounted valve 5 foot above floor to meet MBA standards, Mount 2.0 GPM shower head at 8'-6" above finish floor, Zurn #Z-415-CP with 5-inch chrome plated strainer top with water proofing membrane clamping. Shower heads to be WaterSense Certified.
- F. P-3B SHOWER (TILE WALLS AND FLOOR - BARRIER FREE)
1. Fixture: Tile walls and floor with accessories furnished under Division 08 and 09
  2. Trim: Delta T17261 Compel chrome plated single lever valve and shower head. Mounted main control valve 48-inches above floor to meet ADA requirements, Mount 2.0 GPM main shower head at 8'-6" above finish floor, Delta R1000 diverter body with T11861Compel chrome plated trim cover, Mount diverter valve 48-inches above floor to meet ADA requirements, Delta 51552 chrome plated hand shower with slide bar, slide bar shower head shall be mounted at ADA mounting height. Zurn #Z-415-CP with 5-inch chrome plated strainer top with water proofing membrane clamping. Shower heads to be WaterSense Certified.
- G. P-3C SHOWER (TILE WALLS AND FLOOR - LAKERS)
1. Fixture: Tile walls and floor with accessories furnished under Division 08 and 09.
  2. Trim: Delta T17259 Trinsic chrome-plated single lever valve and shower head. Mounted valve 5 foot above floor to meet MBA Standards, Mount 2.0 GPM shower head at 8'-6" above finish floor, Zurn #Z-415-CP with 5-inch chrome-plated strainer top with water proofing membrane clamping. Shower heads to be WaterSense Certified.
- H. P-3D SHOWER (TILE WALLS AND FLOOR - BARRIER FREE - LAKERS)
1. Fixture: Tile walls and floor with accessories furnished under Division 08 and 09
  2. Trim: Delta T17259 Trinsic chrome-plated single lever valve and shower head. Mounted main control valve 48-inches above floor to meet ADA requirements, Mount 2.0 GPM main shower head at 8'-6" above finish floor, Delta R1000 diverter body with T11859 Trinsic chrome-plated trim cover, Mount diverter valve 48-inches above floor to meet ADA requirements, Delta 51552 chrome plated hand shower with slide bar, slide bar shower head shall be mounted at ADA mounting height. Zurn #Z-415-CP with 5-inch chrome plated strainer top with water proofing membrane clamping. Shower heads to be WaterSense Certified.
- I. P-4C LAVATORY (WALL HUNG - PHOTO SENSOR)
1. Fixture: Zurn Z5310-RS, 20"x18" wall hung lavatory with right hand soap dish.

2. Faucet: Zurn Z6930-XL-TMV-1, chrome plated, photo sensor, battery powered faucet, lead free with 0.5 gpm flow control aerator, supply hoses for mixing valve, single stainless supply hose (lead free) and thermostatic mixing valve for single faucet.
3. Trim: Zurn Z8700-PC Series 1-1/4 inch semi-cast brass p-trap. Zurn Z8804-XL-PC wheel handle stops. Zurn Z8743-PC 1-1/4 inch grid drain.
4. Carrier: Zurn Z1231.

J. P-4D LAVATORY (WALL HUNG - BARRIER FREE - PHOTO SENSOR)

1. Fixture: Zurn Z5310-RS, 20"x18" wall hung lavatory with right hand soap dish.
2. Faucet: Zurn Z6930-XL-TMV-1, chrome-plated, photo sensor, battery powered faucet, lead free with 0.5 gpm flow control aerator, supply hoses for mixing valve, single stainless supply hose (lead free) and thermostatic mixing valve for single faucet.
3. Trim: Zurn Z8700-PC Series 1-1/4 inch semi-cast brass p-trap. Zurn Z8804-XL-PC wheel handle stops. Zurn Z8746-PC 1-1/4 inch offset grid drain.
4. Carrier: Zurn Z1231.
5. Mounting: 34 inches from finished floor to flood rim. Insulate water piping and trap under lavatory.
6. Carrier: Zurn Z1231.

a. P-4H SHAMPOO SINK (WALL HUNG - INTERCEPTOR)

7. Fixture: Belvedere 3800, 19"x20"x10-5/8"
8. Faucet: Belvedere 622 Flo-Temp.
9. Trim: Belvedere 403 vacuum breaker and hose 3-1/2 inch drain with fine screen hair strainer. Zurn Z1176 hair interceptor with stainless steel basket. Allow minimum of 7 inches below bottom of interceptor. Zurn Z8802-XL-LR-8860-12-PC supplies with wheel handle stops.

a. P-4K LAVATORY - UNDERMOUNT PHOTO SENSOR - 0.35GPM

10. Fixture: American Standard 0614.000, 21.25"x14" bowl.
11. Faucet: Sloan EAF-200-LT-ISM-51 Chrome-plated Photo Sense Faucet with temperature control level above counter on faucet, 0.35 GPM, provide EAF-44-A daisy chain electric splitter cable.
12. Trim: Zurn Z8700-PC Series 1-1/4 inch semi-cast brass p-trap. Zurn Z8804-XL-PC wheel handle stops. Zurn Z8743-PC 1-1/4 inch grid drain.

K. P-4L LAVATORY - UNDERMOUNT PHOTO SENSOR - BARRIER FREE - 0.35 GPM

1. Fixture: American Standard 0614.000, 21.25"x14" bowl.
2. Faucet: Sloan EAF-200-LT-ISM-51 Chrome-plated Photo Sensor Faucet with temperature control level above counter on faucet, 0.35 GPM, provide EAF-44-A daisy chain electric splitter cable.
3. Trim: One Zurn Z8700-PC Series 1-1/4 inch semi-cast brass p-trap. Zurn Z8804-XL-PC wheel handle stops. Zurn Z8746-PC 1-1/4 offset grid drain.
4. Mounting: See Architectural Drawings for counter height. Insulate water piping and P-trap under sink. Install 5" from counter front to edge of lavatory for ADA compliance.

L. P-4M LAVATORY - UNDERMOUNT - SINGLE LEVER - 0.4 GPM

1. Fixture: American Standard 0614.000, 21.25"x14" bowl.

2. Faucet: Grohe 34271 001 Chrome-plated faucet with single lever handle. Provide 48187000 flow control kit 0.4 GPM.
3. Trim: Zurn Z8700-PC Series 1-1/4 inch semi-cast brass p-trap. Zurn Z8804-XL-PC wheel handle stops. Zurn Z8743-PC 1-1/4 inch grid drain.

M. P-4N LAVATORY - UNDERMOUNT, SINGLE LEVER - BARRIER FREE - 0.4 GPM

1. Fixture: American Standard 0614.000, 21.25"x14" bowl.
2. Faucet: Grohe 34271 001 Chrome plated faucet with single lever handel. provide 48187000 flow control kit 0.4 GPM.
3. Trim: One Zurn Z8700-PC series 1-1/4 inch semi-cast brass p-trap. Zurn Z8804-XL-PC wheel handle stops. Zurn Z8746-PC 1-1/4 offset grid drain.
4. Mounting: See Architectural Drawings for counter height. Insulate water piping and P-trap under sink. Install 5" from counter front to edge of lavatory for ADA compliance.

N. P-5A SINK (SINGLE COMPARTMENT - BARRIER FREE)

1. Fixture: Elkay ELUHAD2816, 30.5"x18.5"x5".
2. Faucet: Grohe 31349 00E, Chrome-plated dual spray pull down, single lever faucet for 1.5 gpm laminar flow.
3. Trim: One Zurn Z8743-I-PC drain with 1-1/2 inch tailpiece. Zurn Z8804-XL-PC wheel handle stops. One Zurn Z8702-PC Series 1-1/2 inch by 1-1/2 inch semi-cast brass P-trap.

O. P-5B SINK (SINGLE COMPARTMENT - BARRIER FREE)

1. Fixture: Elkay ELUHAD1616, 18.5"x18.5"x5"
2. Faucet: Grohe 31349 00E, Chrome-plated dual spray pull down, single lever faucet for 1.5 gpm laminar flow.
3. Trim: One Zurn Z8748-PC offset drain with 1-1/2 inch tailpiece. Zurn Z8804-XL-PC wheel handle stops. One Zurn Z8702-PC Series 1-1/2 inch by 1-1/2 inch semi-cast brass P-trap.

P. P-5C SINK (SINGLE COMPARTMENT - BARRIER FREE)

1. Fixture: Elkay ELUHAD1212, 14.5"x14.5"x5".
2. Faucet: Grohe 31349 00E, Chrome plated dual spray pull down, single lever faucet for 1.5 gpm laminar flow.
3. Trim: One Zurn Z8743-I-PC drain with 1-1/2 inch tailpiece. Zurn Z8802-XL-LR-8860-12-PC supplies with wheel handle stops and Z8702-PC Series 1-1/2 inch by 1-1/2 inch semi-cast brass P-trap.

Q. P-6 JANITORS FLOOR BASIN

1. Fixture: Stern-Williams terrazzo SB-900, 24"x24"x12" with stainless steel cap, less tiling flanges.
2. Faucet: Zurn Z843M6-CS with vacuum breaker, integral stops, wall brace, and check stops.
3. Mounting: Mount faucet 36 inches above finished floor.

R. P-7 LAUNDRY TUB (TWO COMPARTMENT - FREE STANDING)

1. Fixture: Mustee 28F Big Tub, one-piece molded utility tub, 40"x24"x 34" tall.

2. Faucet: Elkay LK2500CR Chrome-plated faucet with flexible utility spout.
3. Trim: Two Zurn Z8743-I-PC drain with 1-1/2 inch tailpiece. Zurn Z8802-XL-LR-8860-12-PC supplies with wheel handle stops. One Zurn Z8702-PC Series 1-1/2 inch by 1-1/2 inch semi-cast brass P-trap. One Z8751 1-1/2 inch continuous waste.

S. P-9A WATER COOLER FOUNTAIN (HIGH-LOW - BARRIER FREE)

1. Fixture: Rectangle arm with bowl, Elkay ERFPM28RAK with stainless steel apron.
2. Trim: One Zurn Z8802-XL-LR-8860-12-PC supply with wheel handle stop. Two Zurn Z8700-PC Series 1-1/4 inch semi-cast brass P-trap.
3. Capacity: 8 GPH at 90 degree room temperature.
4. Mounting: 36 inches from low bubbler to finish floor.

T. P-10A ROOF DRAIN

1. Fixture: Zurn #ZA100-DP with deck clamp, aluminum dome and sump receiver. Size as shown on drawings. Zurn #Z190 expansion joint if offset is not required.

U. P-10B ROOF DRAIN (OVERFLOW DRAIN)

1. Fixture: Zurn #ZA100-DP-DR-W2, 2" internal dam, with adjustable drain riser extension, deck clamp, aluminum dome and sump receiver. Size as shown on drawings. Zurn #Z190 expansion joint if offset is not required.

V. P-10C AREA DRAIN

1. Fixture: Zurn #Z520-C-Y-P, 9" diameter top, dura-coated cast iron area drain with sediment bucket, adjustable strainer and flashing clamp device if drain is installed above slab on grade. Size as shown on the drawings.

W. P-12 DOWNSPOUT NOZZLE

1. Fixture: Zurn #ZS-199-DC nickel bronze downspout cover with frame with fabricated secured perforated stainless steel hinged strainer. Size as shown on drawings.

X. P-14A FLOOR DRAIN (REGULAR - GENERAL PURPOSE)

1. Fixture: Zurn #ZN415B-Y-P cast iron floor with sediment bucket and polished nickel bronze top, adjustable, strainer and flashing clamp device if drain is installed above slab on grade. Provide trap primer connections. Size of drain as shown on drawings.

Y. P-14B FLOOR DRAIN (EQUIPMENT ROOMS)

1. Fixture: Zurn #ZN541-P round, cast iron, 12" diameter drain with sediment bucket, flange and clamp device if drain is installed above slab on grade. Provide trap primer connections. Size of drain as shown on drawings.

Z. P-14D FLOOR DRAIN (KITCHEN - SANITARY - FULL GRATE - 8"x8" TOP)

1. Fixture: Zurn #ZN1910-K-23-P cast iron floor drain with porcelain enamel interior, nickered bronze rim and grate. Provide trap primer connection. Size of drain as shown on drawings.

AA. P-14E FLOOR DRAIN (KITCHEN - SANITARY - HALF GRATE - 8"x8" TOP)

1. Fixture: Zurn #ZN1910-K-23-2-P cast iron floor drain with porcelain enamel interior, nickel bronze rim and half grate. Provide trap primer connection. Size of drain as shown on drawings.

BB. P-14H COURTYARD AREA DRAIN

1. Fixture: NDS 101 Spee-D Basin with 9-inch by 9-inch atrium grate. Color to be by Architect.

CC. P-14J RECEPTOR DRAIN

1. Fixture: Zurn Z127-AR-DP cast iron floor with strainer and acid resistant epoxy coated finish, and top-set roof deck plate. Roof deck plate is not required on drains at elevator discharge. Provide trap primer connections. Size of drain as shown on drawings.

DD. P-15D TRENCH DRAIN ( STAINLESS STEEL, 30-INCH LONG )

1. Fixture: Trench Drain to be by IMC/TEDDY FWR-30 floor water receptacle, 4-inch deep, 16-gauge Type 304 stainless steel one piece construction. Size of drain as shown on drawings.

EE. P-17A TRAP PRIMER (FLOOR DRAIN CONNECTION)

1. Fixture: Precision Plumbing Products P-1 and P-2, sized as required for the number of floor drains served, with trap primer valve and distribution unit.

FF. P-17B TRAP PRIMER ASSEMBLY (FLUSH VALVE TUBE CONNECTION)

1. Fixture: Zurn P6000-TPO, exposed trap primer assembly, with flush tube trap primer collar, spud coupling and flange for top spud connection, supply tube and fitting, vacuum breaker, vacuum breaker tube nut and wall escutcheon.

GG. P-17C TRAP PRIMER ASSEMBLY (GRAY WATER - SINK TAILPIECE CONNECTION)

1. Fixture: Zurn Z1021-Z assembly or TP2922-PC tailpiece with SS braided primer hose, FIP compression fitting and wall escutcheon.

HH. P-18A WALL HYDRANT (NON-FREEZE - KEY OPERATED)

1. Fixture: Zurn Z1320-SS, anti-siphon non-freeze wall hydrant, stainless steel face, with integral vacuum breaker. Mounting: 18" from center line of hydrant to finished grade.

II. P-19B HOSE BIBB (COLD WATER - EQUIPMENT ROOMS)

1. Fixture: Zurn Z1341 with vacuum breaker, rough bronze finish.

JJ. P-21 ICE MAKER BOX

1. Fixture: Water-Tite Model Number AB9700 HA water supply box with shock arrestor, 6"x5"x3.5".

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Connect to plumbing fixtures and equipment provided under this and other sections of specification, architectural drawings, and manufacturer's shop drawings. Provide rough-in connections as shown on drawings.
- B. Use schedule and details on drawings or manufacturer's shop drawings for connection sizes to fixtures.
- C. Connect wall hung urinals to waste piping with red brass nipples.
- D. Provide separate P-trap for each fixture, floor drain, and piece of equipment.
- E. Provide cast iron P-traps under floor drains.
- F. Provide deep seal traps under floor drains in air conditioning unit plenums, walk-in cooler and freezer units, storage rooms, toilet rooms, and elsewhere as indicated on drawings.
- G. Install barrier free fixtures in accordance with rules and regulations of the Americans with Disabilities Act (ADA).
- H. Provide outlet devices which limit hot water flow to lavatories and sinks to a minimum of 0.5 GPM, sized as recommended by manufacturer and as required by ASHRAE 90.1-2007 and state and local energy codes.
- I. Install lavatories and sinks with a minimum of 4" clearance on each side, from a wall or partition.
- J. Install water closets with a minimum of 15" clearance from the centerline of the bowl to each side, from a wall, partition, divider, or another fixture.
- K. Water closets shall have a minimum of 21" clearance in front of bowl.
- L. Coordinate dimensions required for minimum fixture clearances with other Divisions.
- M. Add trap primer connection to floor drain if required. (See drawing for requirement)
- N. Where automatic electronic flushing devices are specified, coordinate installation with Division 26.
- O. Provide check valves on hot and cold water supply, on janitor sink faucet or any mixing faucet not equipped with integral check valve.
- P. Caulk around joints at fixtures mounted on wall or floor, or backed up to walls.
- Q. Mount fixtures rigid to walls as shown on drawings or details.
- R. Install a dropped eared "L" fitting, mounted on FRT wood backing for rigid support for all shower heads.

- S. Flush Valves: Install flush valves on wide side of water closet stall as required for ADA accessibility. Install water closet flush valve no higher than 44" above finished floor. Flush valve handles for urinals shall be mounted between 28" and 44" above finished floor.
- T. Securely fasten the dishwasher waste discharge line to underside of counter top before connection to sink tailpiece.
- U. Provide 12" minimum access to fixtures with concealed slip-joint connections.
- V. Run connection size cold water line to back of refrigerator and connect with shut off valve at connection point. Field verify exact connections required.

### 3.2 TESTING AND CLEANING

- A. Inspect and test all work to insure that it is installed in accordance with drawings and specification and is functioning as designed. Test procedures and pressure as required by other sections.
- B. Correct all deficiencies found and retest.
- C. Turn all work over to Owner in a clean, sanitary condition.

END OF SECTION 224000

## SECTION 230500 - COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Common work results for requirements specifically applicable to Division 23.
- B. Requirements of Division 01 Specifications, General Provisions of the Contract and General and Supplementary Conditions apply to this Division.

#### 1.2 REFERENCES

- A. AGA: American Gas Association.
- B. ANSI: American National Standards Institute.
- C. ARI: American Refrigeration Institute.
- D. ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers.
- E. ASME: American Society for Mechanical Engineers.
- F. ASTM: American Society for Testing and Materials.
- G. AWWA: American Water Works Association.
- H. FM: Factory Mutual.
- I. IRI: Industrial Risk Insurers.
- J. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
- K. NEMA: National Electrical Manufacturers' Association.
- L. NFPA: National Fire Protection Association.
- M. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
- N. UL: Underwriters' Laboratories, Inc.
- O. USGBC: United States Green Building Council.
- P. U.L. Fire Resistance Index.
- Q. ASTM E814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

### 1.3 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Incomplete submittals containing unmarked cutsheets or not providing specific detail of what is being proposed will be rejected and will not be reviewed.
- C. Include Products as specified in the individual sections of Division 23.
- D. Submit shop drawing and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- E. Submit copies of shop drawings in accordance with Division 01, including:
  - 1. Building Automation System including direct digital control drawings.
  - 2. Section 230913 Instrumentation and Control Devices (in separate submittal package from Section 230923 Building Automation and Direct Digital Controls). These two sections shall be submitted at least 15 working days apart.
- F. Brochures: Submit manufacturer's product data and brochures including:
  - 1. Complete descriptions.
  - 2. Illustrations.
  - 3. Rating data, accessories, dimensional data, and applicable options and features marked for the specific items scheduled on drawings and specified herein.
  - 4. Capacities stated in the terms specified.
  - 5. Performance curves for all air handling units, fans, and pumps.

### 1.4 REGULATORY REQUIREMENTS

- A. Perform Work specified in Division 23 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.
  - 1. NFPA 54: National Fuel and Gas Code.
  - 2. NFPA 90A: Air Conditioning and Ventilation Systems.
  - 3. NFPA 92B: Guide for Smoke Management Systems in Malls, Atria, and Large Areas.
  - 4. NFPA 96: Cooking Equipment and Vapor Removal.
  - 5. NFPA 101: Life Safety Code.
  - 6. ANSI Handicapped Code-A117.1.
  - 7. IBC: International Building Code, with Mechanical, Plumbing and Energy Conservation Codes.
  - 8. Special regulations, supplement, and amendments of the State and/or local authorities having jurisdiction.
- B. Comply with the applicable edition date of each regulation as adopted by the authorities having jurisdiction.

- C. Smoke control systems shall be tested by a special inspector and a complete report of testing shall be prepared by the special inspector or their agency as required per local code. The special inspector is required to be secured by the Owner or Contractor for the testing as required by local code.
  - 1. The report shall include identification of all devices by manufacturer, name plate data, design values, measuring valves, and identification tag or mark. The report shall be reviewed by the responsible registered design professional, and when satisfied that the design intent has been achieved, the responsible registered design professional shall seal, sign, and date the report.
  - 2. Special inspection agencies for smoke control shall have expertise in Fire Protection Engineering, Mechanical Engineering, and Certification as Air Balances. Special inspection agency shall submit an inspection plan indicating methods for testing smoke control systems per local code.

#### 1.5 LEED REQUIREMENTS

- A. Coordinate and provide support as necessary to assist the commissioning agent in commissioning this project in accordance with the LEED New Construction (NC) V2009 Energy and Atmospheric (EA) Prerequisite 1 and EA Credit 3 for Enhanced Commissioning. Refer to the Commissioning Plan provided by the commissioning agent, Section 019113 and Section 230800 for specific requirements.
- B. Develop and execute IAQ Management Plan to obtain the LEED NC Indoor Environmental Quality (IEQ) Credit 3.1.
- C. Ensure compliance to LEED NC IEQ Credit 4.1 Low-Emitting Materials, Adhesives and Sealants and Credit 4.2 Paints and Coatings.
- D. Provide indoor air quality testing to achieve LEED IEQ Credit 3.2.
- E. Ensure compliance with LEED NC EA prerequisite 3 Fundamental Refrigerant Management and careful selection of equipment to achieve LEED NC EA Credit 4 for Enhanced Refrigerant Management.

#### 1.6 COMMISSIONING REQUIREMENTS

- A. Commissioning:
  - 1. Section 019113 "Commissioning Requirements" requires the engagement of a Commissioning Agent to document the completion of the HVAC and Electrical systems upgrades for the project. Comply with the requirements of Section 019113 as a Commissioning Team member for the commissioning of the various building systems.
- B. Provide commissioning support to the Commissioning Agent as indicated in Section 019113 and Section 230800.
- C. The complete test and balance scope of work will be provided by the commissioning agent for the project. Coordinate and provide support as necessary to assist with the test and balance work. Division 23 shall not provide test and balance services.

## 1.7 PROJECT/SITE CONDITIONS

- A. Layouts indicated on drawings are diagrammatical and intended to show relative positions and arrangement of equipment, ductwork and piping. Coordinate mechanical work with other trades and measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings, using as necessary rises, drops, offsets, transitions, and alternate routings to fit in the available space unless prevented by Project conditions.
- B. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.
- C. Place anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.
- D. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.
- E. Determine sizes and verify locations of existing utilities on or near site.
- F. Keep roads clear of materials and debris.
- G. Visit site and be informed of conditions under which Work must be performed.
- H. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or as applicable, means of access using duct, wall, or ceiling access doors.
- I. Install ductwork and piping to leave sufficient space for AHJ inspection of wall construction.

## 1.8 FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required to perform Division 23 work.

## 1.9 COORDINATION DRAWINGS

- A. Prior to commencement of installation, prepare coordination drawings for work under this division, as specified in Division 01, in full cooperation with persons performing work under other Divisions, including but not limited to mechanical, electrical, plumbing, fire protection, telecommunications, audio/visual and miscellaneous steel.
- B. Drawings shall not be formally submitted but shall be kept on site for reference. Notify Architect and CM of conflicts that cannot be resolved.
- C. Prepare coordination drawings or 3-D Model as specified herein. Facilitate the coordination effort with all other trades, specifically Divisions 21, 22, 26 and 28 and shall include:
  - 1. Mechanical Rooms.
  - 2. Fire Pump Room.
  - 3. Coordinated room layouts shall include:

- a. Room dimensions.
- b. Support column locations.
- c. Locations and dimensions of equipment foundations and pads required.
- d. Locations and dimensions of equipment and apparatus, including electrical control panels and starters, and service and coil pull areas.
- e. Dimensioned floor drain locations.
- f. Locations of wall mounted equipment.
- g. Trench locations and sizes.
- h. Sleeve locations in mechanical rooms and equipment rooms.
- i. AHU (fan) and duct layouts in AHU equipment rooms.
- j. Piping 3" and larger.
- k. Conduit 3" and larger.

D. Roof layouts including:

- 1. Air intakes.
- 2. Vents.
- 3. Boiler stacks.
- 4. Generator exhaust.
- 5. Exposed ductwork.

1.10 COMPLETENESS OF WORK

- A. The Contract Documents depict HVAC systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout the Division 23 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

1.11 REFERENCE STANDARDS AND DEFINITIONS

- A. Comply with provisions of Division 01.

1.12 PRODUCT SUBSTITUTIONS

- A. Comply with provisions of Division 01.

1.13 WARRANTIES

- A. Comply with provisions of Division 01.
- B. Provide extended warranties for all HVAC equipment used during construction such that Owner receives a one (1) year warranty period from Substantial Completion date.

#### 1.14 RECORD DRAWINGS

- A. Provide record drawings that illustrate the work of Division 23 as finally constructed. Deliver record drawings to the Architect in a form suitable for production.
- B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.
- C. Deliver record drawings to Architect within 30 days of Substantial Completion.

#### 1.15 OWNING AND OPERATING MANUALS

- A. Comply with the requirements of Division 01, but provide a minimum of three (3) hard copy bound sets and electronic records in pdf format.
- B. Manuals shall include clear and comprehensive instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.
- C. Copies of final reviewed submittals indicating all model numbers, serial numbers, cut sheets, and all performance criteria on furnished equipment shall be included.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT SUPPORTS

- A. Structural Steel for Supports: ASTM A36
  - 1. Use galvanized members installed in fan plenums or areas of high humidity or condensation, and outside. All fasteners shall be stainless steel. Any damage caused by cutting, drilling, or welding or any other means to galvanized surface must be repaired by apply two coats of cold-galvanizing.
  - 2. Use hot dipped galvanized members installed in fan plenums or areas of high humidity or condensation, in tunnels and outside. All fasteners shall be stainless steel. Any damage caused by cutting, drilling, or welding or any other means to galvanized surface must be repaired by applying two coats of cold-galvanizing.
  - 3. Furnish other members with shop coat of red primer.
  - 4. Retouch primer after field welding.

#### 2.2 FLASHINGS AND COUNTERFLASHINGS

- A. Furnish materials and coordinate installation for flashing and counterflashing roof penetrations for flues, pipe, drains, and ducts.
- B. Materials:
  - 1. Sheetmetal: 24-gauge minimum ASTM A525, Class G90.
  - 2. Sheet Lead: 3 pounds per square foot.

3. Stainless Steel: Minimum 20-gauge.
4. Sheet Copper: 24 oz/sf.

## 2.3 WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
- B. Size: 24" x 24" minimum, as indicated, or as required to allow inspection, service and removal of items served.
- C. 14-gauge minimum sheet metal for doors, 16-gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.
- D. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.
- E. Prime painted or rust inhibitive paint finish.
- F. UL labeled when in fire-rated construction to match wall or ceiling rating.
- G. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are fire and/or smoke dampers, mechanical system valves, and equipment needing periodic or replacement maintenance.
- H. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
- I. Acceptable Manufacturers: Milcor, Nystrom, Karp, J.L. Industries or Williams Brothers.
  1. For masonry and drywall construction: Milcor Style M.

## 2.4 PIPE ENCLOSURES

- A. For exposed vertical piping in kitchen: 18-gauge stainless steel (Type 302) with No. 4 finish.
  1. Extend from 2" above ceiling to equipment or island partition.
  2. Size covers to contain number of pipes served.
- B. Minimize number of covers by enclosing maximum number of pipes in each drop.
- C. Anchor to equipment or partition.
- D. Fasten seams and joints with stainless steel pop rivets.
- E. Provide 1-1/2" ceiling flange as closure.

## 2.5 SLEEVES

### A. Materials:

1. Concrete Floors, Concrete and Masonry Walls: 18-gauge galvanized sheetmetal.
2. Drywall Partitions: 18-gauge galvanized steel sheet metal.

### B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2". Provide larger annular space if required by firestopping product installation instructions.

### C. Sleeves supporting riser piping 4" and larger shall have three (3) 6" long reinforcing rods welded radially at 120 degree spacing to the sleeve and shall be installed with the rods embedded in the concrete slab.

## 2.6 ESCUTCHEON PLATES

### A. Provide B and C No. 10 or equal chrome-plated escutcheon plates where pipes penetrate partitions or ceilings in finished areas.

## PART 3 - EXECUTION

### 3.1 CUTTING AND PATCHING

- A. Repair or replace damage caused by cutting or installation of work specified in Division 23.
- B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

### 3.2 FLASHING AND COUNTERFLASHING

- A. Counterflash ducts and pipes where penetration of roofs and outside walls occur.

### 3.3 CONNECTION TO EQUIPMENT FURNISHED BY OWNER

- A. Connect or install equipment shown on mechanical drawings that requires mechanical connections.
- B. Provide piping, shutoff valves, unions, and other piping appurtenances required for a complete installation.
- C. Provide Food Service equipment connection for heat rejection water at all walk-in coolers and freezers, beer coolers, and ice makers and for duct connection at all exhaust hoods.
- D. Provide steam strainers, steam traps, and pressure reducing valves in steam lines.

### 3.4 DELIVERY, STORAGE, AND PROTECTION

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where deliver in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.
- B. Store items in a clean, dry place, and protect from damage. Mechanical equipment may not be staged or stored outdoors unless intended for outdoor use.
- C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.
- D. Protect valves and piping from damage. Cover equipment during work of finishing trades.
- E. Keep dirt and debris out of pipes and ducts.
- F. Repair, restore, and replace damaged items.
- G. Cover factory finished equipment during work of finished trades, such as fan coils, fin tubes, etc.
- H. Protect cooling and/or heating coils with temporary filter media during construction.

### 3.5 SLEEVES

- A. Floors: Sleeve all pipe penetrations. Extend sleeve 1-1/2" above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.
- B. Masonry or Concrete Walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.
- C. Drywall Partitions: Sleeve all penetrations of piping in systems over 160 deg F.
- D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.
- E. Install piping, insulation and sleeves in strict accordance with applicable U.L. floor or partition assembly instructions. Coordinate with Division 07 Firestop manufacturer's installation instructions.
- F. Penetrations not Sleeved or Firestopped:
  - 1. Seal voids between pipe and partition. Seals shall be airtight.

### 3.6 ESCUTCHEON PLATES

- A. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in "finished" spaces. Mechanical rooms, store rooms, electric closets, and janitor closets are not considered "finished" spaces.
- B. Clearance between Sleeve and Pipe: Minimum of 1/2 inch for hot piping and 1 inch for cold piping, or as otherwise dictated by U.L. Fire Resistance Directory.

### 3.7 EQUIPMENT GUARDS

- A. Use suitable structural frames with minimum 12-gauge, 3/4" galvanized mesh, or expanded metal mesh. Attach to equipment by removable clips and bolts with wing nuts, or other approved connectors.
- B. At belts, provide opening for measuring RPMs.
- C. Provide at all belts, couplings, moving machinery and equipment.
- D. Design for easy access to belts and other items requiring replacement.
- E. Comply with OSHA Regulations.
- F. Provide weather-proof protection for all equipment installed outdoors.

### 3.8 CLEANING HVAC SYSTEMS

- A. General Cleanup:
  - 1. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Architect. See Division 01 of specifications for further requirements.
  - 2. Seepage, discoloration, or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.
- B. Factory Finishes:
  - 1. Clean items with factory finishes. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula. If finishes are badly damaged or if there are many damaged, scratched or bare places, refinish the entire item.
- C. Ducts and Apparatus:
  - 1. Thoroughly clean ducts and apparatus casings before fans and filters are operated.
- D. HVAC Closed and Open Water Systems:
  - 1. Initial flushing:
    - a. Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system components.
    - b. Bypass factory equipment unless acceptable means of protection are provided, or by subsequent inspection of water boxes and other "hide-out" areas takes place.
    - c. Isolate or protect "clean" system components including pumps and pressure vessels and any component that may be damaged.
    - d. Open all valves, drains, vents, strainers, and the like at all system levels. Close all valves isolating piping from the existing central piping systems.
    - e. Remove plugs, caps, spool pieces, and components to facilitate early discharge from the system.

- f. Sectionalize system to obtain debris carrying velocity of six feet per second.
- g. Connect dead end supply and return headers and the like as necessary, or provide drains in dead end eccentric caps.
- h. Install temporary strainers where necessary to protect downstream equipment.
- i. Supply and drain-off "flushing" water by fire hoses, garden hoses, temporary or permanent piping, Contractor's booster pumps, and the like.
- j. Flush for not less than four hours. Drain all dirt legs. If water drained is not visibly clean, repeat the above procedure until dirt legs are visibly clean.
- k. Before starting the cleaning and flushing process, confirm a thermometer has been installed on the system. During flushing and cleaning process, monitor the water temperature to ensure the water temperature does not become too hot.

2. Cleaning (Closed Systems Only):

- a. Utilize defoamers to preclude damage to existing work, and specifically adjacent electrical equipment.
- b. Utilize heat to maximize effectiveness of compounds or use live steam injection where practical and safe. Do not raise cleaning water temperature in excess of 150 degrees F. Install a thermometer in the piping system and constantly monitor the water during cleaning to prevent over-heating.
- c. Install temporary strainers, reinforced against blowout, sized to not impair equipment performance, to preclude passing of particles larger than 60% of smallest radial and at a minimum to retain all particles larger than 1000 microns.
- d. Permanent facility pumps shall not be used for circulating cleaning water. Contractor shall supply temporary pumps for this process.
  - 1) If the system construction, flow rates, and pressures are such that it is impractical for the Contractor to provide temporary pumps, the permanent facility pumps may be used with the specific express permission of the Owner, provided the guarantee on the entire pump assembly is unconditionally extended for two years after date of Substantial Completion. Leakage from pump seals or other damage resulting from circulating the uncleaned water shall require immediate rectification at no additional cost to the Owner.
- e. Add 20 pounds of Garratt Callahan Formula 248, or equal, alkaline cleaner for each 1000 gallons of system water for chemical cleaning (approximate .2% solution). Formula 248 is a dry blend of buffered phosphates, a corrosion inhibitor, a surfactant, and an iron oxide sequestrant.
- f. Circulate for a period of at least 72 hours.
- g. Every eight hours, blow-down the condensers and system low points for three minutes.
- h. Drain and flush the system. Rapid flushing from the lowest point in the system is needed to remove debris.
- i. Inspect the system and repeat first four steps.
- j. Begin the corrosion control program immediately at double the normal inhibitor dosage for one week. After one week, drop to the normal dosage.
- k. Chemical Treatment Compound: Use Garratt Callahan Company Formula 12-L closed system inhibitor strictly following manufacturer's directions.
- l. Before starting the cleaning and flushing process, confirm a thermometer has been installed on the system. During flushing and cleaning process, monitor the water temperature to ensure the water temperature does not become too hot.

### 3.9 OPERATION OF HVAC SYSTEMS DURING CONSTRUCTION

- A. During construction, meet or exceed the recommended "Control Measures" of the SMACNA IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.
- B. Install specified filters prior to system operation. In addition to specified filters, install a roughing filter upstream of mixed air filter. Roughing filter shall consist of two layers of roll filter media clipped and sealed to entering side of filter frame. Change roughing filter as necessary to minimize dust collection on specified filters.
- C. Cover return and exhaust air grilles with temporary MERV 8 filter media. Attach media to avoid damage to grille or ceiling. Change temporary media as required to protect against dust buildup on ductwork and filter media. Remove temporary media from grilles after flooring is installed, walls are sanded and painted and other dust generating construction has been completed.
- D. During periods of excessive dust generation such as drywall sanding, seal off return and exhaust openings and grilles and turn off fans to prevent dust from accumulating in ductwork.
- E. If outside air source contains less dust than building air, adjust A/C unit dampers to operate with as much outside air as possible without causing a freezing condition for coil, or exceeding capacity of coil to adequately condition supply air.
- F. Furnish and install a new set of specified filter media prior to start of system test and balance. Furnish a new, clean set of the specified media and turn over to Owner's Representative.
- G. Provide a written start-up plan for all mechanical systems. Include measures for operation during construction. The following items shall be included:
  - 1. HVAC operation and building pressure control.
  - 2. Temperature and humidity control for finishes.
  - 3. Filter changes during construction.
  - 4. Extended warranties.

### 3.10 TESTING MECHANICAL SYSTEMS

- A. Test all systems and equipment installed to demonstrate proper operation.
- B. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.
- C. Correct and retest work found defective when tested.
- D. Make repairs to piping systems with new materials. Peening, doping, or caulking of joints or holes will not be acceptable.
- E. Food Service Heat Rejection Piping: Hydrostatically test piping at 125 psig pressure or at design pressure as indicated on drawings, whichever is greater, for a period of six hours without evidence of leaking.
- F. Ductwork Leakage Testing: Refer to Section 233113 for required leakage testing for ductwork.

- G. System Balance and Testing: Prepare to assist test and balance firm by assuring systems are complete and operational.
- H. Test all fire dampers by manually disconnecting linkage and observing that blades fall into position.
- I. Test all smoke and combination fire/smoke dampers by observing damper operation during fire alarm system commissioning.
- J. Records of Testing: Maintain records of system testing and results thereof. Deliver results as part of project closing file and on an intermediate basis as requested by Architect.

END OF SECTION 23050

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230513 - MOTORS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Division 26: Electrical.

#### 1.2 SUBMITTALS

- A. Submit motor information with submittals and shop drawings for Division 23 equipment.

#### 1.3 REFERENCE STANDARDS

- A. Each motor, controller, and all components shall be designed, manufactured, and tested in accordance with the following latest applicable standards:
  - 1. National Electric Manufacturers Association Standards (NEMA).
  - 2. ANSI/NEMA MG 1 - Motors and Generators.
  - 3. NFPA 70 - National Electrical Code (NEC).
  - 4. IEEE-112, Test Method "B".
  - 5. IEEE Standard 519-1992.
  - 6. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
  - 7. AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.
  - 8. NEMA - ICS-3-303.
  - 9. IEEE STD 444 (ANSI C34.3).
  - 10. Energy Policy Act of 1992 (EP Act).
- B. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this Project.

### PART 2 - PRODUCTS

#### 2.1 ALTERNATING CURRENT (AC) MOTORS

- A. Acceptable Manufacturers: MagneTek/Century, Lincoln, Marathon, Gould, Toshiba, Baldor, General Electric, Reliance, Siemens, U.S. Motors, Westinghouse.
- B. In general, motor voltages shall be as follows, unless specified or indicated otherwise:
  - 1. 1 hp and larger: 460V, three (3) phase, 60 hertz.
  - 2. Smaller than 1 hp: 120V, one (1) phase, 60 hertz.

- C. All motors shall be started across the line, unless specified otherwise. All motors 100 horsepower and larger shall be suitable for wye-delta starting unless specified otherwise. Motors shall be selected with low starting current and shall be designed for continuous duty to provide the running torque and pull in torque required to suit the load. Unless otherwise indicated on the Contract Documents, all motors shall be single speed (1750 rpm). All motors shall have standard open drip-proof enclosures unless otherwise specified. All motors exposed to the actually installed outside in the weather shall be of the totally enclosed fan cooled (TEFC) or totally enclosed air over (TEAO) Types. All motors not utilized with variable speed drives shall have a minimum service factor of 1.15 and shall be selected to operate at design conditions without exceeding their nameplate rating (without exploiting the service factor rating). Motors used in conjunction with variable speed drives shall have a 1.00 service factor unless otherwise indicated and be compatible with the drive and rated for inverter output duty. Two (2) speed motors shall be two (2) speed, two (2) winding or two (2) speed, single winding type as specified herein and as indicated on the Contract Documents.
1. Standard open drip-proof three (3) phase motors ten (10) horsepower and smaller shall have cast aluminum end bells with steel frames. Three (3) phase motors fifteen (15) horsepower and larger shall have cast iron end bells and housings.
  2. Standard open drip-proof single phase motors shall have cast aluminum end bells with steel frames.
  3. Totally enclosed fan cooled (TEFC) and totally enclosed air over (TEAO) three (3) phase motors shall have cast iron housings. TEFC motors shall have corrosion resistant fans.
  4. Vertical pump motors shall have cast iron end bells and a cast aluminum housing. These motors shall be sized to drive the pump through its characteristic curve without exceeding the rated motor full load horsepower.
- D. Windings and Insulation:
1. All motors shall have copper windings.
  2. Motors shall be equipped with Class B, 80 deg C rise or Class F, 105 deg C rise insulation suitable for use in a 40 deg C ambient temperature. All motors used for cooling tower applications shall be equipped with Class F, 105 deg C rise insulation suitable for use in a 40°C ambient temperature. Windings shall be treated with an epoxy varnish to inhibit the absorption of moisture.
- E. Bearings:
1. Single phase, fractional horsepower motors shall be equipped with quiet operating, all angle, babbitt-lined sleeve bearings.
  2. Polyphase motors shall be equipped with deep groove type ball bearings, generously sized for the loads to which applied and for severe duty application. Provide the necessary seals on the shaft to keep the bearing system free of contamination and moisture. Lubricant shall be high temperature, non-bleeding grease.
    - a. Provide inlet and outlet plugs on poly-phase motors so that grease fittings can be easily inserted for bearing relubrication except as otherwise specified. The end shields shall be carefully machined to add extra grease capacity. Lower outlet plugs shall be equipped with combination breather/drains on TEFC and TEAO motors.

- F. Motors shall be specifically designed for quiet operation and for severe duty. Standard open drip-proof motors shall be equipped with aluminum or stainless steel stamped nameplates. Totally enclosed fan cooled and air over motors shall be equipped with stainless steel stamped nameplates with either zinc or cadmium-plated hardware. Motor nameplates shall clearly indicate frame size, horsepower, frequency, voltage, speed, starting torque class, insulation class, service factor and winding material.
- G. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather protected.
- H. Motors specified with variable frequency drive controllers shall be inverter duty rated and shall be insulated against eddy currents. Motors specified with variable frequency drive controllers shall comply with NEMA, MG1, Part 31 for Definite Purpose, Inverter-Fed motors including insulation meeting the requirement for 1600 Vpk at 0.1  $\mu$ S rise time. In addition to compliance with MG1, Part 31, motors also shall be designed for starting across the line and specifically designed to reduce in-rush current.
  - 1. To protect motor bearings and shafts from damage due to induced electrical currents along the motor shaft, provide Aegis SRG, conductive microfiber motor shaft grounding ring on the driven-end of all inverter-fed motors. For inverter-fed motors 100 HP and larger, also provide either an insulated motor bearing or a ceramic bearing on non-driven end of motor. Comply with manufacturer's installation instructions and with NEMA MG1, Part 31, Section 31.4.4.3 for inverter-fed motor bearings.
  - 2. For inverter-fed motors 100 HP and larger, also provide either an insulated motor bearing or a ceramic bearing on non-driven end of motor. Comply with manufacturer's installation instructions and with NEMA MG1, Part 31, Section 31.4.4.3 for inverter-fed motor bearings. To protect motor bearings and shafts from damage due to induced electrical currents along the motor shaft, provide Aegis SRG, conductive microfiber motor shaft grounding ring on the driven-end of all inverter-fed motors.
- I. Install premium efficiency electric motors for motors 1 horsepower and above. Premium efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer Method B. The efficiency will be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:
  - 1. HP: 3/4 Eff: 80.0%.
  - 2. HP: 1 Eff: 85.5%.
  - 3. HP: 1-1/2 Eff: 86.5%.
  - 4. HP: 2 Eff: 86.5%.
  - 5. HP: 3 Eff: 89.5%.
  - 6. HP: 5 Eff: 89.5%.
  - 7. HP: 7-1/2 Eff: 91.7%.
  - 8. HP: 10 Eff: 91.7%.
  - 9. HP: 15 Eff: 93.0%.
  - 10. HP: 20 Eff: 93.6%.
  - 11. HP: 25 Eff: 93.6%.
  - 12. HP: 30 Eff: 94.1%.
  - 13. HP: 40 Eff: 94.5%.
- J. Sound power levels not greater than recommended in NEMA M61-12.49. VFD duty rated motors shall not increase by more than 3 dB when operating on VFD.

- K. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.

## 2.2 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Acceptable Manufacturers: Marathon Electric, Regal Beloit, Baldor, Johnson Control, US Motors, GENTEC and McMillan.
- B. Where specified to be ECM on schedules, plans or details, motors shall be Permanent Magnet EC (electronically commutated) type. AC induction motors shall not be allowed. Examples of unacceptable motors are: shaded pole, permanent split capacitor (PSC), split phase, capacitor start and 3 phase induction type.
- C. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and pre-wired to the specific voltage and phase.
- D. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal.
- E. Motor shall be a minimum of 85% efficient at all speeds.
- F. Motors must meet FCC Part 15, Class B for conducted EMI.
- G. Electronic commutation (EC) motors must be tested in the fan (or other) application by the fan manufacturer to ensure durability and performance.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Arrange and set motors.
- B. Line up motors on direct drive equipment using dial type gauges.
- C. Make connections and test motor for proper rotation/phasing under Division 26.

### 3.2 ADJUSTMENTS

- A. Motors, together with driven equipment, shall be dynamically and statically balanced. Imbalance shall be reduced to minimum specified by equipment manufacturers not to exceed 2 mils peak to peak.

END OF SECTION 230513

## SECTION 230514 - VARIABLE FREQUENCY MOTOR DRIVES

### PART 1 - GENERAL

#### 1.1 SUMMARY OF WORK

- A. Variable Frequency Drives (VFDs).

#### 1.2 REFERENCES

- A. UL 508.
- B. NEC.
- C. Canadian Underwriters Laboratory (C-UL).

#### 1.3 QUALITY ASSURANCE

- A. To ensure quality and minimize infantile failures at the jobsite, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.
- B. All optional features shall be functionally tested at the factory for proper operation.

#### 1.4 SUBMITTALS

- A. All VFDs for the project shall be provided by a single manufacturer. This includes drives provided packaged with equipment.
- B. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalog information.
- C. The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
- D. Harmonic filtering. The seller shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will meet the IEEE Standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.

## 1.5 WARRANTIES

- A. VFD shall be warranted by the manufacturer for a period of 60 months from date of substantial Completion. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Danfoss Graham VLT 6000 Series.
- B. ABB ACH Series.
- C. Yaskawa.

### 2.2 GENERAL

- A. Furnish complete variable frequency VFDs as specified herein for the fans and pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA 1 enclosure, or other NEMA type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD.
- B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
- C. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- D. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- E. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.

- F. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
- G. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- H. The VFD shall be able to provide full torque at any selected frequency from 29 Hz to base speed to allow driving direct drive fans without derating.
- I. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
- J. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
- K. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
- L. Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
- M. VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

## 2.3 PROTECTIVE FEATURES

- A. A minimum of Class 20 (I squared T) electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.
- B. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults in plain English. Codes are not acceptable.
- C. Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.

- D. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
- E. VFD package shall include semi-conductor rated input fuses to protect power components.
- F. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the VFD manufacturer must ensure that inverter rated motors are supplied.
- G. VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
- H. VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
- I. VFD shall catch a rotating motor operating forward or reverse up to full speed.
- J. VFD shall be rated for 100,000 amp interrupting capacity (AIC).
- K. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
- L. VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

## 2.4 INTERFACE FEATURES

- A. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.
- B. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
- C. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
- D. Lockable, alpha-numeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.
- E. The keypads for all sizes of VFDs shall be identical and interchangeable.
- F. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
- G. Display shall be programmable to display in seven (7) languages including English, Spanish and French.

- H. The display shall have four lines, with 20 characters on three lines and eight large characters on one line.
- I. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
- J. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
- K. BACNet communication shall be available for factory or field installation within the VFD. Provide any and all software and hardware necessary to connect each VFD to the BAS Network.
- L. As a minimum, the following points shall be controlled and/or accessible:
  - 1. VFD Start/Stop.
  - 2. Speed reference.
  - 3. Fault diagnostics.
  - 4. Meter points:
    - a. Motor power in HP.
    - b. Motor power in Kw.
    - c. Motor kW-hr.
    - d. Motor current.
    - e. Motor voltage.
    - f. Hours run.
    - g. Feedback signal #1.
    - h. Feedback signal #2.
    - i. DC link voltage.
    - j. Thermal load on motor.
    - k. Thermal load on VFD.
    - l. Heatsink temperature.
- M. Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VFD.
- N. Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- O. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
- P. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
- Q. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set "sleep" level for a specified time. The VFD shall automatically restart when the speed command exceeds the set "wake" level.

- R. The sleep mode shall be functional in both follower mode and PID mode.
- S. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
- T. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.
- U. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (°F) for a cooling tower application.
- V. VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
- W. If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
- X. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
- Y. The VFD shall store in memory the last 10 faults and related operational data.
- Z. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- AA. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
- BB. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
- CC. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.
- DD. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

## 2.5 ADJUSTMENTS

- A. VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
- B. Sixteen preset speeds shall be provided.
- C. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
- D. Four current limit settings shall be provided.
- E. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
- F. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- G. An automatic "on delay" may be selected from 0 to 120 seconds.

## 2.6 SERVICE CONDITIONS

- A. Ambient temperature, -10 to 40 deg C (14 to 104 deg F).
- B. 0 to 95% relative humidity, non-condensing.
- C. Elevation to 3,300 feet without derating.
- D. AC line voltage variation, -10 to +10% of nominal with full output.
- E. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

## PART 3 - EXECUTION

### 3.1 START UP SERVICE

- A. Provide manufacturer's start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

### 3.2 EXAMINATION

- A. Verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.
- B. Cover and protect VFD from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

END OF SECTION 230514

## SECTION 230519 - HYDRONIC SPECIALTIES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. This section includes requirements for:
  - 1. Pressurized expansion tanks
  - 2. Tangential air separator
  - 3. Suction diffuser
  - 4. P.T. test plugs
  - 5. Pressure gauges
  - 6. Thermometers
  - 7. Thermometer test wells
  - 8. Hydronic pressure reducing valves
  - 9. Relief valves
  - 10. Auto-flow balancing valves.
  - 11. Flow measure station
  - 12. Flow balancing valve
  - 13. Flow measuring meter

#### 1.2 RELATED WORK

- A. Section 23 20 00: HVAC Piping
- B. Section 23 21 23: HVAC Pumps

#### 1.3 SUBMITTALS

- A. Submit product data for review including:
  - 1. Pressurized expansion tanks
  - 2. Tank air control fitting
  - 3. Tangential air separator
  - 4. Suction diffuser
  - 5. Flow measuring station
  - 6. Auto Flow balancing valve
  - 7. Flow measuring meter
  - 8. Pressure gauges and P.T. plugs
  - 9. Thermometers
  - 10. Strainers
  - 11. Relief Valves

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Bell & Gossett ITT
- B. Keckley
- C. Trerice Company
- D. Taco
- E. Thrush

- F. Wheatley
- G. Peterson Engineering
- H. Mueller
- I. Armstrong
- J. Dieterich Standard
- K. Water Side Connections: Flanged

## 2.2 PRESSURIZED EXPANSION TANK

- A. Shell Material: Carbon steel.
- B. Diaphragm: Heavy duty butyl rubber.
- C. Construction Standard: ASME Section VIII, Division 01.
- D. Maximum Design Pressure: 125 PSI, ASME Stamped.
- E. Working Pressure: As shown on drawings.
- F. Capacity: Provide tanks for horizontal or vertical mounting with capacity and size as indicated on Drawings.
- G. Connections: Provide system connection opening in tank and .302"-32 charging valve connection to facilitate on-site charging of the tank to meet system requirements.
- H. Sight Glass: Provide sight glass to indicate water level in tank.

## 2.3 TANGENTIAL AIR SEPARATOR

- A. Type: Similar to Bell & Gossett, Type R.
- B. Provide an external air separation unit consisting of a steel tank, collector tube, and strainer.
- C. Connections: Screwed or flanged tangential inlet and outlet.
- D. Design internal perforated stainless air collector tube to direct released air into compression tank.
- E. Construct unit in accordance with ASME Boiler and Pressure Vessel Code and stamp for working pressure specified on schedules.
- F. Blowdown connection to facilitate routine cleaning of unit.
- G. Unit to prevent accumulation of air in hydraulic heating and/or cooling system and prevent noises caused by entrained air in piping.

## 2.4 SUCTION DIFFUSER

- A. Provide at each end suction pump a suction diffuser with integral strainer of size and type noted on the drawings.

- B. Construct unit of cast iron, angle type body with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16" diameter openings for pump protection.
- C. Equip orifice cylinder with a disposable, fine mesh strainer which shall be removed after system start-up.
- D. Design orifice cylinder to withstand pressure differential equal to pump shutoff head and have a free area equal to five times cross-sectional area of pump suction opening.
- E. Design vane length not less than 2-1/2 times the pump connection diameter.

## 2.5 P.T. TEST PLUGS

- A. Provide 1/4" solid brass pressure/temperature test plugs at locations shown on drawings.
- B. Provide N2 Nordel self-closing valve rated for 275 degrees F service.
- C. P.T. test plugs shall be installed at the following locations and elsewhere as shown on the drawings.
  - 1. Entrance and exit of building when connected to the chilled water central plant.
  - 2. At suction and discharge of pumps.
  - 3. At water inlet and outlet of heat exchanger.
  - 4. At water inlet and outlet of air handling unit coils.
  - 5. Adjacent to each pressure gauge and thermometer.

## 2.6 PRESSURE GAUGES

- A. Type: Round face, dial type by Tterice.
- B. Tterice 800 LF, 3-1/2" face, glycerin filled, ASME B40.1 Grade A accuracy, 1% full scale.
- C. Tterice P500, 4-1/2" face, ASME B40.1 Grade A accuracy, 1% full scale; stainless steel Bourdon tube for high operating Temperatures. 0-100 psi range for hot water.
  - 1. Reheat hot water - 0-100 psi
- D. Gauge Cocks: Tterice Model 735 needle valves.
- E. Provide Tterice Model 872 snubber on all gauges.

## 2.7 THERMOMETERS

- A. Range:
  - 1. Reheat hot water: 30 degrees F - 240 degrees F

## 2.8 THERMOMETER TEST WELLS

- A. Provide Tterice stainless steel thermometer test wells at locations shown on drawings.
- B. Provide stainless steel test wells with 2-1/2" extension neck and screw plug capped with chain and filled with light clear oil.

## 2.9 RELIEF VALVES

- A. Provide relief valves for each hydronic system as shown on drawings.

- B. Construct valve to ASME requirements, tested by National Board of pressure vessels, and labeled with ASME symbol.
- C. Construct valve body of non-ferrous material.
- D. Provide diaphragm type valve operating with slow opening and closing feature.
- E. Valve to seat against face of EPDM rubber.
- F. Set differential between opening and closing pressure to prevent water flash and water hammer.
- G. Include manual lever for testing valve.

#### 2.10 TRIPLE DUTY VALVES

- A. Type: Similar to Bell & Gossett No. 3DS.
- B. Provide triple duty valves as shown on the plans that incorporate non-slam, vertical lift check, calibrated balance, and positive shutoff, all in one valve.
- C. Provide valve weighted disc, hand lap seat and disc, and suitable for 300 degrees F operating temperature.
- D. Unit to be cast iron body construction, suitable for maximum working pressure as specified on drawings.

#### 2.11 FLOW MEASURING STATION

- A. Type: Similar to Bell & Gossett, Type OP.
- B. Provide orifice insert with provisions for connecting a portable differential pressure meter for flow measurement.
- C. Plate all surfaces and provide with name tags showing the capacity curve applicable to this meter.
- D. Provide brass threads on sizes 1/2" thru 2" machine 2-1/2" thru 4" for socket weld; 5" and above for butt weld.
- E. Provide meter connections with built-in check valves suitable for working pressure as specified on drawings at 250 degrees F.
- F. Provide measuring station with engraved tag attached indicating design flow, pressure, and flow characteristics of station.

#### 2.12 AUTO-FLOW BALANCE VALVE

- A. Type: Similar to Flow Design Model AC with 2-32 psi spring range.
- B. Factory set to automatically limit flow to within 5% of flow range. Pressure drop through valve shall not exceed 5 ft. for 2 inch size. Valves flow range shall be independently tested and certified by professional engineer.

- C. Provide with removable cartridge without the use of special tools or cutting piping. Provide two extended pete ports on each valve to clear insulation.
- D. Valve shall be constructed for 400 psig design at 250 degrees F. The flow cartridge shall have stainless steel internal parts. Machined threads shall be provided to adjust cartridge height without the use of shims or crimped sheet metal. Valve body shall be brass with brass ball valve and 'O' ring type union. All valves shall be factory leak tested.
- E. Provide integral union on the downstream side of the assembly.
- F. Refer to piping details for additional information.
- G. Provide electronic pressure (0-75 psi) and temperature (-10 - 230 F) test kit.

#### 2.13 FLOW BALANCING VALVE

- A. Type: Similar to Armstrong "CBV", B & G "Circuit Setter" or Taco "AccuFlow".
- B. Provide calibrated, non-ferrous valve with provisions for connecting a portable differential pressure meter for flow measurement and balance.
- C. Provide meter connections with built-in check valves.
- D. Provide integral pointer to register degree of valve opening with tamper proof memory feature.
- E. Provide valve with drain connection.
- F. Construct valve with integral seals to prevent leakage around rotating element.
- G. Construct valve for 125 psi working pressure at 150 degrees F.
- H. Provide preformed polyurethane insulation for easy access to valve without disturbing field applied adjacent insulation.
- I. Provide valve with engraved tag attached indicating design flow, pressure, and flow characteristic of station.

#### 2.14 FLOW MEASURING METER

- A. Type: Similar to Bell & Gossett, Model RO-5.
- B. Provide portable readout meter capable of indicating pressure differential across previously specified flow measuring devices.
- C. Provide necessary hoses, shutoff and vent valves, and carrying case.
- D. Reading range to be midscale of units to be read.
  - 1. SPX/APV
  - 2. Tranter

#### 2.15 STRAINERS

- A. Acceptable Manufacturers: Mueller, Keckley, Elliott, Webster.

- B. Cast semi-steel body or cast iron construction for steel piping and bronze body construction for copper piping; equipped with removable, Monel or stainless steel 20 mesh, water screen; maximum pressure drop 2 psi with free area at least four times area of pipe. Provide with blow-off outlet piped to nearest floor drain.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install hydronic specialty items in locations shown on drawings.
- B. Insulate any components subject to sweating or any hot or cold service in accordance with Section 23 07 00.
- C. Utilize manufacturer's instructions to install specialty items. Manufacturer's instructions must be adhered to for proper operation of air removal devices and flow control valves.
- D. Provide manual air vents at top of pipe risers and other locations where air can be trapped or collected.
- E. Pipe relief valve outlets and drain connections from hydronic systems to nearest floor drain.
- F. Support pump inlet and strainer fittings with floor mounted pipe and flange supports.
- G. Locate thermometers and pressure gauges no higher than 7 feet above finished floor elevation, positioned to be read from the floor.
- H. After systems are started up, placed in service and tested/adjusted to perform as designed, contractor shall provide competent representative to demonstrate proper operation and provide instruction to maintenance personnel to include performance on both cooling and heating cycles.

END OF SECTION 230519

## SECTION 230523 - VALVES FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 232000: HVAC Piping.

#### 1.2 QUALITY ASSURANCE

- A. Boiler Valves: ASME Boiler Code Specifications.
- B. Valve Bodies, Shells, and Seats: Factory tested.
- C. Bronze Body Valves:
  - 1. Materials for pressure containing parts: ASTM B-62 (less than 200 psi), B-61 (200 psi and above).
  - 2. Design, workmanship, testing: MSS-SP-80.
- D. Iron Body Valves:
  - 1. Materials for pressure containing parts:
    - a. ASTM A126, Grade B.
    - b. ASTM A536, Grade 65-45-12.
  - 2. Face-to-face and end-to-end dimensions: ANSI B16.10.
  - 3. Design, workmanship, testing: MSS-SP-70, 71.
- E. Butterfly Valves:
  - 1. Face-to-face and end-to-end dimensions: MSS-SP-67.
  - 2. Grooved end valves shall be of the same manufacturer as adjoining couplings.
- F. Valve Stems: ASTM B584-78, Class 13C (cast silicon brass), ASTM B-371-79, Alloy A (rolled silicon brass), or other material equally resistant to dezincification.
- G. Pressure Castings: Free of impregnating materials.
  - 1. Castings used for coupling housing, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
- H. Valve name or trademark and working pressure stamped or cast into body.
- I. Standard for 200 PSI and 300 PSI Valves with Metallic Seats: ASTM B61-76

### 1.3 SUBMITTALS

- A. Submit product data for review.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Iron Body Valves: Nibco, Kitz, Stockham, Crane, Milwaukee, Dezurik, Mueller, Kennedy, or Victaulic.
- B. Bronze Body Valves: Nibco, Kitz, Stockham, Milwaukee, Dezurik, Kennedy or Victaulic.
- C. Butterfly Valves: Nibco, Kitz, Stockham, Crane, Mueller, Dezurik, Keystone or Victaulic.
- D. Ball Valves: Nibco, Kitz, Apollo, Watts, Milwaukee, Jamesbury, Hammond or Victaulic.

### 2.2 MATERIALS

- A. Nibco Figure numbers are indicated below unless noted otherwise:
- B. Check Valves:
  - 1. HVAC Circulating Water Piping:
    - a. System pressures 125 psi and less: Figure 910, non-slam.
    - b. System pressures 126 psi to 250 psi: Figure 960, non-slam.
    - c. Grooved end valves for system pressures 300 psi and less: Victaulic Series 716 (sizes to 12"); 230 psi and less: Victaulic Series W715 (14" through 24").
  - 2. Food Service Heat Rejection Piping:
    - a. System pressures 125 psi and less: Figure 910, non-slam.
    - b. System pressures 126 psi to 250 psi: Figure 960, non-slam.
    - c. Grooved end valves for system pressures 300 psi and less: Victaulic Series 716 (sizes to 12"); 230 psi and less: Victaulic Series W715 (14" through 24").
- C. Ball Valves:
  - 1. HVAC Circulating Water Piping:
    - a. 2" and less, Figure T-585-70 or S-585-70, 2-piece, full port, 600 psi, WOG, TFE seats.
  - 2. Food Service Heat Rejection Water Piping:
    - a. 2" and less, Figure T-585-70 or S-585-70, 2-piece, full port, 600 psi, WOG, TFE seats.

3. Provide ball valves with locking handles.
  4. Provide extended lever for insulated service.
- D. Butterfly Valves - 2-1/2" and Up:
1. HVAC Circulating Water Piping:
    - a. Figure LD-2000, lug type, 200 psi, Class 125, EPDM liner, aluminum bronze disc.
  2. Food Service Heat Rejection Water Piping:
    - a. Figure LD-2000, lug type, 200 psi, Class 125, EPDM liner, aluminum bronze disc.
    - b. Victaulic MasterSeal, grooved end, 300 psi, EPDM pressure responsive seat and aluminum-bronze disc.
      - 1) For sizes 14" through 24", Victaulic AGS-Vic300.
  3. Butterfly valves rated bubble tight for dead end service at full pressure in both directions without the need for downstream blind flange.
  4. Provide hand wheel and closed housing worm gear on valves 8 inches and larger. Provide clamp lock hand lever operators on valves less than 8 inches.
- E. Lubricated Plug Cocks:
1. For valves 2" and less, Nordstrom Figure No. 114.
  2. For valves 2-1/2" to 4", Nordstrom Figure No. 115.
  3. For valves 5" and up, Nordstrom Figure No. 169.
  4. Provide visual position indicators on all plug cocks.
- F. Valve Connections: Two inches and smaller - threaded; 2-1/2 inches and larger - flanged.
- G. Provide chain operators for gate valves, butterfly valves, and plug cocks located in mechanical rooms as required by mechanical plans or where valves are mounted above 7'-0" A.F.F.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Furnish and install valves in each piping connection at each piece of HVAC equipment to allow equipment to be isolated from piping systems.
- B. Furnish and install valves in all piping systems to isolate each floor or main section of the building. Install sufficient number of valves to minimize the portion of the system which must be shut down for service or maintenance purposes.
- C. Install valves in water piping systems so ordinary maintenance work can be performed on the equipment that the valves isolate, without having to drain the system beyond the valve.
- D. Locate valves so as to be easily accessible by maintenance personnel.

- E. Locate ceiling/wall access panels at shut-off and control valves for proper access and operation. Furnish and install access doors in accordance with Section 230500 and other Divisions as applicable.

END OF SECTION 230523

## SECTION 230529 - PIPE HANGERS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 230700: HVAC Insulation.
- B. Section 232000: HVAC Piping.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Anvil, Carpenter and Patterson, Fee and Mason, B-Line, Viking, Reliable, and Michigan. Anvil numbers are used for reference.

#### 2.2 HANGERS

- A. Anvil Figure #260 MSS Type 1, clevis hangers for:
  - 1. Non-insulated steel and galvanized piping 2" through 24" diameter.
  - 2. Non-insulated cast iron pipe.
  - 3. Non-insulated PVC piping.
- B. Anvil Figure CT-69, MSS Type 10 with adjustable wrought tubing ring hanger, copper-plated for:
  - 1. Non-insulated copper tubing with no longitudinal movement.
- C. Anvil Figure #CT-121, MSS Type 8, riser clamps (at floor penetrations) to support:
  - 1. Copper pipe risers.
- D. Anvil Figure #261, MSS Type 8, riser clamps (at floor slab penetrations) to support:
  - 1. Steel pipe risers.
  - 2. PVC pipe risers.
- E. Anvil Anvil-Strut Trapeze Hangers: Where three or more lines of pipe run parallel, support them with trapeze hangers, sized for maximum 3/16" deflection.

## 2.3 INSERTS

- A. Concrete Insert: Anvil Figure #281, MSS Type 18, universal concrete inserts, adequately sized and correctly positioned to support full load operating systems.
- B. Concrete Insert, Wedge Type: Anvil Figure #281, 1/4" to 7/8".
- C. Lightweight Concrete Insert: Anvil Figure #285.
- D. Continuous Concrete Insert: Anvil Powerstrut Figure #PS-349 pre-galvanized.

## 2.4 EXPANSION ANCHORS

- A. Hilti Kwik-bolt, zinc-plated, metal expansion anchor.
- B. Anchor to meet U.L., ICBO-4627 and FM listings.

## 2.5 CLAMPS

- A. C-Clamps: Anvil Figure #92, MSS Type 23.
  - 1. Use these for attaching hangers to steel beams. Do not weld hanger rods to structural steel members.
- B. Malleable Beam Clamps: Anvil Figure #218, MSS Type 30: Use these for attaching hangers to bar joists.

## 2.6 HANGERS RODS

- A. Provide mild steel, all-thread rods with maximum loads as follows:
  - 1. 3/8" - 300 lbs.
  - 2. 1/2" - 600 lbs.
  - 3. 5/8" - 1,200 lbs.
  - 4. 3/4" - 2,000 lbs.
  - 5. 1" - 5,000 lbs.

# PART 3 - EXECUTION

## 3.1 PIPE HANGERS

- A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight or stresses from vibration and swaying of pipe. Support pipe risers at regular intervals in pipe shafts at least once at each floor level or a maximum of 12'-0" apart. Do not use perforated metal, strap iron, or band iron. Do not make offsets in hangers.

- B. Maximum allowable spacing of pipe hangers is listed below. Space hangers and brackets at closer intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging or swaying of pipe.
- C. Steel Pipe - Water:
1. 1/4" to 1-1/2" - 7' 0" oc.
  2. 2" to 2-1/2" - 10' 0" oc.
  3. 3" to 4" - 12' 0" oc.
  4. 4" and above - 14' 0" oc.
- D. Copper Pipe - Water:
1. 1/4" to 1-1/2" - 5' 0" oc.
  2. 2" to 2-1/2" - 8' 0" oc.
  3. 3" and above - 10' 0" oc.
- E. Copper Pipe - Vapor:
1. 1/4" to 1" - 5' 0" oc.
  2. 1-1/4" to 2" - 8' 0" oc.
  3. 2-1/2" to 4" - 10' 0" oc.
  4. 5" and above - 15' 0" oc.
- F. PVC Pipe:
1. 3/4" to 3" - 4' oc.
  2. 4" and above - 8' oc.
- G. Polypropylene Pipe:
1. 3/4" to 3" - 2' oc.
  2. 4" and above 4' oc.
- H. Sway Bracing:
1. Provide sway bracing and additional supports to meet the seismic bracing requirements.

END OF SECTION 230529

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230548 - VIBRATION AND SEISMIC ISOLATION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

##### A. Intent:

1. All mechanical, plumbing and fire protection equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
2. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
3. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.
4. All such systems must be installed in strict accordance with seismic codes, component manufacturers and building construction standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.
5. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements.
6. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
7. Seismic restraints shall be designed in accordance with seismic force levels as detailed in Section 1.6.

##### B. The work in this section includes, but is not limited to the following:

1. Vibration isolation for piping, ductwork and equipment.
2. Equipment isolation bases.
3. Flexible piping connections.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Certification of seismic attachment of housekeeping pads.
8. All mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification). (Items noted with \* require solid bracing only.)
  - a. AC Units.
  - b. Fans (All types).
  - c. Tanks (All types).
  - d. Air Distribution Boxes.
  - e. Compressors.
  - f. Generators.
  - g. Transformers.
  - h. Air Handling Units.

- i. Computer Room Units.
- j. Air Separators.
- k. Condensers.
- l. Light Fixtures.
- m. Unit Substations\*.
- n. Battery Racks\*.
- o. Condensing Units.
- p. Motor Control Centers\*.
- q. VFDs\*.
- r. Boilers.
- s. Conduit.
- t. Piping.
- u. Water Heaters.
- v. Bus Ducts\*.
- w. Pumps (All types).
- x. Cabinet Heaters.
- y. Ductwork.
- z. Switchgear.
- aa. Cable Trays\*.
- bb. Electrical Panels.

C. Definitions:

1. Life Safety Systems:

- a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
- b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
- c. Smoke management systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

2. Positive Attachment:

- a. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided ACI Type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic attachment points.

3. Transverse Bracing:

- a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.

4. Longitudinal Bracing:

- a. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

## 1.2 SUBMITTAL DATA REQUIREMENTS

A. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:

1. Descriptive Data:

- a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
- b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.

2. Shop Drawings:

- a. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
- b. Provide all details of suspension and support for ceiling suspended equipment.
- c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturer's submittals must include spacing, static loads and seismic loads at all attachment and support points.
- d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

3. Seismic Certification and Analysis:

- a. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
- b. All restraining devices shall have a pre-approval number from a recognized government agency showing maximum restraint ratings. Pre-approvals based on independent testing are preferred to pre-approvals based on calculations. Where pre-approved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45E to the weakest mode.
- c. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in Section 1.6 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

## 1.3 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable Codes and Standards:

1. IBC {{2006, 2003 or 2000}} with applicable amendments.

#### 1.4 MANUFACTURER'S RESPONSIBILITY

- A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
  1. Determine vibration isolation and seismic restraint sizes and locations.
  2. Provide vibration isolation and seismic restraints as scheduled or specified.
  3. Provide calculations and materials if required for restraint of unisolated equipment.
  4. Provide installation instructions, drawings and trained field supervision to ensure proper installation and performance.

#### 1.5 RELATED WORK

- A. Supplementary Support Steel:
  1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc., including roof mounted equipment, as required or specified.
- B. Attachments:
  1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double-sided beam clamps, etc., in accordance with the requirements of the vibration vendors calculations.

#### 1.6 SEISMIC FORCE LEVELS

- A. Design restraints, isolators, anchors, bracing and attachments for Seismic Design Category {{C}} or as noted on Contact Documents. Comply with requirements of IBC 2006 and ASCE 7-05.

### PART 2 - PRODUCTS

#### 2.1 INTENT

- A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. Mason Industries products are the basis of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with the specification and have the approval of the specifying engineer. Submittals and certification sheets shall be in accordance with Section 1.2.
- B. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater than 1/4" (6mm).

## 2.2 PRODUCT DESCRIPTIONS

### A. Vibration Isolators and Seismic Restraints SPECIFICATION/NUMBER:

1. Two layers of 3/4" thick neoprene pad consisting of 2" square waffle modules separated horizontally by a 16-gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be Type Super "W" as manufactured by Mason Industries, Inc.
2. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall be Type BR as manufactured by Mason Industries, Inc.
3. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be Type PB as manufactured by Mason Industries, Inc.
4. A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be Type HG as manufactured by Mason Industries, Inc.
5. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be Type SLF as manufactured by Mason Industries, Inc.
6. Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. Installed and operating heights are equal. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Restraining Bolts shall have a neoprene bushing between the bolt and the housing. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall be Type SLR or SLRS as manufactured by Mason Industries, Inc.
7. Spring mountings as in Specification 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4" travel in all directions before contacting the resilient snubbing collars. Mountings shall be Type SSLFH as manufactured by Mason Industries, Inc.

8. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8". Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be Type MT and leveling valves Type LV as manufactured by Mason Industries, Inc.
9. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be Type SLR-MT as manufactured by Mason Industries, Inc.
10. Hangers shall consist of rigid steel frames containing minimum 1-1/4" thick neoprene elements at the top and a steel spring with general characteristics as in Specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30E arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30E capability. Hangers shall be Type 30N as manufactured by Mason Industries, Inc.
11. Hangers shall be as described in 10, but they shall be supplied with a combination rubber and steel rebound washer as the seismic upstop for suspended piping, ductwork, equipment and electrical cable trays. Rubber thickness shall be a minimum of 1/4". Submittals shall include a drawing of the hanger showing the installation of the rebound washer. Hangers shall be Type RW30N as manufactured by Mason Industries, Inc.
12. Hangers shall be as described in 10, but they shall be pre-compressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30E capability. Hangers shall be Type PC30N as manufactured by Mason Industries, Inc. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall be Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.
13. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Solid seismic brace assemblies shall be Type SSB, SSBS or SSRF as manufactured by Mason Industries, Inc.

14. Note: Specifications 12 - 14 apply to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze. Specifications apply to hanging equipment as well.
15. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Pre-approval Number. Rod clamp assemblies shall be Type SRC or UC as manufactured by Mason Industries, Inc.
16. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross brace shall be Type CCB as manufactured by Mason Industries, Inc.
17. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4" (6mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm<sup>2</sup>). A minimum air gap of 1/8" (3mm) shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to ensure no short circuits exist before systems are activated. Snubber shall be Type Z-1225 as manufactured by Mason Industries, Inc.
18. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" thick. Rated loadings shall not exceed 1000 psi). Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" nor more than 1/4". Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8" deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable (G) force. Submittals shall include the load deflection curves up to 1/2" deflection in the x, y and z planes. Snubbers shall be Type Z-1011 as manufactured by Mason Industries, Inc.
19. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is rolled up to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be Type SAS as manufactured by Mason Industries, Inc.
20. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be Type SAB as manufactured by Mason Industries, Inc.
21. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14" (350mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1". Bases shall be Type WF as manufactured by Mason Industries, Inc.

22. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6". The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable. Base shall be Type BMK or K as manufactured by Mason Industries, Inc.
23. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal or structural steel sections containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4" thick. Steel springs shall be laterally stable and rest on 1/4" thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs water-proofing shall consist of a continuous flexible flashing nailed over the lower curbs water-proofing. All spring locations shall have accessibility to adjust springs. Lower curbs shall have provision for 2" of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit must be solidly fastened to the top floating rail, and the lower section anchored to the roof structure. Curb shall be Type SRSC or RMSS as manufactured by Mason Industries, Inc.
24. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16" to 24" may be single sphere. Sizes 3/4" to 1-1/2" may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi up to 170° with a uniform drop in allowable pressure to 215 psi at 250 deg in sizes through 14". 16 through 24" single sphere minimum ratings are 180 psi at 170 and 150 psi at 250 deg. Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.
25. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have 1/2" thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi maximum on the washer area.
26. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be Type SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

27. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:
- a. Flanged:
    - 1) 3" x 12"
    - 2) 6" x 18"
    - 3) 12" x 24"
    - 4) 4" x 12"
    - 5) 8" x 18"
    - 6) 14" x 30"
    - 7) 5" x 18"
    - 8) 10" x 18"
    - 9) 16" x 32"
  - b. Male Nipples:
    - 1) 1/2" x 12"
    - 2) 1-1/4" x 12"
    - 3) 2" x 12"
    - 4) 3/4" x 12"
    - 5) 1-1/2" x 12"
    - 6) 2-1/2" x 18"
    - 7) 1" x 12"
28. At equipment, hoses shall be installed on the equipment side of the shut-off valves horizontal and parallel to the equipment shafts wherever possible. Hoses shall be Type FFL or Type MN as manufactured by Mason Industries, Inc.
29. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be Type ADA as manufactured by Mason Industries, Inc.
30. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of 1-5/8" motion, or to meet location requirements. Pipe guides shall be Type VSG as manufactured by Mason Industries, Inc.
31. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" past either face of the wall. Where temperatures exceed 240 deg, 10# density fiberglass may be used in lieu of the sponge. Seals shall be Type SWS as manufactured by Mason Industries, Inc.

32. The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in Specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be Type WBI/WBD as manufactured by Mason Industries, Inc.
33. Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor shall be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping pad anchors shall be attached to the structural slab using a stud wedge anchor. Housekeeping pad anchors shall be Type HPA and stud wedge anchor shall be Type SAS both as manufactured by Mason Industries, Inc.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.
- B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.
- C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.
- D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. Building includes, but is not limited to, slabs, beams, columns, studs and walls.
- E. Coordinate work with other trades to avoid rigid contact with the building.
- F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- G. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.
- H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor's expense.
- I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:

1. Flanges of structural beams
  2. Upper truss cords in bar joist construction.
  3. Cast-in-place inserts or wedge type drill-in concrete anchors.
- J. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.
- K. At locations where Specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with Specification 14 braces.
- L. At locations where Specification 12 cable restraints are installed on support rods with spring isolators, the spring isolation hangers must be Specification Type 10A.
- M. At all locations where Specification 12 or 13 restraints are attached to pipe clevis, the clevis cross bolt must be reinforced with Specification Type 15 braces.
- N. Drill-in concrete anchors for ceiling and wall installation shall be Specification Type 18 and Specification Type 19 female wedge type for floor mounted equipment.
- O. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.
- P. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed Specification 23 capabilities.
- Q. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide Specification 27 wall seals.
- R. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be Specification Type 28 (see selection guide).
- S. Locate isolation hangers as near to the overhead support structure as possible.
- T. All fire protection piping shall be braced in accordance with NFPA 13 and 14.
- U. All fire protection equipment is considered Life Safety equipment and shall be seismically restrained using the seismic force levels for Life Safety equipment in Table 1.6-1, if higher levels are shown.
- V. VAV boxes and fan powered equipment weighing less than 50 lbs (23kg) and rigidly connected to the supply side of the duct system and supported with a minimum of 4 hanger rods.

### 3.2 VIBRATION ISOLATION OF PIPING

- A. Horizontal Pipe Isolation: The first four pipe hangers in the main lines near the mechanical equipment shall be as described in Specification 11. Brace hanger rods with SRC clamps Specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in Specification 10 and 10A. Floor supported piping shall rest on isolators as described in Specification 6. Heat exchangers and expansion tanks are considered

part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1-1/2" deflection for pipe sizes up to and including 6", and 2-1/2" deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Hanger locations that also have seismic restraints attached must have Type RW Rebound Washers to limit uplift. Where piping connects to mechanical equipment install Specification 23 expansion joints or Specification 24 stainless hoses if 23 is not suitable for the service.

- B. Riser Isolation: Risers shall be suspended from specification 10A hangers or supported by Specification 5 mountings, anchored with Specification 25 anchors, and guided with Specification 26 sliding guides. Steel springs shall be a minimum of 0.75" (19mm) except in those expansion locations where additional deflection is required to limit load changes to (25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.
- C. Seismic Restraint of Piping:
1. Seismically restrain all piping listed as a, b or c below. Use Specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.
    - a. Gas piping that is 1" I.D. or larger.
    - b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1-1/4" I.D. and larger.
    - c. All other piping 2-1/2" diameter and larger. Transverse piping restraints shall be at 40' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
  2. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
  3. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
  4. Gas piping transverse restraints must be at 20' (6m) maximum and longitudinal restraints at 40' (12m) maximum spacing.
  5. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" (600mm) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
  6. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
  7. Branch lines may not be used to restrain main lines.
  8. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in areas with  $S_s$  of 0.35 or greater shall be braced as in Sections 3.2.C.2 and 3. For areas with  $S_s$  less than 0.35, 2 band clamps may be used with a reduced spacing of 1/2 of those listed in Sections 3.2.C.2 and 3.
  9. Connection to the structure must be made with a non-friction connection (i.e., no "C" clamps).
  10. Hanger locations that also have seismic restraints attached must have Specification 10A Type RW Rebound Washers.

D. Pipe Exclusions:

1. Gas piping less than 1" inside diameter
2. Piping in boiler and mechanical rooms less than 1-1/4" inside diameter
3. All other piping less than 2-1/2" inside diameter
  - a. All piping suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12" or less.
  - b. All trapezed piping where the distance from the suspension point to the trapeze member is 12" or less.
  - c. If any suspension location in the run exceeds the above, the entire run must be braced.

3.3 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF DUCTWORK

A. Vibration Isolation of Ductwork:

1. All discharge runs for a distance of 50' from the connected equipment shall be isolated from the building structure by means of Specification 10 hangers or Specification 5 floor isolators. Spring deflection shall be a minimum of 0.75".
2. All duct runs having air velocity of 1000 fpm or more shall be isolated from the building structure by Specification 11 hangers or 5 floor supports. Spring deflection shall be a minimum of 0.75".

B. Seismic Restraint of Ductwork:

1. Seismically restrain all ductwork with Specification 12 or 13 restraints as listed below:
  - a. Restrain rectangular ducts with cross sectional area of 6 sq.ft. or larger.
  - b. Restrain round ducts with diameters of 28" or larger.
  - c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
2. Transverse restraints shall occur at 30' intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
3. Longitudinal restraints shall occur at 60' intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA Duct Construction Standards.
4. The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
6. Walls, including gypsum board non bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

7. Connection to the structure must be made with a non-friction connection (i.e., no "C" clamps).
8. Hanger locations that also have seismic restraints attached must have Specification 10A Type RW Rebound Washers.

C. Ductwork Exclusions:

1. Rectangular and square and ducts that are less than 6 square feet in cross sectional area.
2. Oval ducts that are less than 6 square feet in cross sectional area based on nominal size.
3. Round duct less than 28" in diameter.
  - a. All trapezed ductwork where the distance from the suspension point to the trapeze member is 12" or less.
  - b. Ductwork hung with straps where the top of the duct is 12" or less from the suspension point and the strap has 2 #10 sheet metal screws within 2" of the top of the duct.
  - c. If any suspension location in the run exceeds the above, the entire run must be braced.

### 3.4 ELECTRICAL SERVICES

A. Seismic Restraint:

1. All electrical conduit 2-1/2" in diameter and larger shall be restrained with Specification Type 12 seismic cable restraints or Specification Type 13 for seismic solid brace restraints.
2. All electrical bus ducts, cable trays and ladder trays shall be restrained with Specification Type 12, seismic cable restraints or Specification 13 seismic solid brace restraints.
3. Transverse restraints shall occur at 30' intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.
4. Longitudinal restraints shall occur at 60' intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4' of the intersection of the electric run and if the restraints are sized for the larger electric run.
5. All floor mounted transformers, motor starters, switchgears and substations must have a resilient media between the equipment mounting hole and the anchor bolt. Anchor bolts shall be designed in accordance with Section 1.6 seismic forces. Neoprene bushings shall be Specification Type 4 and anchor bolts shall be Specification Type 18 or 19.
6. Wall mounted panels, transformers and motor starters shall be mounted with Specification Type 3 bushings. Floor mounted panels shall be mounted on Specification Type 4 bushings. Anchor bolts shall be Specification Type 18 or 19.
7. All generators shall be mounted on a Specification Type 21 concrete inertia base, with Specification Type 5 spring isolators and Specification Type 17 seismic snubbers.
8. Connection to the structure must be made with a non-friction connection (i.e., no "C" clamps).

B. Exclusions:

1. All conduit less than 2-1/2" diameter suspended by individual hanger rods.
  - a. All conduits suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12" or less.
  - b. All trapezed conduits, bus ducts and cable trays where the distance from the suspension point to the trapeze member is 12" or less.
  - c. If any suspension location in the run exceeds the above, the entire run must be braced.

END OF SECTION 230548

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Identification of HVAC piping and equipment as specified herein.

#### 1.2 RELATED WORK

- A. Division 01 73 29: Cutting and Patching.
- B. Division 01: Seismic Requirements.
- C. Division 01 33 23: Shop Drawings, Product Data, and Samples.
- D. Division 01 66 00: Product Storage and Handling Requirements.

### PART 2 - PRODUCTS

#### 2.1 NAMEPLATES AND TAGS

- A. Acceptable Manufacturers: Seton Nameplate Corporation, Marking Services Inc. or equal.
- B. Rigid plastic, "Setonite" or Bakelite with engraved lettering, minimum 1/2" high.
- C. Brass tags, at least 1-1/2" inches in diameter, with alpha-numeric I.D., permanently stamped black filled letters showing the service, and black filled numbers showing the valve or equipment number. At substantial completion, a schedule of all valves shall be submitted to the Architect and Owner's Representative.

#### 2.2 PIPE IDENTIFICATION AND PAINTING

- A. Identify all piping as specified herein painted under Division 09.
- B. Paint piping as specified in Division 09.
- C. Pipe Identification:
  - 1. Identify piping by stenciling or tagging (to denote contents and direction of flow) on piping at no more than 25 foot intervals at valves, and at least once in each separate space through which the pipe passes. Colors shall conform to ASME 13.1.
  - 2. Stenciling shall be a minimum of 2" high letters.

3. In addition to identifying, stencil design operating pressures in psig on steam piping.

## 2.3 EQUIPMENT AND APPARATUS IDENTIFICATION

- A. Acceptable Manufacturers: Seton Name Plate Corporation or equal.
- B. Nameplates: Rigid plastic, "Setonite" or Bakelite, with engraved lettering (indicating names and numbers of mechanical apparatus), a minimum of 1/2" high. Fill engraved lettering with a permanent coloring material which contrasts with color of tag material to allow for easy reading.
- C. Use names, numbers, and abbreviations appearing in schedules on Contract Drawings.
- D. Where stenciling is used to identify large pieces of equipment, such as boilers, chillers, air handling units, etc., stenciling shall be in a conspicuous place visible from control panel area and of at least one (1) inch letters and/or numbers. Large pieces of equipment may be stenciled with an oil based enamel or semi-gloss latex.
- E. Provide nameplates, located in a conspicuous location directly on the equipment or apparatus, for mechanical equipment including, but not limited to:
  1. Starters.
  2. Variable frequency drives.
  3. Pumps.
  4. Fans.
  5. HVAC equipment.
  6. Control panels.
- F. Name Tag Fasteners: Commercial quality, rust resisting nuts and bolts with backwashers, self-tapping screws, or rivets. If equipment surface does not allow for direct attachment, use copper or brass rings to attach tags.
- G. Valve Tags:
  1. Each manual and automatic control valve shall be identified with a brass tag. The tag shall contain an alpha-numeric I.D. which shall include floor-level and building section as part of the I.D.
    - a. Match existing identification scheme, if applicable.
  2. A valve schedule shall be provided to Architect and Owner's Representative. Mount valve schedule under glass and mount as directed by Owner's Representative.
  3. Securely fasten tags to valves with a brass "S" hook or chain.
- H. Control Diagram Frames:
  1. Seton Name Plate Corporation, No. 111P aluminum frames, or equal by Brady or Avery, with "Plexiglas" or "Lucite" glazing.
  2. Provide control and systems instructions and diagrams, framed and glazed with specified items. Mount framed diagrams on walls in conspicuous, easily accessible places in each separate equipment room housing an A/C system to which the individual diagrams are applicable. The following instructions and diagrams are required:

- a. Electrical control diagrams.
  - b. Wiring diagrams.
  - c. Sequence of operation, where applicable.
3. Diagrams and instructions may be reduced in size provided they are easily readable and lettering is not smaller than "10 pt." type.

END OF SECTION 230553

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Perform test and balance work by engaging services of an independent test and balance agency (TAB) which is engaged solely in full time test and balance work, is a member of the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).
- B. Perform test and balance in accordance with AABC or NEBB National Standards, including revisions to the date of the contract.

#### 1.2 SERVICES

- A. Commissioning:
  - 1. Section 019113 "Commissioning Requirements" requires the engagement of a Commissioning Agent to document the completion of the HVAC and Electrical systems upgrades for the project. Comply with the requirements of Section 019113 as a Commissioning Team member for the commissioning of the various building systems.
- B. During construction, the Balancing Agency shall inspect the installation of piping systems, sheetmetal work, temperature controls and other parts of the HVAC system. The inspections shall be performed periodically as work progress. A minimum of two inspections are required as followed:
  - 1. When 60 percent of the duct work is installed.
  - 2. When 90 percent of the equipment is installed.
  - 3. The TAB shall submit a written report of each inspection to the Owner's Representative.
- C. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space in the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the Contractor within a reasonable period of time, the balancing agency shall proceed to other systems to test as available or cease testing and balancing services and advise the Architect in writing of the deficiencies.
- D. If these specifications set forth more stringent requirements than the AABC or NEBB National Standards, these specifications shall prevail.

#### 1.3 QUALIFICATIONS OF THE TAB FIRM

- A. The firm shall have completed six projects of like size and scope.

- B. The firm shall maintain current insurance coverages in the minimum amounts specified in other sections of these specifications. The insurance coverage shall be carried with companies satisfactory to the Owner. Certificates of each of the above policies, together with a statement by the issuing company to the effect that said policy will not be cancelled without ten (10) days prior notice being given the Owner, shall be delivered to the Owner before any work is started.
- C. The firm shall be capable of performing the services specified at the location of the facility described within the time specified, of preparing and submitting the detailed report of the actual field work performed, and following up the basic work as may be required.
- D. The test and balance firm shall submit biographical data on the individual proposed to directly supervise the project. It shall also submit its record of at least two years specialized experience in the field of air and hydronic system balance, and shall possess calibrated instrumentation. The supervisory personnel for the test and balance firm shall be certified test and balance engineers. Project managers and technicians shall be permanent, full-time employees of the TAB firm.

#### 1.4 THE TAB REPORT

- A. The TAB activities will culminate in a report to the Owner's representative. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operating personnel.
- B. Measurements and recorded readings of (air, water, electricity, etc.) that appear in the reports must be done on-site by the permanently employed technicians or engineers of the firm.
- C. Comment sheets and punch lists shall be signed by the Contractor to acknowledge receipt. Any outstanding items at the time of completion shall be included in the report.
- D. The report shall be certified and approved by the test and balance engineer of the firm.

### PART 2 - PRODUCTS

#### 2.1 NOT APPLICABLE

### PART 3 - EXECUTION

#### 3.1 SYSTEMS PREPARATION

- A. Contractor shall ensure the building and systems are ready for test and balance.
- B. Test and balance contractor shall meet the following requirements for CalGreen and LEED. Perform building flush out by supplying total air volume of 14,000 cubic feet per square foot of floor area.
- C. The TAB shall perform its services in close coordination with the equipment vendors and other trades of Division 23 work, including sheetmetal, piping, and controls.

- D. Correct deficiencies of materials and workmanship identified as delaying completion of TAB work.
- E. Complete operational readiness of the building requires that construction status of the building shall permit the closing of doors, windows, and ceilings installed to obtain projected operating conditions.
- F. Complete operational readiness of the air conditioning systems as described herein.
- G. Air Distribution Systems:
  - 1. Verify installation for conformity to design. Supply, return, outside air and exhaust ducts terminated and pressure tested for leakage as required by specifications.
  - 2. Verify that volume, fire and smoke dampers are properly located and are functional. Dampers shall be fully open or in the neutral position. Manual volume damper gradients and spin damper handles shall be exposed through insulation. Dampers shall be pre-set to full open position with unrestrictive movement from full closure to full open. All dampers shall be verified to have locking devices installed. Dampers serving requirements of minimum and maximum outside, return and relief air shall provide tight closure and full opening, smooth and free operation. Verify that electric actuators have control power and are properly connected for full operation of system test.
  - 3. Supply, return, exhaust and transfer grilles, registers, diffusers, terminal units with controls and filters installed. All air devices shall be cleaned externally and internally. All opposed blade volume face dampers shall be cleaned and set to full open.
  - 4. Air handling systems, units, duct systems and associated apparatus, such as heating and cooling coils, filter sections, and access doors shall be blanked and/or sealed to eliminate excessive by-pass or leakage of air.
  - 5. Fans (supply, return and exhaust) operating at full load and verified for freedom from vibration, proper fan rotation and belt tension; heater elements in motor starters to be of proper size and rating. Check motor amperage and verify that it is at nameplate rating.
  - 6. Verify proper installation of duct mounted smoke detectors.
  - 7. Prior to systems testing, ensure new pre-filters and final filters are installed on:
    - a. Air handling units.
    - b. Return air filter grilles.
- H. Water Circulating Systems:
  - 1. Check and verify pump alignment and rotation. Verify location of gauge cocks or PT test plugs.
  - 2. Open valves to full open position, close by-pass stop valves. Set mixing valves to full flow through systems components. Remove and clean all strainers. Repeat operation until circulating water is clean and free of air. Purge all air from water lines including, coils, risers, heat exchangers and other equipment.
  - 3. Record each pump motor amperage on each phase and voltage after reaching rated speed. Amperage shall not exceed nameplate full load amps.
  - 4. Verify proper size and rating of electrical heater elements.
  - 5. Water circulating systems shall be full and free of air; expansion tanks set for proper water level; air vents installed at high points of systems and operating freely. Set system static pressure 10 feet water column above highest system elevation.
  - 6. Check and set operating temperatures of heat exchangers to design requirements.
  - 7. Verify that piping to cooling coils is complete and set for counter flow. Verify location of thermometer wells, gauge cocks and balance cocks for coils.

8. Check and set operating temperatures of chillers and boilers as noted on the drawings for system operation.

I. Automatic Controls:

1. Verify that control components are installed in accordance with project requirements and functional, including electrical interlocks, damper sequences, air and water resets, fire and freezestats, temperature/humidity sensors and high and low limit switches.
2. Verify that airflow and static pressure transmitters are installed and calibrated.
  - a. Ensure proper startup and operation of variable frequency drives.
3. Verify that controlling instruments are calibrated and set for designed operating conditions.
4. Verify variable frequency devices are adjusted in manual mode, to allow drive to meet rated motor nameplate amps.

J. Notification of System Readiness:

1. After completion of the work above, notify the TAB certifying that the work has been accomplished and that the building and the air conditioning systems are ready for testing, adjusting, and balancing.
2. Provide to the TAB all project drawings and specifications, addendums, approved HVAC related revisions, RFIs, Division 23 equipment submittal data, approved shop drawings, approved HVAC wiring diagrams, control diagrams, and equipment brochures as appropriate.

- K. As part of bid, Contractor shall include costs necessary to make any changes in the sheaves, belts, dampers and other devices required for correct balance as required by the TAB.

- L. Provide and coordinate services of qualified, responsible trades, suppliers and personnel as required to correct, repair, adjust or replace any and all deficient items or conditions found during the testing, adjusting and balancing period.

- M. In order that all systems may be properly tested, balanced, and adjusted, operate said systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB.

- N. Project completion schedules shall provide sufficient time to permit the completion of TAB services prior to Owner occupancy.

- O. Install devices to allow access to the devices for adjustment. Should any such device not be readily accessible, Contractor shall provide access as requested by the TAB firm. Also, any malfunction encountered by TAB personnel shall be reported to the Architect. Correct report malfunction so balancing work can proceed.

### 3.2 TAB PROCEDURES

- A. The TAB shall perform trouble shooting functions such as obtaining by measurement static pressure profiles, temperature and pressure reading, or additional traverses to assist in determining any system balancing problems. The TAB shall render to the Contractor and Architect suggested solutions to any balancing problem which may occur.

B. Rooftop Units (RTU):

1. Supply Air:

- a. Fans at RTUs checked for rotation, measure and record motor amperage, fan static pressure drops, RPM etc. Measure and record supply outlets prior to fan adjustments and with all integral volume dampers at 100% open.
- b. Submit this preliminary TAB Report to the Engineer for review and approval to proceed.
- c. Balance outlets within 10% of design CFM.
- d. While balancing supply grilles, verify that all grilles have blades aligned and throw angle set as specified per the drawings. Report all discrepancies at each grille.
- e. Measure and record final total supply air through a pitot tube traverse and record static pressure at traverse point. Adjust fan speed to produce design CFM while maintaining minimum system static pressure for proper operation. This procedure maintains required air quantities and minimum energy consumption.
- f. If a pitot tube traverse is not practical, the summation of the outlets may be used. An explanation why a traverse was not made must be presented on the appropriate data sheet.
- g. Inspect supply air system and identify system air leakage through traverse and outlet summation.
- h. If traverse quantities and outlet summations differ more than 5% then an explanation must be presented with appropriate recommendations. Report traverse and outlet totals compared to reading from airflow measuring station. If necessary, coordinate the recalibration of the airflow transmitter to ensure proper operation of the control functions. Coordinate with the temperature control vendor to ensure traverse and airflow station reading are in agreement.
- i. Measure final static pressures across each component under full load condition.

2. Return Air:

- a. Fans checked for rotation, measure and record, motor amperage, fan static pressure, drops RPM etc. Measure and record return inlets prior to fan or damper adjustments.
- b. With supply system in the maximum mode, proportion return inlets.
- c. With supply system in the maximum mode, traverse and adjust return fan to design cfm. Re-measure and adjust return inlets within 5% of design cfm.
- d. Measure and record final total return air through a pitot tube traverse and record flow and static pressure at traverse point.
- e. If a pitot tube traverse is not practical, the summation of the outlets may be used. An explanation of why a traverse was not made must be presented in the appropriate data sheet.
- f. Identify system air leakage through traverse and inlet summation.
- g. If traverse quantities and outlet summations differ more than 5% then an explanation must be presented with appropriate recommendations. Report traverse and outlet totals compared to reading from airflow measuring station. If necessary, coordinate the recalibration of the airflow transmitter to insure proper operation of the control functions. Coordinate with the temperature control vendor to ensure traverse and airflow station reading are in agreement.

3. Outside Air:

- a. With supply system in the maximum mode, adjust minimum outside air damper to design through pitot tube traverse. Measure and record traverse and static pressure. If a pitot tube traverse is not practical, the percentage of outside air maybe determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat of compression and motor heat where applicable. Record all temperatures.
    - b. After completion, take total air handling unit static profile and record all final statics, motor amperage and rpm, and cfm.
  - 4. Exhaust Air:
    - a. Fans checked for rotation, measure and record motor amperage, rpm, fan static pressure drops etc. Measure and record exhaust inlets prior to fan or damper adjustment.
    - b. Ensure backdraft damper is open and has free operation.
    - c. Perform pitot tube traverse, and proportion main branch lines on major exhaust systems and hooded fans, where possible.
    - d. Proportion exhaust inlets.
    - e. Adjust fan speed to achieve design CFM and adjust inlets to within 5% of design.
    - f. Measure and record final total exhaust air through a pitot tube traverse and record static pressure and flow at traverse point.
    - g. If a pitot tube traverse is not practical, the summation of the outlets may be used. An explanation of why a traverse was not made must be presented in the appropriate data sheet.
    - h. Inspect exhaust air system and identify system air leakage through traverse and inlet summation.
    - i. If traverse quantities and outlet summations differ more than 5% then an explanation must be presented with appropriate recommendations.
  - 5. Ventilation and Pressurization Verifications:
    - a. Balance each supply, return and exhaust air outlet within 5% of design. On systems with volumetric fan control, ensure supply and return air fans are tracking to maintain design outside air.
  - 6. Duct Mounted Smoke Detectors:
    - a. Measure and record pressure differential across intake and exhaust tubes. Pressure differential must be within manufacturer's recommendation for specific duct velocity.
    - b. Report pressure differential for each duct mounted smoke detector on final TAB report.
- C. Controls:
- 1. AHU Controls:
    - a. TAB shall notify Architect of any control device not properly installed, calibrated or functioning to meet the full intent of the Contract Documents.
    - b. For DDC systems, the TAB shall work closely with the controls supplier to verify calibration of all control, sensing and measuring devices. Actual measurements at devices shall match readouts at the BAS computer.

- c. Check temperature controls for proper calibration and setpoint. Record final temperatures.
  - d. Check economizer controls for proper damper operation and control calibration (outside air conditions may preclude actual calibration test).
  - e. Check and test calibration the supply/return volumetric synchronization system. Check differential setpoint between supply and return fan volumes to insure design outside air is introduced into system.
  - f. Determine system static pressure set point and coordinate with controls supplier.
  - g. Check static pressure control, under maximum and minimum conditions, for proper operation.
  - h. Determine and adjust high limit fan discharge static pressure switch; coordinate set point with controls supplier.
2. Thermostats and Controllers:
- a. Check for proper control of valves, VAV boxes, supply fans, exhaust fans, ventilation fans, and unit heaters.
  - b. Determine calibration setpoint of all thermostats.
  - c. Set at design set point.
- D. Capacity and Performance Test:
1. Cooling Coils:
- a. Measure and record entering and leaving dry and wet bulb air temperatures with glass stem, mercury thermometers accurate to 1/4 degrees F.
  - b. Record final air temperatures, BTU/HR.
  - c. Convert actual test condition to design entering temperatures to ensure design coil capacities at design temperatures. (Winter test may have entering temperatures too extreme to accurately convert to design summer loads).
2. Heating Coils (Air Handling Unit and Preheat Only):
- a. Measure and record entering and leaving dry bulb temperature with glass stem, mercury thermometers accurate to 1/2 degree F.
  - b. Convert actual test conditions to design entering temperatures to ensure design coil capacities at design temperatures. (Summer temperatures may have entering temperatures too extreme to accurately convert to winter loads.)
3. VAV Heating Coils:
- a. Adjust manual balancing devices to achieve design rated pressure drop at each coil. Record design and actual GPM.
  - b. Measure entering and leaving air temperatures. Use bimetal thermometers with 1 degree F accuracy.
  - c. Compute BTU/HR at minimum CFM through box and compare to design BTU/HR.
4. Thermostat Calibration:
- a. Measure and record dry and wet bulb temperatures at each thermostat.
  - b. Note any thermostat which is not controlling with +/- 1-1/2 degree F.
5. Control Temperature Readouts:

- a. Test actual temperature next to sensing bulb (if possible) and compare to read-out gauge. BAS readout.
- b. Report any gauge out of calibration.

### 3.3 REPORTS

#### A. Problems Encountered:

1. Report any items not installed, improperly installed, or not functioning properly.
2. Items which have not been corrected by Friday of each week will be officially turned over to the Contractor with a copy to the Owner.

#### B. Final Report:

1. The Test and Balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the balancing agency's certified Test and Balance Engineer.
2. The report shall contain the following general data in a format selected by the balancing agency:
  - a. Project number.
  - b. Contract number.
  - c. Project title.
  - d. Project location.
  - e. Project Architect.
  - f. Project mechanical engineer.
  - g. Test and Balance Agency.
  - h. Test and Balance Engineer.
  - i. General contractor.
  - j. Division 23 contractor.
  - k. Controls supplier.
  - l. Dates tests were performed.
  - m. Certification.
3. The Test and Balance report shall be recorded on report forms conforming to the recommended forms in the AABC or NEBB National Standards. At a minimum, the report shall include:
  - a. Preface: A general discussion of the system, any abnormalities and problems encountered.
  - b. Instrumentation List: The list of instruments including type, model, manufacturer, serial number, and calibration dates.
  - c. System Identification: In each report, the VAV boxes, zones, supply, return, and exhaust openings, and traverse points shall be numbered and/or lettered to correspond to the numbers and letters used on the report data sheets.
4. Any unresolved problems will be reported in a general remarks section in front of the test and balance data.
5. Any unusual operations or pertinent remarks which may aid the maintenance personnel or ease the reading of the report will be made in the general remarks section of the report.

6. Report operating data and final tests in final report. This data will include, but not necessarily be limited to the scope of work outlined above.
  7. The final report shall be submitted to the Owner not later than one month after completion of the construction.
- C. Air handling equipment test-report forms. Record the following on each air-handling equipment test form:
1. Manufacturer, model number, and serial number.
  2. All design and manufacturer's rated data.
  3. Total actual CFM by traverse if practical. If not practical, the sum of the outlets may be used, or a combination of each of these procedures.
  4. Static Pressure Profile: Suction and discharge static pressure of each fan component as well as unit total and external static data.
  5. Outside-air and return-air total CFM include traverses.
  6. Actual operating current, voltage, and brake horsepower of each fan motor as well as starter and heater data.
  7. Final RPM of each fan
  8. Fan and motor sheave manufacturer, model, size, number of grooves, and center distance.
  9. Belt size and quantity.
  10. Static-Pressure Controls: Final operating set points.
  11. All unit components identified including filter data, etc.
- D. Pump Test Forms: Submit pump curve showing "design", "operating", and "no-flow" points of operation. Also, record the following items on each pump test form:
1. Manufacturer, size, and serial number.
  2. All design and manufacturer's rated data.
  3. Pump operating suction and discharge pressure and final total dynamic head.
  4. No flow (pump discharge valve closed) suction and discharge pressure and corresponding total dynamic head. This procedure is to determine actual impeller size.
  5. Rated and actual operating current, voltage, and brake horsepower of each pump motor as well as starter and heater data.
- E. Heating and Cooling-Coil Test Forms: Record the following items on each test form:
1. Manufacturer.
  2. All design and manufacturer's rated data.
  3. Rated and actual static pressure drop across each coil.
  4. Wet-bulb and dry-bulb temperatures entering and leaving each cooling coil; dry-bulb temperatures entering and leaving each heating coil.
- 3.4 CALLBACK
- A. At the time of final inspection, the balancing agency shall recheck, in the presence of the Owner's Representative, specific and random selections of data recorded in the certified Test and Balance report.
- B. Points and areas for recheck shall be selected by the Owner's Representative.

- C. If random tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified Test and Balance report, the report shall automatically be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified Test and Balance report submitted, and a new inspection test made, all at no additional cost to the owner.
- D. TAB firm shall provide for one callback request to retest any unresolved problems noted in the final report. The revised results are forwarded through channels, after completion of test.
- E. During the TAB work, the temperature regulation will be adjusted for proper relationship between controlling instruments. Advise Owner of any instruments out of calibration.
- F. Make one inspection within ninety days after occupancy of the building to insure that satisfactory conditions are being maintained throughout and to satisfy any unusual conditions.

### 3.5 OPPOSED SEASON TESTING

- A. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that in which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.
- B. During the opposed season testing, any necessary modifications to the initial adjustment required to produce optimum operation of the systemic components shall be made to produce the proper seasonal conditions in each conditioned space. At the time of opposite season checkout, give Owner timely notification before any readings or adjustments are made.
- C. This service allows for testing of equipment that, due to extreme weather conditions, cannot be accurately tested at the time of the initial balance. If a project is balanced during the summer, the opposed season test is performed during the winter months and vice-versa.

END OF SECTION 230593

## SECTION 230700 - HVAC INSULATION

### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. Exposed: Equipment, ducts and piping in areas which will be visible without removing ceilings or opening access panels.
- B. Concealed: Installed above ceiling, in walls or chases.
- C. Outdoors: Exposed to the weather or ambient conditions.

#### 1.2 CERTIFICATION/QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001-2000 certified.
- B. Fire-Test Response Characteristics: Testing in accordance with ASTM E-84. Insulation and related materials, adhesives, coatings, sealers, jackets and tapes, shall have a fire-test response characteristic of: Flame spread rating of 25 or less; Smoke development of 50 or less.
- C. Materials shall meet the requirements of NFPA 90-A.

#### 1.3 SUBMITTALS

- A. Submit manufacturer's product data and installation procedures for review.

### PART 2 - PRODUCTS

#### 2.1 PIPE AND EQUIPMENT INSULATION

- A. Materials for Pipe and Equipment: Provide factory pre-molded or shop or site mitered segment type insulation for pipe, pipe fittings, and valves.
- B. Fitting Insulation: Same thickness and material as adjoining pipe insulation.
  - 1. At hanger and support points as specified herein.
- C. Flexible Tubular Elastomeric:
  - 1. Acceptable Manufacturers: Armacell LLC, AP Armaflex; K-Flex, Inc; Aeroflex USA Inc, Aerocel.
  - 2. Provide fire-retardant closed-cell slip-on flexible type. Minimum "K" value of 0.27 Btu\*in\*sf/deg F\*Hr.
  - 3. Use on the following services:

- a. Moisture condensate drains - 1/2" thick
- b. Refrigerant lines for kitchen freezer and cooler - 1-1/2" thick
- c. Refrigerant piping, valves, and fittings - 1-1/2" thick

D. Flexible Sheet Elastomeric:

- 1. Acceptable Manufacturers: Armacell, AP Armaflex; Rubatex
- 2. Provide fire-retardant closed-cell flexible sheet type. Minimum "K" value of 0.27 Btu\*in\*sf/deg F\*Hr.
- 3. Use on the following services:
  - a. Expansion and buffer tanks: 1-1/2" thick

E. Fiberglass Pipe Insulation:

- 1. Acceptable Manufacturers: Johns-Manville "Micro-Lok 850"; CertainTeed; Knauf; Owens Corning.
- 2. Jacket: ASJ fiberglass reinforced kraft paper with aluminum foil and minimum "K" value of 0.27 Btu\*in\*sf/deg F\*Hr.
- 3. Use on the following services:
  - a. Heating hot water piping, runouts to terminal units (12 feet or less)
    - 1) 1-1/2" and greater - 2" thick.
    - 2) Less than 1-1/2" - 1-1/2" thick.
  - b. Air separators - 2" thick.
  - c. Kitchen dishwasher final rinse booster heater - 2" thick.
  - d. Vent piping from relief valves - 1-1/2" thick.
- 4. Provide covering: 0.016" thick stamped aluminum jacket equivalent to Childers for all piping and fittings in mechanical rooms.

## 2.2 DUCTWORK INSULATION

A. Blanket Type Duct Insulation:

- 1. Minimum 3/4 pound per cubic foot density, factory-reinforced foil-faced, kraft vapor barrier, with a minimum "R" value as described below.
- 2. Acceptable Manufacturers: Johns-Manville, CertainTeed, Knauf, Owens Corning.
- 3. Use on the following:
  - a. Supply air ductwork, unlined in an unconditioned space including concealed above ceiling - R-6.
  - b. Unlined conditioned supply ducted - R-8.
    - 1) Insulation may be omitted from low pressure supply ductwork exposed in area served by the ductwork, except where exposed ductwork is in rooms with doors/openings to exterior.
  - c. Make-up air ductwork - R-8.
  - d. Ductwork supplying conditioned outside air - R-6.

- e. Unlined return air ductwork - R-6.
- f. Supply diffuser housings/plenum exposed above ceiling - R-8.

## 2.3 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

- A. For all services, use pre-molded insulation for pipe fittings, elbows, tees, butterfly valves, and couplings 2-1/2 and larger. Finish shall be as specified under Products above or as specified below. PVC fitting covers may be used over the pre-molded insulation for:
  - 1. Heating hot water.
- B. PVC fitting covers with fiberglass inserts may be used on piping fittings elbows and valves 2" and less for the following services:
  - 1. Heating hot water.
- C. For pipe fittings, valves, strainers, and other irregular surfaces, in chilled water or refrigerant systems operating below 60 degrees F, when inside building or in equipment rooms, cover insulation with white colored woven glass fabric embedded in white vapor barrier coating, Foster 30-35 or equal.
- D. For any service when above grade exposed-to-the-weather outside building, cover straight pipe insulation with 0.016" thick stamped aluminum jacket equivalent to Childers and cover fittings with factory formed covers equivalent to Elljacs. Install jacket seams on bottom of pipe.
- E. For flexible tubular elastomeric pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of fire retardant self-extinguishing vinyl lacquer type highly flexible coating equivalent to Armstrong "Armaflex Finish", custom color blended to match surrounding surfaces.

## PART 3 - EXECUTION

### 3.1 INSTALLATION - GENERAL

- A. Deliver and store insulation materials in manufacturer's containers and kept free from dirt, water, chemical and mechanical damage.
- B. Complete piping and ductwork pressure testing prior to applying insulation.
- C. Apply insulation in workmanlike manner by experienced, qualified workmen.
- D. Surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.
- E. Adhesives, cements and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.

- F. Stop duct coverings, including jacket and insulation, at fire penetrations of fire or smoke rated partitions, floors above grade and roofs. "Fan-out" or extend jacketed insulation at least 2" beyond angle frames of fire dampers and secure to wall. Maintain vapor barrier.

### 3.2 BLANKET TYPE DUCT INSULATION

- A. Apply jacketed blanket type glass fiber covering to ducts pulled snug but not so tight as to compress corners more than 1/4". Use insulation having 2" tab, or cut insulation long enough to allow for "peel-off" of insulation from jacket to effect a minimum overlap of 2". Staple lap with flare type staples on 1" centers. Cover standing seams, stiffeners, and braces with same insulation blanket, using 2" jacket lap and staple lap as herein before outlined. Cover and seal all staples with Foster 30-80 reinforced with glass cloth. Do not use pressure sensitive tape.
- B. Secure jacket to covering using equivalent of Foster No. 85-20 or Childers CP-82 adhesive.
- C. For ducts 24" or wider, mechanically fasten insulation to duct bottom, using weld pins having self-locking, metal discs, locating fasteners on not over 12" centers laterally and longitudinally. Seal pins as above.
- D. For ducts up to 18" deep, mechanically fasten insulation to duct sides, using one row of pins, plates or discs located on not over 12" centers longitudinally and equidistant laterally between duct top and bottom. For ducts over 24" deep, apply fasteners as before only using minimum of two rows.

### 3.3 FLEXIBLE SHEET ELASTOMERIC INSULATION

- A. Prior to application of flexible sheet elastomeric insulation, thoroughly clean all metal surfaces, making sure that all dirt, scale, loose paint, plaster, and oil has been removed and that surfaces are dry. If surface has been primed, test a two square foot section using adhesive equivalent to Armstrong No. 520 in order to determine whether solvent in adhesive will loosen or lift the primer. If primer is loosened, then remove it. When testing proves acceptable, adhere insulation with smooth side out, using thin but adequate coating of same adhesive. Follow manufacturer's instructions. Coat all butt edges of each sheet. Stagger all joints. Insulate all standing seams or flanges with same thickness of insulation material as that used on main surface.

### 3.4 INSTALLATION OF PIPE AND EQUIPMENT COVERING

- A. Where glass fiber or flexible tubular elastomeric insulation is used on piping sized 2" and larger, insert a section of foamglass or calcium silicate insulation, at hanger or support points, between pipe and metal shield for full length of shield, to prevent crushing of insulation. Where insulation passes through pipe hangers and across trapeze supports, 12" long metal saddles shall be used. Insulation thickness to be same as adjoining glass fiber insulation. On cold pipe, vapor barrier should be carried through the hanger and sealed. Saddles shall be used where rigid foamglass inserts are not acceptable.

- B. Where glass fiber or flexible tubular elastomeric insulation is used on piping sized 2" and larger insert a section of foamglass or calcium silicate insulation, at hanger or support points, between pipe and metal shield for full length of shield, to prevent crushing of insulation. Where insulation passes through pipe hangers and across trapeze supports, 18" long metal saddles shall be used. Insulation thickness to be same as adjoining glass fiber insulation. On cold pipe, vapor barrier should be carried through the hanger and sealed. Pipe saddles shall cover 180 degrees of the pipe.
- C. Apply flexible tubular elastomeric insulation to pipe and fittings with all joints tightly fitted and sealed with adhesive.

### 3.5 INSULATION OF REFRIGERATED WALK-IN BOX PENETRATIONS

- A. Insulate all piping and conduit through box ceiling, walls and partitions, using foamed-in-place polyurethane. Finish penetration points using two-piece locking (overlapping) escutcheons fabricated from same quality metal as adjoining surface, and fix in place with galvanized sheet metal screws.
- B. Insulate the following, using 3/4" thick elastomeric pipe insulation, being careful to maintain the integrity of the vapor barrier:
  - 1. Condensate drain piping. Condensate drain piping from the freezer shall be heat taped prior to installation of insulation.
- C. Refer to previously specified refrigerant suction and hot gas line piping insulation.

END OF SECTION 230700

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230750 - FIRE RATED DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Fire-rated insulation for the following applications:
  - 1. Commercial kitchen grease ducts.
  - 2. Trash and linen chutes.
  - 3. Clothes dryer ducts.
  - 4. Construction requiring fire-rated enclosure assembly construction.

#### 1.2 RELATED SECTIONS

- A. Section 042000: Unit Masonry for Fire-Rated Construction for HVAC Ducts (as an alternative to using fire-rated insulation).
- B. Section 078400: Penetration Firestopping.
- C. Section 092123: Gypsum Board Shaft Wall Assemblies for Fire-Rated Construction for HVAC Ducts (as an alternative to using fire-rated insulation).
- D. Section 230700: HVAC Insulation.
- E. Section 233114: Sheetmetal - Special Ductwork.

#### 1.3 REFERENCES

- A. Grease Duct Enclosure System Test Standards:
  - 1. ASTM E 2336 (AC101); "Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems Acceptance Criteria for Grease Duct Enclosures"
    - a. ASTM E 2336 SECTION 16.1 - ASTM E 136; "Standard Test Method for Materials in a Vertical Tube Furnace at 750 deg C"
    - b. ASTM E 2336 SECTION 16.2 - ASTM E 119; "Standard Test Methods for Fire Tests of Building Construction and Materials" - applied to a wall configuration
    - c. ASTM E 2336 SECTION 16.3 - ASTM C 518; "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus"
    - d. ASTM E 2336 SECTION 16.4; "Internal Fire Test" - tested to 500°F for 4 hours and 2000 deg F for 30 minutes.
    - e. ASTM E 2336 SECTION 16.5 - ASTM E 119; "Standard Test Methods for Fire Tests of Building Construction and Materials" - Applied to an elbow shaped duct configuration.

2. ASTM E 814 (UL1479); "Standard Test Method for Fire Tests of Through-Penetration Fire Stops"
3. ASTM E 84; "Standard Test Method for Surface Burning Characteristics of Building Materials"
4. NFPA 96; "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations"
  - a. ASTM D 6329; "Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers"

B. Ventilation Air Duct Enclosure System Test Standards:

1. ISO 6944-1985; "Fire Resistive Tests - Ventilation Ducts"
2. ISO 834; "Fire Resistive Tests - Elements of Building Construction"
3. ASTM E 814 (UL1479); "Standard Test Method for Fire Tests of Through-Penetration Fire Stops"
4. ASTM E 84; "Standard Test Method for Surface Burning Characteristics of Building Materials"
5. ASTM D 6329; "Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers"
6. NFPA 90A; "Standard for the Installation of Air-Conditioning and Ventilating Systems"

C. Independent Listing Agency References:

1. Underwriters Laboratories (UL).
2. International Code Council - Engineering Service (ICC-ES).
3. Intertek Testing Service (ITS) - Label Mark is OPL.

D. Health Studies on Bio-solubility of Ceramic and Mineral Fibers:

1. Long Fiber Fraction Half Life Solubility Study - Performed in accordance with Guideline 97/69/EC dated 5 December 1997 Appendix Q.

#### 1.4 SYSTEM DESCRIPTION

- A. Work of this section includes labor, material, methods, and equipment to provide a 1 or 2 hour fire-resistive enclosure system for the ducted system scheduled or indicated.
- B. Work of this section includes labor, material, methods, and equipment to provide a 1 or 2 hour F and T-Rated through penetration firestop for a floor, ceiling, or wall penetration by a duct system scheduled or indicated.
- C. Grease Duct: The fire-rated insulation shall be installed by qualified installer directly to the duct to provide a zero-clearance fire resistance-rated grease duct enclosure as required by code and as detailed in ICC Evaluation Service Report and tested to ASTM E2336. Product shall be UL or OPL classified and labeled for the application.
  1. As required by local code for adequate clean out of commercial kitchen grease duct, pre-fabricated access doors shall be installed by qualified installer as per ICC ESR.

- D. Ventilation Air Ducts: The fire-rated insulation shall be installed by qualified installer directly to the duct to provide a 1 or 2 hour fire resistance-rated shaft enclosure alternative per testing to ISO 6944, ASTM E 814 (UL 1479), and ASTM E 84. Product shall be UL or OPL classified and labeled for the application.
- E. Fire-rated insulation shall be used for ducts which penetrate a rated assembly and require a one- and two-hour fire-resistance-rated enclosure per local code.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Submit ICC-ES Building Code Report.
  - 2. Submit UL and/or Intertek Testing Service (ITS) listings.
  - 3. Submit produce datasheet and installation manual.
  - 4. Preparation instructions and recommendations.
  - 5. Storage and handling requirements and recommendations.
  - 6. Installation methods including the listed details.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2 years experience installing similar products.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship is approved by Architect.
  - 3. Revise mock-up area as required to produce acceptable work.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Deliver materials in original sealed packages, clearly labeled with manufacturing information including product identification, manufacturing lot numbers, and appropriate third party classification listings.
- C. Store material out of weather and away from incidental damage.
- D. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Thermal Ceramics - FireMaster FastWrap XL or Pyroscat.
- B. Unifrax - FyreWrap Elite.
- C. 3M - FireBarrier 15A or 20A.

### 2.2 MATERIALS

#### A. Grease Duct:

- 1. A lightweight, nominal 1.5" thick, 6 pcf, inorganic, non-asbestos, noncombustible, bio-soluble, high temperature, core insulation blanket.
- 2. Flexible, fully encapsulated duct wrap to provide 2-hour fire resistive enclosure assembly per codes and standards listed in Section 1.3 of this document.
- 3. Provide rated access doors (for cleanout as required) to maintain 2-hour rating and required clearance.
- 4. Provide firestop sealants, tape, insulation pins, clips, banding and other components as per manufacturer's instructions to ensure installation complies with the complete tested system and corresponding Design Listing(s).
- 5. Product Characteristics:
  - a. Thickness: 1-1/2 inch (38 mm).
  - b. Nominal Density: 6 pcf.
  - c. R-Value: 7.35 per layer of fire-rated wrap when tested in accordance with ASTM C 518.
  - d. Flame Spread: <25 when tested in accordance with ASTM E 84.
  - e. Smoke Development: <50 when tested in accordance with ASTM E 84.

### 2.3 ACCESSORY MATERIALS:

- A. Glass Filament Tape: Minimum 3/4 inch (19 mm) wide used to temporarily secure blanket until permanent attachment using steel banding and/or steel insulation pins.
- B. Aluminum Foil Tape: Minimum 3 inches (76 mm) used to seal cut edges.
- C. Carbon Steel or Stainless Strapping Material Minimum: 1/2 inch (13 mm) wide and 0.015 inch (.38 mm) thick
- D. Steel Insulation Pins: Minimum 12-gauge, length sufficient to penetrate through duct wrap insulation.
- E. Insulation Clips: Galvanized steel, minimum 1-1/2 inches (38 mm) round or square.
- F. Through Penetration Firestop Sealants:

1. Packing Material: Remove encapsulation material from fire rated insulation, use core blanket (white) as penetration packing material.
2. Firestop sealants per applicable building code report and/or laboratory design listings.

G. Grease Duct Access Doors:

1. Field fabricated access doors are not acceptable. Provide factory pre-manufactured access doors for all grease ductwork as follows:
  - a. Ductmate F2-HT Doors (NFPA 96 compliant and tested with fire-rated wrap per ASTM E 2336).
  - b. Ductmate Ultimate Door (NFPA 96 compliant, UL Listed per UL 1978, and tested with fire-rated wrap per ASTM E 2336).
  - c. FireMaster Ductmate F2-HT-XL3 Access doors are supplied as a complete installation with DuctMate F2-HT Door and 3 layers of fire-rated insulation installed as tested in accordance with ASTM E 2336. Supplied in standard door sizes.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.2 PREPARATION

- A. Remove dirt and dust from surfaces of openings and items penetrating rated floors and rated walls.

#### 3.3 INSTALLATION

- A. Install fire-rated insulation in direct contact with the ductwork in accordance with manufacturer's instructions, applicable laboratory listings and building code reports, and referenced standards. For additional complex duct design installation recommendations refer to the manufacturer's installation guide.
- B. Mechanical Fastening of Enclosure Material to Ductwork:
  1. Banding: Carbon steel or stainless steel banding is used to hold the outer layer of the blanket enclosure in place. Banding is minimum 1/2 inch (12.7 mm) wide, and is placed around the entire perimeter of the duct on maximum 10-1/2 inches (267 mm) centers and 1-1/2 inches (38 mm) from each blanket or collar edge.

2. Pinning: To prevent blanket sag on duct spans 24 inch wide (610 mm) or larger, minimum 12-gauge steel insulation pins are welded to the duct along bottom horizontal and outside vertical runs in columns spaced 12 inches (305 mm) apart, 6 to 12 inch (152 to 305 mm) from each edge, and on 10-1/2 inches (267 mm) centers. Pins are also required 1 inch (25 mm) from the end of a duct and 1 inch (25 mm) from any edge near a 90° bend spaced 6 inch (152 mm) apart. Pins are locked in place with 1-1/2 inch (38 mm) diameter or 1-1/2 inch (38 mm) square galvanized steel speed clips or cup head pins. Pins are turned down or the excess cut off to eliminate sharp edges.

C. Grease Duct Access Door Installation:

1. Field fabricated doors are not acceptable.
2. Prefabricated Ductmate F2-HT or Ductmate Ultimate doors may be installed per manufacturers' installation instructions and field insulated.

D. Through-Penetration Firestop System:

1. When the duct penetrates a concrete or dry wall fire rated floor, ceiling, or wall an approved firestop system shall be employed. Fire-rated insulation shall be installed directly to the duct through the penetration, or terminated on both sides of the penetration depending on the annular space allowance between the duct and the duct opening. When the fire-rated insulation enclosure system is terminated on both sides of the through penetration, the duct wrap material is mechanically attached to the duct at the termination points using either steel banding or steel pins.
2. To fire stop the through penetration void area, fill the annular space between the wrapped duct or bare duct and the periphery of the opening with scrap fire rated insulation firmly packed into the opening. Compress scrap blanket to percentage stated in the firestop listing for a minimum depth as specified in the firestop listing. Recess packing material below surface on both sides of walls or top side only for floors to the depth stated in the firestop listing. Seal over the packing material using an approved firestop sealant to a depth as stated in the firestop listing, flush with top side of a floor assembly and both sides of a wall assembly.

### 3.4 REPAIR PROCEDURES

- A. Repair damaged fire-rated insulation in accordance with manufacturer's instructions.
- B. Remove damaged section by cutting the bands and removing the anchor clips holding it in place. Apply a new section of the same dimension ensuring the same overlap and installation method that existed previously. Cut edges and tears in the foil must be taped with aluminum tape to prevent the insulation from wicking moisture or grease.

### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 230750

## SECTION 230800 - COMMISSIONING OF HVAC

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Commissioning is a systematic process of ensuring that the building systems perform according to the design intent.
- B. Refer to Section 019100 Commissioning Requirements.

#### 1.2 RELATED DOCUMENTATION

- A. Contract drawings, Division 00, Conditions of the Contract, and Division 01, General Requirements, apply to the Work of this Section.

#### 1.3 RELATED SECTIONS

- A. Form - Product Substitution.
- B. Section 013300 Submittal Procedures.
- C. Section 019100 Commissioning Requirements.

#### 1.4 SYSTEM TO BE COMMISSIONED

- A. HVAC Systems:
  - 1. Make-Up Air Unit.
  - 2. Split System Heat Pump / Condensing Units.
  - 3. Garage Exhaust Systems.

### PART 2 - PRODUCTS

- A. Refer to Section 019100 Commissioning Requirements.

### PART 3 - EXECUTION

- A. Refer to Section 019100 Commissioning Requirements.

END OF SECTION 230800

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230913 - INSTRUMENTATION AND CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 WORKED INCLUDED

- A. Provide input and output control devices to integrate with direct digital control and building automation system.
- B. Furnish instrumentation control devices as an integral part of the Building Automation System Section specified in Section 230923.

#### 1.2 RELATED WORK

- A. Commissioning:
  - 1. Section 019113 "Commissioning Requirements" requires the engagement of a Commissioning Agent to document the completion of the HVAC and Electrical systems upgrades for the project. Comply with the requirements of Section 019113 as a Commissioning Team member for the commissioning of the various building systems.
- B. Section 230500: Common Work Results for HVAC.
- C. Section 230923: Building Automation System and Direct Digital Controls.
- D. Section 232000: HVAC Piping.
- E. Section 233113: HVAC Sheetmetal.
- F. Section 233600: Air Terminal Units.
- G. Division 26: Electrical.

#### 1.3 WARRANTY

- A. Provide five (5) year parts and labor warranty from date of substantial completion.

#### 1.4 SUBMITTAL

- A. Submit product data and schedules for all input/output devices.
- B. Submit Section 230913 Instrumentation and Control Devices in separate submittal package from Section 230923 Building Automation and Direct Digital Controls. These two sections shall be submitted at least 15 working days apart.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products and components by manufacturers listed. Where manufacturers are not listed, provide component that complies with specifications.
- B. Manufacturers listed must meet performance and material specifications of product or component. Listing of a manufacturer as an acceptable manufacturer does not grant permission to deviate from the specifications.

### 2.2 INPUT DEVICES

#### A. General Requirements:

- 1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

#### B. Temperature Sensors:

##### 1. General Requirements:

- a. Sensors and transmitters shall be provided as outlined in the input/output summary and sequence of operations.
- b. The temperature sensor shall be of the resistance type and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
- c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:
- d. Provide tag of the unit served on the inside cover of all temperature sensors and thermostats. Mount in a concealed location.

##### 2. Room Temperature Sensors with Integral Display

- a. Room sensors shall be constructed for either surface or wall box mounting.
- b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
  - 1) Display room and outside air temperatures.
  - 2) Display and adjust room comfort setpoint.
  - 3) Timed override request push button with LED status for activation of after-hours operation.
  - 4) Display controller mode.
  - 5) Occupancy sensors where shown on floor plans.
  - 6) Password selectable adjustment of setpoint and override modes.

##### 3. Outside Air Sensors:

- a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield. Sensor to be located on the North side of the building.

- b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
    - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
  - 4. Duct Mount Sensors:
    - a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
    - b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
    - c. For outdoor air duct applications, a weather-proof mounting box with weather-proof cover and gasket shall be used.
  - 5. Averaging Sensors:
    - a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
    - b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
    - c. Capillary supports at the sides of the duct shall be provided to support the sensing string.
  - 6. Acceptable Manufacturers: Johnson Controls, Siemens, Kele, and Viasala.
- C. Humidity Sensors:
- 1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
  - 2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
  - 3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
  - 4. Outside air relative humidity sensors shall be installed with a rain-proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealite fittings and stainless steel bushings.
  - 5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
  - 6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
  - 7. Acceptable Manufacturers: Johnson Controls, Veris Industries, and Viasala.
- D. Differential Pressure Transmitters:
- 1. General Air and Water Pressure Transmitter Requirements:
    - a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.

- b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
    - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
    - d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
  - 2. Low Differential Air Pressure Applications (0" to 5" w.c.):
    - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
    - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
      - 1) (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application)
      - 2) 4-20 mA output.
      - 3) Maintain accuracy up to 20 to 1 ratio turndown.
      - 4) Reference Accuracy: +0.2% of full span.
    - c. Acceptable Manufacturers: Air Monitor, Paragon, Rosemont.
  - 3. Medium Differential Air Pressure Applications (5" to 21" w.c.):
    - a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
      - 1) Zero and span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
      - 2) Accuracy: 0.2% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG).
      - 3) Thermal Effects: <+.033 F.S./Deg. F over 40 deg F to 100 deg F (calibrated at 70 Deg F)
    - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 Standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
    - c. Acceptable Manufacturers: Air Monitor, Paragon, Rosemont.
- E. Flow Monitoring:
- 1. Air Flow Monitoring:
    - a. Fan Inlet Air Flow Measuring Stations:

- 1) At the inlet of each fan and near the exit of the inlet sound trap, airflow traverse probes shall be provided that shall continuously monitor the fan air volumes and system velocity pressure.
- 2) Each traverse probe shall be of a dual manifolded, cylindrical, Type 3003 extruded aluminum configuration, having an anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifold shall have sensors located along the stagnation plane of the approaching airflow. The manifold should not have forward projecting sensors into the air stream. The static pressure manifold shall incorporate dual offset static taps on the opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as + 20% in the approaching air stream.
- 3) The airflow traverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presence in the air stream. Each airflow-measuring probe shall contain multiple total and static pressure sensors placed at equal distances along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for Duct Traversing.
- 4) Airflow measuring stations shall be manufactured by Air Monitor Corporation, Tek-Air Systems, Inc., or Ebtron.

b. Single Probe Air Flow Measuring Sensor:

- 1) The single probe airflow-measuring sensor shall be duct mounted with an adjustable sensor insertion length of up to eight inches. The transmitter shall produce a 4-20 mA or 0-10 VDC signal linear to air velocity. The sensor shall be a hot wire anemometer and utilize two temperature sensors and a heater element temperature. The other sensor shall measure the downstream air temperature. The temperature differential shall be directly related to airflow velocity.

c. Duct Air Flow Measuring Stations:

- 1) Each device shall be designed and built to comply with, and provide results in accordance with, accepted practice as defined for system testing in the ASHRAE Handbook of Fundamentals, as well as, in the Industrial Ventilation Handbook.
- 2) Airflow measuring stations shall be fabricated of 14-gauge galvanized steel welded casing with 90 Deg. connecting flanges in configuration and size equal to that of the duct into which it is mounted. Each station shall be complete with an air directionalizer and parallel cell profile suppressor (3/4" maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 6000 feet per minute. This air directionalizer and parallel cell honeycomb suppressor shall provide 98% free area, equalize the velocity profile, and eliminate turbulent and rotational flow from the air stream prior to the measuring point.
- 3) The total pressure measurement side (high side) will be designed and spaced to the Industrial Ventilation Manual 16th Edition, Page 9-5. The self-averaging manifolding will be manufactured of brass and copper components.
- 4) The static pressure sensing probes (low side) shall be bullet-nosed shaped, per detailed radius, as illustrated in Industrial Ventilation Manual 16th Edition, Page 9-5.

- 5) The main take-off point from both the total pressure and the static pressure manifolds must be symmetrical.
  - 6) Total and static pressure manifolds shall terminate with external ports for connection to control tubing. An identification label shall be placed on each unit casing, listing model number, size, area, and specified airflow capacity.
  - 7) Acceptable Manufacturers: Air Monitor Corporation, Tek-Air, and Ebtron.
- d. Static Pressure Traverse Probe:
- 1) Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple static pressure sensors located along exterior surface of the cylindrical probe.
  - 2) Acceptable Manufacturers: Air Monitor and Ebtron.
- e. Shielded Static Air Probe:
- 1) A shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding. A suitable probe for indoor and outdoor locations shall be provided.
2. Outside Air Flow Measuring Stations:
- a. Ebtron Gold Series thermal dispersion type, air flow measuring probes and calibrated transmitter located in outside air stream prior to outside damper.
  - b. Install and wire in accordance with manufacturer's recommendation distances upstream and downstream of outlets and dampers.
  - c. Connect to BAS via BACnet. Modulate outside air and return air dampers to maintain outside air at setpoint.
  - d. Provide sensor density for standard, "C" Density, accurate to +/- 3% of reading up to 5,000 fpm.
  - e. Where AFMs cannot be installed in accordance to manufacturer guidelines, provide "D" Density, accurate to +/- 3% of reading and consult factory for best location.
- F. Carbon Dioxide (CO2) sensor:
1. Acceptable Manufacturers: JCI, BAPI, MSA, Kele, Telaire.
  2. Duct Mount:
    - a. The CO2 sensor shall comprise a diffusion gas chamber that should incorporate a gas permeable filter that prevents particulate and water contamination of the sensor.
    - b. For long-term stability, the sensor shall utilize a dual channel infrared detector, open channel for CO2 absorption, the other for reference to correct for long-term sensor drift.
    - c. The sensor shall incorporate elevation correction adjustment and have an accuracy of +/- 50 ppm or 7% at temperatures of 59-90 degrees F (15-32 degrees C).
    - d. The sensor shall be installed in a duct-mounted aspiration box with air sampling probe protruding into the air stream. The same manufacturer shall supply both CO2 sensor and aspiration box.

3. Wall Mounted CO2 Sensor:

- a. Similar to above without aspiration box.
- b. Appearance of CO2 sensors shall match temperature sensors.

G. Smoke Detectors:

- 1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 28 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 28, Fire Alarm System. Coordinate interface with BAS and Fire Alarm System.

H. Status and Safety Switches:

1. General Requirements:

- a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BAS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches:

- a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
- b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
- c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
- d. Acceptable Manufacturers: Veris Industries, Hawkeye.

3. Air Flow Switches:

- a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
- b. Acceptable Manufacturers: Johnson Controls, Cleveland Controls

4. Air Pressure Safety Switches:

- a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2-amps at 120 VAC.
- b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
- c. Acceptable Manufacturers: Johnson Controls, Cleveland Controls.

5. Low Temperature Limit Switches:

- a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16-amps at 120 VAC.

- b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
- c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
- d. The low temperature limit switch shall be equal to Johnson Controls A70.

## 2.3 OUTPUT DEVICES

### A. Actuators:

#### 1. General Requirements:

- a. Damper and valve actuators shall be electronic.

#### 2. Electronic Damper Actuators:

- a. Electronic damper actuators shall be direct shaft mount.
- b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
- c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
- d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
- e. Acceptable Manufacturers: Johnson Controls, Belimo and Honeywell.

#### 3. Electronic Valve Actuators:

- a. Electronic valve actuators shall be manufactured by the valve manufacturer.
- b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.

- c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
- d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
- e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.
- f. Acceptable Manufacturers: Johnson Controls, Belimo and Siemens.

B. Control Dampers:

- 1. The BAS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BAS Contractor or as specifically indicated on the Drawings.
- 2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
- 3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
- 4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomeric seals on the blade edges and flexible stainless steel side seals. Dampers of 48" x 48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Standard 500.
- 5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD60, and Vent Products 5650.
- 6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Johnson Controls D-1600, Ruskin CD36, and Vent Products 5800.
- 7. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays:

1. Control Pilot Relays:

- a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
- b. Mounting Bases shall be snap-mount.
- c. DPDT, 3PDT, or 4PDT relays shall be provided as appropriate for application.
- d. Contacts shall be rated for 10-amps at 120 VAC.
- e. Relays shall have an integral indicator light and check button.
- f. Acceptable Manufacturers: Johnson Controls, Lectro.

D. Control Valves:

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.
2. Chilled water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 PSI.
3. Ball valves shall be used for chilled water applications, at In-row cooling for server room.
4. Valve discs shall be composition type. Valve stems shall be stainless steel.
5. Acceptable Manufacturers: Johnson Controls, Belimo or Siemens.

E. Control Valves, Segmented Ball Valves:

1. Provide segmented control valves for all chilled water valves at AHUs and for the Campus chilled water return valve at the pump room.
2. High Performance Segmented V-Ball Control Valve: Carbon steel body, stainless steel V-notch ball and shaft, low friction bearings and a low friction graphite ball set; ANSI Class 150 or 300 flanges as required by application.
3. Rated ANSI Class VI leakage rate, -20 degrees F to 450 degrees F temperature range and minimum 285 PSI allowable shutoff pressure drop at -20 to 100 F.
4. Rotation: 90 degrees; rangeability: 300 to 1 with equal percentage control characteristic; valve shall accommodate standard electric actuators.
5. Provide appropriate valve CV for each application.
6. Warranty: Valve and linkage, three (3) year warranty from date of installation.
7. Acceptable Manufacturer: VSI or approved equal.

F. Electronic Signal Isolation Transducers:

1. A signal isolation transducer shall be provided whenever an analog output signal from the BAS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
2. The signal isolation transducer shall provide ground plane isolation between systems.
3. Signals shall provide optical isolation between systems.
4. Acceptable Manufacturers: Advanced Control Technologies.

G. External Manual Override Stations:

1. External manual override stations shall provide the following:
  - a. An integral HAND/OFF/AUTO switch shall override the controlled device pilot relay.
  - b. A status input to the Building Automation System shall indicate whenever the switch is not in the automatic position.
  - c. A Status LED shall illuminate whenever the output is ON.
  - d. An Override LED shall illuminate whenever the HOA switch is in either the HAND or OFF position.
  - e. Contacts shall be rated for a minimum of 1-amp at 24 VAC.

2.4 MISCELLANEOUS DEVICES

A. Local Control Panels:

1. All control panels shall be factory constructed, incorporating the BAS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices-such as relays, transducers, and so forth-that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

B. Power Supplies:

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60 Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak-to-peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

C. Thermostats:

1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Actuation/Control Type:

1. Primary Equipment:
  - a. Controls shall be provided by equipment manufacturer as specified herein.
  - b. All damper and valve actuation shall be electric.
2. Air Handling Equipment:
  - a. All air handlers shall be controlled with a HVAC-DDC Controller.
  - b. All damper and valve actuation shall be electric.
3. Terminal Equipment:
  - a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.
  - b. All Terminal Units shall be controlled with HVAC-DDC Controller.

#### B. HVAC Input Devices - General:

1. All Input devices shall be installed per the manufacturer recommendation.
2. Locate components of the BAS in accessible local control panels wherever possible.
  - a. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
3. Input flow measuring devices shall be installed in strict compliance with ASME Guidelines affecting non-standard approach conditions.
4. Outside Air Sensors:
  - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
  - b. Sensors shall be installed with a rain-proof, perforated cover.
5. Water Differential Pressure Sensors:
  - a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.

- 1) Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
  - b. The transmitters shall be installed in an accessible location wherever possible.
6. Air Flow Measuring Stations:
  - a. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.
    - 1) Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.
7. Duct Temperature Sensors:
  - a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
  - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
  - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
  - d. The sensor shall be mounted to suitable supports using factory approved element holders.
8. Space Sensors:
  - a. Mounted per ADA requirements.
  - b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
9. Low Temperature Limit Switches:
  - a. Install on the discharge side of the first water or steam coil in the air stream.
  - b. Mount element horizontally across duct in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.
  - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
10. Air Differential Pressure Status Switches:
  - a. Install with static pressure tips, tubing, fittings, and air filter.
11. Water Differential Pressure Status Switches:
  - a. Install with shut off valves for isolation.
- C. HVAC Output Devices:
  1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.

2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI.
5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

### 3.2 TRAINING

- A. The BAS contractor shall provide the following training services:
  1. Three (3) days of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.
  2. One week off-site training for one (1) person on complete BAS System including operation and programming.

### 3.3 COMMISSIONING

- A. Fully commission all aspects of the Building Automation System work.
- B. Acceptance Check Sheet:
  1. Prepare a check sheet that includes all points for all functions of the BAS as indicated on the point list included in this specification.
  2. Submit the check sheet to the Engineer for approval.
  3. The Engineer will use the check sheet as the basis for acceptance with the BAS Contractor.
- C. VAV Box Performance Verification and Documentation:
  1. The BAS Contractor shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are "Pass", "No change in flow between full open and full close", and "Reverse operation or Maximum flow not achieved". The report shall be submitted as documentation of the installation.
  2. The BAS Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.

- D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION 230913

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 230923 - BUILDING AUTOMATION AND DIRECT DIGITAL CONTROLS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. The Building Automation System (BAS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. BAS Supplier/Installer shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BAS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- C. The work of the single BAS Supplier/Installer shall be as defined individually and collectively in all Sections of this Division of specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.
- D. The BAS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BAS.
- E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.
- F. Manage and coordinate the BAS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- G. The BAS as provided shall incorporate, at minimum, the following integrated features, functions and services:
  - 1. Operator information, alarm management and control functions.
  - 2. Enterprise-level information and control access.
  - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
  - 4. Diagnostic monitoring and reporting of BAS functions.
  - 5. Offsite monitoring and management access.
  - 6. Energy management.
  - 7. Standard applications for terminal HVAC systems.

8. Indoor air quality monitoring and control.
9. Full building floor plan graphics by level and sector/quad.

## 1.2 RELATED WORK

### A. Commissioning:

1. Section 019113 "Commissioning Requirements" requires the engagement of a Commissioning Agent to document the completion of the HVAC and Electrical systems upgrades for the project. Comply with the requirements of Section 019113 as a Commissioning Team member for the commissioning of the various building systems.

### B. Section 230593: HVAC Test and Balance.

### C. Section 230913: Instrumentation and Control Devices.

### D. Division 26: Electrical.

## 1.3 QUALITY ASSURANCE

### A. General:

1. The Building Automation System Supplier/Installer shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Automation Systems.
2. The BAS Supplier/Installer shall be a recognized national manufacturer, installer, and service provider of BAS.
3. The BAS Supplier/Installer shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. As evidence and assurance of the BAS Supplier/Installer's ability to support the Owner's system with service and parts, the BAS Supplier/Installer must have been in the BAS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Automation System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Automation Systems, and shall be the manufacturer's latest standard of design at the time of bid.

### B. Quality Management Program:

1. Designate a competent and experienced employee to provide BAS Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the BAS Supplier/Installer. At minimum, the Project Manager shall:
  - a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
  - b. Manage the financial aspects of the BAS Contract.
  - c. Coordinate as necessary with other trades.
  - d. Be responsible for the work and actions of the BAS workforce on site.

#### 1.4 REFERENCES

- A. All work shall conform to the following Codes and Standards, as applicable:
1. National Fire Protection Association (NFPA) Standards.
  2. National Electric Code (NEC) and applicable local Electric Code.
  3. Underwriters Laboratories (UL) listing and labels.
  4. International Building Code.
  5. UL 864 UUKL Smoke Control.
  6. UL 268 Smoke Detectors.
  7. UL 916 Energy Management.
  8. NFPA 70 - National Electrical Code.
  9. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
  10. NFPA 92A and 92B Smoke Purge/Control Equipment.
  11. Factory Mutual (FM).
  12. American National Standards Institute (ANSI).
  13. National Electric Manufacturer's Association (NEMA).
  14. American Society of Mechanical Engineers (ASME).
  15. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  16. Air Movement and Control Association (AMCA).
  17. Institute of Electrical and Electronic Engineers (IEEE).
  18. American Standard Code for Information Interchange (ASCII).
  19. Electronics Industries Association (EIA).
  20. Occupational Safety and Health Administration (OSHA).
  21. American Society for Testing and Materials (ASTM).
  22. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
  23. Americans Disability Act (ADA).
  24. ANSI/EIA 909.1-A-1999 (LonWorks).
  25. ANSI/ASHRAE Standard 195-2004 (BACnet).
- B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
- C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

#### 1.5 SUBMITTALS

- A. Shop Drawings, Product Data, and Samples:
1. The BAS Supplier/Installer shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
  2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
  3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BAS work.
  4. Submit 23 09 23 Building Automation and Direct Digital Controls in a separate submittal package from Section 230913 Instrumentation and Control Devices. These two sections shall be submitted at least 15 working days apart.

5. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BAS Supplier/Installer where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
6. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
7. The BAS Supplier/Installer shall correct any errors or omissions noted in the first review.
8. At a minimum, submit the following:
  - a. BAS network architecture diagrams including all nodes and interconnections.
  - b. Systems schematics, sequences and flow diagrams.
  - c. Points schedule for each point in the BAS, including: Point Type, Object Name, Expanded ID, Display Units, Controller Type, and Address.
  - d. Samples of Graphic Display screen types and associated menus, including building floor plan graphics.
  - e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
  - f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
  - g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
  - h. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address.
  - i. Details of all BAS interfaces and connections to the work of other trades.
  - j. Product data sheets or marked catalog pages including part number, photo, and description for all products including software.

## 1.6 RECORD DOCUMENTATION

### A. Operation and Maintenance Manuals:

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BAS provided:
  - a. Table of contents.
  - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
  - c. Manufacturers product data sheets or catalog pages for all products including software.
  - d. System operator's manuals.
  - e. Archive copy of all site-specific databases and sequences.
  - f. BAS network diagrams.
  - g. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.
- B. After completion of all tests and adjustments the Supplier/Installer shall provide a copy of all as-built information and product data to be installed on a customer designated computer workstation or server.

## 1.7 WARRANTY

### A. Standard Material and Labor Warranty:

1. From date of substantial completion for the BAS system, provide a five-year labor and material warranty on the BAS.
2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BAS Supplier/Installer at the cost of the BAS Supplier/Installer.
3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BAS Supplier/Installer's normal business hours.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The Building Automation System (BAS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BAS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The Building Automation System shall consist of the following:
  1. A Tracer Summit BAS consists of building control units (BCUs) and PC Workstations that use Tracer Summit software.
  2. Building Control Units (BCUs).
  3. Input/Output Module(s).
  4. Local Display Device(s).
  5. Portable Operator's Terminal(s).
  6. Distributed User Interface(s).
  7. Network processing, data storage and communications equipment.
  8. Other components required for a complete and working BAS.
  9. Full building floor plan graphics.
- C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Base Bid:
  - 1. Tracer Summit.
- B. Alternate Bid (Pending prior approval by Owner):

## 2.3 BAS ARCHITECTURE

- A. Automation Network:
  - 1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
  - 2. Provide all necessary hardware and software to completely interface the building BAS with the existing Johnson Controls Metasys Campus Automation System. Network communications shall be prioritized to maintain a reasonable lag of 1 minute.
  - 3. The BAS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.
  - 4. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
  - 5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
- B. Control Network:
  - 1. BAS shall provide supervisory control over the control network and shall support the following communication protocols:
    - a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
    - b. LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
    - c. Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 19200 or 38400 baud.
  - 2. DDC Controllers shall reside on the control network.
  - 3. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
  - 4. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
  - 5. The Conformance Statements shall be submitted 10 day prior to bidding.
- C. Integration:

1. Hardwired:
  - a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
  - b. There will be one separate physical point on each system for each point to be integrated between the systems.
2. Direct Protocol (Integrator Panel):
  - a. The BAS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BAS system and 3rd party manufacturers' control panels. The BAS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, air handling units, terminal units, CRAC units, variable frequency drives, and power monitoring system.
  - b. All data required by the application shall be mapped into the Automation Engine's database, and shall be transparent to the operator.
  - c. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BAS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.
3. BACnet Protocol Integration - BACnet:
  - a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet Standard 135-2003.
  - b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
  - c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.
4. Smoke Control and Fire Panel Integration:
  - a. Smoke Control shall consist of the following components:
    - 1) A set of hardware components UL Listed for smoke control applications.
    - 2) A smoke control application running in a UL Listed NAE device.
  - b. The system shall receive fire alarm and smoke control inputs and shall automatically trigger smoke control schemes.
  - c. The system shall allow the operator to execute real-time control from:
    - 1) An Annunciator Panel.
    - 2) The Automation Display.
    - 3) Incorporated (ADI) UL Listed Firefighter's Smoke Control Stations (FSCS).
    - 4) The primary User Interface.

## 2.4 USER INTERFACE

- A. Dedicated Web Based User Interface:

1. Where indicated on plans the BAS Supplier/Installer shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BAS Network Automation Engines to facilitate greater fault tolerance and reliability.
2. Dedicated User Interface Architecture: The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BAS Supplier/Installer and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
  - a. Microsoft Internet Explorer for user interface functions.
  - b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary Building Automation functions.
  - c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports.
  - d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.
3. PC Hardware: The personal computer(s) shall be configured as follows:
  - a. Memory - 3 GB at 1333 MHz (Minimum).
  - b. CPU- Intel Core i5 Processor at 4 MB Cache, 3.2 GHz (Minimum).
  - c. Hard Drive - 250 GB free hard drive space (minimum).
  - d. Hard drive backup system - CD/RW, DVD/RW or network backup software provided by IT department.
  - e. CD ROM Drive - 32X performance.
  - f. Ports - (2) Serial and (1) parallel, (2) USB ports.
  - g. Keyboard - 101 Keyboard and 5 Button Mouse.
  - h. CRT configuration - (2) CRTs as follows:
    - 1) Each Display - 20" Flat Panel LCD Monitor 1600 x 1200 at 60 Hz resolution (minimum).
    - 2) 24 bit or higher color resolution.
    - 3) Display card with multiple monitor support.
    - 4) Energy Star rated.
  - i. LAN communications - Ethernet communications board; 3Comm or equal.
4. Operating System Software:
  - a. Windows 7 Professional 64 bit.
  - b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
  - c. Provide software registration cards to the Owner for all included software.
5. Peripheral Hardware:
  - a. Reports Printer:
    - 1) Printer Make - Hewlett Packard OfficeJet.

- 2) Print resolution - 600 DPI black, 1200 DPI color.
- 3) Print Speed - 28 ppm black, 20 ppm color.
- 4) Buffer - 64 K Input Print Buffer.
- 5) Color Printing - Include Color Kit.

B. Distributed Web Based User Interface:

1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
  2. The software shall run on the Microsoft Internet Explorer (8.0 or higher) browser.
  3. Minimum Hardware Requirements:
    - a. 2 GB RAM.
    - b. 2.1 GHz Clock Speed Pentium 4 Microprocessor.
    - c. 100 GB Hard Drive.
    - d. 1 Keyboard with 83 keys (minimum).
    - e. SVGA 1024 x 768 resolution display with 64K colors and 16 bit color depth.
- 1) Mouse or other pointing device.

C. User Interface Application Components:

1. Operator Interface:
  - a. An integrated browser based client application shall be used as the user operator interface program.
  - b. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
  - c. The user interface software shall provide help menus and instructions for each operation and/or application.
  - d. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
  - e. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to the following:
    - 1) User access for selective information retrieval and control command execution.
    - 2) Monitoring and reporting.
    - 3) Alarm, non-normal, and return to normal condition annunciation.
    - 4) Selective operator override and other control actions.
    - 5) Information archiving, manipulation, formatting, display and reporting.
    - 6) BAS internal performance supervision and diagnostics.
    - 7) On-line access to user HELP menus.
    - 8) On-line access to current BAS as-built records and documentation.
    - 9) Means for the controlled re-programming, re-configuration of BAS operation and for the manipulation of BAS database information in compliance with the prevailing codes, approvals and regulations for individual BAS applications.

- f. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Navigation Trees:

- a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
- b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
- c. The navigation trees shall be "dockable" to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

3. Alarms:

- a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
  - 1) Log date and time of alarm occurrence.
  - 2) Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
  - 3) Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
  - 4) Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
  - 5) Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
  - 6) Any attribute of any object in the system may be designated to report an alarm.
- b. The BAS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.
- c. The BAS shall annunciate application alarms at minimum, as required by Part 3.

4. Reports and Summaries:

- a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:

- 1) All points in the BAS.
- 2) All points in each BAS application.
- 3) All points in a specific controller.
- 4) All points in a user-defined group of points.
- 5) All points currently in alarm.
- 6) All points locked out.
- 7) All BAS schedules.
- 8) All user defined and adjustable variables, schedules, interlocks and the like.

- b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
- c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a Building Automation and diagnostics tool.
- d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.

5. Schedules:

- a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
  - 1) Weekly schedules.
  - 2) Exception Schedules.
  - 3) Monthly calendars.
- b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
- c. It shall be possible to define one or more exception schedules for each schedule including references to calendars.
- d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
- e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
- f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BACnet Standard.
- g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a Building Automation and diagnostics tool.

6. Password:

- a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
- b. Each user shall have the following: a user name (24 characters minimum), a password (12 characters minimum), and access levels.
- c. The system shall allow each user to change his or her password at will.

- d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
  - e. A minimum of five levels of access shall be supported individually or in any combination as follows:
    - 1) Level 1 = View Data.
    - 2) Level 2 = Command.
    - 3) Level 3 = Operator Overrides.
    - 4) Level 4 = Database Modification.
    - 5) Level 5 = Database Configuration.
    - 6) Level 6 = All privileges, including Password Add/Modify.
  - f. A minimum of 100 unique passwords shall be supported.
  - g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
  - h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
7. Screen Manager: The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
8. Dynamic Color Graphics:
- a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable. Full building floor plan graphics are required.
  - b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
  - c. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
  - d. Graphics Runtime Functions: A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
    - 1) All graphics shall be fully scalable.
    - 2) The graphics shall support a maintained aspect ratio.
    - 3) Multiple fonts shall be supported.
    - 4) Unique background shall be assignable on a per graphic basis.
    - 5) The color of all animations and values on displays shall indicate if the status of the object attribute.
  - e. Operation from Graphics: It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device.
  - f. Graphic Editing Tool: A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.

- 1) The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
    - 2) In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.
  - g. Aliasing: Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
9. Historical Trending and Data Collection:
  - a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
    - 1) Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
      - a) Defined time interval.
      - b) Upon a change of value.
    - 2) Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
  - b. Option: Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.
  - c. Option: The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in either Microsoft Access or SQL database format.
10. Trend Data Viewing and Analysis:
  - a. Provide a trend viewing utility that shall have access to all database points.
  - b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
  - c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends.
  - d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
  - e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
  - f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
  - g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.

D. Portable Operator Terminal:

1. For systems that do not provide full access to systems configuration and definition via the Browser Based user interface the BAS Supplier/Installer shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:
  - a. Personal Laptop Computer Manufacturer - Dell, Compaq or HP.
  - b. 4 GB RAM at 1066 MHz (minimum) - Windows 7 Professional 64 bit.
  - c. CPU-Intel Core i3 at 3 MB Cache, 2.13 GHz (minimum).
  - d. 250 GB Hard Drive (minimum).
  - e. (1) CD-ROM Drive, 32x speed.
  - f. (1) Serial (1) Parallel (2) USB ports.
  - g. 1 Keyboard with 83 keys (minimum).
  - h. Integral 2 button Track Point with Track Ball.
  - i. 17" HD 1600 x 900 resolution color display.
  - j. Two PCMCIA Type II or one Type III card slot.
  - k. Complete operator workstation software package, including any hardware or software.
  - l. Original printed manuals for all software and peripherals.
  - m. Original installation disks or CD for all software, device drivers, and peripherals.
  - n. Software registration cards for all included software shall be provided to the Owner.
  - o. Carrying case.
  - p. 6-cell lithium ion battery.
  - q. External power supply/battery charger.
2. Proprietary Portable Terminal:
  - a. Manufacturers providing proprietary portable terminals shall submit technical data sheets for the terminal and all associated software and hardware.
  - b. The proprietary terminal shall meet the same operator interface software requirements as specified above.
3. Software:
  - a. Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
  - b. When used to access First or Second Tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
  - c. When used to access Application Specific Controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

2.5 DDC SYSTEM CONTROLLERS

A. Digital Controller with Extension Capability (DX):

1. Each DX shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each DCX shall be a microprocessor-Based, multi-tasking, real-time digital control processor.

2. DX controllers shall support, but not be limited to, the following configurations of systems to address current requirements described in the "Execution" portion of this Specification, and to address future expansion.
  - a. Mechanical pumps with pump logic.
  - b. Generic system interlocking through hardware.
3. Point Types: Each DX shall support the following types of point inputs and outputs:
  - a. Analog inputs shall monitor the following analog signals:
    - 1) 4-20 mA Sensors.
    - 2) 0-10 VDC Sensors.
    - 3) 1000 ohm RTDs.
  - b. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
  - c. Counter inputs shall monitor dry contact pulses with an input resolution of one Hz minimum.
  - d. Analog outputs shall provide the following control outputs:
    - 1) 4.20 mA - Sink or Source.
    - 2) 0-10 VDC.
  - e. Binary outputs shall provide SPDT output contacts rated for 2-amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays. Inductive loads (i.e., solenoids) shall be controlled by pilot relays.
  - f. Tri-state outputs shall be paired binary outputs for use as Power Close/Power Open control output contacts rated for 2-amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays.
4. Manual Overrides:
  - a. Manual override switches shall be provided for all binary outputs that do not have a MCC Hand/Off/Auto switch.
  - b. Switches shall be mounted within the system controller key-accessed enclosure, or the adjacent local control panel.
  - c. Switches for analog outputs shall be rotary gradual position, providing the full analog signal range of the associated analog output, and shall be operable whether the panel processor is operational or not.
5. Controllers shall have a built-in status, and adjust panel interface to allow for the local adjustment of all setpoints, temporary override of any input or output points, and status of any points in alarm.
6. Power Fail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the DX-9100.
7. The capability to extend the input and output capacity of the DX via Point Expansion Modules shall be provided.
  - a. The Point Expansion Modules shall communicate to the DX controller over a local RS-485 expansion bus.

- b. The Point Expansion Modules shall have available a range of configurations of 4, 8, 12, or 16 data points:
  - 1) Analog Inputs - 0-10V, 4-20mA, 1000 ohm RTD.
  - 2) Analog Outputs - 0-10V, 4-20mA.
  - 3) Digital Inputs w/ digital counter.
  - 4) Digital Outputs - triacs or relay contacts.
- c. Expansion module data points shall be available for inclusion in all DX control strategies.

B. Local Display Capability:

- 1. LCD (Liquid Crystal Display) graphic display shall be provided. The LCD shall have a minimum of 16 lines of text with 40 characters per line. The following features shall be incorporated in the LCD graphic display:
  - a. The ability to display and monitor up to 96 points for the system being controlled.
  - b. A system graphical representation of the controlled equipment, including live point data from the system controller.
  - c. An audible alarm and a light emitting diode (LED) to notify the user of alarm conditions.
  - d. The ability to view an alarm summary that includes all the points currently in alarm, and to view an alarm log that shows the alarm history for the system being controlled.
  - e. The ability to view trend graphs for the analog points being monitored by the system controller.
  - f. A password system that allows for three levels of access to the system controller.

## 2.6 APPLICATION SPECIFIC CONTROLLERS

A. Air Handling Unit Controllers (AHU):

- 1. Each air handling unit controller shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each AHU controller shall be a microprocessor-Based, multi-tasking, real-time digital control processor.
- 2. AHU controllers shall support, but not be limited to, the following configurations of systems to address current requirements as described in the "Execution" portion of this Specification, and to address future expansion:
  - a. Air Handling Units:
    - 1) Mixed Air-Single Path.
    - 2) Mixed Air-Dual Path.
    - 3) 100% Single Path.
    - 4) 100% Dual Path.
- 3. Each AHU controller shall have sufficient memory to support its own operating system and databases, including:
  - a. Control processes.

- b. Energy management applications.
  - c. Operator I/O (Portable Service Terminal).
4. Point Types: Each AHU controller shall support the following types of point inputs and outputs:
- a. Analog inputs shall monitor the following analog signals:
    - 1) 4-20 mA Sensors.
    - 2) 0-10 VDC Sensors.
    - 3) 1000 ohm RTDs.
  - b. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
  - c. Counter inputs shall monitor dry contact pulses with an input resolution of one Hz minimum.
  - d. Analog outputs shall provide the following control outputs:
    - 1) 4.20 mA - Sink or Source.
    - 2) 0-10 VDC.
  - e. Binary outputs shall provide SPDT output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays. Inductive loads (i.e., solenoids) shall be controlled by pilot relays.
  - f. Tri-state outputs shall be paired binary outputs for use as Power Close/Power Open control output contacts rated for 2-amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays.
5. Manual Overrides:
- a. Manual override switches shall be provided for all binary outputs that do not have a MCC Hand/Off/Auto switch.
  - b. Switches shall be mounted within the system controller key-accessed enclosure, or the adjacent local control panel.
  - c. Switches for analog outputs shall be rotary gradual position, providing the full analog signal range of the associated analog output, and shall be operable whether the panel processor is operational or not.
6. AHU controllers shall have a library of control routines and program logic to perform the sequence of operations specified in the "Execution" portion of this Specification.
7. AHU controllers shall directly support the temporary use of a portable service terminal that can be connected to the AHU via zone temperature or directly at the controller.
8. Power Fail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the AHU.

B. Unitary Controllers (UNT):

- 1. Each unitary controller shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each Unitary Controller shall be a microprocessor-Based, multi-tasking, real-time digital control processor.

2. Unitary controllers shall support, but not be limited to, the following types of systems to address specific applications described in the "Execution" portion of this Specification, and to address future expansion:
  - a. Fan Coils (Two-Pipe, Four-Pipe).
3. Point Types: Each unitary controller shall support the following types of point inputs and outputs:
  - a. Analog inputs shall monitor the following analog signals:
    - 1) 0-10 VDC Sensors.
    - 2) 1000 ohm RTDs.
  - b. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
  - c. Counter inputs shall monitor dry contact pulses with an input resolution of one Hz minimum.
  - d. Analog outputs shall provide the following control outputs:
    - 1) 0-10 VDC.
  - e. Binary outputs shall provide SPDT output contacts rated for 2-amperes at 24 VAC. Surge and noise suppression shall be provided on all pilot relays. Inductive loads (i.e., solenoids) shall be controlled by pilot relays.
  - f. Tri-state outputs shall be paired binary outputs for use as Power Close/Power Open control output contacts rated for 2-amperes at 24 VAC. Surge and noise suppression shall be provided on all pilot relays.
  - g. Pneumatic outputs shall provide a 3-15 PSI pneumatic output. Gradual override capability and output pressure gauge shall be provided.
4. Manual Overrides:
  - a. Manual override switches shall be provided for all binary outputs that do not have a MCC Hand/Off/Auto switch.
  - b. Switches shall be mounted within the system controller key-accessed enclosure, or the adjacent local control panel.
  - c. Switches for analog outputs shall be rotary gradual position, providing the full analog signal range of the associated analog output, and shall be operable whether the panel processor is operational or not.
5. Unitary controllers shall have a library of control routines and program logic to perform the sequence of operations specified in the "Execution" portion of this Specification.
6. Unitary controllers shall directly support the temporary use of a portable service terminal that can be connected to the UNT via zone temperature or directly at the controller.
7. Power Fail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the UNT.

C. VAV Modular Assembly (VMA):

1. The VAV Modular Assembly shall provide both standalone and networked direct digital control of pressure-independent, variable air volume terminal units. It shall address both single and dual duct applications.
2. The VAV modular assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece.
3. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 30 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.
4. The controller shall determine airflow by dynamic pressure measurement using an integral dead-ended differential pressure transducer. The transducer shall be maintenance-free and shall not require air filters.
5. Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature/humidity effects.
6. The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
7. Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. In addition, this tuning reduces commissioning costs, and eliminates the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.
8. The controller shall provide the ability to download and upload VMA configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
9. Control setpoint changes initiated over the network shall be written to VMA non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
10. The VMA shall include troubleshooting LED indicators to identify the following conditions:
  - a. Power On.
  - b. Power Off.
  - c. VMA Off Line.
  - d. VMA Replacement.
  - e. VMA Corrupted Memory.
11. The controller firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.
12. The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
13. The controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain ("K" factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
14. Controller performance shall be self-documenting via on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance. The VMA shall calculate exponentially weighted moving averages (EWMA) for each of the following. These metrics shall be available to the end user for efficient management of the VAV terminals.
  - a. Absolute temperature loop error.
  - b. Signed temperature loop error.
  - c. Absolute airflow loop error.
  - d. Signed airflow loop error.
  - e. Average damper actuator duty cycle.

15. The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:
  - a. Unreliable space temperature sensor.
  - b. Unreliable differential pressure sensor.
  - c. Starved box.
  - d. Actuator stall.
  - e. Insufficient cooling.
  - f. Insufficient heating.
16. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The VMA would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.
17. The controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality), and shall be capable of resetting the box minimum airflow Based on the percent of outdoor air in the primary air stream.
18. The controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.
19. Inputs:
  - a. Analog inputs with user defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:
    - 1) 0-10 VDC Sensors.
    - 2) 1000ohm RTDs.
    - 3) NTC Thermistors.
  - b. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
  - c. For noise immunity, the inputs shall be internally isolated from power, communications, and output circuits.
  - d. Provide side loop application for humidity control.
20. Outputs:
  - a. Analog outputs shall provide the following control outputs:
    - 1) 0-10 VDC.
  - b. Binary outputs shall provide a SPST Triac output rated for 500 mA at 24 VAC.
  - c. For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.
21. Application Configuration:
  - a. The VAV Modular Assembly shall be configured with a software tool that provides a simple Question/Answer format for developing applications and downloading.
22. Sensor Support:

- a. The VMA shall support an LCD display room sensor.
- b. The VMA shall also support standard room sensors as defined by analog input requirements.
- c. The VMA shall support humidity sensors defined by the AI side loop.

## 2.7 FIELD DEVICES

### A. Serial to Wireless Converter:

1. The Serial to Wireless Converter (SWCVT) shall convert Field Bus Data to Internet Protocol (IP) packet and transmits them to the Network Automation Engines.
2. The SWCVT shall receive IP packets and convert them to bacnet protocol, and route them to the field devices.
3. The SWCVT shall be capable of transmission of 100 mWatts at 2.4 GHZ using 802.11g protocol with back compatibility to 802.11b.
4. The SWCVT shall support Wired Equivalent Privacy (WEP) and Wi-Fi protected Access (WPA) security protocols.
5. The SWCVT shall allow data rates up to 54 Mbps.
6. The SWCVT shall employ two antennas.
  - a. An internal antenna.
  - b. An external omni-directional antenna.
7. The SWCVT shall accept an optional antenna for outdoor use.
8. The SWCVT shall have the ability to use whichever antenna provides the strongest signal.
9. The SWCVT shall support a minimum of 32 devices.
10. The SWCVT shall operate over a minimum of two hundred (200) feet within a building.
11. The SWCVT is assembled in a plenum rated plastic housing with flammability rated to UL 94-5VB.
12. The SWCVT shall have LED indicators to provide information regarding the following conditions:
  - a. Power On/Off.
  - b. Wireless Link Association - Wireless connection is established/wireless connection is not established.
  - c. Wireless - Wireless Traffic/No Traffic.
  - d. Fault Conditions - Network Fault/Device Fault/No Faults.
13. The SWCVT shall be Underwriters Laboratory listed to UL 916 per File E107041, CCN PAZX.
14. The SWCVT shall comply with FCC Part 15.247 Regulations for low-power unlicensed transmitters.

### B. One-to-One Wireless Temperature Sensing System:

1. The sensor system shall provide wireless communication with a Wireless Room Temperature Sensor (WRS).
2. The sensor shall receive wireless Radio Frequency (RF) signals containing temperature and set point data from a Wireless Room Temperature Sensor (WRS Sensor).
  - a. The Receiver shall be FCC compliant to CFR 47, Part 15 Subpart B Class A.

- b. The Receiver shall operate as a bidirectional transceiver with the sensor to confirm and synchronize data transmission.
  - c. The Receiver shall be capable of communication with WRS Sensors up to a distance of 1,000 Feet.
  - d. The Receiver shall be assembled in a plenum rated plastic housing with flammability rated to UL 94-5VB.
  - e. The Receiver shall have LED indicators to provide information regarding the following conditions:
    - 1) RF Signal - Weak Signal/Good Signal/Excellent Signal.
    - 2) Zone Bus - Zone Transmission/No Zone Transmission.
3. The WRS Sensors shall sense and report room temperatures to the wireless temperature Receiver.
- a. The WRS Sensors shall use direct sequence spread spectrum RF technology.
  - b. The WRS Sensors shall operate on the 2.4 GHZ ISM Band.
  - c. The WRS Sensors shall meet the IEEE 802.15.4 Standard for Low-Power, Low Duty-Cycle RF Transmitting Systems.
  - d. The WRS sensors shall be FCC compliant to CFR Part 15 Subpart B Class A.
  - e. The WRS sensors shall be available with:
    - 1) Warmer/Cooler Set Point Adjustment.
    - 2) No Set Point Adjustment.
    - 3) Set Point Adjustment Scale - 55 to 85 deg F.
  - f. The WRS sensors shall be assembled in NEMA 1 plastic housings.

## 2.8 SYSTEM TOOLS

## PART 3 - EXECUTION

### 3.1 BAS REQUIREMENTS

#### A. Graphic Displays:

- 1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
- 2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection, including floor plan graphics for the entire stadium.

#### B. Custom Reports:

- 1. Provide custom reports as required for this project.

#### C. Actuation/Control Type:

- 1. Primary Equipment:

- a. Controls shall be provided by equipment manufacturer as specified herein.
  - b. All damper and valve actuation shall be electric.
2. Air Handling Equipment:
  - a. All air handlers shall be controlled with a HVAC-DDC Controller.
  - b. All damper and valve actuation shall be electric.
3. Terminal Equipment:
  - a. Terminal Units (VAV, etc.) shall have electric damper and valve actuation.
  - b. All Terminal Units shall be controlled with HVAC-DDC Controller.

### 3.2 INSTALLATION

#### A. BAS Wiring:

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the BAS Supplier/Installer unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Supplier/Installer. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Supplier/Installer, the Supplier/Installer shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring:
  - a. All Class 2 (24 VAC or less) wiring shall be installed in conduit unless otherwise specified.
  - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24 VAC power can be run in the same conduit. Power wiring 120 VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

#### B. BAS Line Voltage Power Source:

1. 120-volt AC circuits used for the Building Automation System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BAS Raceway:

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible metal conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible metal conduit may be used within partition walls. Flexible metal conduit shall be UL listed.

D. Penetrations:

1. Provide UL rated fire stopping for all penetrations used by dedicated BAS conduits and raceways.
2. All openings in fire-proofed or fire-stopped components shall be closed by using UL approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BAS Identification Standards:

1. Node Identification: All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

F. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

G. BAS Panel Installation:

1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BAS Supplier/Installer shall be responsible for coordinating panel locations with other trades including work specified under Divisions 23 and 26.

### 3.3 TRAINING

A. The BAS Supplier/Installer shall provide the following training services:

1. Three (3) days of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.
2. One week off-site training for one (1) person on complete BAS System including operation and programming.

### 3.4 COMMISSIONING

- A. Fully commission all aspects of the Building Automation System work.
- B. Acceptance Check Sheet:
  - 1. Prepare a check sheet that includes all points for all functions of the BAS as indicated on the point list included in this specification.
  - 2. Submit the check sheet to the Engineer for approval.
  - 3. The Engineer will use the check sheet as the basis for acceptance with the BAS Supplier/Installer.
- C. VAV Box Performance Verification and Documentation:
  - 1. The BAS Supplier/Installer shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are "Pass", "No change in flow between full open and full close", and "Reverse operation or Maximum flow not achieved". The report shall be submitted as documentation of the installation.
  - 2. The BAS Supplier/Installer shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.
- D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION 230923

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 231123 - FACILITY NATURAL GAS PIPING

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Natural gas piping system for gas appliances and equipment as indicated on the Drawings and as specified herein.

#### 1.2 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230529: Pipe Hangers.

#### 1.3 QUALITY ASSURANCE

- A. Material standards: Applicable ASTM standards for material requirements.
- B. Dimensional standard: ANSI B36.10, latest edition.
- C. Screw threads: American Pipe Thread Standards.

#### 1.4 SUBMITTALS

- A. Submit product data for review for piping, fittings, valves, and coatings. Submittal data shall include:
  - 1. Manufacturer of pipe.
  - 2. Tests or listing by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
  - 3. Product data for piping, fittings, valves and coatings.
  - 4. Welding procedures for steel pipe.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Steel Pipe: Schedule 40 black steel ASTM A 53 seamless or continuous weld.
- B. Fittings:
  - 1. Welded fittings: Factory made fittings, full line size for all branches, elbow, or tee. Use reducers after fittings if dictated by branch pipe size.
  - 2. Screw fittings: Grinnell or approved equal, Class 150, malleable iron.

a. Joint compound: LACO, Rector-Seal, WKM Key-Tite

C. Valves:

1. 2" and smaller: AGA or UL approved.
2. 2-1/2" and larger: Certified by the manufacturer for natural gas service.
3. Provide valves with handle.
4. Valves shall be acceptable to local authorities.

D. Exterior coating: Republic Steel Corporation's X-Tru-Coat high density polyethylene extruded coating.

E. Lubricated Plug Cocks:

1. For valves 2" and less, Nordstrom Figure No. 114.
2. For valves 2-1/2" to 4", Nordstrom Figure No. 115.
3. For valves 5" and up, Nordstrom Figure No. 169.
4. All valves shall be AGA approved for natural gas service.

F. Valve Connections: Two inches and smaller - threaded; 2-1/2 inches and larger - flanged.

G. Gas Pressure Regulator Valves:

1. Gas pressure regulator valves shall meet ANSI Z21.80a, CSA 6.22a-2005 by Pietro Fiorentini, Fisher, Maxitrol or approved equivalent.
2. Gas regulators for 2 psi and less shall be provided with an automatic vent limiting device for indoor use only.
3. All pressure regulators above 2 psi shall have a vent piped in accordance with Government and local codes and regulations to the exterior of the building. Provide vent protectors for outdoor applications to protect vents from foreign particles, insects, dust, rain or snow.
4. See drawings and schedules for location and sizes of gas pressure regulator valves and vent routing.

H. Roof Top Support Mounting Blocks:

1. Roof top supports for mounting natural gas piping by Miro, Roof Top Blox, B-Line or Durablok, Wood blocking shall not be used. Material to be UV and weather resistant.
2. Connect piping to support blocking or stands per manufacturers specifications and spacing requirements.

## 2.2 FLEXIBLE GAS PIPING FOR UNDERGROUND AND ABOVE GROUND INSTALLATION

- A. Conform to CSA International Certified Corrugated Stainless Steel Tubing (CSST) Flexible Gas Piping.
- B. Tubing shall be made from 300 series Stainless Steel Strip conforming to ASTM E84.
- C. Tubing shall be suitable for operation with Natural Gas and LP Gas (Propane).
- D. The jacket shall be extruded from fire-retarded polyethylene.

- E. Double wall TRACPIPE PS-II for underground and under floor installations.

## 2.3 FLEXIBLE GAS PIPING MECHANICAL ATTACHMENT FITTINGS

- A. Fittings shall be made from yellow brass.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Jointing: All welded construction, except where required for servicing and for sizes 4" and smaller as specified herein.
- B. Screwed fittings:
  - 1. May be used in lieu of welded joints for sizes 4" and smaller when pressure is less than 2 psi.
  - 2. Install screwed joints to be accessible for repair.
  - 3. Do not install screwed fittings in furred ceilings or chases.
- C. Provide a gas valve at each piece of equipment and where indicated and where indicated on drawings.
- D. Certified corrugated stainless steel (CSST) shall be installed per manufacturers recommendation for hanging supports and to protect piping from damage. Contractor shall be a certified installer for CSST gas piping. Install system per installation guide and protect piping from damage by providing protective plates and proper spacing in walls.
- E. Underground gas piping shall be of the same metals and meet the same working pressure requirements specified herein, except that it shall be coated and protected as follows:
  - 1. Coat exterior surface of underground gas pipe with high density polyethylene extruded coating.
  - 2. The protective coating shall be factory applied with a fluid mastic undercoat. The polyethylene coating shall be minimum of 0.040 inches thick.
  - 3. Field welds, joints and fittings shall be protected with mastic undercoat and by wrapping with at least two (2) layers (half lap) of "X-Tru-Tape" installed as recommended by the manufacturer or with Raychem "Thermofit" heat shrinkable pipe sleeves applied as recommended by the manufacturer.
- F. Concealed piping: Where indicated on drawings or when required by local code authorities, provide an A-53 Schedule 10 black steel pipe to completely enclose the gas pipe throughout all chases and concealed areas of the building. Vent sleeve to atmosphere at the top of the building.

END OF SECTION 231123

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 232000 - HVAC PIPING

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Piping and Pipe Fittings for:
  - 1. HVAC Circulating Water Piping.
  - 2. Food Service Heat Rejection Piping.
  - 3. Cooling Coil Condensate Piping.

#### 1.2 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230519: Hydronic Specialties.
- C. Section 230523: Valves for HVAC.
- D. Section 230700: HVAC Insulation.
- E. Section 232215: Steam and Steam Condensate Specialties.

#### 1.3 QUALITY ASSURANCE

- A. All piping shall be manufactured in the USA. Piping manufactured and supplied from China is not acceptable.

#### 1.4 SUBMITTALS

- A. Submit product data for review on piping and fittings. Submittal data shall include:
  - 1. Manufacturer of pipe.
  - 2. Tests or listings by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
  - 3. Product data for pipe and fittings to be used on each piping system.
  - 4. Welding procedures for steel pipe.
  - 5. Solder and brazing product data and installation procedures for copper pipe.
  - 6. Product data and installation procedures for grooved piping systems.
  - 7. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

## PART 2 - PRODUCTS

### 2.1 STEEL PIPE

- A. Black Steel: Electric resistance welded or seamless, ASTM A53 or ASTM A106 Grade B. Mill wrap uninsulated underground steel pipe with Republic X-Tru-Coat or equal.
  - 1. Through 10" standard weight Schedule 40.
  - 2. 12" pipe and larger: standard weight with 0.375" wall thickness.
  - 3. Provide for the following services:
    - a. Heating hot water piping 1-1/4" diameter and larger. (Contractor option: Copper up to 2" diameter. See "COPPER PIPE" below.)
    - b. Food service heat rejection piping, 1-1/4" diameter and larger (Contractor Option: Copper up to 2" diameter: See "Copper Pipe herein").

### 2.2 STEEL PIPE FITTINGS

- A. Flanges, Fittings, and Unions: Mark in accordance with MSS-SP-25.
- B. Fittings:
  - 1. 2-1/2" and larger: Class 150 wrought steel, butt welded fittings, ASME B16.9.
  - 2. 2" and Smaller:
    - a. Water Service: Class 150 malleable iron, screwed.
- C. Flanges, 2-1/2" and Larger: Class 150, A53 wrought forged steel, slip-on or weld neck, ASME/ANSI B16.5.
- D. Gaskets:
  - 1. Inorganic fibers, 1/16 or 1/8 inch thick, reinforced EPDM binder, 550 deg F (continuous) and 700 psig operation, Garlock 5507 or equal:
    - a. Hot water.
- E. Unions, 2" and Smaller: Material as specified under fittings, screwed with brass seat.
  - 1. Unions are not required in installations utilizing grooved mechanical couplings (the couplings shall serve as unions).
- F. Branch connections from mains or headers, 2-1/2" and larger: Welded tees or welding outlets, Bonney Forge Weldolets or Thredolets. Use forged outlets only if branch line is at least one pipe size smaller than main or header.
- G. Bolting Materials: Same finished carbon steel bolts and hex nuts, ASTM A307. Threads and Dimensions: ASME/ANSI B1.1 and B18.2.
  - 1. Use galvanized bolts and nuts on piping outside the building.

H. Thread Lubricant: Similar to Crane "Formula 425".

I. IPS Grooved Piping System:

1. Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods as specified herein. All grooved components shall be of one manufacturer and conform to local code approval and as listed by ASME/ANSI B-31.1, B-31.3, B-31.9, ASME, UL/ULC, FM, IAPMO or applicable Building Code. Grooved end product manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476.
  - a. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
2. Grooved Pipe: Carbon Steel, as specified with roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends shall be grooved in accordance with manufacturer's current listed standards conforming to ANSI/AWWA C-606.

J. Mechanical Couplings for Steel Pipe:

1. Acceptable Manufacturers: Victaulic, Grinnell. Victaulic model numbers are used to establish product type, quality and performance.
2. Mechanical couplings shall consist of two housings and be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12 or malleable iron conforming to ASTM A-47, Grade 32510.
  - a. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
    - 1) 2" through 12": Installation-ready for direct stab installation without field disassembly, with Grade EHP gasket rated to +250 degrees F/120 degrees C. Victaulic Style 107.
    - 2) Victaulic Zero-Flex Style 07.
  - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Installation-ready Style 177 or Style 77.
  - c. 14" through 24": Victaulic AGS Series with lead-in chamfer on housing key and wide width FlushSeal gasket.
    - 1) Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
    - 2) Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.
  - d. Style HP-70 rigid coupling for high pressure service.
  - e. Flange Adapter: Flat face, ductile iron housings with elastomeric pressure responsive gasket for direct connection to ANSI Class 125 to 150 flanged components. Victaulic Style 741 / W741.

3. Gaskets: Grade "EHP" EPDM compound (red color coded) with a temperature operating range of -30 degrees F to +250 degrees F, Grade "E" EPDM compound (green color coded) conforming to ASTM D-2000 designation CA615A25B24F17; UL/ULC classified to ANSI/NSF 61 with temperature operating range -30 degrees F to +230 degrees F.

## 2.3 COPPER PIPE

- A. Conform to ASTM B-88 Specification for wrought seamless copper.
  1. Type L, hard for:
    - a. HVAC heating hot water pipe, 1" and smaller; Contractor option for copper or steel pipe 1-1/4" to 2".
    - b. Food service heat rejection, Supply and return water piping, 1" and smaller. Contractor option for copper or steel pipe 1-1/4" to 2".
- B. Type M, hard for:
  1. HVAC cooling coil condensate piping.

## 2.4 COPPER PIPE FITTINGS

- A. Sweat type, wrought copper, ASTM B62 with dimensions conforming to ASTM/ANSI B16.22 and sweep patterns for copper tubing.
- B. Dielectric Connections:
  1. Provide at junction of copper pipe and equipment with steel piping systems.
  2. Central, dielectric insulating unions and insulating flange unions, as manufactured by Central Plastic Company or CTS Fabrication USA (1-1/2" thru 8").
  3. Provide copper solder joint to plated female iron pipe for sizes 1/2" through 2".
  4. Provide insulating flange unions, malleable female iron pipe thread to copper solder joint flange unions for sizes 2-1/2" through 4".
  5. Brass fittings and valves may not be used for dielectric union locations.
- C. Unions: Brass ground joint, 250 lb working pressure.
- D. Nipples: Brass.
- E. Mechanical Couplings for Copper Pipe:
  1. Acceptable Manufacturers: Victaulic, Grinnell. Victaulic model numbers are used to establish product type, quality, and performance.
  2. Provide Victaulic Style 606 Couplings or Style 641 Flange Adapter and copper connection roll groove wrought copper or cast bronze fittings for:
  3. Grooved copper products shall be manufactured to copper tube dimensions. Flaring of tube or fitting ends to IPS sizes is not permitted.

## 2.5 PVC PIPE AND FITTINGS

- A. PVC pipe, fittings, cement, and joint cleaner for entire project shall be supplied by a single manufacturer.
- B. PVC Schedule 40, Type I, DWV, ASTM D-2665, 1120, 160 PSI at 73 degrees F. Solvent cement shall meet ASTM No. D-2564 for (PVC-DWV) plastic and pipe fittings. If permitted by governing code authority, may be used for:
  - 1. Air handling unit cooling coil condensate drains above grade only if room is not used as return air plenum.
  - 2. Cooling coil condensate drains from rooftop units shall be UV resistant where exposed.

## 2.6 AQUATHERM

## 2.7 MISCELLANEOUS PIPE ACCESSORIES

- A. Escutcheons: Chrome pipe escutcheons, slip-on or split type where pipe passing through finished walls or ceiling may be visible.
- B. Exposed Metal Pipe and Trim: Chrome-plated.
- C. Control System Connectors: Crane No. 386, 1" steel half couplings, or 1" female pipe thread connectors.
- D. Install 18-gauge sheetmetal or galvanized steel pipe saddles to protect insulation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Clean inside of pipe before installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.
- B. Install pipe so that it does not interfere with opening of doors or apparatus, access to equipment, or to electrical equipment.
- C. Do not install pipes in such a way that they will apply torque to pumps. After pumps have been installed and pumps have been operated, recheck and realign pumps if necessary.
- D. Run pipes in straight lines and square with building. Install risers plumb. Make offsets only where indicated and where necessary.
- E. Install branch connections using separate tee or lateral fittings for each branch. Do not combine branches into "bullhead tee" arrangement.
- F. Do not install water pipes in electric rooms, tele/data rooms, transformer rooms, audio/visual rooms or elevator equipment rooms. Fire protection piping runouts serving only these rooms shall be installed in these rooms.

- G. Do not install piping above electrical equipment such as starters, variable frequency drives, motor control centers, or disconnects. Maintain code required clearance above, below and to sides of electrical equipment.
- H. Provide flanges or unions throughout the pipe systems at all equipment. Make provisions for servicing and removal of equipment without dismantling piping.
  - 1. Unions and flanges servicing and disconnects are not required in installations using grooved mechanical joint couplings (the couplings shall serve as unions and disconnect points).
- I. Grading Pipes for Drainage:
  - 1. Slope cooling coil condensate drains at 1/8" per foot.
- J. Piping Expansion:
  - 1. Install piping to allow thermal expansion and contraction without injury to piping, equipment, or structure.
    - a. Use loops or expansion joints where necessary.
    - b. Provide pipe guides as necessary.
    - c. For water systems, use adequate numbers of Victaulic flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops in accordance with Victaulic instructions and as approved by the engineer. Where expansion loops are required, use Victaulic flexible couplings on the loops.
- K. Branch Lines:
  - 1. Where possible, branch lines shall come off top of mains to prevent sediment, welding slag, or pipe burrs from entering the branch lines and causing valve leakage or failure.

### 3.2 PIPE JOINTING

- A. Preparing Pipe Ends:
  - 1. Machine cut pipe ends square.
  - 2. Ream pipe ends, after cutting, to full diameter.
  - 3. Where pipe is to be threaded, secure pipe in pipe stand, die-cut, full depth, right hand threads. Threads are to be taper type.
  - 4. Pipe shall be grooved using grooving tools and required roll sets of the same manufacturer as the grooved components. The grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
  - 5. All threaded pipe joints to have suitable pipe sealant applied to threads prior to assembly of joint. Joints shall be leak proof.
  - 6. Where pipe is to be welded, die-cut end of butt joints at 30 degree taper. Weld should have a full penetration with no bubbles or holes. Remove all slag.
- B. Welded Steel Piping:

1. Where welded piping is specified, make welds by oxy-acetylene process or electric process in accordance with ASME/ANSI B31.1.
    - a. Welding Rods: Grade recommended for purpose by manufacturer's and identification.
  2. Line welds, single V-butt type:
    - a. Mill or machine bevel pipe at 37 1/2 degrees to within 1/16" of inside wall, except that in field limited amount of pipe may be flame beveled.
    - b. Pipe with a wall thickness of 3/16" or less need not be beveled but may be welded by melting down into building up over abutting ends.
    - c. Separate abutting ends of joints before welding to permit complete fusion to bottom without overlapping.
    - d. Tack in two or more points to maintain alignment and fusion weld.
  3. Make all welds of sound weld metal, thoroughly fused into ends of pipe and to bottom of vee.
    - a. Build in excess of pipe wall to give reinforcement to one fourth pipe wall thickness.
    - b. Weld metal shall present a gradual increase in thickness from surface of pipe to center of weld.
    - c. Minimum weld width: Two and one half times thickness of pipe wall.
  4. Use welding ells at turns in welded lines.
  5. Do not weld pipe couplings in place of welding fittings for any branch connections.
  6. Weld-o-lets and thread-o-lets:
    - a. Scribe and cut openings in main pipes for welded branches accurately taking care to remove all of plugs and cuttings from main pipe.
    - b. Full weld fillet welds for full depth of fillet, with additional beads to form well rounded connection as recommended by weld-o-let manufacturer.
  7. Cut openings into pipe for welded connections accurately to give matched intersections.
  8. Make welded fittings of same material with same pressure and temperature rating as pipe with which they are used.
  9. Make flanged connections to control valves, pump suction and specialties with ANSI Standard welding neck flanges. All other flange connections may be made with slip-on flanges provided they are seal welded on inside.
  10. Fuse all fillet welds for flanges or fittings into pipe and plate for minimum distance of 1-1/2 times pipe wall thickness and depth weld on 1-1/4 times pipe wall thickness.
- C. Grooved Coupling Installation:
1. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing.
  2. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.
    - a. The gasket shall be molded and produced by the coupling manufacturer.
  3. All grooved components (couplings, fittings, valves, gaskets, bolts and nuts) shall be of one manufacturer.

4. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products.
  - a. The representative shall periodically visit the jobsite and review installation to ensure that the contractor is following best recommended practices. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s)).

D. Soldered and Brazed Joints:

1. Make Type L and M copper pipe joints with suitable flux and 95/5, lead free solder.
2. Make Type K copper pipe joints with silver (BAg Series) brazing filler material with flux or copper-phos (BCup Series) brazing filler material without flux per the recommendations of the Copper Development Association.

E. "T" Drill Branch Tee Connections for Copper Piping Systems:

1. Braze "T" Drill joints in accordance with Copper Development Association Copper Tube Handbook using BCup Series filler metal.
2. Form mechanically extracted collars in a continuous operation by drilling a pilot hole and drawing out the tube surface to form collar having a height not less than three times the thickness of the tube wall.
3. Use fully adjustable collaring device to ensure proper tolerance and uniformity of joint.
4. Install on branch lines at least two pipe sizes smaller than main line.
5. Branch line shall take off top of pipe main to prevent sediment, welding slag, or pipe burrs from entering branch lines. Velocity will carry sediment into branch.
6. Dimple pipe to ensure that penetration of branch tube into collar is of sufficient depth for brazing and to ensure branch tube does not obstruct flow in main line.
7. Mechanically formed branch collars and joints shall be approved by the authority having jurisdiction.

F. PVC Joints:

1. Make joints in accordance with cement manufacturer's printed instructions.

G. Bracing Joints:

1. Provide braces and bridle rods as required to reinforce joints.
2. If mechanical lock type couplings are used, then prepare pipe ends and make joints in accordance with pipe coupling manufacturer's printed instructions.

3.3 ESCUTCHEONS

- A. Provide chrome-plated escutcheons where uninsulated pipes penetrate walls or ceilings of finished spaces.

3.4 AIR VENTING

- A. Provide manually operated air vents at water coils to eliminate air from systems.
- B. Use ball valves for manual air vents.

- C. Provide automatic air vents as specified per 230913 at high points at piping risers.

### 3.5 CONTROL SYSTEM CONNECTORS

- A. Weld connectors at points indicated, and at other points where necessary for installation of thermometers and automatic controls.

### 3.6 TESTING

- A. Refer to Section 230500 for all testing requirements.

END OF SECTION 232000

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## SECTION 232123 - HVAC PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230513: Electric Motors.
- C. Section 230523: Valves for HVAC.
- D. Section 230700: HVAC Insulation.
- E. Section 232000: HVAC Piping.

#### 1.2 WARRANTY

- A. Manufacturer shall warrant equipment for a period of 18 months from date of shipment or one year from date of beneficial use by Owner.

#### 1.3 SUBMITTALS

- A. Submit manufacturer's product data for review.
- B. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Pump curves shall indicate the complete family of impellers available for pump.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Peerless.
- B. Armstrong.
- C. Bell & Gossett.
- D. Paco.
- E. Buffalo.

- F. Aurora.
- G. Allis-Chalmers.
- H. Taco.
- I. Weinman.
- J. Patterson.

## 2.2 GENERAL REQUIREMENTS

- A. Statically and dynamically balance rotating parts.
- B. Construction to permit complete servicing without breaking piping connections.
- C. Provide flanged pump connections, tapped with pressure gauge ports.
- D. Provide heating pumps suitable for handling water at 230 degrees F.
- E. Construct pumps of bronze fitted construction with bronze impeller and carbon steel shafts. Ensure shaft deflection does not exceed 0.002" at sealing faces at maximum load.
- F. Hydrostatic test pump casings at one and one-half times the design working pressure.
- G. Construct pump casings of cast iron with replaceable bronze wearing rings and rated for 150 psig working pressure.
- H. Impeller diameter not to exceed 90% of the maximum diameter for which pump curves are published.
- I. Coupling and Base Plate:
  - 1. Mount pump and motor on common steel base plate furnished by pump manufacturer.
  - 2. Manufacturer to furnish and mount steel flexible coupling. Fasten metal coupling guard to pump base plate.
- J. Nameplate:
  - 1. Stainless steel on pump and motor securely fastened to casings.
  - 2. Provides data necessary for equipment identification and replacement.

## 2.3 BASE MOUNTED END SUCTION COUPLED PUMPS

- A. Type: Centrifugal, single stage, direct connected.
- B. Bearings: Oil or grease lubricated ball bearings.

- C. Coupling: Flexible type with OSHA coupling guard.
- D. Baseplate: Cast iron or fabricated steel.
- E. Seals: Mechanical seal with Ni-Resist stationary seat, carbon washer, ethylene propylene flexible members, brass metal parts and 1808 stainless steel spring. Mount seals over a bronze shaft sleeve.

## 2.4 IN-LINE CENTRIFUGAL

- A. Type: Centrifugal, single stage, close coupled.
- B. Bearings: Bronze bearings, oil lubricated.
- C. Seals: Mechanical seal with carbon seal face rotating against a ceramic seat.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install pumps in accordance with manufacturer's instructions.
- B. Provide pumps with soleplates, bedplates, or base plates carefully leveled, grouted, and bolted in place on concrete pads or foundations as shown on drawings. Grout to be expanding type containing catalyzed metallic aggregate. After grout has set, cut flush with bedplate and seal to prevent fraying deterioration at edges. Refer to drawings and Section 230548 for further requirements for piping, pumps, and vibration isolation.
- C. Pump manufacturer's authorized representative shall make hot alignment check on couplings between motors and pumps. Operate equipment until components have reached operating temperature before hot check is made. Reposition equipment as required and repeat hot alignment check until parallel and angular alignments in both plan and elevation are within limits set by equipment manufacturers. Alignment to be accomplished with dial indicator.
- D. Provide suction diffusers on each pump as specified in Section 230519.
- E. Provide air ventcock in high point of casing.
- F. Provide OSHA coupling guard if not furnished by the manufacturer.
- G. Refer to Section 230700 for insulation requirements. Insulate all parts subject to heat and condensation. Apply insulation after final alignment and adjustment.

### 3.2 TESTING, START-UP, DEMONSTRATION

- A. Test pumps, valves, piping, and fittings for mechanical tightness, both before start-up and after start-up.

- B. Furnish electrical connections for motor drive and to verify proper phasing under Division 26.
- C. Start-up pumps, test individually and as a part of the system they serve.
- D. Prepare pumps for test and balance as required by Section 230593. Correct deficiencies found and retest.
- E. Demonstrate and instruct maintenance personnel in the operation of pumps and systems.

END OF SECTION 232123

## SECTION 232300 - REFRIGERATION PIPING SYSTEM

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Piping, valves and fittings for refrigerant piping systems shown on drawings.

#### 1.2 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230529: Pipe Hangers.
- C. Section 230700: HVAC Insulation.

#### 1.3 SAFETY CODE

- A. Comply with the requirements of ANSI B9.1, Code for Refrigerant Systems.

#### 1.4 SUBMITTALS

- A. Submit for review manufacturer's product data for refrigerant piping system components.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Piping: Type "L" ACR hard copper, ASTM B280.
- B. Fittings: Wrought copper.
- C. Solder: Silver solder, or phos-copper solder having a melting point of 1125 degrees F or higher.
- D. Service Valves: Henry valves or equal. Provide packed type receiver, purge, and gauge valves with valve stem seal cap parts.
  - 1. Valves up to 5/8" OD: Henry Figure 516 or equal, diaphragm type.
  - 2. Valves larger than 5/8" OD: Henry Figure 203 or equal.
- E. Solenoid Valves: Sporlan Co., or equal, suitable for the type of refrigerant used, and of a type permitting manual lifting of stem for emergency operation. Size valves for pressure drop of 2 pounds with R-12 refrigerant, and a 3 pound drop with R-22 refrigerant, at design flow.

F. Refrigerant Filter Dehydrator and Moisture Indicator:

1. Dehydrator: Sporlon Co. Catch-All, or equal, with replaceable core, type, of size recommended by manufacturer for maximum design tonnage.
2. Moisture Indicator: Sporlan Co. See-All, type SA-125, or equal.

G. Pipe Supports:

1. Pipes subject to vibration: Isolation type brackets.
2. Pipes not subject to vibration: Anvil No. CT-95 or equal.
3. Riser clamps: Anvil CT-121 or equal.

H. Escutcheons: Chrome plated escutcheons sized for pipe.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Make solder joints with carbon dioxide or nitrogen passing through joints being soldered. Insure a clean, tight system. Pull a clean rag through each piece of tubing after cutting or reaming.
- B. Install pipe and hangers in accordance with hanger manufacturer's printed instructions.

#### 3.2 LEAK TESTING

- A. Test for leaks by use of carbon dioxide or nitrogen and a liquid soapsuds solution. Correct leaks found.
- B. Evacuate system to 20" vacuum and charge with refrigerant until a pressure of 15 psig is reached. Then test for leaks using a Halide leak detector. Correct leaks found.
- C. Pressurize system, with carbon dioxide or nitrogen, to 300 psig on the high side, and 200 psig on the low side, and test for leaks. Correct leaks found.

#### 3.3 SYSTEM DEHYDRATION

- A. Dehydrate system by "Double Dehydration" method.
- B. Use a suitable vacuum pump. Evacuate system to a vacuum of 0.2" Hg absolute and operate pump for eight hours when that pressure is reached.
- C. After eight hours, admit dry nitrogen directly to the system, and then evacuate system to a vacuum of 0.2" Hg absolute and operate pump for four hours.

#### 3.4 CHARGING SYSTEM

- A. When system dehydration is complete and all leaks are corrected, charge system with refrigerant.

#### 3.5 SAFETY CODE

- A. System shall be in accordance with ANSI B9.1 Code for Refrigeration Systems.

END OF SECTION 232300

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## SECTION 232500 - CHEMICAL WATER TREATMENT

### PART 1 - GENERAL

#### 1.1 INCLUDED WORK

- A. Furnish and install chemical water treatment systems complete with equipment, piping, tubing, and interconnection components, electric controls, and water treatment materials and chemicals, and test equipment and chemicals necessary maintaining water treatment program.
- B. Equipment, material, and chemicals shall be provided by a single water treatment firm for individual responsibility to ensure system compatibility.
- C. For additions or renovations requiring water treatment, supplier shall consult with the operating maintenance personnel and obtain services and equipment as requested by them.
- D. The products and systems set forth in Part 2 are performance oriented without regard to raw water conditions at the site, existing special conditions or an individual manufacturer's equipment or chemicals. Proposers shall obtain samples of the water to be supplied to the facility, analyze it and submit their proposals for equipment and chemicals based on the water to be treated and any other special conditions. A copy of the water analysis must be furnished with the proposal. The requirements of this paragraph also apply to additions and renovations to existing facilities where the proposer is already rendering chemical water treatment.
- E. The chemical water treatment supplier shall provide necessary products for boiler boilout, boiler water treatment, boiler feed system, cooling tower, condenser systems cleanout, initial passivation treatment of galvanized towers, cleaning and operation of closed water systems, and for a maximum of three months treatment of all open and closed water systems during operation of the facility.
- F. The chemical water treatment company representative shall develop a program for routine chemical treatment and testing for use of Maintenance Personnel after systems have been placed in operations.

#### 1.2 RELATED WORK

- A. Section 230500: Common Results for HVAC.
- B. Section 232000: HVAC Piping.
- C. Section 232123: HVAC Pumps.

#### 1.3 SUBMITTALS

- A. Submit shop drawings, product data, and manufacturer's installation instructions for review.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE SUPPLIERS

A. Acceptable Suppliers Include:

1. Betz Dearborn.
2. Anderson Chemical Company.
3. Alliance Group.
4. Garrett Callahan.
5. Alken Murray.
6. Nalco.
7. Diversey.

- B. Chemical water treatment supplier must have qualified service representation within 200 miles of facility, shall render monthly service to facility, and be available for emergency service as required.

### 2.2 BOILER SYSTEM

- A. Specific chemicals and equipment for the boiler system shall be determined by proposers based on raw water analysis required under Part 1 above.

- B. Provide separate equipment for scale control and steam line treatment and oxygen scavenger.

1. Scale control (phosphate alkalinity) and steam line (neutralizing a mine) treatment shall be injected into the boiler.
2. Oxygen scavenging shall be injected into the deaeration side of the deaerator, if two compartment, or in the deaerator or feed water heater if single compartment.

- C. Chemical Feed Unit: Packaged unit consisting of mixing tank agitator, chemical feed pump, piping connections, and other accessories Neptune, Model 525-STA.

1. Mixing tank shall be stainless steel or polyethylene.
  - a. Capacity: 50 gallons.
  - b. Hinged cover.
  - c. Non-valve type gauge glass.
  - d. Cast iron or PVC strainer and suction piping.
  - e. Stainless steel or PVC relief valve and piping.
  - f. Steel frame with agitator bracket and pump motor.
2. The agitator mounted on mixing tank shall have a stainless steel shaft and impeller.
3. The chemical feed pump mounted on tank stand shall be duplex positive displacement type.
4. Provide a separate pump for each boiler.
5. Provide one chemical feed unit for the boiler and one chemical feed unit for the deaerator.

- D. Provide water sample cooler for each boiler, Neptune, Model SC316. The maximum working pressure shall be 300 psi and maximum working temperature of 425 degrees F.

- E. Provide an automatic blowdown controller for each boiler equal to Lakewood Model 250. The automatic blowdown system shall monitor the boiler water's conductivity and if the conductivity is above a pre-selected setpoint, the blowdown valve will remain open until the conductivity falls below the setpoint level. If the conductivity is below the setpoint level, the blowdown valve will close until the next cycle.
  - 1. A high alarm shall be provided to warn operators of abnormally high conductivity conditions.
  - 2. The automatic blowdown control shall include the controller, sensor, and sensor assembly, including ball valve and orifice union.
- F. Corrosion Test Coupons: Provide corrosion coupon rack in condensate return piping at the deaerator/boiler feed unit to facilitate use of corrosion coupons. Provide one set of steel, brass, and copper coupons.

## 2.3 HVAC CIRCULATING CLOSED WATER SYSTEMS

- A. Provide for the following systems:
  - 1. Heating hot water.
- B. Provide and install a One Shot Feeder with funnel, an air release valve, sized for each system to be served (minimum size 5 gallons), rated for a pressure of 300 psi.
- C. Bypass Filters:
  - 1. Bypass filters shall be similar and approved equal to MSO and UMO Series medium pressure flow filters as manufactured by Filterite Corporation, Timonium, Maryland 21093 or Nowata Filtration "A" Series and shall be constructed as follows:
    - a. Bypass filter shall be carbon steel vertical tank type housing with integral angle iron leg supports and base plates for floor mounting. Housing shall have 2" NPT side inlet and outlet connections with 1/2" NPT drain and 1/4" vent connections as shown on the Drawings.
    - b. Housing shall have easy opening and closing top with ethylene propylene or Buna N O-ring seal and four (4) or six (6) captive eye bolts for internal cartridge filter tube replacement. Bypass filter shall be rated for working pressures of the system in which they are installed as indicated on the Drawings.
    - c. Internal cartridge filters shall be CUNO Micro-Klean III filter cartridges with 25 micron porosity on a tin-plated core. Provide and install a new, clean set of filter tubes in all bypass filters at time of issuance of a Substantial Completion Certificate by the Owner.
    - d. Bypass filters shall be rated for at least 18 gpm flow with 3.0 psig initial pressure drop and shall have configuration as indicated on the Drawings.
    - e. Bypass filters shall be installed into a bypass piping system on the chilled and heating hot water system. Filters shall also be used for feeding an aqueous solution of sodium nitrite based corrosion inhibitor into the water systems as outlined in this section.

## 2.4 TEST CABINET, EQUIPMENT AND TEST CHEMICALS

- A. Provide a test cabinet, equipment, and chemicals to place systems in operation and to effect the recommended water treatment and testing program.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install equipment furnished under Part 2 of this specification in locations set forth on the drawings.
- B. Furnish and install the necessary piping, valves, fittings, etc., as necessary to place treatment and control equipment in operation.
- C. The necessary electrical connections shall be provided under Division 26.
- D. Coordinate and schedule the services of the chemical water treatment and HVAC equipment provided for assistance as necessary to complete systems cleaning, flushing, boil out, start-up, treatment, and operation as is necessary, in accordance with the requirements of paragraphs below.
- E. The chemical water treatment system representative shall field verify the completed installation, including field calibration of controllers, pumps, and other operating parts. In addition, the representative shall ensure that all necessary chemicals and test equipment is on hand when needed.

### 3.2 SYSTEM PREPARATION FOR OPERATION

- A. Boiler System:
  - 1. Comply with the requirements and instructions of boiler manufacturer and as specified in other sections.
- B. HVAC Circulating Closed Water Systems:
  - 1. Initial Flushing:
    - a. Refer to Section 230500, 3.9 for requirements.
  - 2. Cleaning:
    - a. Refer to Section 230500, 3.9 for requirements.
  - 3. Final Flushing:
    - a. Return systems to conditions required by "Initial Flushing" after all cleaning and passivating solutions have been displaced by clean make-up disinfected water.
    - b. Flush all dead ends and isolated "clean" equipment.
    - c. Operate gently, all valves to dislodge any debris in valve body by throttling velocity.

- d. Flush for not less than 4 hours.
4. Placing into "Next Phase" Condition:
- a. Clean all "temporary" and permanent strainers. The water treatment supplier shall schedule removal of "temporary" strainers 3 months after final acceptance of facility, at a time approved by the Owner, unless directed otherwise by the Architect.
  - b. Dewater and clean all sumps, basins, storage, and pressure vessels and the like.
  - c. Disassemble, inspect, clean, repair, replace and re-assemble any critical component or questionable item. Any convoluted flexible connector left in place shall be removed and cleaned.
  - d. Preliminarily adjust all control valves.
  - e. Close-up and fill system as soon as possible to minimize corrosion of untreated surfaces.
  - f. Charge system with next phase chemical treatment compound.
  - g. For systems indicated with glycol, fill system from pre-mixed tanker trucks or barrels at indicated concentrations. Handle glycol in accordance with manufacturer's instructions and regulatory requirements.
5. Chemical Treatment Compound:
- a. A liquid solution of borate-nitrite with color concentration indicator shall be added to provide protection from corrosion, fouling. Product must contain a scale modifier with borate as the pH buffer. Additions shall be added at 1 gallon per 1000 gallons system capacity (or as required). Nitrite levels shall be maintained at 300-500 ppm in chilled closed systems and 800-1000 ppm in hot closed systems.

### 3.3 OWNER OPERATOR TRAINING

- A. Provide the maintenance personnel with an Operations Manual to include operating and maintenance instructions for all equipment furnished under this section, recommended chemical treatment and testing program, and any special safety information.
- B. Instruct Owner's operating personnel in the requirements of the treatment and testing program.
- C. Service representative shall provide service at the facility on a bi-weekly basis during the first two (2) months of building operations and monthly thereafter.
- D. At each on site analysis, verbally consult with and advise appropriate maintenance personnel of status of program and recommended changes. Follow the verbal consultation with a written report.

END OF SECTION 232500

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## SECTION 233113 - SHEETMETAL DUCTWORK

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Provide an installed duct system which will supply the air quantities indicated by the drawings and have the lowest possible friction loss with the least possible leakage loss. System static pressure loss for each system shall not exceed that which is indicated in the equipment schedule as external static pressure or in the fan schedule as static pressure and shall include the losses of all accessories. Friction losses shall be minimized by reduction in the number of offsets and elbows by pre-planning the duct system installation and coordination with other trades to prevent interferences. Maintain access to accessories requiring maintenance, service, and inspection. Radius elbows are preferred for turns to minimize friction, noise, and vibrations; and, especially, for sections having large volume or higher velocities and sections which may have turbulence.
- B. Provide and/or construct materials, ductwork, joints, transformations, splitters, dampers, and access doors as specified herein for the sheet metal ductwork as shown on drawings.

#### 1.2 QUALITY CONTROL AND REGULATORY STANDARDS

- A. SMACNA Manual: Sheet Metal Tradesman shall have access on the construction site to "HVAC Duct Construction Standards, Metal and Flexible, First Edition, 1985". Comply with applicable provisions of the SMACNA Manual and more stringent requirements of this specification.
- B. Quality control involves not only the general performance requirements for air ducts, but also quality workmanship which includes layout preplanning so that offsets, rises, falls, elbows, fittings, etc., are minimized or eliminated. General performance requirements for ducts include:
  - 1. Dimensional stability (shape deformation and strength).
  - 2. Containment of the air being conveyed (leakage control). (See Part 3 of this specification for leakage testing).
  - 3. Vibration (fatigue and appearance).
  - 4. Noise (generation, transmission, or attenuation).
  - 5. Exposure to (damage, weather, temperature extremes, flexure cycles, wind, corrosive atmospheres, biological contamination, flow interruption or reversal, underground or other encasement conditions, combustion, or other in-service conditions).
  - 6. Support (alignment and position retention).
  - 7. Seismic restraint.
  - 8. Thermal conductivity (heat gain or loss and condensation control).
- C. Provide galvanized duct materials which meet applicable requirements of local and state codes, whichever is the most stringent.
- D. Support ductwork in accordance with applicable requirements of local and state codes and details on drawings.
- E. Emboss fittings with material gauge, manufacturer, and type material.

- F. Sealers, liners, pre-insulated jackets and flexible ducts shall comply with a flame spread rating of 25 or less and a smoke developed rating of not over 50.

### 1.3 SUBMITTALS AND SHOP DRAWINGS

- A. Submit material/product data as described in Division 01.
- B. Shop Drawings: Provide shop drawings of sheet metal shop ductwork, as follows:
  - 1. Draw to a scale not less than 1/4-inch to one foot.
  - 2. Provide sheet sizes equal to Contract Drawings..
  - 3. Show duct sizes.
  - 4. Show fitting details.
  - 5. Show lighting and ceiling diffusers.
  - 6. Show bottom of duct elevation above finished floor.
- C. Coordinated Shop Drawings: Provide coordinated shop drawings for sheet metal work in mechanical equipment rooms, and other congested areas listed.
  - 1. Draw to a scale of 1/2 inch to 1 foot.
  - 2. Provide sheet sizes to match Contract Drawings.
  - 3. Show duct sizes.
  - 4. Show bottom duct elevations from finished floor.
  - 5. Show lighting, equipment, piping, columns and beams, with mounting heights.
  - 6. Show construction details of all fittings.
  - 7. Show construction details of plenums and casing.
- D. Floor Plans: Provide sheet metal floor plans drawn to the same scale as the Contract Drawings.
  - 1. Use Contract Drawing Sheet size.
  - 2. Show on each floor plan the floor penetrations, fire dampers and access doors, ducts with sizes and bottom elevations, terminal types and air quantities.
- E. Certifications: Provide a duct schedule, certified by an officer of the sheet metal fabrication subcontractor, that the ductwork conforms to SMACNA Standards and for each sheet metal system furnished on the project include:
  - 1. System name.
  - 2. Duct material.
  - 3. Duct gauge.
  - 4. SMACNA rectangular reinforcement number.
  - 5. SMACNA intermediate reinforcement number.
  - 6. SMACNA transverse reinforcement number.
  - 7. Rod diameter and type.
  - 8. Sealant type.
  - 9. Attachment method.
  - 10. Duct system design pressure.

### 1.4 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.

- B. Section 230593: HVAC Systems Test and Balance.
- C. Section 230700: HVAC Insulation.
- D. Section 233114: Sheetmetal - Special Ductwork.
- E. Section 233300: Air Duct Accessories.

## PART 2 - PRODUCTS

### 2.1 MATERIAL

- A. Sheet metal ductwork, angles, bar slips, hangers, and straps: Galvanized, prime quality steel sheets.
- B. Screws: Cadmium-plated.
- C. Joint Sealers: Hardcast RTA-50, consisting of two parts, mineral impregnated woven fiber tape and plastic type activator/adhesive.
- D. Sheetmetal Accessories: As specified in Section 233300.

### 2.2 PRESSURE CLASSIFICATION

- A. Ductwork where maximum dimension is less than 97" shall be constructed based on applicable pressure classification in accordance with SMACNA Manual including sheetmetal gauge, reinforcement gauge and spacing.
- B. Construct the following for 1" pressure classification, Table 1- 4:
  - 1. Supply ductwork downstream of terminal boxes.
  - 2. Low pressure supply ductwork to reheat coils.
  - 3. Low pressure supply and return ductwork at fan coil units.
- C. Construct the following for 2" pressure classification, Table 1- 5:
  - 1. Return ductwork.
  - 2. Exhaust ductwork.
  - 3. Make-up air ductwork.
- D. Construct the following for 6" w.g. pressure classification Table 1-8:
  - 1. Supply ductwork and plenums downstream of supply fans up to terminal boxes.

### 2.3 RECTANGULAR DUCTWORK

- A. Transverse Joints:
  - 1. "S" and drive construction for 1" and 2" pressure classification.

- a. Provide duct gauge and reinforcing angles in accordance with Table 1-11.
  2. Duct Connection System: Connection system as manufactured by Ductmate or Nexus shall incorporate gasketed joints, metal cleats and bolted corners. Minimum metal gauge shall be 24-gauge. Connection systems may be used for all pressure classifications.
  3. For pressure classifications above 2", use double "S" joint up to 30" and companion angle or manufacturer's connection system above 30".
- B. Longitudinal Seams: Pittsburgh Lock
- C. Transitions:
1. Do not exceed 1" in 7" of slope for increase-in-area transitions.
  2. Do not exceed 1" in 4" of slope for decrease-in-area transitions, 1" in 7" is preferable.
  3. Do not exceed 45 degrees on the entering or leaving side for angle of transitions at connections to equipment without the use of approved vanes.
- D. Elbows:
1. Fabricate ells using one of the following specifications: The fabrication methods are listed in order of preference. Use radius elbows where ever possible. Use square elbows only when available space prevents the use of radius elbows.
    - a. Unvaned, long radius elbow with the throat radius equal to 3/4 of the width of the duct and with a full heel radius.
    - b. Six inch throat radius with full radius, single thickness vanes and full heel radius. Maximum unsupported length of vanes shall be 36". Securely fasten vanes to runners. Secure vanes in stable position. Construct vane edges to project tangents parallel to duct sides.
    - c. Square elbows with airfoil, double thickness turning vanes.
  2. Turning vanes:
    - a. True airfoil design; smoothly-rounded entry nose with extended trailing edge. Generated sound power level shall not exceed 54 decibels in band 4 at 2000 FPM in a 24" x 24" duct.
    - b. Acceptable Manufacturers: Aero/Dyne Company, High Efficiency Profile, HEP. Contact Aero/Dyne Company at 1215 High Street, Suite 103, Auburn, CA 95603. (Telephone #800-522-2423).
    - c. Fabricate assemblies with Aero/Dyne Company side rails; install vanes on design centers of 2.4 inches across the full diagonal dimension of the elbow.
    - d. Submit manufacturer's product data for review. Proposed substitutions shall include independent performance test data for pressure loss and generated sound power levels.
- E. Branch Connections:
1. Pressure classification 2" and less:
    - a. Rectangular branch from rectangular main: 45 degree entry with all corners closed as shown in Figure 2-8.
    - b. Round branches: Spin-in fitting without scoop.
    - c. Parallel flow branches: See Figure 2-7.

- d. Space duct joints to avoid cutting them for branch take offs and outlet collars.
2. Pressure classification above 2":
- a. Round branches: Conical round fittings only.
  - b. Rectangular branch from rectangular main: 45 degree entry with all corners closed as shown in Figure 2-8.
  - c. Parallel flow branches: See Figure 2-7.
  - d. Space duct joints to avoid cutting them for branch take offs and outlet collars.
- F. Duct Sealing:
- 1. All longitudinal and transverse joints, seams and duct sidewall penetrations, regardless of pressure classification, shall be sealed with duct sealer. Follow SMACNA Table 1-2, Seal Class A for all supply, return and exhaust ductwork.

## 2.4 ROUND DUCTWORK

- A. Applicable for pressure classification above 2".
- B. Round Duct (Spiral Pipe) and Fittings:
- 1. Manufactured from galvanized steel meeting ASTM A-525. Construction shall be in accordance with SMACNA HVAC Duct Construction Standards and manufacturer's standards.
  - 2. Use appropriate seams made to eliminate leakage based on pressures for which system has been designed. Longitudinal seam duct to have fusion welded butt seam.
  - 3. Fittings and couplings shall have minimum gauges specified by SMACNA Manual.
  - 4. Fittings shall have continuous welds along all seams. Divided flow fittings shall be manufactured as separate fittings, not as tap collars welded into spiral duct sections.
  - 5. Ninety degree tees (conical) and 45 degree laterals (wye) up to and including 12" diameter tap size to have radiused entrance into the tap, produced by machine or press forming. Entrances to be free of weld build-up, burrs, or irregularities.
  - 6. Elbows in diameters 3" thru 8" shall be two section stamped elbows. Other elbows shall be gored construction with all seams continuous welded. Fabricate to center line radius of 1.5 times the cross sectional diameter. Elbows, not die-stamped, shall be fabricated as follows:
    - a. Less than 30 degree angle: minimum 2 gores.
    - b. Between 30 thru 60 degrees: minimum 3 gores.
    - c. Over 60 degrees: minimum 5 gores.
  - 7. Two piece mitered elbows shall not be used.
  - 8. Tees shall be conical. Saddle taps or straight tees shall not be used.
  - 9. The leading edge of all vanes in ducts over 20" diameter shall be hemmed with 1/2" foldback. Turning vanes in ducts over 24" shall be reinforced by stays or sectional construction to limit unsupported length to 24". Vanes shall be a minimum of 20-gauge.
  - 10. Reduction of divided flow fittings to conical span section in the 36 common reductions in sizes 4" thru 22".
  - 11. Spun bellmouth connections are to be used at each round take-off from plenum.
  - 12. Galvanized areas damaged by welding to be coated with corrosion resistant aluminum paint.

C. Couplings for Round Medium-Pressure Duct:

1. Pipe-to-pipe joints shall be sleeve couplings, reinforced by rolled beads.
2. Pipe-to-fitting joints shall be slip-fit of projecting collar fitting into pipe.
3. Insertion length of sleeve coupling and fitting collar shall be 2" minimum.

2.5 INTERNAL DUCT LINER

A. Applicable for 2" and less pressure classification.

1. Liner: One-inch thick Permacote Linacoustic fiberglass or approved equal. The airstream surface coating shall contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than 0.70 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than 0.25 BTU in/(hr ft<sup>2</sup> F) at 75 degrees.
2. Provide liner that complies with UL 181 Erosion Test and has a flame spread of 25 or less and a smoke developed rating of 50 or less.
3. Adhere liner to the duct with a continuous coating of approved adhesive and with adhesive clips or welded studs on 16" centers.
4. Provide coating of Foster 30-30 on air entering side and seal other joints with metal or fiberglass cloth so that liner will be smooth to air flow.
5. Interrupt duct liner at each duct mounted electric booster coil, 18" upstream and 30" downstream.

B. For 4" pressure classification and above:

1. Referenced on drawings as "Sound Absorber."
2. Acceptable duct liner: CertainTeed "Ultralite" liner or Owens Corning "Aeroflex", 2" thick, 1-1/2 pound density.
3. Cover duct liner with heavy fiberglass cloth and galvanized lath as used to hold plaster or cover liner with perforated metal. Adhere duct liner to sheet metal with 100% coverage of adhesive and coat exposed leading edges and transverse joints with adhesive. Additionally, secure duct liner with mechanical fasteners to compress the liner sufficiently to hold it firmly in place.
4. Flame spread rating shall be less than 25 and smoke developed rating less than 50. Liner shall meet the Erosion Test Method described in UL181.

2.6 A/C UNIT DISCHARGE OR RETURN AIR PLENUMS

A. For units noted on drawings with a discharge or return air plenum, construct plenums as specified below:

1. Construct of welded 18-gauge galvanized sheetmetal.
2. Provide supplemental exterior reinforcing to avoid buckling and collapse during fan start-up and under extreme filter loading conditions.
3. Reinforce plenum spans and walls as outlined in SMACNA "Duct Manual".
4. Liner shall be 2" thick, 1-1/2 pounds per cubic foot density "Sound Absorber" as specified herein.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, APPLICATION, ERECTION

- A. Do not exceed 45 degrees for easement transition angle.
- B. Seal all transverse and longitudinal joints and seams and duct wall penetrations with approved sealer in accordance with manufacturer's directions.
- C. Counterflashing: Counterflash ductwork penetrating roof.
- D. Support round ducts from building structure with galvanized steel hangers in accordance with SMACNA. Secure hangers to masonry portion of building by means of inserts or other acceptable anchors.
- E. Secure hangers to steel structure members by means of C-clamps. Vertical risers, and other duct runs where methods of support specified above are not applicable, shall be supported by angle brackets as shown in SMACNA Manual.
- F. Support rectangular ducts by 1" x 1/8" galvanized band iron or 3/8" galvanized rod hangers attached to reinforcing angles and spaced same as reinforcing angles. Secure hangers to concrete beam or slab by inserts, anchor shield and bolt, toggle bolt, or expansion bolt.
- G. Attach hangers to ductwork using sheet metal screws.
- H. Space hangers approximately 8' along the duct for ducts under 60". Ducts over 60" and larger, and heavier sections such as welded duct and sound absorbers, space hangers at approximately 4' intervals.
- I. Hangers and bracing used with ductwork shall be galvanized.
- J. Support sound absorbers by inserts in the slab.
- K. Provide smooth insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. Provide metal collar equivalent in depth to insulation thickness.

### 3.2 CLEANING

- A. Clean mechanical system thoroughly to assure all foreign matter and dirt is removed.

### 3.3 LEAKAGE TESTING OF INSTALLED SYSTEMS

- A. Test duct for leakage in accordance with "System Pressure Testing for Leaks", published by United Sheet Metal Division of United McGill Corporation. Use prescribed test kit containing test blower, two U-tube manometers and calibrated curve attached to the orifice tube assembly.

- B. Pressurize installed duct system to maximum pressure for fabrication classification. Total allowable leakage shall not exceed one percent of air handling capacity of system. If system is tested in sections, add leakage rates for individual sections to determine leakage for the whole system.
- C. Correct leaks found in excess of allowable limits. Retest.
- D. Have test results available for review on a progressive and final basis. Include test results in project closing file.
- E. Testing in accordance with printed procedure.

#### 3.4 AIR TEST AND BALANCE

- A. Prepare the system for tests as specified in Section 230593 and correct deficiencies found by the Test and Balance firm.
- B. Duct dimensions shown on drawings indicate inside clear dimensions. Make allowances for duct requiring internal sound lining, or insulation to provide "inside clear" (IC) dimensions.
- C. In addition to the requirements above, add supplemental bracing as necessary to prevent sagging and drumming, and/or vibration.

END OF SECTION 233113

## SECTION 233114 - SHEETMETAL - SPECIAL DUCTWORK

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Fabricate and install special duct work for:
  - 1. Kitchen range exhaust duct.
  - 2. Dishwasher exhaust duct.
  - 3. Air distributing apparatus casing.

#### 1.2 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 233113: Sheetmetal Ductwork.
- C. Section 233300: Air Duct Accessories.
- D. Section 233813: Commercial Kitchen Hoods.

#### 1.3 SUBMITTALS

- A. Submit manufacturer's product data for review.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL AND FABRICATION

- A. Kitchen Range Exhaust Duct:
  - 1. Fabricate, install and support ductwork as required by NFPA 96 and local codes.
  - 2. Ductwork and support material: Carbon steel not less than 0.054" (No. 16 MSG) or stainless steel not less than 0.043" (No. 18 MSG) in thickness.
  - 3. All seams, joints, and penetrations shall have a liquid tight continuous external weld, except where the duct stub collar of the hood or a listed ventilator is connected to the exhaust duct. Refer to NFPA 96 for details of this connection when used.
  - 4. Install cleanout doors in the sides of the duct located at each change of direction and in straight sections not more the 20 feet apart. Openings shall be at the sides of duct and in horizontal sections shall be not less than 1-1/2" from the bottom of the duct. In interior duct installations, provide convenient one-hour rated ceiling access panels to provide access to cleanout doors.
  - 5. See mechanical drawings for additional details for materials and installation and refer to NFPA for additional details relative to internal and external installation.

6. Paint exterior ductwork with paint and primer, suitable for application, to protect ductwork in accordance with NFPA 96, 4-6.2. Remove all rust and other debris from duct before painting.
- B. Dishwasher exhaust ductwork: Welded aluminum above the ceiling and stainless steel from ceiling to dishwasher connection.
1. Rain cap, flashing collar, and roof thimble.
- C. Air distributing apparatus casing:
1. Construction: 18 gauge (16 gauge if over 10 feet high) galvanized sheetmetal formed in 1-1/2 inch high standing seam panels.
  2. Form casing in a rectangular shape, with slope of air stream between system components limited to a maximum of 45 degrees.
  3. Provide supplemental interior angle iron reinforcing before fan inlet, and exterior reinforcing after fan discharge, to avoid buckling and collapse during fan start-up and under extreme filter loading conditions.
  4. Reinforce casing spans and walls in medium or high pressure casing, as outlined in SMACNA "Duct Manual".
  5. Provide access doors as specified in Section 233300.
  6. Install access door in a 16 gauge (minimum) channel or zee-section frame provided in the casing.
  7. Extend side members of access door frame from floor to roof line.
  8. Provide internal duct sound liner in apparatus casings. Liner shall be CertainTeed "Ultralite", or approved equal.
  9. Liner shall be 1" thick, UL listed, neoprene coated, mat faced, flexible fiberglass, and density of one pound per cubic foot. Provide liner that complies with UL 181 Erosion Test and has a flame spread rating of 24 or less and a smoke developed rating of 50 or less.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, APPLICATION, ERECTION

- A. Apparatus casing:
1. Rivet or bolt casing panels at floor line to a continuous 2"x2"x1/4" galvanized angle attached on 18 inch centers by expansion shields and bolts to a concrete curb or floor as detailed on drawings.
  2. Join walls and roof similarly or by flanging casing and attaching to masonry by bolts and expansion shields on 24 inch centers.
  3. Seal standing seam joints and attachment joints with either liquid high velocity duct sealant, mastic, or caulking compound applied so that pressure differential drives sealant into joint.
  4. Seal piping and conduit penetrations air and moisture tight with sealant plates and gaskets.
  5. Sound liner:
    - a. Adhere liner to the duct with a continuous coating of approved adhesive and with adhesive clips or welded studs, on 16" centers.

- b. Provide coating of Foster CP-30 on air entering side and seal other joints with metal or fiberglass cloth so that liner will be smooth to air flow.

B. Dishwasher Exhaust Duct:

- 1. Install as shown on drawings.
- 2. Support ductwork as specified under this Division.
- 3. Slope ductwork toward dirty side of dishwasher as shown on mechanical drawings.

3.2 CLEANING AND TESTING

- A. Clean and test work as specified in Section 230500.

END OF SECTION 233114

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 233115 - FABRIC DUCTWORK

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.
- B. Types of non-metal ductwork required for this project include the following:
  - 1. Fabric Air Dispersion Products.

#### 1.2 QUALITY ASSURANCE

- A. Building Codes and Standards:
  - 1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and are also classified in accordance with ICC Evaluation Service AC167 and UL 2518.
  - 2. All product sections must be labeled with the logo and classification marking of Underwriters Laboratories.
- B. Design and Quality Control:
  - 1. Manufacturer must have documented design support information including duct sizing, vent and orifice location, vent and orifice sizing, length, and suspension. Parameters for design, including maximum air temperature, velocity, pressure and fabric permeability, shall be considered and documented.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
- B. Building Code Data: Submit UL file number under which product is Classified by Underwriters Laboratories for both NFPA 90-A, ICC AC167, and UL 2518.
- C. Provide detailed drawings confirming configuration of components and fabric system.
- D. Provide detailed installation instructions for components to be installed.
- E. Provide warranty and maintenance documentation.

#### 1.4 WARRANTY

- A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system, as well as, a Design and Performance Warranty.

## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect fabric air dispersion systems from damage during shipping, storage and handling.
- B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented water-proof wrapping.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. DuctSox Corporation (DuctSox nomenclature and model numbers are used for reference).
- B. FabricAir Inc.
- C. KE Fibertec NA, Inc.

### 2.2 FABRIC AIR DISPERSION SYSTEM

- A. Sedona-Xm Fabric: Air diffusers shall be constructed of a twill polyester fire retardant fabric complying with the following physical characteristics:
  - 1. Fabric Construction: 100% Polyester.
  - 2. Coating: Anti-microbial agent.
  - 3. Weight: 6.8 oz./yd<sup>2</sup> per ASTM D3776.
  - 4. Color: Coordinate with Architect.
  - 5. Air Permeability: 2 cfm/ft<sup>2</sup> per ASTM D737, Frazier.
  - 6. Temperature Range: 0 degrees F to 180 degrees F.
  - 7. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements of NFPA 90-A and UL 2518.
- B. Systems Fabrication Requirements:
  - 1. Dispersion orifice sizing, up to 5 inch diameter (design dependent).
  - 2. Size, quantity, and location of orifices to be specified and approved by manufacturer.
  - 3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener - supplied by contractor.
  - 4. Inlet connection includes zipper for easy removal/maintenance.
  - 5. Lengths to include required zippers as specified by manufacturer.
  - 6. System to include adjustable flow devices to balance turbulence, airflow, and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 - 0.60 in w.g. static pressure.
  - 7. End cap includes zipper for easy maintenance.
  - 8. Fabric system shall include connectors to accommodate suspension system listed below.
  - 9. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows are 5 gores and the radius of the elbow is 1.5 times the diameter of the fabric duct.

10. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

C. Design Parameters:

1. Fabric air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard.
2. Fabric air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.
4. Do not use fabric diffusers in concealed locations.
5. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.

D. Suspension Hardware: (include applicable components only)

1. SkeleCore FTS (Fabric Tension System): (Available for duct diameters from 8" to 60") System shall cylindrically tension fabric along the entire length of fabric duct. Tensioning system shall include full 360 degree tensioning and intermediate rings with quick connection spacer tubes concealed inside the fabric system. Interior structure to include multiple mechanically adjustable tension devices. To provide proper fabric tensioning, structural and fabric system shall be configured in segments of no more than 45 feet. Each cylindrical ring shall require vertical metal to metal vertical cable safety attachment.

a. Component Options Include:

- 1) Metal cylindrical rings.

## PART 3 - INSTALLATION

### 3.1 INSTALLATION OF FABRIC AIR DISPERSION SYSTEM

- A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

### 3.2 CLEANING AND PROTECTION

- A. Clean air handling unit and ductwork prior to the fabric duct system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
- B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
- C. If the fabric duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION 233115

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Lakers Practice Facility  
Los Angeles, CA  
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## SECTION 233248 - ACOUSTICAL AIR PLENUMS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 237310: Modular, Indoor, Air Handling and Energy Recovery Units

#### 1.2 QUALITY CONTROL/STANDARDS

- A. Plenum design to meet combustion requirements established by ASTM E84. Panels not to exceed the following limits:
  - 1. Flame Spread: 10-20.
  - 2. Smoke Developed: 0-20.
  - 3. Fuel Contributed: 10-15.
- B. All lining material to meet erosion test method as described in UL Publication No. 181.
- C. Provide certified test data in accordance with the following:
  - 1. Minimum allowable transmission loss (TL) of panel including all components, when tested in accordance with ASTM E90-61T, shall be as follows:
    - a. Frequencies - Hz: 125 250 500 1000 4000 8000
    - b. Decibels: 23 35 45 53 58 58
  - 2. Composite panel assembly when tested in accordance with ASTM C423-65T, shall have minimum absorption coefficients as follows:
    - a. Frequencies - Hz: 125 250 500 1000 2000 4000 8000
    - b. Coefficients: 0.63 1.9 1.17 1.8 1.1 0.97 0.93

#### 1.3 SUBMITTALS

- A. Submit product data and performance criteria for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. VibroAcoustics.
- B. IAC.
- C. United Sheet Metal.

D. Semco.

## 2.2 ACOUSTICAL AIR PLENUMS

- A. Air plenums shall be 4" thick with interior perforated panel of #22 U.S. gauge galvanized steel with 3/32" diameter holes spaced on 3/16" staggered centers. Support panel walls and partitions directly on concrete floor slab.
- B. Exterior solid panels sheets shall be #18 U.S. gauge galvanized steel.
- C. Sound retarding and absorbing fill shall be incombustible, inert, mildew resistant, and vermin-proof.
- D. Internal panel reinforcement shall be a minimum of #18 U.S. gauge galvanized steel and spaced so that span does not exceed 2'. Perimeter and internal reinforcement and panel sheets shall be welded and riveted to form a rugged metal-sheathed acoustical panel. Spot welds not to exceed 3" on centers.
- E. Prior to attaching face sheet, panel shall be filled with sound retardant and absorbing fill as specified above. Fill shall be slightly larger and thicker than inside dimension of the panel. No voids will be tolerated.
- F. Face sheet shall be welded and riveted to panel assembly to compress and hold fill materials in place under severe conditions of vibration such as encountered in shipment, installation, and operation.
- G. Door panels shall be constructed of solid #18 U.S. gauge galvanized metal sides. Doors shall be supplied 24" wide by 60" high or 36" by 72" high as specified on the drawings. Doors shall be 4" thick of the overlapping seal type. Each door shall be supplied with single continuous air/acoustical seals around the sill, jambs, and head. Doors to have 3 hinges and 2 latches with an inside release handle. Each door shall be assembled with hinge hardware attached and adjusted, and latches installed in the field. Door latches shall be wedge type with inside handle. Hinges shall be heavy duty type designed for door size and weight. Doors shall be installed to open against air pressure.
- H. Windows shall be furnished for doors where shown on drawings and consist of two layers of 1/4" safety glass separated by air space and sealed acoustically and air tight with rubber seals. Air space to contain a desiccant material to prevent misting.
- I. Roof channels, aprons and corner joiners shall be made of #16 U.S. gauge galvanized steel formed to prevent a direct path for sound and/or air leakage. Floor channels shall be made of #18 U.S. gauge galvanized steel. Panel joiners shall be made of #20 U.S. gauge galvanized steel and roll formed for greater strength than standard 16-gauge joiners. Where roll formed joiner sections are not utilized standard 16 gauge shall be utilized. All panel accessories shall be furnished in standard lengths shall be field cut to required dimensions. Where panel walls and partitions join concrete floor, secure panels to 2" X 2" X 3/16" galvanized structural steel angle framing. Secure angle framing to concrete floor on not over 24" centers, and caulk airtight with "Dow Corning #780" building sealant or "General Electric PTV" silicone rubber. All panel joiners and connectors requiring felted surfaces to have the felt field applied.

- J. Openings for fan and duct connections where required shall be provided by plenum manufacturer. Pipe and conduit penetrations shall be located and cut in the field and sealed in accordance with the manufacturer's recommendations.
- K. Plenum structure shall be normally self-supporting. Where roof spans and wall loadings require additional structural strength, provide either by heavier roof and wall joiners, or additional structural members and/or pipe columns.
- L. Metal surfaces shall be galvanized except 5" wide flange beams. Prime paint all such structural members.
- M. Panels shall have Heat Transfer Factor of 0.07 BTHU/Sq. Ft./F temperature difference at standard air.
- N. Plenum installation shall be capable of withstanding positive internal static air pressure of 8".
- O. Plenum installation shall be capable of withstanding negative internal static air pressure of 4".
- P. All lining material shall meet erosion test method as described in UL Publication No. 181.
- Q. Plenum manufacturer shall warrant that when plenums are installed in workmanlike manner in accordance with specifications and manufacturer's instructions that plenums will meet acoustical, thermal, and air pressure performance specified.
- R. Plenums shall be furnished clean, well made, and free of any defects that adversely affect appearance, serviceability or performance.

## 2.3 ACCESS DOORS

- A. Provide access doors for access to all heaters, fire dampers, automatic dampers, smoke dampers, air monitor stations, if installed, and other equipment installed in ducts and/or as indicated on drawings.
- B. Where required, provide access doors in masonry walls under Section 230500.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instruction at locations shown on drawings.

END OF SECTION 233248

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 233300 - AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Air distribution registers, grilles, and diffusers.
- B. Fire dampers.
- C. Smoke dampers.
- D. Combination fire and smoke dampers.
- E. Access doors.
- F. Flex duct.

#### 1.2 RELATED WORK

- A. Section 233113: Sheetmetal Ductwork.
- B. Section 233114: Special Ductwork.
- C. Section 230923: Direct Digital Controls.

#### 1.3 QUALITY CONTROL

- A. Air Diffusers, Grilles, and Registers: Ratings certified by Air Diffusion Council.
- B. Smoke and Combination Fire/Smoke Dampers: Comply with requirements of UL 555S.
- C. Roof Ceiling Assembly: Comply with requirements of UL Fire Resistance Index.

#### 1.4 WARRANTY

- A. Provide five (5) year parts and labor warranty from date of substantial completion.

#### 1.5 SUBMITTALS

- A. Submit manufacturer's product data for review.

## PART 2 - PRODUCTS

### 2.1 REGISTERS, GRILLES AND DIFFUSERS

- A. Acceptable Manufacturers: Titus, Metalire, Anemostat, Price.
- B. Ceiling diffusers, grilles and registers shall be of steel construction in accordance with the roof/ceiling assembly as detailed in the UL Fire Resistance Index. Ceiling diffusers, grilles and registers in areas relying on operable windows for natural ventilation, such as suites, press boxes, broadcast booths, etc. shall be of aluminum construction.
- C. Sidewall Supply Registers:
  - 1. Similar to Titus Model 300FL unless otherwise noted on drawings.
    - a. Furnish register with complete extruded aluminum construction for both core and frame. The core shall be removable.
    - b. Provide aluminum OBD.
    - c. Provide surface mount border with countersunk screw holes.
    - d. Finish: Coordinate with Architect.
    - e. Located as shown per the contract drawings.
- D. Supply Diffuser in Exposed Round Spiral Duct Noted as Type A Duct-D-Fuser.
  - 1. McGill Airflow Corporation's TDF Type A Duct-D-Fuser.
  - 2. Custom air diffusion devices shall be provided where indicated on the drawings. Diffusers shall be designed by the supplier to provide the required cfm as noted on the drawings. The throw should be designed for a terminal velocity of 50 fpm at the wall directly in front of the diffuser or 8 feet above the floor below. Submittals shall include calculations or design program printouts noting the diffuser size, diffuser spacing, throw distance and angle, and the approximate pressure drop.
  - 3. Diffusers shall be constructed of nozzled perforated carbon steel panels flush mounted to the ductwork. Provide diffusers framed and factory mounted.
- E. Sidewall Return and Exhaust Registers:
  - 1. Similar to Titus Model 350ZFL with 0 degree deflection unless otherwise noted on drawings.
    - a. Furnish register with complete extruded aluminum construction for both core and frame. The core shall be removable.
    - b. Provide aluminum OBD.
    - c. Provide surface mount border with countersunk screw holes.
    - d. Finish: Coordinate with Architect.
    - e. Located as shown per the contract drawings.
- F. Flowbar Diffusers:
  - 1. Similar to Titus Model FL.

- a. Provide modulinear type with 1" slots unless otherwise noted. Linear slot diffuser shall have frame and support bars constructed of heavy gauge extruded aluminum.
- b. Furnish extruded aluminum pattern controllers, 24" long, positioned between spring loaded spacers. Pattern controllers shall allow the airstream to be directed flat against the ceiling in either direction or downward, as well as, allowing for throw reduction every two feet.
- c. Mechanical contractor shall provide and install all plenums, hoods, blank-offs, and associated sheet metal components for a complete system.
- d. Linear slots shall be capable of supporting the ceiling system. Linear diffusers supported by screws in the flanges or from air plenums are unacceptable. For lay-in ceiling, provide hanger wire support clips that are integral with the slot diffuser for proper support from the building structure.
- e. Provide end and corners as required. Ends shall be butt type and corners shall be mitered one piece.
- f. Finish: Coordinate with Architect.
- g. Plenums shall be supplied by the flow bar manufacturer. Plenums shall be minimum 24-gauge steel with lined inside with black matte fiberglass insulation.
- h. Sizes and locations as shown per the contract drawings.

G. Ceiling Supply Diffusers:

1. Similar to Titus Model OMNI, architectural plaque diffuser.
  - a. Coordinate ceiling frame type with architectural ceiling type. In all cases, provide concealed mounting.
  - b. Ceiling diffusers may be suitable for lay-in tile installation by mounting it in a factory fabricated, 24" x 24" panel, only if diffuser face is a minimum of 15" x 15". Provide frame Style 3.
  - c. Do not use directional diffusers. For diffusers noted on drawings as 3-way or 2-way blow, provide 4-way diffusers with sides blanked off with sheetmetal plates installed in the diffuser.
  - d. Provide ceiling diffusers complete with OBD where diffuser is installed in an inaccessible ceiling. Do not furnish OBD for diffusers installed in accessible ceilings or exposed diffusers.
  - e. Finish: Coordinate with Architect.
2. Similar to Titus Model PAS, Perforated Air Diffuser.
  - a. Provided as noted on floor plans for commissary areas.
  - b. Provide similar construction and finish as for Model OMNI above.

H. Ceiling Exhaust and Return Grilles and Registers:

1. Similar to Titus Model 50F.
  - a. Provide Titus Model 50R-SS with stainless steel construction for all grilles exposed to outdoor conditions similar to transfer grilles at concourse toilets.
  - b. Provide 1/2" eggcrate type with all aluminum construction.
  - c. Coordinate ceiling frame type with architectural ceiling type. In all cases, provide concealed mounting.

- d. Provide ceiling exhaust and return registers complete with OBD where installed in an inaccessible ceiling. Do not furnish OBD for registers installed in accessible ceilings or exposed registers.
  - e. Finish: Coordinate with Architect.
- I. Heavy Duty Bar Return and Exhaust Grilles:
  - 1. Similar to Titus Model 30RL with 0 degrees deflection.
    - a. Furnish register with 16-gauge steel border and 14-gauge steel bars spaced at 3/8". The core shall be removable. Provide surface mount border with countersunk screw holes.
    - b. Finish: Coordinate with Architect.
    - c. Sizes and locations for basketball court return grilles.
- J. Refer to contract drawings for the number of modules, sizes, and locations.

## 2.2 FIRE AND SMOKE DAMPERS

- A. Acceptable Manufacturers:
  - 1. Ruskin.
  - 2. Air Balance.
  - 3. Greenheck.
- B. Damper Fire Ratings: See drawings for fire ratings of walls and floors in which dampers are installed. Coordinate damper fire rating with wall and floor rating. Dampers with asbestos paper or coating are unacceptable.
- C. Fusible Link: Provide fusible links which will melt at 165°F causing damper to close and lock in closed position.
- D. Provide Type "C" multi-leaf fire dampers rated for use in dynamic systems with airflow up to 4000 fpm at 6" w.c. Construct dampers of steel with rust resistant finish.
- E. Provide Ruskin Model CFD(R)5 ceiling fire dampers at all penetrations to rated lids at exit passageways.
- F. Smoke Dampers:
  - 1. Low pressure duct (2" pressure class and lower): Ruskin SD-35.
  - 2. Medium pressure duct (4" - 6" pressure class): Ruskin SD-60.
  - 3. Operators: Electric, 120 volt. Provide unit-mounted end switch for damper status.
  - 4. Install and mount qualified operator at time of fabrication by damper manufacturer. Operator shall be mounted out of airstream in accessible location. Furnish damper and operator by a single entity meeting applicable UL 555S qualifications for both damper and operator. Damper operator shall be adequate size to open or close damper in 15 seconds.
- G. Combination Fire and Smoke Dampers:
  - 1. Low pressure ductwork: Ruskin Model FSD-36.

2. Medium pressure ductwork: Ruskin Model FSD-60.
3. Operator: Electric, 120 volt. Provide unit-mounted end switch for damper status.
4. Install and mount qualified operator at time of fabrication by damper manufacturer. Furnish damper and operator by a single entity meeting applicable UL 555S qualifications for both damper and operator. Damper operator shall be of adequate size to open or close damper in 15 seconds. Mount operator on face of damper in the airstream as noted on drawings.

H. Sleeves:

1. Unless otherwise required by the authority having jurisdiction, sleeves for fire dampers and fire and smoke combination dampers shall be the rigid type of construction recommended in Schedule 2 of SMACNA Publication for "Fire Damper and Heat Stop Guide for Air Handling Systems". Use 16-gauge for ducts 24" or less in diameter or either rectangular dimension and 14 for ducts over 24". Provide minimum 18" long sleeves. Coordinate required length with wall thicknesses.
2. Conform to the requirements of UL 555S. Test damper and operator as a unit to comply with UL 555S.
3. Install 1-1/2" x 1-1/2" x 1/8" angle bar on four sides of sleeves and both sides of wall.
4. Fasten angles to sleeve only.
5. Do not fasten angles to the wall.

I. Maximum pressure drop for combination fire/smoke dampers:

1. Supply ducts: 0.25" at 2500 FPM.
2. Return and exhaust ducts: 0.15 at 1500 FPM.

2.3 ACCESS DOORS

A. Acceptable Manufacturers:

1. Ruskin, Model ADH22.
2. Venco CAD-10.

B. Provide insulated doors in ductwork for access to service equipment such as automatic dampers, fire dampers, smoke dampers, casing mounted coils (each side), filters (each side), duct mounted smoke detectors duct mounted air flow measuring stations (each side) and elsewhere as noted on drawings.

C. Size access doors as follows:

1. Duct Sizes under 12": Door sized sufficient to service equipment or replace fusible link.
2. Duct sizes 12" to 20": 12" x 12" door.
3. Duct sizes 20" to 36": 18" x 18" door.
4. Duct sizes 36" and above: 24" x 24" door.

D. Apparatus Casing Access Doors: Prehung door frame assemblies, size 22" x 58", Ruskin ADW2.

E. Provide reinforced wire glass view windows, 12" x 12" in access doors at humidifiers.

- F. Use double panel construction, two sheets of at least 24-gauge galvanized steel with 1" thick insulation between panels.
- G. Mount doors in a rigid frame of at least 22-gauge formed galvanized steel or aluminum.
- H. Use angle iron bracing as required to make the door frame a rigid assembly.
- I. Provide latches that permit easy removal of access door while maintaining positive closing and minimum leakage.
- J. Provide sponge rubber gaskets for all doors.
- K. In accordance with NFPA 90A, identify each access door with 1/2" high stenciled letters as 'Fire Damper', 'Smoke Damper', or 'Combination Fire/Smoke Damper'.

## 2.4 FLEXIBLE DUCT

- A. Acceptable Manufacturers:
  - 1. Flexmaster U.S.A., Model No. Type 5 insulated; Wiremold; Omniair 1200; J. P. Lanburn.
- B. Characteristics of Flexible Duct to Air Terminals:
  - 1. Approved as UL Class 1 air duct.
  - 2. Flame spread less than 25, smoke developed rating less than 50.
  - 3. Insulated with 1/2" thick fiberglass insulation.
  - 4. Provide a minimum of three feet of flexible duct upstream of diffusers. Do not exceed six feet of length.
  - 5. Flexible duct shall meet standards of local building code.
- C. Seal off the insulation jacket at its ends and at joints with mastic, hardcast, or similar material. Replace flex if jacket is punctured.
- D. Complete insulation coverage up to the boxes.
- E. Do not route flexible duct through corridor walls, fire or smoke partitions.
- F. No bends shall be made in flexible duct with the center line radius less than one and one-half duct diameter and only one bend may occur per four foot length of duct material.
- G. Install UL listed flexible duct connectors made of 28 ounce, heavy glass fabric double coated with neoprene between duct and fan discharge.

## 2.5 MANUAL VOLUME DAMPERS

- A. Type: Opposed blade.
- B. Material: Steel, 3V type blades mounted in steel channel frame.
- C. Shaft: 1/2" square rod operator with end bearings and gasket seal at duct penetrations. Terminate shaft in damper frame with bushings.

- D. Operator: Locking quadrant handle with damper position indicator and insulation standoff mounting bracket for externally insulated ductwork.
- E. Remote Control Operator: Provide Young Regulator Model 1200-FS or equal for remote volume adjustment in areas with inaccessible ceilings where access panels are not desired. Termination shall be with a concealed ceiling cap similar to Young Model 896-FS or with a plenum bracket similar to Young Model PL.
  - 1. The assembly shall consist of a locking worm gear regulator and a 1/4" flexible steel shaft. The shaft is coupled to the worm gear at one end, and the other end is brought to an accessible location for control of balancing dampers in inaccessible areas.
  - 2. Coordinate flexible shaft length as required.
  - 3. Install per manufacturer's recommendations.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install sheet metal accessories in locations shown on drawings.
- B. Install accessories in accordance with manufacturer's published recommendations, as well as, applicable sections of SMACNA Manual and other standards set forth in Part 1.
- C. Provide all screws, bolts, nuts, inserts, and material required for attaching sheet metal to duct, walls, floors, and ceilings.
- D. Where diffusers or grilles and registers are not provided with volume dampers, install spin-in fitting with balancing damper in duct runout.

#### 3.2 TESTING

- A. Check work for satisfactory installation and performance.
- B. Ensure that adequate access does in fact exist for fire and smoke dampers and that damper operator motors are not hindered in operation by proximity to walls or other objects.
- C. Check duct connections at access doors for air leakage or condensation. Correct conditions found.

END OF SECTION 233300

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Los Angeles, CA  
RA Project No. 2014-015

## SECTION 233319 - SOUND ATTENUATORS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 237313: Factory Assembled, Modular Construction Air Handling Systems.

#### 1.2 CERTIFICATION

- A. Silencer ratings shall be certified by nationally known qualified independent testing laboratory. Testing shall be conducted in strict accordance with ASTM E477 method for testing prefabricated silencers for acoustical and airflow performance.

#### 1.3 SUBMITTALS

- A. Submit product data for review. Include in submittal:
  - 1. Dimensions and location of each silencer.
- B. Independent laboratory certified minimum dynamic insertion loss, self-generated noise, and pressure drop ratings for each silencer.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. United McGill Corporation.
- B. VibroAcoustics.
- C. Rink Corporation.
- D. Industrial Acoustics Company.
- E. Kinetics Noise Control.

#### 2.2 EQUIPMENT REQUIREMENTS

- A. Construct duct silencers in accordance with SMACNA Standards for high pressure duct. Provide air-tight casing when tested to 8" water gauge pressure differential. Suitably stiffen casings to prevent permanent deformation when tested to 8" water gauge pressure differential.
- B. Fabricate outer casings of rectangular silencers from minimum 22-gauge galvanized steel.

C. Fabricate outer casings of round silencers from galvanized steel as follows:

1.	OUTSIDE DIAMETER	MINIMUM METAL GAUGE
a.	12" - 26"	24
b.	27" - 36"	22
c.	37" - 50"	20
d.	51" - 60"	18

D. Fabricate interior casings from minimum 26-gauge galvanized perforated steel.

E. Filler material shall be inorganic mineral or glass fiber packed under minimum 5% compression. Filler material shall be vermin, moisture-proof and inert. Combustion rating of filler material shall be not less than the following when tested in accordance with NFPA 255, ASTM E84, or UL-723.

1. Flame Spread: 25.
2. Smoke Development Rating: 50.
3. Fuel Contribution: 20.

F. See drawings for size, location, and acoustical and pressure drop performance required for each silencer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install silencers in accordance with manufacturers published installation instructions. The duct silencer supplier or his qualified representative to be responsible for providing such supervision as may be required to assure correct and complete installation of the duct silencers.
- B. Resiliently isolate silencers from the building construction at points of penetration of the building structure with minimum 1/2" thickness, 3 lb./cubic foot density glass fiber.
- C. Seal multiple silencer units grouped together in parallel airtight with Ec-800 sealant as manufactured by 3M Company or approved equal.

#### 3.2 TESTING

- A. Demonstrate satisfactory performance to Architect. Be prepared to measure and/or evaluate compliance with laboratory certified ratings outlined above.

END OF SECTION 233319

## SECTION 233416 - CENTRIFUGAL FANS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. This section includes requirements for forward curved, backward inclined, and airfoil type centrifugal fans.
- B. Provide fan type, capacity, direction of notation, discharge direction, and arrangement as shown on drawings.

#### 1.2 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230513: Motors for HVAC.
- C. Section 230548: Vibration Isolation.
- D. Division 26: Electrical.

#### 1.3 PERFORMANCE

- A. Certify fan performance in accordance with AMCA Certified Air and Sound Rating Criteria Standards 210, 300, and 301.

#### 1.4 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Barry.
- B. Trane.
- C. Twin City.
- D. Greenheck.
- E. StrobicAir.

## 2.2 KITCHEN EXHAUST FAN

- A. Kitchen fan to be StrobicAir or equivalent.
- B. High Temperature coated rated fan with color per owner and architects color scheme for roof.
- C. Discharge nozzle to be TS1 Windband Asy metal large high temp.
- D. Supply vortex breaker, wagon wheel, TS-1.
- E. Provide bypass damper - 304 S.S Opposed blade. Provide Bypass actuators for dampers. Provide bypass damper actuators.
- F. 304 SS Rain hood for TS1.
- G. Provide Mix Box side inlet for bypass air.

## 2.3 EQUIPMENT REQUIREMENTS

- A. Wheels and Housings: Wheel diameters and outlets areas sized in accordance with AMCA Standards.
- B. Drive Arrangements: Conform with AMCA Standard AS2404 and as shown on drawings.
- C. Housing Constructions: Heavy steel with slip joint inlets and outlets. Rivet blades to steel shroud.
- D. Painting: Factory applied, rust-resistant paint.
- E. Shaft: Solid hot rolled steel, ground accurately for a smooth bearing fit.
- F. Mount relubricable anti-friction, self-aligning pillow block ball bearings on Class I fans and spherical roller type bearings on Class II and III fans. Position bearing supports to directly oppose drive belt tensions and transmit loads to the fan base.
  - 1. Bearings to have a minimum AFBMA 1-50 life in excess of 200,000 hours for operating conditions.
- G. Mount Motor: Adjustable slide rail on a steel isolation base.
- H. Provide steel fan base for Arrangement 9 and 10 fans. Provide fan base for Arrangement 3 fans under Section 230548, Vibration Isolation. Prime-coat paint bases.
- I. Outlet Velocities: As scheduled on drawings.
- J. Provide spark-proof constructed fans with explosion-proof motors where scheduled.
- K. Provide fans noted on drawings with an asphaltum finish, or a bitumastic finish inside and to the housing and wheel, inlet bell, and vanes as scheduled.
- L. Provide lifetime lubricated and sealed bearings in fans and motors above ceilings.

- M. Provide OSHA approved expanded metal beltguards with aligned opening for checking fan shaft speed.
- N. Provide fans with nested type moveable inlet guide vanes as scheduled.
- O. Provide fans which all use same type grease.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install fans in locations shown on drawings and in accordance with manufacturer's instructions.
- B. Connect fans to ductwork only by means of flexible connections.
- C. Fans for outdoor mounting shall be completely weather-proofed with a fan motor and drive weather cover, and receive a second factory coat of paint.

#### 3.2 TEST AND ACCEPTANCE

- A. Start-up and checkout fan for proper motor phasing, alignment, and vibration free operation. Improperly aligned fans to be corrected. Change unmatched belts.
- B. Test fans in accordance with Section 230500.
- C. Demonstrate system operation to Owner's maintenance personnel and instruct them in operational requirements.
- D. Verify that, where applicable, fans are interlocked with supply (and exhaust) fans as required by control drawings.

END OF SECTION 233416

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## SECTION 233423 - POWER ROOF VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230513: Motors for HVAC.
- C. Division 26: Electrical.

#### 1.2 PERFORMANCE

- A. Fans to have IRI and FIA approval for use as mechanical smoke and heat venting.
- B. Fan to be listed under UL Standard 7-05 Power Roof Ventilators, and unit to be acceptable to IRI and FIA for mechanical smoke and heat venting.

#### 1.3 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. American Cool Air Corporation - Cool Air Type HS.
- B. Penn.
- C. Greenheck.
- D. Loren Cook.
- E. Acme.

#### 2.2 EQUIPMENT REQUIREMENTS

- A. Drive: Variable-pitch, V-belt.
- B. All ferrous construction.
- C. Locate motor out of airstream with belts and bearings enclosed in tubes to protect from high-temperature air.

- D. Positive ventilation of motor compartment, belt, and bearing tubes.
- E. External grease fittings and lubrication lines isolated from airstream.
- F. Safety disconnect switch mounted to power roof ventilator housing. Switch to be readily accessible from roof.
- G. All components exposed to airstream to withstand five hours continuous service at 600 degrees F without failure.
- H. Weatherproof motor cover to protect motor and drive.
- I. Automatic heat vent device which opens spring-operated damper doors if air temperature under power roof ventilator reaches 165 degrees F. This provides gravity type ventilation when unit is out of service.
- J. See schedule on drawings for capacity requirements.
- K. Provide manufacturer's standard roof curb as detailed on drawings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Secure fan to curb with rustproof screws.
- B. Install fans as shown by manufacturer's written instructions in accordance with IRI and FIA requirements.
- C. Final installation to be free of leaks both from fan to curb interface and outlet damper termination point.

#### 3.2 TEST AND OPERATION

- A. Start-up and check fan for proper motor phasing, alignment and vibration for operation.
- B. Test fans in accordance with Section 230500.
- C. Demonstrate system operation to Owner's maintenance personnel and instruct them in operational requirements.

END OF SECTION 233423

## SECTION 233600 - AIR TERMINAL UNITS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 230500.
- B. Furnish labor, materials, tools, equipment, and services for air terminal units.
- C. Coordinate work with other Divisions.
- D. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

#### 1.2 QUALITY ASSURANCE

- A. Acoustical Liner: Meet requirements of NFPA 90A, UL 181, and ASTM C665 as specified.
- B. Air Diffusion Council, ADC Standard 1062R2, Air Diffusing Equipment Test Code
- C. Air Moving and Conditioning Association, AMCA Standard 210, Test Code for Air Moving Devices.
- D. ASHRAE Standard 70-72, Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- E. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 1980 edition.
- F. SMACNA HVAC Duct Construction Standards, 1st Edition, 1985.

#### 1.3 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 230523: Valves for HVAC.
- C. Section 230593: HVAC Systems Test and Balance.
- D. Section 230700: HVAC Insulation.
- E. Section 232000: HVAC Piping.
- F. Section 233113: Sheetmetal Ductwork.

#### 1.4 SUBMITTALS

- A. Submit product and performance data for review.
- B. Submit test reports as specified herein.
- C. Submit certificates as specified herein.

#### 1.5 GUARANTEE

- A. Manufacturer guarantees resultant noise levels to be within NC rating published by manufacturer.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier, Trane, Anemostat, Titus, Environmental Technologies, MetalAire, Nailor, Kreuger.

#### 2.2 SINGLE DUCT UNITS

- A. Single Duct Units: Pressure independent with multi-axis flow ring and heating coil. Boxes shall be constant volume or constant, variable volume as indicated on Drawings.
  - 1. Acoustical Liner:
    - a. Foil Face: Foil faced, glass fiber insulation, 1" thick, 1.9 lb/cu.ft., R-Value of 4.3. Comply with the requirements of UL 181, NFPA 90A, and Bacteriological Standard ASTM C665.
  - 2. Casing: Minimum 22-gauge galvanized steel.
  - 3. Provide insulated gasketed access panel on bottom of box for access to integral, internal air valves, and heating coil inspection.
  - 4. Leakage: Maximum 1% of nominal capacity at 1" wg. inlet static pressure.
  - 5. Multi-point, multi-axis flow ring or cross sensor.
  - 6. Provide integral flow taps and calibration chart on each unit.
  - 7. Factory calibrate sensor and controller for design maximum and minimum CFM.
  - 8. Coils as shown on drawings and specified herein.
  - 9. Factory mount, wire, connect, calibrate, set-up and test DDC controller, pressure transducer, and electronic damper actuator furnished to box manufacturer under Section 230913. Damper actuators integral with box may be furnished by box manufacturer and operation coordinated with DDC controller.
  - 10. Control transformer: Provide and factory mount 120v/24v control circuit transformer for each box, sized to handle all box controls. Provide safety devices including toggle disconnect switch and primary and secondary fusing.
- B. Heating Coils: ARI certified, continuous plate or spiral fin type, leaked test at 300 psi under water.

1. Fins: Aluminum, maximum 8 fins per inch.
2. Tubes: Seamless, copper tubes mechanically expanded into the fin collars; arranged for counter-flow of heating water.
3. Water Velocity: 8 FPS maximum with head loss not greater than indicated on drawings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install all units as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Check connections to ensure they are tight with all leakage of 1% or less.
- C. Provide insulation in accordance with Section 230700.
- D. Coordinate control installations with temperature controls vendor.

#### 3.2 CLEANING, TESTING, START-UP, DEMONSTRATION

- A. Clean units in accordance with Section 230500, including flushing of connected piping and cleaning of water control valves.
- B. Start-up units, check for proper operation as a system with air handling unit, fans, and connected ductwork.
- C. Test units in accordance with Section 230500.
- D. Prepare units for Test and Balance as required by Section 230593, correct any deficiencies found and retest.
- E. Demonstrate operation of units as a complete system to maintenance personnel and instruct them in the operation, adjustment and repair of the system.

END OF SECTION 233600

Back-Check No. 2 - ASI 009  
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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 234100 - PARTICULATE AIR FILTRATION

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 230500: Common Work Results for HVAC.
- B. Section 237313: Factory Assembled, Modular Construction Air Handling Units.
- C. Section 237324: Factory Assembled, Custom Air Handling Units.

#### 1.2 QUALITY ASSURANCE

- A. ASHRAE 52.2 - 1999: Minimum Efficiency Reporting Value (MERV ratings).
- B. ASHRAE 52.1 - 1992: Average dust spot efficiency and arrestance efficiency.
- C. NFPA 90A: For fire and smoke developed ratings.
- D. ISO 9001:2000 certified manufacturing facility.

#### 1.3 SUBMITTALS

- A. Submit manufacturer's product data for review.
- B. Submit evidence of manufacturing facility certification with ISO 9001-2000.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. AAF Intl.
- B. CamFil-Farr.
- C. Airguard.
- D. Flanders/Precision Aire.

#### 2.2 REQUIREMENTS

- A. MERV Ratings: Minimum Efficiency Reporting Value of MERV when evaluated under the guidelines of ASHRAE Standard 52.2-1999.

- B. Average Atmospheric Dust Spot and Arrestance: Average dust spot efficiency of and a minimum arrestance based evaluation ASHRAE Standard 52.1-1992.
- C. Performance: Media to maintain or increase in efficiency over the life of the filter.
- D. Sizes: As schedule on mechanical drawings.

## 2.3 DISPOSAL PANEL FILTERS

### A. Construction:

1. Media: Cotton and synthetic blend, lofted to a uniform depth of 0.18", and formed into a uniform radial pleats. There shall be at least 16, 15 or 11 pleats per linear foot for 1" deep, 2" deep or 4" deep filters respectively.
2. Support: Welded wire grid, spot-welded on one-inch centers, treated for corrosion resistance, bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation.
3. Frame: Minimum 28-point high wet-strength beverage board. Bond frame to media to prevent air bypass. Include integral diagonal support members on the air entering and air existing side to maintain uniform pleat spacing in varying airflows.

### B. Performance:

1. Efficiency: MERV 7; 25-30% average dust spot and minimum arrestance of 91%. The media shall maintain or increase in efficiency over the life of the filter.
2. Initial Resistance to Airflow: Not to exceed 0.25", 0.28" or 0.27" w.g. at airflow of 350, 500 or 500 fpm on 1", 2", or 4" deep models respectively.

## 2.4 CARTRIDGE TYPE FILTERS

### A. Construction:

1. Media: Microfine glass laminated to a reinforcing backing to form a uniform lofted media blanket.
2. Blanket: Form into uniform tapered radial pleats and bonded to a stiffened backing that is bonded to the downstream side of the media to preclude media oscillation.
3. Bonding: Mechanically and chemically bond media within the frame to prevent air bypass.
4. Frame: Constructed of corrosion resistant galvanized steel. Media support contour stabilizers shall be mechanically fastened to diagonal support members of the same construction shall create a rigid and durable filter enclosure. There shall be a minimum of four contour stabilizers on the air entering side and four on the air exiting side.

### B. Performance:

1. Efficiency: MERV 9, 11, 13, 14; average dust spot efficiency of 40-45%, 60-65%, 80-85%, 90-95%.
2. Initial Resistance to Airflow: Not to exceed 0.26", 0.39", 0.50", 0.68", respectively, at airflow of 500 fpm.
3. Maximum Pressure Withstand Rating: 10" w.g. without failure of the media pack.

## 2.5 HOUSINGS AND FRAMES

### A. General:

1. Filter Housing: Two-stage filter system consisting of 16-gauge galvanized steel enclosure, aluminum filter mounting track, universal filter holding frame, dual-access doors, static pressure tap, filter gaskets and seals. In-line housing depth shall not exceed 21".

### B. Construction:

1. 16-gauge galvanized steel with pre-drilled standing flanges to facilitate attachment to other system components. Corner posts of Z-channel construction shall ensure dimensional adherence. The housing shall be weather-proof and suitable for rooftop/outdoor installation.
2. The housing shall incorporate the capability of two stages of filtration without modification to the housing. A filter track, of aluminum construction shall be an integral component of housing construction. The track shall accommodate a 2" deep prefilter, a 6" or 12" deep rigid final filter, or a pocket filter with header.
3. Dual Access Doors, Swing-Open Type: High-memory sponge neoprene gasket to facilitate a door-to-filter seal. Each door shall be equipped with adjustable and replaceable positive sealing UV-resistant star-style knobs and replaceable door hinges.
4. Universal Holding Frame: Constructed of 18-gauge galvanized steel, equipped with centering dimples, multiple fastener lances, and polyurethane filter sealing gasket, shall be included to facilitate installation of high-efficiency filters.
5. Fittings: Housing shall incorporate a pneumatic fitting to allow the installation of a static pressure gauge to evaluate pressure drop across a single filter or any combination of installed filters.

### C. Performance:

1. Leakage at rated airflow, upstream to downstream of filter, holding frame, and slide mechanism shall be less than 1% at 3.0" w.g. Leakage in to or out of the housing shall be less than one half of 1% at 3.0" w.g.
2. Accuracy of pneumatic pressure fitting, when to evaluate a single-stage, or multiple filter stages, shall be accurate within 3% at 0.6" w.g.

## 2.6 MANOMETERS

- A. Provide a Dwyer or equal, inclined draft gauge, marked for clean and dirty resistance across each filter bed. If two filter beds are installed in tandem, provide manometer for each filter bed.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Provide filters in locations as shown on drawings of sizes and capacities as scheduled.
- B. Install filters in accordance with manufacturers published installation instructions. Provide manufacturer's recommended media change data to maintenance personnel.

- C. Installed filters in frames or apparatus casing so as to be leak free. Verify with light test from both sides.
- D. Install and level draft gauge, outside air stream, for each bank of filters.
- E. Protect cooling and/or heating coils with temporary media during construction.
- F. Upon completion of ductwork and fan system, clean systems as required in Section 230500 and install specified filter media prior to placing system in operation.
- G. Deliver one complete change of media to the maintenance personnel.
- H. Provide insulation as required on filter housing to prevent condensation.
- I. Insulate and make leak-proof filter doors.

END OF SECTION 234100

## SECTION 234400 - BI-POLAR IONIZATION AIR PURIFICATION SYSTEM

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. This section describes the design, performance, and installation of an air purification system intended for use as part of another manufacturer's air handling unit.

#### 1.2 RELATED WORK

- A. Section 230593: HVAC Systems Test and Balance
- B. Section 230923: Building Automation and Direct Digital Controls
- C. Section 232000: HVAC Piping
- D. Section 233113: Sheetmetal Ductwork
- E. Division 26: Electrical

#### 1.3 SUBMITTALS

- A. Submit product data including: Product performance data for filters, gauges, and housings.
  - 1. Product drawings detailing all physical, electrical, duct work and control requirements.
  - 2. Indoor Air Quality calculations for all known indoor contaminants. Calculations must be in accordance with formulas referenced by ASHRAE Standard 62-2001 to validate acceptable indoor air quality at the quantity of outside air scheduled. Demonstrate design experience and proficiency in multiple projects completed over a minimum period of five (5) years.

#### 1.4 REFERENCE CODES AND STANDARDS

- A. ASHRAE Standards 62 and 52
- B. UL Standard 867
- C. CFR 39-75 Title 21, April 17, 1974
- D. National Electric Code NFPA 70, 1990

#### 1.5 QUALITY ASSURANCE

- A. The Air Purification System shall be a product of an established manufacturer with installations in successful operation for a minimum of five (5) years.

- B. The electrical and electronic components of the air purification system shall be factory tested and operated after complete assembly for at least 24 hours of continuous operation. A report shall be forwarded to the contractor prior to installation of the air purification system. The report of satisfactory operation should include pertinent performance data listed in the submittal.
- C. The complete Air Purification System including the Bi-polar ionization unit and Remote Monitor as assembled, complete with power and control wiring, safety switches, airflow switches, controls, housing and filters shall be listed by either UL or ETL.

## 1.6 WARRANTY

- A. Comply with the provisions specified in Division 01.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Bioclimatic, Inc.
- B. Atmos Air
- C. Cosatron - Alternate technology
- D. Ion-Air, Inc.
- E. The contractor shall be responsible for any costs associated by substitution. Prior approval requests shall include completed "System Validation Calculations" specified in this section.

### 2.2 DESIGN AND PERFORMANCE CRITERIA

- A. Air handling units scheduled on drawings shall contain an Air Purification System capable of :
  - 1. Effectively controlling microorganisms (mold, bacteria, etc.).
  - 2. Controlling gas phase contaminants generated from food, alcoholic beverages, and human occupants.
  - 3. Capable of reducing static space charges.
- B. The operation of the air purification system shall be through a combination of, Catalytic, and Association/Disassociation processes.
- C. In addition to requirement for IAQ calculations specified above, successful bidder must provide laboratory tests for gas phase removal which match the ASHRAE 62-2001 IAQ calculations provided. These tests will include but is not limited to Ammonia and Formaldehyde. Architect, Engineer and Owner reserve the right to obtain additional tests.
- D. The Air Purification System shall operate in such a manner so that agglomeration or precipitation of airborne particulate shall not be permitted to collect on occupants, walls, floor or furnishings by virtue of its operation.

- E. Air exchange rates may vary through the full operating range of a VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
1. Velocity Profile:
    - a. The air velocity through the plenum approaching the air purification system shall not exceed 1,000 fpm (5 m/s) in the Electrode or Bi-polar Ionization Section.
  2. Humidity:
    - a. The ionization system shall be operational up to 99% relative humidity. Relative humidity from 0 - 99% shall not cause damage, deterioration or dangerous conditions within the air purification system. Systems not operational above 85% and above must include a separate preheat system to ensure effective operation.
  3. Ozone Generation:
    - a. The operation of the electrodes or Bi-polar ionization unit shall conform to ASHRAE Standard 62-2001 and CFR 39-75 with respect to ozone generation.

## 2.3 EQUIPMENT REQUIREMENTS

- A. A schematic representation of the air purification system is indicated on the drawings. Each unit shall include mounting rack, electrodes, generator, safety switches, pre-filters, primary filters, differential pressure gauge and accessories.
- B. Electrode Specifications (Bi-polar Ionization):
1. Each unit shall include the required number of electrodes and power generators sized to the air handling unit capacity. Electrodes shall be installed in pairs and include insulators to create the required dielectric. The dielectric shall consist of suitable organic or inorganic non-corrosive insulation material so that the presence of water vapor, gasses or airborne particles will not affect the dielectric value. The electrodes shall be installed into a tube socket with suitable bonding material and include a silicone O ring to prevent moisture penetration. The tube socket shall include an external molded ring, which seals the tube socket to the base upon installation. Electrodes of ferrous or copper composition with or without plating are not acceptable.
  2. Electrodes shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Provide a minimum of one power generator per 6,000 cfm of air passing over the electrodes.
  3. Electrical service shall be 115/208/230 volts, 1 phase, 50/60 Hz. In the event line voltage varies 10% or greater from nominal power conditioning shall be required.
  4. Electrical power to the electrodes shall be interrupted when the air flow is less than 100 fpm or when access doors to the electrode plenum section are opened.
- C. Plenum Specifications:
1. Housings shall be of horizontal design with double wall construction.
- D. Mounting Rack:

1. Electrodes and power generators shall be installed on slide/stationary racks with a single point wiring connection. Interconnecting wiring shall carry voltage no higher than the primary source to the remote monitor and regulator. The rack assembly shall be a factory fabricated assembly mounted to vertical supports on approximately 24 in./600 mm centers. Provide a factory fabricated, full width slide rack assembly fabricated from structural aluminum to permit side access service of electrodes and power generator. When fully extended outside of the plenum for service, the slide rack shall be self-supporting. It shall include one quick disconnect electrical connector for removal from the power source without the use of hand tools.

E. Bi-Polar Ionization Generators:

1. Bi-polar ionization generator(s) capable of controlling gas phase contaminants listed in Paragraph 2.1 shall be provided.
  - a. The ionization system shall produce Bi-polar ionization through its generator and alternating current output in such a manner so that agglomeration, condensation, or precipitation of airborne particulate within the building space will not occur. Operation of the Bi-polar generator shall not produce ozone in excess of ambient levels or more than 0.015 parts per million.
  - b. The Bi-polar ionization system shall consist of ionization tubes, power generators, remote monitor and power regulator, safety door switches, airflow switches, and other accessories required for safe and efficient operation. The Bi-polar system shall be installed where indicated on the plans within the air handling unit plenum.
  - c. Provide test jacks with a 1 to 4 volt output to indicate high voltage output with a standard multimeter.

F. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Provide power conditioning when the line voltage varies more than +/- 10% from design or when electrical spikes or transients are present.

G. Control Requirements:

1. Provide remote monitoring and regulation of generator operation to sense and enunciate voltage, current and electrical / electronic features. Visual alarms shall be included to (sequentially/simultaneously) indicate power generator high voltage electrode status and faults prior to unit failure. High voltage output shall not vary more than (2% for a 10% variation in line voltage). (Provide Form C contacts to interface with a building management system).

H. Provide simultaneous status indication of each power generator. (optional)

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Assemble mounting racks within the air handling unit plenum in accordance with manufacturer's recommendations and instructions.

- B. The air purification system manufacturer shall complete all interconnecting control and power wiring. The electrical contractor shall complete single point power connections.
- C. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and consulting engineer.
- D. Any material damaged by water or moisture shall be replaced at no cost to the owner.
- E. All equipment shall be protected from dust and damage on a daily basis throughout construction.
- F. Clean all components prior to commissioning.
- G. Install electrodes when commissioning air purification system.

### 3.2 TESTING

- A. Provide the manufacturers recommended electrical and static pressure tests.

### 3.3 COMMISSIONING AND TRAINING

- A. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
- B. Manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.
- C. Provide a minimum of 4 hours of on-site training with Owner's maintenance personnel. Training shall include system and equipment concepts, equipment operation, problem trouble shooting, and repair and preventive maintenance procedures.

### 3.4 SERVICE

- A. A manufacturer's authorized representative shall visit the project site at least once per quarter during the initial year's operation to inspect equipment and report its status to the owner's maintenance personnel. Three (3) visits are required.

END OF SECTION 234400

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 235216 - CONDENSING BOILERS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Manufactured units.
- B. Boiler construction.
- C. Boiler trim.
- D. Fuel burning system.
- E. Factory installed controls.

#### 1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 230913 - Instrumentation and Control Devices.
- C. Section 232116 - Hydronic Piping Specialties.
- D. Section 232113 - HVAC Piping.
- E. Section 232500 - HVAC Water Treatment.
- F. Section 235100 - Breechings, Chimneys, and Stacks.
- G. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at [www.ahrinet.org](http://www.ahrinet.org).
- B. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2012.
- C. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda (ANSI/ASHRAE/IES Std 90.1).
- D. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2007.
- E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; The American Society of Mechanical Engineers; 2013.

- F. HI BTS-2000 - Testing Standard, Method to Determine Heating Efficiency of Commercial Space Heating Boilers; The Hydronics Institute of AHRI; 2007.
- G. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at [www.nationalboard.org](http://www.nationalboard.org).
- H. NFPA 31 - Standard for the Installation of Oil Burning Equipment; 2011.
- I. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.
- J. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association; 2014.
- K. SCAQMD 1146.1 - South Coast Air Quality Management District Rule No.1146.1; current edition; [www.aqmd.gov](http://www.aqmd.gov).
- L. SCAQMD 1146.2 - South Coast Air Quality Management District Rule No.1146.2; current edition; [www.aqmd.gov](http://www.aqmd.gov).

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

#### 1.5 SUBMITTALS

- A. Submit product data and drawings in accordance with the requirements of Division 01.
- B. Product Data: Provide data indicating general construction assembly, components, venting controls, safety controls, trim, and wiring diagrams with electrical characteristics and connection requirements, and service connections. Also include efficiencies at varying entering water temperatures and pressure drop curves from 0 GPM to design GPM.
- C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.
- D. Manufacturer's Factory Inspection Report: Submit boiler inspection prior to shipment.
- E. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.
  - 1. Indicate compliance with specified performance and efficiency.
  - 2. Provide results of the following combustion tests:
    - a. Boiler firing rate.
    - b. Over fire draft.
    - c. Gas flow rate.
    - d. Heat input.
    - e. Burner manifold gas pressure.

- f. Percent carbon monoxide.
- g. Percent oxides of nitrogen.
- h. Percent oxygen.
- i. Percent excess air.
- j. Flue gas temperature at outlet.

- 1) Ambient temperature.
- 2) Net stack temperature.
- 3) Percent stack loss.
- 4) Percent combustion efficiency.
- 5) Heat output.

- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- H. Software: Copy of software provided under this section.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. ASME Compliance: Condensing boilers must be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".
- C. I=B=R Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.
- D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have the minimum efficiency according to "Gas and Oil Fired Boilers-Minimum Efficiency Requirements."
- E. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers".
- F. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment". Boilers shall be listed and labeled by a testing agency acceptable to the authorities having jurisdiction.
- G. NOx Emission Standards: When installed and operated in accordance with manufacturer's instruction, condensing boilers shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rule 1146.2; and the Texas Commission on Environmental Quality (TCEQ), Title 30, Chapter 117, Rule 117.465.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

## 1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for heat exchanger.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Natural Gas, Propane, or Combination Natural Gas/Propane for Outdoor Applications:
  - 1. LAARS Heating Systems Company; Model \_\_\_\_\_: [www.laars.com](http://www.laars.com).
  - 2. Lochinvar LLC; Model KBN-700: [www.lochinvar.com](http://www.lochinvar.com).
  - 3. The Fulton Companies; Model \_\_\_\_\_: [www.fulton.com](http://www.fulton.com).
  - 4. Substitutions: Refer to Division 01.

### 2.2 MANUFACTURED UNITS

- A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.
- B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.
- C. Unit shall be suitable for individual or multiple boiler operation and be equipped with the required control panel and controls.
- D. Annual Fuel Utilization Efficiency (AFUE) in accordance with ASHRAE 103: 0.82.

### 2.3 BOILER CONSTRUCTION

- A. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE 90.1.
- B. Required Directory Listings:
  - 1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at [www.ahrinet.org](http://www.ahrinet.org).
  - 2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at [www.nationalboard.org](http://www.nationalboard.org).
- C. Heat Exchanger: Construct with 316L stainless steel fire tubes and tube sheet for working pressures of not less than 160 psig.
- D. Provide adequate tappings; water connections; intake and flue connections; drains; observation ports; removable panels and access doors for entry, cleaning, and inspection.

- E. Insulate casing with suitable insulation material, protected and covered by heavy gauge, metal jacket.
- F. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, weather-proofed, or \_\_\_\_\_ finish.

## 2.4 BOILER TRIM

- A. ASME rated pressure relief valve.
- B. Flow switch.
- C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.
- D. Temperature and pressure gauge.
- E. Pressure Switches:
  - 1. High gas pressure.
  - 2. Low gas pressure.
  - 3. Air pressure.
- F. Manual reset high limit.
- G. Boiler Pump (where required by boiler design):
  - 1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.
  - 2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.
  - 3. Pump time delay.

## 2.5 FUEL BURNING SYSTEM

- A. Provide forced draft automatic burner integral to boiler, designed to burn natural gas, and maintain fuel-air ratios automatically.
  - 1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor with variable speed centrifugal fan.
  - 2. Forced Draft Design: Mixes combustion air and gas to achieve 90 percent combustion efficiency.
  - 3. Combustion Air Filter: Protects fuel burning system from debris.
  - 4. 20 to 1 turndown ratio of firing rate without loss of combustion efficiency or staging of gas valves.
  - 5. Spark ignition, 100% main valve shutoff and electronic flame supervision.
- B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

- C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1, SCAQMD 1146.2, and TCEQ 117.465 for natural gas fired system, as applicable.
- D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.
- E. Exhaust Manifold: Corrosion resistant cast aluminum or stainless steel with a collection reservoir and gravity drain for condensate drainage.

## 2.6 FACTORY INSTALLED CONTROLS

- A. Option for internal or external (0-10) VDC control.
- B. Temperature Controls:
  - 1. Automatic reset type to control fuel burning system on-off, firing rate, and \_\_\_\_\_ to maintain temperature.
  - 2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
  - 3. 3Low-fire start time delay relay.
- C. Electronic PI setpoint/modulation control system.
- D. Microprocessor-based, fuel/air mixing controls.
- E. Control panel shall support both RS-232 and RS-435 remote communication.
- F. The control panel shall incorporate three self-governing features designed to enhance operation in modes where it receives and external signal or loss of external signal including:
  - 1. Setpoint high limit: Allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. Setpoint limit is based on a PID function that automatically limits the firing rate to maintain outlet temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature.
  - 2. Setpoint Low Limit: Allows for a selectable minimum operating temperature.
  - 3. Failsafe Mode: Allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can shutoff the unit upon a loss of external signal, if desired.
- G. The boiler control system shall incorporate the following additional features for enhanced external system interface:
  - 1. System start temperature feature.
  - 2. Pump delay timer.
  - 3. Auxiliary start delay timer.
  - 4. Auxiliary temperature sensor.
  - 5. Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate.
  - 6. Remote interlock circuit.
  - 7. Delayed interlock circuit.
  - 8. Fault relay for remote fault alarm.

- H. Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME Section IV and CSD-1.

## 2.7 VENTING

- A. The exhaust vent (8" minimum) must be UL Listed for use with Category III and IV appliances and compatible with operating temperatures up to 480 degrees F, positive pressure, condensing flue gas service. UL Listed vents of stainless steel must be used with boilers.
- B. Combustion Air Intake: Boilers shall be capable of drawing combustion air from the outdoors through an 8" minimum duct connected between the boiler and outside with an appropriate screened entrance cap or hood.
- C. Venting and combustion air shall meet the manufacturer's venting guide and requirements.

## 2.8 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide factory tests to check construction, controls, and operation of unit.
  - 1. Tests will be witnessed by Architect at manufacturer's expense.
- C. Manufacturer to conduct boiler inspection prior to shipment; submit copy of inspection report to Architect.
- D. Non-Conforming Work: See Section 014000.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install the boiler, piping, controls, wiring, combustion and venting in accordance with manufacturer's written instructions.
- B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.
- C. Install boiler and provide connection of liquefied petroleum gas service in accordance with requirements of NFPA 58 and applicable codes.
- D. Install boiler and provide connection of No. 2 fuel oil service in accordance with requirements of NFPA 31 and applicable codes.
- E. Install boiler on concrete housekeeping base, sized minimum of 4 inches larger than boiler base in accordance with Section 033000.
- F. Coordinate factory installed controls with Section 230913.

- G. Coordinate provisions for water treatment in accordance with Section 232500.
- H. Pipe relief valves to nearest floor drain.
- I. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer/cooler prior to discharging into nearest floor drain.
- J. Install primary boiler pump in accordance with Section 232123.
- K. Provide piping connection and accessories in accordance with Section 232114.
- L. Provide for connection to electrical service in accordance with Section 262717.
- M. Vent combustion fumes in accordance with manufacturer's recommendations. Refer to Section 235100.

### 3.2 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.
  - 1. Use operation and maintenance data as reference during demonstration.
  - 2. Conduct walking tour of project.
  - 3. Briefly describe function, operation, and maintenance of each component.
- E. Training: Train Owner's personnel on operation and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's training personnel.
  - 4. Location: At project site.

END OF SECTION 235216

## SECTION 235236 - HOT WATER HEATING BOILERS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. The work to be performed consists of providing all labor, equipment, materials, etc. to furnish and install new factory assembled, hot water boilers as described in the specifications herein.
- B. This section includes gas-fired, condensing boilers for heating hot water.
- C. This Section includes gas-fired, flexible tube boilers for heating hot water.

#### 1.2 RELATED WORK

- A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein: Section 230010 - General Requirements Section 230020 - HVAC Scope of Work Section 230513 - Motor Requirements for HVAC Equipment Section 230548 - Vibration Isolation Section 230593 - Testing, Balancing, and Adjusting Section 232113 - Pipes, Valves, Fittings, and Accessories Section 232500 - Water Treatment Systems Section 235123 - Flue Piping

#### 1.3 REFERENCES

- A. ASME Section IV (Heating Boilers)
- B. ANSI Z21.13/CSA 4.9 (Gas Fired Low Pressure Boilers)
- C. NFPA 54 (ANSI Z221.3) National Fuel Gas Code
- D. ASME CSD-1 (Controls and Safety Devices)

#### 1.4 QUALITY ASSURANCE

- A. The equipment shall, as a minimum, be in compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, appurtenances, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.
- B. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalogue.
- C. The equipment must fit within the allocated space, leaving ample allowance, as may be required by local or state codes, for maintenance and cleaning, and must leave suitable space for easy removal of all equipment appurtenances.

- D. All units of the same classification shall be identical to the extent necessary to insure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
- E. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified. The boiler manufacturer shall be responsible for guarantying that the boiler provides the performance as specified herein.
- F. Factory Testing - Hydrostatic: Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME "H" stamp.
- G. Factory Testing - Fire Testing: Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

#### 1.5 SUBMITTALS

- A. The contractor shall submit all product data for approval by the engineer.
- B. Shop Drawings shall consist of: General assembly drawing of the boiler including product description, model number, dimensions, clearances, weights, service sizes, etc. Schematic flow diagram of gas valve trains. Schematic wiring diagram of boiler control system. Schematic wiring diagram shall be ladder-type showing all components, interlocks, etc. Schematic wiring diagram shall clearly identify factory wiring and field wiring.
- C. Installation Instructions: Manufacturer's printed instructions for installation shall be submitted.
- D. Boiler Inspector's Certifications
- E. Factory Test Reports
- F. Operation and Maintenance Manuals: Manufacturer's printed operation and maintenance manuals shall be submitted prior to final acceptance by the engineer. Operation and maintenance manuals shall contain shop drawings, product data, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data, complete parts list, etc.
- G. Manufacturer's Warranties: Manufacturer's printed warranties, as specified hereinafter, shall be submitted prior to final acceptance by the engineer.

#### 1.6 CERTIFICATIONS

- A. Manufacturer's Certification: The boiler manufacturer shall certify the following: The boiler, burner and other associated mechanical and electrical equipment have all been properly coordinated and integrated to provide a complete and operable boiler. ASME certification. CSA (AGA/CGA) certification. The specified factory tests have been satisfactorily performed. The equipment furnished contains inter-changeable parts with the specified equipment so that all major equipment parts can be obtained from the specified manufacturer.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. The contractor shall be responsible for the timely delivery of the equipment to the jobsite. The contractor shall be responsible for unloading and rigging of the equipment. The contractor shall be responsible for protecting the equipment from the weather, humidity and temperature conditions, dirt, dust, other contaminants, as well as jobsite conditions during construction.
- B. Equipment shall be unloaded, handled, and stored in accordance with the manufacturer's handling and storage instructions.

## 1.8 WARRANTIES

- A. The boiler manufacturer shall warrant each boiler, including boiler, trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of start-up, whichever occurs first. Heat exchanger and fuel burner shall be warranted for a period of five (5) years from date of shipment.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Patterson-Kelley: Mach Series
- B. Hydrotherm: KN Series
- C. Cleaver Brooks
- D. Bryan Boiler

### 2.2 GENERAL

- A. Furnish and install factory "packaged" low pressure hot water boilers. Each factory "packaged" boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.
- B. Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

## 2.3 PERFORMANCE CRITERIA

- A. The minimum capacity of each boiler shall be as scheduled per the Contract Documents. Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 92%. Each boiler shall be capable of operating with a minimum outlet water temperature of 68 deg F. Boiler shall comply with ASME Section IV for 80 psig (max 200 deg F).
- B. Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5 in wc to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14 in wc.
- C. Ambient air temperature shall be assumed to range from 50 deg F to 90 deg F with an average of 70 deg F.
- D. Power voltage shall be 120 VAC, 1-phase, 60 hertz. Control voltage shall be 24 VAC (transformer to be supplied by boiler manufacturer).

## 2.4 BOILER DESIGN

- A. Each hot water boiler shall consist of a horizontal, cast aluminum or cast iron heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.
- B. Each boiler heat exchanger shall be cast aluminum or cast iron, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section.
- C. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5. All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.
- D. Boiler heat exchanger headers shall be fabricated steel or cast iron and be completely removable for inspection. Seals shall be EPDM, rated for 400 deg F service. Push nipples or gaskets between the sections are not permitted.
- E. Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from a minimum 16-gauge carbon steel. The front and top wall shall be secured in place with 1/4 -20 NC bolts (sheet metal screws are not acceptable). The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50 deg F above ambient temperature when the boiler is operated at full rated load.
- F. An observation port shall be located on the boiler to allow for observation of the burner flame.
- G. Flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting (stack) as defined in NFPA 54 (ANSI Z221), latest edition. Contractor must provide venting (stack) certified for installation on a Category IV appliance.

- H. Jackets: Stainless steel.

## 2.5 BOILER TRIM

- A. Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows: Safety relief valve shall be provided in compliance with the ASME Code. Contractor to pipe to acceptable drain. Water pressure-temperature gauge. Primary low water flow fuel cutoff (probe type with manual reset). Manual reset high limit water temperature controller. Operating temperature control to control the sequential operation of the burner. Separate inlet and outlet water temperature sensors capable of monitoring flow Exhaust temperature sensor

## 2.6 BOILER FUEL BURNING SYSTEM

- A. The boiler manufacturer shall furnish each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified. Burner shall be capable of 99% efficiency without exceeding a NOx reading above 11 ppm.
- B. Each burner shall be provided with an integral gas firing combustion head.
- C. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.
- D. Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall be a maximum of 300 watts and operate at 6000 RPM maximum without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the LED display.
- E. Each burner shall of the radial-fired (down-fired) type and constructed of steel with a stainless steel inner and stainless steel mesh outer screen.
- F. Each boiler shall be provided with a "Full Modulating" firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.
- G. The Micro Processor shall use a Proportional Integral Algorithm to determine the firing rate. The control must have the following capabilities: Maintain single set point Reset the set point based on outdoor air temperature. Boiler shutdown based on outdoor air temperature Internal dual set point program with an external switchover. (e.g. - night setback w/external clock, supplied by others) Alarm relay for any for any manual reset alarm function. Programmable Low Fire Delay to prevent short cycling based on a time and temperature factor for release to modulation. LED Display showing current supply and return temperatures, current set points as well as differential set points. It must also display any fault codes whether automatically reset or manually reset. Local Manual Operation. Remote Control System (Building Management /

Sequencer Control) - The boiler control shall be capable of accepting a 0 -10vdc remote external analog signal to control the firing rate On board Domestic Hot Water Priority capable of changing from the heating pump to the DHW pump as well as changing the boiler set point from a heating temperature to a higher set point temperature to satisfy the DHW system and then return to the heating mode. Computer (PC) interface for programming and monitoring all functions

## 2.7 MAIN GAS VALVE TRAIN

- A. Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following: Two (2) manual shutoff valves Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing. Air - Gas ratio control (maximum inlet pressure 14 in wc) One (1) low gas pressure switch (manual reset). One (1) high gas pressure switch (manual reset). Two (2) pressure test ports

## 2.8 IGNITION SYSTEM

- A. Each boiler shall be equipped for direct spark ignition or ignition components.
- B. Ignition components: The ignition hardware shall consist of Alumina ceramic insulated ignition electrodes and UV sensing tube permanently arranged to ensure proper ignition electrode and UV alignment.

## 2.9 COMBUSTION AIR CONTROL SYSTEM

- A. Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following: The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower. One (1) low airflow differential pressure switch to insure that combustion air is supplied. High exhaust back pressure switch

## 2.10 BURNER CONTROL SYSTEM

- A. The control system shall be supplied with a 24 VAC transformer (120 VAC, single phase, 60 hertz primary). The 120/1/60 power supply to each boiler shall be protected by a 15 Amp circuit breaker located in the MCC (supplied by contractor).
- B. The boiler shall include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.
- C. Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.
- D. Each boiler control system shall provide timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

## 2.11 BOILER CONTROL PANEL

- A. The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:
1. One (1) burner "on-off" switch. One (1) electronic combination temperature control, flame safeguard and system control. Control circuit breaker, 5 amp All necessary control switches, pushbuttons, relays, timers, terminal strips, etc. LED Display Panel to adjust set points and control operating parameters. LED display to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, sensor values such as inlet, outlet, flue gas and outdoor air. Controls: The boiler control package shall be a MTI Heat-Net or equivalent, integrated boiler management system. The control system must be integral to each boiler, creating a control network that eliminates the need for a "wall mount" stand-alone boiler system control. Additional stand-alone control panels, independent of a Building Management System (BMS), shall not be allowed to operate the boiler network. The Heat-Net control shall be capable of operating in the following ways: As a stand-alone boiler control system using the Heat-Net protocol, with one "Master" and multiple "Member" units. As a boiler network, enabled by a Building Management System (BMS), using the Heat-Net protocol, with one "Master" and multiple "Member" units. As "Member" boilers to a Building Management System (BMS) with multiple input control methods. Failsafe mode - When a Building Automation System is controlling set point, if communications are lost, the boiler/system will run off the Local set point. Adaptive Modulation - Lowers the modulation rate of all currently operating boilers before a newly added boiler enters operation. Priority Firing - Allows mixing of condensing, non-condensing base-load and/or other combination of (2) functional boiler types utilizing (2) priority levels. Available priority start/stop qualifiers shall be done using any combination of: A) Modulation. Percentage B) Outdoor Air Temperature or C) Return Water Temperature. Base Loading - Provides the ability to control (1) base load boiler with enable/disable and 4-20mA modulating signal (if required).

## 2.12 MASTER

- A. A boiler becomes a Master when a resistance type 10K sensor is connected to the J10 "SYS/ DHW HEADER" terminals. The sensor shall be auto detected. The Master senses and controls the header/loop temperature utilizing a system setpoint. It uses any boilers it finds "Heat-Net Members" or those defined in the control setup menus to accomplish this. The "Master" shall also have the option of monitoring Outside Air Temperature "OA" to provide full outdoor air reset functionality. Only one master shall be allowed in the boiler network.
- B. When operating as a "Master", the Heat-Net control provides a stand-alone method using a PID algorithm to regulate water temperature. The algorithm allows a single boiler "Master" or multiple "Master + Member" boilers in a network of up to 16 total boilers.
- C. The control algorithm is based upon a control band, at the center of which is the setpoint. While below the control band, boilers are staged on and modulated up until the control band is entered. Once in the control band, modulation is used to maintain setpoint. Optimized system efficiency is always accomplished by setting the Modulation Maximum "Mod-Max" setting to exploit each boiler in the network's inverse efficiency curve. The control shall operate so that the maximum number of boilers required, operate at their lowest inputs until all boilers are firing. Once all boilers are firing, the modulation clamp is removed and all boilers are allowed to fire above this clamped percentage up to 100%. This "boiler efficiency" clamp is defaulted to 80% and thus limits all the boilers individual outputs to 80% until the last boiler fires. The 80% default

must be field adjustable for varying operating conditions. All boilers modulate up and down together always at the same modulation rate. Boilers are shut down only when the top of the band is breached, or before the top of the band, if the control anticipates that there is a light load. Timers shall also be included in each control in the network to prevent any boiler from short cycling.

## 2.13 MEMBER

- A. Additional boilers in the network always default to the role of member. The lack of sensors connected to the J10 terminals "SYS/DHW Header" on each additional boiler shall ensure this.
- B. Each "Member" shall sense its supply outlet water temperature and modulate based on signals from a Building Management System (BMS) or "Master" boiler. When operating as a member, starting, stopping, and firing rate shall also be controlled by the "BMS" or "Master" boiler.
- C. When using the Heat-Net protocol, the system setpoint shall be sent from the "Master", along with the modulation value to control firing rate. It also receives its command to start or stop over the Heat-Net cable. Each "Member" will continuously monitor its supply outlet temperature against its operating limit. If the supply temperature approaches the operating limit temperature (adjustable), the boilers input control rate is limited and its modulation value decreases to minimize short cycling. If the operating limit is exceeded, the boiler shall shut off.
- D. Each Heat-Net control in the boiler network shall have the following standard features: Digital Communications Control. Boiler to Boiler: Heat-Net Building Management System (BMS): MODBUS standard protocol. (BACnet, LON-WORKS and N2 optional protocols): Analog 4:20 and 0-10 vdc also supported. Distributed control using Heat-Net protocol for up to 16 total boilers. System/Boiler operating status in English text display. Interlock, Event, and System logging with a time stamp. Advanced PID algorithm optimized for specific boilers (KN-Series). Four dedicated temperature sensor inputs for: Outside Air Temperature, Supply (Outlet Temperature, Return Temperature (Inlet), and Header Temperature. Automatically detects the optional temperature sensors on start up. Menu driven calibration and setup menus with a bright 4-line Vacuum Fluorescent Display. (8) Dedicated 24vac interlock monitors and 8 dedicated 120 vac system monitors used for diagnostics and providing feedback of faults and system status. Multiple boiler pump or motorized boiler valve control modes. Combustion Air Damper control with proof time. Optional USB/RS485 network plug-in to allow hardware updates or custom configurations. Optional BACnet, LONWORKS and N2 interface. Alarm contacts. Runtime hours. Outdoor Air Reset with programmable ratio. Time of Day clock to provide up to four (4) night setback temperatures. Failsafe mode when a Building Management System (BMS) is controlling setpoint. If communications is lost, the boiler/system shall run off the Local Setpoint. Support for domestic hot water (DHW) using a 10k sensor or a dry contact input from a tank thermostat and a domestic hot water relay (pump/valve) Continuous Daily Runtime Restart feature that monitors the runtime of each boiler and if any in the network have exceeded 24 hours of continuous runtime, the boiler is restarted to protect the UV flame scanner. Allows for selection of any boiler in the network to act as Lead Boiler. Adaptive Modulation feature in which the Master boiler adjusts the system modulation rate to a lower value when a new boiler in the network is started to compensate for the added BTU's to the system. Once the newly added boiler fires and the adjustable timer expire, the Master resumes control of the system modulation to maintain setpoint temperature. Priority Firing - Allows mixing of condensing and non-condensing, base load and/or other combination of (2) functional boiler types utilizing (2) priority levels. Available priority start/stop qualifiers shall be done using any combination of: A) modulation percentage B) outdoor air temperature (or) C) returns water temperature. Base Loading - Provides the ability to control (1) base load boiler with enable/disable and 4-20 mA modulating signal (if required).

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The installation shall be provided by the contractor in accordance with the requirements of the codes specified hereinbefore. All of the contractor's work shall be performed in a workmanlike manner, by experienced workmen previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.

### 3.2 INSTALLATION

- A. Install equipment in strict compliance with manufacturer's installation instructions.
- B. Install equipment in strict compliance with state and local codes and applicable NFPA Standards.
- C. Maintain manufacturer's recommended clearances around sides and over top of equipment.
- D. Install components that were removed from equipment for shipping purposes.
- E. Install components that were furnished loose with equipment for field installation.
- F. Provide all electrical control and power interconnect wiring.
- G. Provide all fuel gas vent and service piping.
- H. Provide all piping for boiler pipe connections.
- I. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.
- J. Install boilers level and plumb, according to manufacturer's written instructions and referenced standards.
- K. Install gas-fired boilers according to NFPA 54.
- L. Support boilers on a minimum 4-inch- (100-mm-) thick concrete base, 4 inches (100 mm) larger on each side than base of unit.
- M. Install electrical devices furnished with boiler, but not specified to be factory mounted.

### 3.3 FIELD TESTING

- A. The boiler manufacturer, or his authorized representative, shall test all boiler and burner interlocks, actuators, valves, controllers, gauges, thermometers, pilot lights, switches, etc. Any malfunctioning component shall be replaced.
- B. All adjustments to boiler, burner, and boiler control system shall be performed by the boiler manufacturer or his authorized representative.

#### 3.4 START-UP, INSTRUCTION AND WARRANTY SERVICE

- A. The boiler manufacturer or his authorized representative shall provide start-up and instruction for each new boiler, including burner and boiler control system. The manufacturer may dispatch factory-trained technicians in the direct employ of the manufacturer's local authorized representative for field services as specified herein. Start-up and instruction shall cover all components assembled and furnished by the manufacturer whether or not of his own manufacture.

END OF SECTION 235236

## SECTION 237415 - LARGE TONNAGE PACKAGED DX ROOFTOP AIR HANDLING UNITS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Packaged rooftop air handling units and components as scheduled and shown on drawings.

#### 1.2 RELATED SECTIONS

- A. The requirements of the General Conditions, Supplementary Conditions, Division 1, equipment schedules, and drawings apply.

#### 1.3 REFERENCES

- A. AMCA 99 - Standard Handbook.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- C. AMCA 300 – 300.
- D. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- E. AMCA 611-95 - Methods of Testing Airflow Measurement Stations for Rating.
- F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- G. ANSI/UL 900 - Test Performance of Air Filter Units.
- H. ARI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment.
- I. ARI 410 - Forced-Circulation Air Cooling and Air Heating Coils.
- J. ARI 430 - Testing and Rating of Central-Station Air Handling Units.
- K. ARI 1060 - Heat and Energy Recovery Components.
- L. ASHRAE 52.1/52.2 - Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.
- M. ASHRAE 15 - Safety Standard for Mechanical Refrigeration
- N. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
- O. ASHRAE 84 - Method of Testing Air-to-Air Heat Exchangers.
- P. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

- Q. ASTM-C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Material and Facings.
- R. NFPA 70 - National Electric Code (conductors, equipment and raceways).
- S. NFPA 90A - Installation of Air Conditioning and Ventilation Systems
- T. SMACNA - HVAC Duct Construction Standards.
- U. UL-181 - Mold Growth and Humidity Test.
- V. UL-1995 - Standard for Safety for Heating and Cooling Equipment.
- W. ANSI Z83.8-2006 - Standard for Gas-Fired Central Furnaces.
- X. ISO/PWD 13261-3 - Sound Power Rating of air-conditioning and air-source heat pump equipment: Part 3, Ducted Equipment.
- Y. ISO 9614 - Determination of sound power levels of noise sources using sound intensity: Part 1, Measurement at discrete points; Part 2, Measurement by scanning, and Part 3, Precision method for measurement by scanning.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer shall have a minimum of 25 years of experience in designing, manufacturing, and servicing air-handling units.
- B. The design indicated on the schedules and shown on the drawings is based upon the products of the named manufacturer. Alternate equipment manufacturers are acceptable if equipment meets scheduled performance requirements and dimensional requirements.

#### 1.5 RATINGS AND CERTIFICATIONS

- A. Air Handling Unit Safety: ETL or UL 1995.
- B. Air Handling Unit Energy Use: ASHRAE 90.1.
- C. Fans: AMCA 210.
- D. Air Coils: ARI 410.
- E. Air Handling Unit Certification Program: ARI 430.
- F. Filter Media: ANSI/UL 900 listed Class I or Class II.
- G. Control Wiring: NEC Codes and ETL requirements.
- H. Motors: Federally mandated Energy Policy Act (EPACT).
- I. Airflow Monitoring Stations: AMCA 611-95.

- J. Heat and Energy Recovery Components: ARI 1060.
- K. Air-to-Air Heat Exchangers: ASHRAE 84.

#### 1.6 SUBMITTAL DOCUMENTATION REQUIRED

- A. Furnish fan performance ratings and fan curves with specified operating point clearly plotted.
- B. Furnish drawings indicating unit dimensions, required clearances, field connection locations, wiring diagrams, shipping drawings, and curb drawings.
- C. Furnish performance report showing fan, motor, coil, and component performance details. Performance report shall detail unit casing performance and include materials, gauges, and finishes.
- D. Furnish operation and maintenance data, including instructions for lubrication, filter replacement, motor and drive replacement, and condensate pan cleaning; spare parts lists, and wiring diagrams.
- E. Adjust and report performance ratings for the proper altitude of operation.
- F. Report rooftop air-handling unit performance ratings in accordance with ARI-430 (static pressure, airflow, fan speed, and fan brake horsepower).
- G. Report static pressure profiles by component section.
- H. Report coil ratings in accordance with ARI-410 (capacities and pressure drops).
- I. Report and rate sound power levels in accordance with ARI-260 (ducted discharge, ducted inlet, free inlet sound) or AMCA-300.
- J. Airflow measuring device performance shall be certified and rated in accordance with AMCA-611. Report data in accordance with AMCA-611. Provide AMCA Certified Rating Seal for Airflow Measurement Performance.
- K. Report panel deflection at +/-8" w.g., stated in terms of 'L/X' where 'L' is the casing panel length and 'X' is a constant provided by the RTU manufacturer.
- L. Report casing leakage rate at +/-8" w.g., specified in terms of percentage of design airflow.
- M. Report weight loads and distributions by component section.
- N. Report product data for filter media, filter performance data, filter assembly, and filter frames.
- O. Report electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- P. Report motor electrical characteristics.
- Q. Report heat and energy recovery component data in accordance with ARI 1060 Certification program.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with ASHRAE 62.1, Section 5 (mold and corrosion resistant casings, filters upstream of wetted surfaces, and drain pan design).
- B. Comply with ASHRAE 62.1, Section 7 (practices to be followed during construction and startup). Protect equipment from moisture by appropriate in-transit and on-site procedures.
- C. Follow manufacturer's recommendations for handling, unloading and storage.
- D. Protect, pack, and secure loose-shipped items within the rooftop air-handling units. Include detailed packing list of loose-shipped items, including illustrations and instructions for application.
- E. Protect, pack and secure controls devices, motor control devices and other electronic equipment. Do not store electronic equipment in wet or damp areas even when they are sealed and secured.
- F. Enclose and protect control panels, electronic or pneumatic devices, and variable frequency drives; and pack with desiccant bags. Replace desiccant bags every 60 days. For equipment stored in an environment with a relative humidity greater than 60%, change bags every 30 days. Do not store equipment in wet or damp areas even when they are sealed and secured.
- G. Seal openings to protect against damage during shipping, handling and storage. Unit shall be shipped with doors bolted shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- H. Provide shrink-wrap around unpainted units. The membrane shall cover entire RTU during shipping and storage. Cover equipment, regardless of size or shape. Tarping is not acceptable.
- I. Shrink-wrap equipment, including electrical components, for protection against rain, snow, wind, dirt, sun fading, road salt/chemicals, rust and corrosion. Keep equipment clean and dry.
- J. Tarp painted units to protect against rain and road debris during shipping.
- K. Clearly mark RTU sections with unit tag number, segment sequence number, and direction of airflow. Securely affix safety-warning labels.

## 1.8 EXTRA MATERIALS

- A. Provide one set of filters for balancing, and one additional set for final turnover to owner.
- B. Provide one extra set of belts, in addition to the factory-installed set.

## 1.9 WARRANTY

- A. Base Bid:

1. Provide warranty for 12 months from date of shipment. Warranty shall cover manufacturer defects. Warranty shall include labor for 12 months from date of shipment. Warranty work shall be performed by manufacturer's factory-trained and factory-employed technician. Service technician must be based within 50 miles of job site. Include factory provided controls in the parts and labor warranties.

B. Alternate Bid:

1. Provide warranty for 60 months from date of shipment. Warranty shall cover manufacturer defects. Warranty shall include parts and labor for 60 months from date of shipment. Warranty work shall be performed by manufacturer's factory-trained and factory-employed technician. Service technician must be based within 50 miles of job site. Include factory provided controls in the parts and labor warranties.

C. Factory Service/Maintenance Agreement:

1. Bid:

- a. Provide service and maintenance agreement for 12 months from date of start-up. Agreement shall cover any and all factory recommended service and maintenance items. Agreement shall include parts and labor for 12 months from date of unit start-up. All service work shall be performed by either a manufacturer's factory-trained technician or certified local mechanical service contractor. Service provider must be based within 50 miles of job site. Include factory provided controls in the service agreement. Coil cleaning shall be included in the agreement. Air filter media shall be excluded from the service agreement.

2. Alternate Bid:

- a. Provide service and maintenance agreement for 60 months from date of start-up. Agreement shall cover any and all factory recommended service and maintenance items. Agreement shall include parts and labor for 60 months from date of unit start-up. All service work shall be performed by either a manufacturer's factory-trained technician or certified local mechanical service contractor. Service provider must be based within 50 miles of job site. Include factory provided controls in the service agreement. Coil cleaning shall be included in the agreement. Air filter media shall be excluded from the service agreement.

1.10 SYSTEM STARTUP

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
- B. Comply with manufacturer's start-up requirements to ensure safe and correct operation and integrity of warranty.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. Base Bid:

1. Aeon.

B. Alternate Bid:

1. Trane.
2. Munters.

### 2.2 GENERAL DESCRIPTION

- A. Rooftop Air Handling Unit (RTU) consists of a structural base, insulated casing, access doors, fans, motors, motor controls, coils, filters, dampers, controls, components, and accessories; as shown on drawings, schedules, and specifications.
- B. Provide RTU to meet the specified levels of performance for scheduled items including airflow, static pressure, cooling capacity, heating capacity, electrical characteristics, sound, casing leakage, panel deflection and casing thermal performance.
- C. RTU shall maintain structural integrity when wall panels are removed.
- D. Provide internal components and accessories as specified and scheduled. Components and accessories shall be installed by the RTU manufacturer in an ISO-9002 certified facility.
- E. Ship units in one piece. Split units only where necessary for shipping and installation.
- F. Manufacturer shall provide detailed, step-by-step instructions for disassembly and reassembly.
- G. For RTU segments that must be broken down for rigging and installation: Segment shall be disassembled and reassembled by manufacturer's factory-trained service personnel.
- H. Manufacturer shall provide a written statement confirming that the unit is built to the manufacturer's factory standards and that the unit will carry the full warranty.

### 2.3 STANDARDS COMPLIANCE

- A. Comply with ratings and certifications referenced in this specification.
- B. Manufacturers who do not comply with ARI-430 shall factory test EACH unit to verify brake horsepower rating, airflow performance and total static pressure performance.
- C. Manufacturers who do not conform to requirements of ARI 260 for ducted discharge and return air sound shall submit EACH unit to an independent sound test laboratory for ARI 260 testing. The test laboratory shall conform to ARI 260, Section 4.4, Test Equipment and Facilities.

## 2.4 BASE RAIL

- A. Provide a structural base rail under the full perimeter of the unit, formed from a minimum of 12-gauge G-90 mill galvanized steel.
- B. Provide clearance for proper external trapping of drain pans steam condensate.
- C. Provide base rail and lifting lug system that does not require additional support for rigging. Include base rail lifting lugs at each side shipping splits and at unit corners.
- D. Provide discharge and return air openings as indicated on the drawings.

## 2.5 CASING

- A. Provide double-wall RTU casing. Exposed insulation is not acceptable.
- B. Panel assembly shall meet UL Standard 1995 for fire safety. Panel insulation shall comply with the requirements of NFPA 90A.
- C. Provide an insulation system that is resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.
- D. Encapsulate insulation with sheet metal so that air does not contact insulation. Panels insulated with fiberglass shall be sealed at each corner and around their entire perimeter, to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.
- E. Provide casing with minimum thermal resistance (R-value) of 12 hr-ft<sup>2</sup>-°F/BTU.
- F. Roof, wall, floor, and access door panels shall be G90 galvanized or 304 stainless steel.
- G. Provide an additional .125" aluminum diamond tread plate floor liner in all access areas.
- H. Provide perforated liner in the fan section and for all other sections. The perforated panel shall enclose matte-faced fiberglass insulation.
- I. Provide a unit frame of G-90 galvanized steel that provides the overall structure of the unit and does not rely on the casing panels for structural integrity. Insulate frame in the same manner as panels, roof, and floors.
- J. Provide RTU casing that leaks no more than 1% of design airflow at +/-8" w.g.
- K. Provide wall panels and access doors that deflect no more than L/240 when subjected to +/- 8" w.g. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.
- L. Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb load at mid-span. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.
- M. Roof of unit shall be sloped to provide complete drainage.
- N. Unit shall have rain break overhangs above access doors.

## 2.6 PRIMARY DRAIN PANS

- A. Provide drain pans that comply with requirements for the RTU casing.
- B. Comply with the stated intent of ASHRAE Standard 62.1.
- C. Provide a drain pan under each cooling coil and humidifier. Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62. Provide 304 Stainless Steel drain pans.
- D. Provide drain connection made of same material as drain pan. Do not use dissimilar metals because of the risk of galvanic corrosion. Weld connection to the drain pan.
- E. Drain pan shall be double wall with an R-value of 12 hr-ft<sup>2</sup>-deg F/BTU. The entire area of the drain pan shall have this level of thermal performance.
- F. Insulate plumbing associated with drain pan drains and connections.
- G. Provide drain pan under the complete width and length of cooling coil and humidifier sections.
- H. Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.
- I. Provide a minimum of 1" clearance between the drain pan and any coil casing, coil support or any other obstruction.
- J. Provide drain pan that allows the design rate of condensate drainage regardless of fan status.
- K. Provide drain pan sloped in at least two planes by at least 1/8" per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

## 2.7 ACCESS DOORS

- A. Provide access door(s) that meet requirements for the RTU casing.
- B. Provide industrial style stainless steel hinges that permit 180 degrees of door swing.
- C. Provide latches with roller cam mechanisms that ensure a tight seal. Rotating knife-edge or "paw" latches are not acceptable.
  - 1. Provide each door with a single handle linked to multiple latching points or a separate handle for each latching point. Doors serving access segments shall have an interior latch handle.
- D. Provide access doors with a locking hasp to accommodate a lockout device.
- E. Provide double-pane viewing windows as shown on the elevation view drawings. Windows shall be a non-condensing type consisting of an integrated silica desiccant dehumidification layer. Minimum dimension shall be 3" x 8".
- F. Provide walk-in service compartment to allow access to compressors, refrigeration system components, and electrical control panel.

## 2.8 FANS

- A. Provide double width double inlet (DWDI) housed fans, or single width single inlet (SWSI) plenum fans as equipment schedule and drawings.
- B. Airfoil fans shall comply with AMCA Standard 99-2408-69 and 99-2401-82. Provide an AMCA Seal on airfoil fans. Airfoil fan performance shall be based on tests made in accordance with AMCA Standard 210 and comply with the requirements of the AMCA certified ratings program for air performance.
- C. Provide fans with true airfoil blades unless otherwise scheduled.
- D. Provide fans with the following accessories:
  - 1. Access door inlet screen (on RTU casing).
  - 2. OSHA-compliant belt guard enclosing the fan motor and drive.
- E. Provide airfoil fans with blades formed of extruded aluminum, as scheduled. Bent sheet metal blades are not acceptable.
- F. Provide an access door in the fan scroll, as shown on drawings.
- G. Provide fans with polished steel shafts with first critical shaft speed at least 125% of the maximum operating speed for the fan pressure class. Shaft shall have an anti-corrosion coating.
- H. Provide fan motor on an adjustable base to allow adjustable and consistent belt tension.
- I. Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the RTU floor and mount directly to the RTU frame. Manufacturers not complying with this requirement must submit detailed structural and weight data to a licensed structural engineer for review and stamped certification. The mechanical engineer shall review these engineers' final reports prior to submittal approval.
- J. Provide vibration isolation springs with 2" static deflection.
- K. Connect DWDI fans to the unit casing or bulkheads with canvas flexible connection.
- L. Provide horizontal thrust restraints between RTU casing and fan housings with end discharge. This requirement applies to the following cases:
  - 1. SWSI fans operating at greater than 3" of total static pressure.
  - 2. DWDI airfoil fans operating at greater than 6" of total static pressure.
  - 3. DWDI airfoil fans operating at greater than 3" of total static pressure.

## 2.9 BEARINGS AND DRIVES

- A. Provide bearings complying with ANSI/AFBMA 9 for fatigue life ratings.
- B. Provide fan bearings with an average life L50 of at least 200,000 hours.

- C. Provide permanently lubricated bearings on forward curved fans smaller than 18". On other fans, provide re-greaseable bearings with hydraulic grease fittings and lube lines extended to the motor side of the fan or to the exterior of the unit (primary access side).
- D. Provide plenum fans with direct-drive transmissions.
- E. Provide drives selected with a 1.5 service factor. Sheaves shall be machined from a close grain cast iron and statically balanced by the manufacturer. Provide a fixed pitch sheave on the motor.
- F. Provide fixed pitch sheaves on both the fan and motor. Fans with motors rated at 15 hp or less may be field balanced using variable pitch sheaves. Provide fixed pitch sheaves when final balance is complete. Air balancer shall select and provide final set of sheaves.
- G. Provide multiple belt drives on belt driven fans with motors 10 hp or greater. Belts shall be V-type, precision molded, raw edge construction, anti-static, oil-resistant and heat-resistant.

## 2.10 ELECTRICAL MOTORS

- A. Provide fan motors built in accordance with the latest standards of the NEMA and IEEE.
- B. Provide RTU and fan motors in compliance with ASHRAE 90.1.
- C. Provide fan motors with the following characteristics:
  - 1. 60 hertz, 1750 rpm operation.
  - 2. Service factor of 1.15.
  - 3. Premium efficiency, or as required to meet ASHRAE 90.1.
  - 4. NEMA design ball bearing type.
  - 5. Rated for continuous duty at full load in a 104 degrees F (40 degrees C) ambient.
  - 6. Open drip-proof (ODP) or totally enclosed, fan cooled (TEFC) as scheduled.
  - 7. Suitable for use in variable frequency application per NEMA MG-1 Part 30.
  - 8. Inverter ready per NEMA STD MG1 PART 31.4.4.2.
- D. Provide direct drive plenum fans coupled to motors with matching speed, as scheduled.

## 2.11 FACTORY INSTALLED ELECTRICAL ACCESSORIES

- A. Provide standard power block for connecting power to the unit.
- B. Provide a factory installed and factory wired, non-fused disconnect switch near the walk-in service compartment.
- C. Provide a factory installed and factory wired 120 volt 13 amp GFI outlet with outlet disconnect switch in the unit control panel.
- D. Provide phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

- E. In addition to motor power terminals, provide an independent power terminal for convenience receptacles and lights. Provide switches as shown on drawings.
- F. Provide factory mounted marine observation lights in all access sections, humidifier section, and fan section. Marine lights shall be pre-wired in conduit to switch located on the exterior of the module adjacent to the access door. Switches shall be factory mounted complete with outlet box for wiring connection by Division 26 and switch face plate.
- G. Provide a 1-hour timer on external light switches.
- H. Provide a 120v convenience receptacle on supply fan segment.
- I. Variable frequency drives shall be factory wired and mounted in the unit as scheduled per contract drawings.

## 2.12 COOLING COMPONENTS

- A. Provide coils manufactured by RTU manufacturer, except where noted in contract documents.
- B. Coils shall meet or exceed performance scheduled on drawings.
  - 1. When applicable, provide coils with performance certified in accordance with ARI Standard 410 for coil capacity and pressure drop. Circuit coils such that the fluid velocity is within the range of certified rating conditions at design flow.
- C. Provide cooling coils with a maximum face velocity as scheduled on drawings. Face velocity calculations shall be based on the finned area of the coil.
- D. Provide cooling coil drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of 6" or 10" or 14" downstream of the face of the coil.
- E. Provide at least 18" or as scheduled on drawings of access between coils. Provide an easily operable access panel or door, as shown on drawings.
- F. Provide coil segment casing that meets or exceeds casing performance of the unit.
- G. Provide panels that are easily removable with no special tools.
- H. Locate access doors to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.
- I. Provide coils built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall be constructed of 304 Stainless Steel and shall not block finned area.
- J. Individual coils shall be removable from the side of the RTU.
- K. Provide an intermediate drain pan on stacked cooling coils. Intermediate drain pan shall slope in a minimum of two planes toward a single drain connection.

- L. Provide a single intermediate vertical coil support on coils with a finned length greater than 62". Provide two vertical supports on coils with a finned length greater than 100," and three vertical supports on coils with a finned length greater than 141."
- M. Extend coil connections through RTU casing. Provide a 1/4" FPT plugged vent/drain tap on each connection. Circuiting shall allow complete draining and venting when installed. Vent and drain connections shall be on the coil connection extension outside of the unit casing.
- N. Insulate gap between coil stub out connection and RTU casing with a spool-shaped sleeve grommet. Adhesive rings applied the casing walls are not acceptable.
- O. Provide coils with die-formed, continuous aluminum or copper fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.008" thick.
- P. Provide coil coatings as scheduled or indicated on drawings.
- Q. DX Cooling Coils:
  - 1. Refrigerant: R-407C or R-410A.
  - 2. Aluminum fins, non-ferrous tubing, pre-charged with sufficient refrigerant for system.
  - 3. Provide factory installed thermostatic expansion valves.

## 2.13 REFRIGERATION SYSTEM

- A. Unit shall be factory charged with refrigerant.
- B. Compressors shall be scroll type with thermal overload protection, dual individually circuited and carry a five (5) year non-prorated warranty.
- C. Compressors shall be mounted in the walk-in service compartment which can be accessed without affecting unit operation.
- D. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
- E. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
- F. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and factory installed replaceable core liquid line filter driers with isolation valves.
- G. Unit shall include 8 stages of capacity control.
  - 1. Unit shall include a digital variable capacity scroll compressor on the first (and second) refrigeration circuits(s) which shall be capable of modulation from 10% - 100% of its capacity.

2. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
3. Each refrigeration circuit shall be equipped with a liquid line sight glass.
4. Each capacity stage shall be equipped with a 5 minute off delay timer to prevent compressor short cycling.
5. Each capacity stage shall be equipped with an adjustable, 20 second delay timer to prevent multiple capacity stages from starting all at once.
6. Lead refrigeration circuits shall be provided with factory installed hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.

#### 2.14 AIR-COOLED CONDENSER

- A. Condenser fans shall be vertical discharge, axial flow, direct drive fans.
- B. Coils shall be designed for use with specified refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
- C. Coils shall be designed for a minimum of 10 Degrees F of refrigerant sub-cooling.
- D. Coils shall be sloped to protect the coils from damage and coils facing away from the unit shall be protected by a sheet of perforated metal.
- E. Condenser fan cycling shall be provided to conserve energy at lower ambient temperatures.

#### 2.15 GAS HEATING

- A. Provide a natural gas furnace with 8 stages of capacity.
- B. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty.
- C. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
- D. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
- E. Unit shall be equipped with redundant gas valves and a high limit cut-out.
- F. Unit shall have gas supply piping entrances in the outside cabinet wall for across the roof gas piping.

## 2.16 ENERGY RECOVERY

- A. Unit shall contain a factory mounted and tested energy recovery wheel(s). The energy recovery wheel(s) shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
- B. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
- C. Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
- D. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
- E. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
- F. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and ARI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the ARI Certified Product.
- G. Hinged service access door shall allow access to the wheel(s).
- H. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

## 2.17 FILTERS

- A. Provide filter segments and filters as scheduled and specified.
- B. Provide side loading filters for filter segments located upstream of coil segment(s) with an access door on the drive side through which filters can be easily loaded.
- C. Provide face loading filters for segments located downstream of coil segment(s). Provide an 18" (minimum) access plenum and access door on the drive side through which face loading filters can be easily loaded.

- D. Provide filter racks integral to the unit and constructed of galvanized steel or 304 stainless steel.
- E. Provide Class 2 or Class 1 filter media per U.L. 900 and as required by local codes.
- F. Filter types, efficiencies, and nominal depths shall be as follows:
  - 1. Flat filters - 2" throwaway, 2" permanent cleanable, 2" 30% pleated, or 4" 30% pleated filters, as scheduled.
  - 2. Rigid filters - 12" rigid, with efficiencies of 60-65% (MERV 11), as scheduled.
    - a. Provide a pre-filter rack in rigid filter segments. Pre-filters shall have 2" throwaway, 2" permanent cleanable, 2" 30% pleated, or 4" 30% pleated filters as scheduled.
- G. Provide a flush mounted, factory installed magnahelic differential pressure gage on the drive side of unit to measure pressure drop across filters. Manufacturer shall provide fully functional gauges, complete with tubing.

## 2.18 OUTSIDE AIR / ECONOMIZER

- A. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq ft of damper area when subjected to 2 inches w.g. air pressure differential across the damper. Damper assembly shall be controlled by spring return enthalpy activated fully with dual minimum position. Unit shall include outside air opening bird screen, outside air hood with rain lip and barometric relief dampers.

## 2.19 CONTROLS

- A. Factory Installed and Factory Provided Controller:
  - 1. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
  - 2. With modulating hot gas reheat option, a field installed space humidity sensor and a field installed supply air temperature sensor shall be furnished to control the amount of reheat during dehumidification. Supply air temperature and space humidity setpoint shall be field adjustable.
  - 3. With modulating gas heat option, a field installed supply air temperature sensor shall be furnished to control the amount of heating. Supply air temperature setpoint shall be field adjustable.
  - 4. With enthalpy activated fully modulating economizer option, an outdoor air humidity sensor shall be factory installed.
  - 5. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
  - 6. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
  - 7. Controller shall contain diagnostics to indicate controller power, communications, unit alarms and sensor failures.
  - 8. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing and occupancy scheduling available without dependence on a building management system.

B. Variable Air Volume Controller:

1. Unit shall be equipped with hot gas bypass on the lead (and lag) refrigeration circuits to protect against evaporator frosting at low suction pressures and to prevent excessive compressor cycling.
2. Outside and return air temperature sensors shall be factory mounted and wired. Supply air temperature sensor shall be factory wired for field installation in the supply air ductwork. Supply air duct static pressure sensor shall be furnished with the unit for field installation.
3. Control of supply air flow for duct static pressure control shall be with unit controller, factory installed (field provided and installed) variable frequency drive, and supply air duct static pressure sensor.
4. Unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

2.20 CURBS

- A. Provide 2" deflection combination spring vibration isolation roof curbs equal to scheduled Vibro-Acoustics Model including duct supports, exterior thermal insulation, 2" fiber glass absorber in bottom of curb, seismic rating to 1g and 125 mph wind, access ports for isolator inspection, elastomeric seal, and wood nailer. Overall height shall be a minimum of 26" tall.

2.21 FINISHES

- A. Manufacturer shall clean the exterior surfaces of units prior to finishing, painting, or shipment.
- B. Manufacturer shall paint outdoor units prior to shipment.
1. Manufacturer shall apply a primer prior to painting units.
  2. Manufacturer shall apply a finish coat of acrylic polyurethane paint.
  3. Finished unit shall exceed 2,500-hour salt spray solution (5%) test without any sign of red rust when tested in accordance with ASTM B-117-95.

2.22 TESTS AND INSPECTIONS

- A. Manufacturer shall hipot test wiring intended to carry voltages greater than 30 Vac.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment per industry standards, applicable codes, and manufacturer's instructions.

- B. Do not use RTUs for temporary heating, cooling or ventilation prior to complete inspection and startup performed per this specification.
- C. Install RTUs on a roof curb or structural steel base as shown on drawings.
- D. Install RTUs with manufacturer's recommended clearances for access, coil pull, and fan removal.
- E. Provide one complete set of filters for testing, balancing, and commissioning. Provide second complete set of filters at time of transfer to Owner.
- F. Install RTU plumb and level. Connect piping and ductwork according to manufacturer's instructions.
- G. Install pipe chases per manufacturer's instructions.

### 3.2 FIELD QUALITY CONTROL

- A. Store RTUs indoors in a warm, clean, dry place where units will be protected from weather, construction traffic, dirt, dust, water and moisture. If units will be stored for more than 6 months, follow manufacturer's instruction for long-term storage.
- B. Rig and lift units according manufacturer's instructions.

### 3.3 RTU INSPECTION

- A. Hire manufacturer's factory-trained and factory-employed service technician to perform an inspection of unit and installation prior to startup. Technician shall inspect and verify the following as a minimum:
  - 1. Damage of any kind.
  - 2. Level installation of unit.
  - 3. Proper reassembly and sealing of unit segments at shipping splits.
  - 4. Tight seal around perimeter of unit at the roof curb.
  - 5. Installation of shipped-loose parts, including filters, air hoods, bird screens and mist eliminators.
  - 6. Completion and tightness of electrical, ductwork and piping connections.
  - 7. Tight seals around wiring, conduit and piping penetrations through RTU casing.
  - 8. Supply of electricity from the building's permanent source.
  - 9. Integrity of condensate trap for positive or negative pressure operation.
  - 10. Condensate traps charged with water.
  - 11. Removal of shipping bolts and shipping restraints.
  - 12. Sealing of pipe chase floor(s) at penetration locations.
  - 13. Tightness and full motion range of damper linkages (operate manually).
  - 14. Complete installation of control system including end devices and wiring.
  - 15. Cleanliness of RTU interior and connecting ductwork.
  - 16. Proper service and access clearances.
  - 17. Proper installation of filters.
  - 18. Filter gauge set to zero.

- B. Resolve any non-compliant items prior to proceeding with the inspection of the fan assembly.

### 3.4 INSPECTION AND ADJUSTMENT: RTU FAN ASSEMBLY

- A. Hire the manufacturer's factory-trained and factory-employed service technician perform an inspection of the RTU fan assembly subsequent to general RTU inspection and prior to startup. Technician shall inspect and verify the following as a minimum:
  - 1. Fan isolation base and thrust restraint alignment.
  - 2. Tight set screws on pulleys, bearings and fan.
  - 3. Tight fan bearing bolts.
  - 4. Tight fan and motor sheaves.
  - 5. Tight motor base and mounting bolts.
  - 6. Blower wheel tight and aligned to fan shaft.
  - 7. Sheave alignment and belt tension.
  - 8. Fan discharge alignment with discharge opening.
  - 9. Fan bearing lubrication.
  - 10. Free rotation of moving components (rotate manually).
- B. Manufacturer shall perform service to bring fan performance within factory specifications.

### 3.5 STARTUP SERVICE AND OWNER TRAINING

- A. Manufacturer's factory-trained and factory-employed service technician shall startup RTUs. Technician shall perform the following steps as a minimum:
  - 1. Energize the unit disconnect switch.
  - 2. Verify correct voltage, phases and cycles.
  - 3. Energize fan motor briefly ("bump") and verify correct direction of rotation.
  - 4. Re-check damper operation; verify that unit cannot and will not operate with all dampers in the closed position.
  - 5. Energize fan motors and verify that motor FLA is within manufacturer's tolerance of nameplate FLA for each phase.
- B. Provide a minimum of 4 hours of training for owner's personnel by manufacturers factory-trained and factory-employed service technician. Training shall include RTU controls, motor starter, VFD, and RTU.
- C. Training shall include startup and shutdown procedures as well as regular operation and maintenance requirements.
- D. If RTU is provided with a factory-mounted variable frequency drive (VFD), hire the VFD manufacturer's factory-trained and factory-employed service technician to inspect, test, adjust, program and start the VFD. Ensure that critical resonant frequencies are programmed as 'skip frequencies' in the VFD controller.
- E. Submit a startup report summarizing any problems found and remedies performed.

### 3.6 FIELD PERFORMANCE VERIFICATION

- A. Leakage: Pressurize casing to +/-8" w.g. and measure leakage. Pressurize casing to -8"w.g. and measure leakage. If leakage exceeds 1% of design airflow, seal leakage points with a permanent solution. Repeat test. If the RTU still does not pass, contact the manufacturer to seal unit.
- B. Submit a field test report with testing data recorded. Include description of corrective actions taken.

### 3.7 CLEANING

- A. Clean unit interior prior to operating. Remove tools, debris, dust and dirt.
- B. Clean exterior prior to transfer to owner.

### 3.8 DOCUMENTATION

- A. Provide Installation, Operation and Maintenance Manuals in the supply fan section of each unit. Provide six (6) additional copies for owner's project system manual.

END OF SECTION 237415

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 237416 - PACKAGED ROOFTOP NATATORIUM AIR HANDLING UNIT

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Packaged system for natatorium environment control including dehumidification, air heating/cooling, outdoor air and an outdoor condenser.

#### 1.2 QUALITY AND SAFETY ASSURANCE

- A. Unit shall be ETL listed.
- B. Units shall be completely factory assembled, wired, piped, and tested. All controls shall be factory adjusted and preset to the design conditions. Test report shall be available on request.
- C. Units shall have a microprocessor controller with unit mounted refrigerant pressure transducers on each independent compressor circuit, air pressure transducers across filters and coils, temperature sensors and an Ethernet connection for monitoring and control via the BAS.

#### 1.3 WARRANTY

- A. Base Bid:

- 1. Provide warranty for 12 months from date of shipment. Warranty shall cover manufacturer defects. Warranty shall include parts and labor for 12 months from date of shipment. Warranty work shall be performed by manufacturer's factory-trained and factory-employed technician. Service technician must be based within 50 miles of job site. Include factory provided controls in the parts and labor warranties.

- B. Alternate Bid:

- 1. Provide warranty for 60 months from date of shipment. Warranty shall cover manufacturer defects. Warranty shall include parts and labor for 60 months from date of shipment. Warranty work shall be performed by manufacturer's factory-trained and factory-employed technician. Service technician must be based within 50 miles of job site. Include factory provided controls in the parts and labor warranties.

- C. Factory Service/Maintenance Agreement:

- 1. Base Bid:

- a. Provide service and maintenance agreement for 12 months from date of start-up. Agreement shall cover any and all factory recommended service and maintenance items. Agreement shall include parts and labor for 12 months from date of unit start-up. All service work shall be performed by either a manufacturer's factory-trained technician or certified local mechanical service contractor. Service provider must be based within 50 miles of job site. Include factory provided

controls in the service agreement. Coil cleaning shall be included in the agreement. Air filter media shall be excluded from the service agreement.

2. Alternate Bid:

- a. Provide service and maintenance agreement for 60 months from date of start-up. Agreement shall cover any and all factory recommended service and maintenance items. Agreement shall include parts and labor for 60 months from date of unit start-up. All service work shall be performed by either a manufacturer's factory-trained technician or certified local mechanical service contractor. Service provider must be based within 50 miles of job site. Include factory provided controls in the service agreement. Coil cleaning shall be included in the agreement. Air filter media shall be excluded from the service agreement.

- D. The silica gel desiccant dehumidification rotor shall be warranted free from defects in material and workmanship for a period of not less than 60 months from date of shipment. Warranty is limited to repair or replacement at manufacturer's option, F.O.B. factory of any rotor or rotor element determined by the manufacturer to be defective.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. Base Bid:

1. Aeon.

B. Alternate Bid:

1. Dectron.
2. Seresco.
3. Innovent

### 2.2 GENERAL

- A. The dehumidifier shall be a single package unit. Unit shall include 2 scroll compressors, evaporator (dehumidifying coil), refrigerant liquid sub-cooling coils, condenser (air reheat coil), outdoor condenser, indirect fired gas heater, outdoor air, supply air fan, exhaust/relief fan, blower motors, motor starters and controls in one complete enclosure.
- B. Refrigerant shall be R 410a.
- C. The system shall be configured with a Zero Reheat dehumidification mode and an air conditioning option to reject up to 100% excess compressor heat during the air conditioning season to an outdoor air-cooled condenser.
- D. All controls shall be factory adjusted and preset to the design conditions. The unit shall have an Ethernet connection to the microprocessor and shall be accessible via the BAS.
- E. The unit shall be double walled construction and designed for outdoor installation.

- F. The unit shall have an indirect fired natural gas burner installed downstream of the blower, sized to meet the skin losses and outdoor air heating loads or as specified by the design engineer.

## 2.3 OPERATION

- A. The unit shall be designed and sized to maintain the specified space temperature and relative humidity range. The unit shall be able to simultaneously reject heat to the room air, or provide air conditioning.
- B. During compressor operation the unit shall perform as described below:
  - 1. The humid air from the natatorium passes through the dehumidifying coil and is cooled below its dew point, thereby condensing moisture.
  - 2. The moisture removed at the evaporator coil shall be greater than or equal to the latent load of the space.
  - 3. The heat captured by this process and the heat generated by the compressor power consumption is absorbed by a mechanical refrigeration system.
- C. The compressor heat shall be distributed based on the demands in the space.
  - 1. Dehumidification (Zero Reheat) Mode: The space temperature is in dead band range. The compressor hot gas flows in parallel to the reheat and air conditioning condenser coils. The unit is dehumidifying with a supply air temperature to the return air temperature.
  - 2. Dehumidification (Full Reheat) Mode: The space is calling for heat. 100% of the compressor hot gas condenses at the reheat coil. The supply air temperature is ~ 15 deg F warmer than the return air.
  - 3. During air conditioning mode any heat not required for reheat shall be rejected outdoors.

## 2.4 CABINET

- A. The unit frame shall be constructed of heavy gauge galvanized steel with a formed galvanized structural steel base. Lifting lugs shall be welded on the base frame for rigging the unit. All exterior panels shall be 20-gauge galvanized G90 steel with a mill applied zinc phosphate primer followed by an exterior grade silicone modified polyester top coat. Panels shall be fastened to the frame with stainless steel hardware. Panels shall be isolated from the steel frame with dielectric gaskets to prevent galvanic corrosion. The floor of each section shall have a galvanized steel deck to isolate the entire unit from the building. All seams shall have exterior grade thermoplastic caulking inside and out to prevent air and water leakage.
- B. The outer roof shall have a small camber slopping to both sides to prevent water collection. Top seams shall be covered with cap strips and sealed with exterior grade thermoplastic caulking to prevent water leakage into the unit
- C. Access doors shall be supported on continuous hinges and have multiple compression latches to provide quick access. Doors shall be provided for entrance to all sections housing components requiring routine maintenance. Full height access doors have stainless steel "hold back" latches to prevent door closure during the performance of service procedures.

- D. All walls, roof, and doors in the air-handling compartment shall be double wall construction enclosing 2" thick fiberglass. Liners shall be painted 22-gauge galvanized G90 steel with a mill applied zinc phosphate primer followed by an exterior grade silicone modified polyester top coat to protect the insulation during routine service and maintenance operations. The floor of the air handling sections are insulated with 2" rigid foam, the floor insulation is protected from damage with a galvanized steel liner.
- E. Each unit shall have a built-in electrical control panel in a separate compartment in order not to disturb the airflow within the dehumidifier during electrical servicing. All electrical components shall be mounted on a 16-gauge sub panel.
- F. The unit shall have built-in air filter racks with separate access door with compression fasteners. The filter rack shall be suitable to handle 2" 30-30 type disposable filters.
- G. The unit shall be equipped with an opening suitable for admitting outdoor air to comply with ASHRAE Ventilation Standard 62-1999. Outdoor air intake assembly shall have a built in air filter rack with separate access door and manual air balancing damper.
- H. The unit shall have the 2 compressors, receivers, solenoid valves and the electrical panel in a separate vestibule compartment out of the processed air stream. All components shall be serviceable while the unit is in operation without disturbing the airflow.

## 2.5 INSULATION

- A. All exterior cabinet sections shall be insulated with two (2) inch thick fiberglass. Thermal conductivity shall be not more than 0.232 Btu/in\*h\*sq ft\*F at 75 F

## 2.6 EVAPORATOR/DEHUMIDIFIER COILS

- A. Shall be six rows deep, 12 FPI for maximum moisture removal capacity, with 1/2 inch OD seamless copper tubing mechanically expanded to assure high heat transfer.
- B. Shall have an integrated liquid refrigerant sub-cooling coil.
- C. Each compressor circuit shall have an independent evaporator coil and incremental drain pan to allow for total independent operation.
- D. Coils shall be fully dipped and coated with a polyester enamel corrosion protection coating that complies with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt and gases. Coils with just protected fins and not fully dipped are not acceptable.
- E. Coil shall have 18-gauge galvanized casing and end plates.
- F. Coil shall be factory tested at air pressures not less than 400 psig in a water bath.
- G. A motorized bypass air damper shall be installed for apparatus dew point control.
- H. Coil shall have a two (2) year warranty.

## 2.7 CONDENSER (AIR REHEAT COIL)

- A. Shall be sized for variable heat transfer into the air with a capacity of 100% of the compressors total required heat of rejection. Shall be manufactured with 3/8" OD seamless copper tubing mechanically expanded to assure high heat transfer with maximum twelve aluminum fins per inch.
- B. Coils shall be fully dipped and coated with a polyester enamel corrosion protection coating that complies with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt and gases. Coils with just protected fins and not fully dipped are not acceptable.
- C. Coil shall have 18-gauge galvanized casing and end plates.
- D. Coil shall be factory tested at air pressures not less than 400 psig in a water bath.
- E. Coil shall have a two (2) year warranty.

## 2.8 DRAIN PAN

- A. Each compressor circuit shall have an independent evaporator coil and incremental drain pan to allow for total independent operation.
- B. Each evaporator coil shall be provided with a positive draining IAQ type double pitched stainless steel drain pan. The drains for the main drain pan shall extend through bottom of the unit. A single "P" trap shall be provided to be field mounted external to the unit and freeze protected for proper operation of the unit. Drain pipe to be heat traced by installing Contractor.
- C. All drain connections to be from the bottom of the unit.

## 2.9 BLOWERS

- A. The supply air blower wheel shall be a single width/single inlet airfoil plenum type, secured a machined, ground and polished solid steel shaft. Blower wheel shall be polyester powder paint coated steel. The shaft shall be coated with a rust inhibitor and supported by two outboard bearings.
- B. The complete blower assembly shall be statically and dynamically balanced on precision electronic balancers.
- C. Bearings shall be self-aligning ball bearing pillow block type and are designed for an L-50 life of 200,000 hours.
- D. The exhaust blower (EF1) shall be sized for 110% of the minimum outdoor air requirement to maintain the Natatorium's negative pressure requirement during normal operation.
- E. Fan shall be direct driven and blower wheel shall be a single width/single inlet backward inclined airfoil plenum type, secured a machined, ground and polished solid steel shaft. Blower wheel shall be made of corrosion proof glass reinforced polypropylene. The shaft shall be coated with a rust inhibitor.

- F. The exhaust fan shall be controlled from an end switch on the power open and spring return outside air damper. The gravity exhaust dampers shall be protected by louvers to divert rain from the face of the dampers.

## 2.10 BLOWER MOTORS

- A. Motors shall be premium efficiency heavy-duty open drip proof 3-phase, 1800 rpm, mounted on a heavy-duty sliding base.
- B. Motor and blower assembly shall be mounted on a heavy-duty steel frame supported by springs with a minimum deflection of 1 inch. Frame shall be suitably coated for corrosion protection.
- C. Blower drive shall include fixed pitch sheaves with multiple V-belts having a minimum service factor of 150%.

## 2.11 COMPRESSORS

- A. The unit shall have 1 compressor circuit.
- B. Compressors shall be heavy duty suction-cooled, hermetic scroll type complete with forced feed lubrication, suction and discharge service valves, suction strainer, crankcase heater, and 3 phase solid state thermal motor protection.
- C. The compressor shall be mounted on rubber in shear isolators to prevent transmission of any noise and vibration to the space below.
- D. Compressors shall be located outside the conditioned air stream in the service vestibule.
- E. Compressors shall have a 5-year extended warranty.

## 2.12 REFRIGERATION CIRCUIT

- A. Unit shall have pressure transducers monitoring the refrigerant high and low pressures. The refrigeration circuit shall accessible for diagnostics, adjustment and servicing without the need of service manifold gauges.
- B. The multiple independent refrigerant circuits shall be completely piped, tested, dehydrated and fully charged with oil and refrigerant R-410a. The refrigerant circuit components include compressor, condenser with integral liquid subcooling, liquid line service and charging valve, replaceable core filter drier in the liquid line, filter in the suction line, liquid line sight glass, relief valve, solenoid control valves, check valves, liquid and moisture indicator (out of process air stream), thermostatic expansion valves and pump down solenoid valves.
- C. Unit shall have an externally adjustable balanced port design mechanical thermostatic expansion valve. The valve shall have a removable powerhead.
- D. Unit shall have pressure transducers monitoring the refrigerant high and low pressures. The refrigeration circuit shall accessible for diagnostics, adjustment and servicing without the need of service manifold gauges.

- E. Tamper proof, hermetically sealed non-adjustable high and low pressure controls and refrigeration service valves shall be installed using Schraeder type valves. Refrigeration service valves shall be located outside of the airstream.
- F. Receivers shall have two refrigerant level (maximum and minimum) indicating sight glasses.
- G. Suction line shall be fully insulated with 1/2 inch closed cell insulation.

#### 2.13 CONTROL PANEL

- A. The main control panel and a disconnect switch shall be mounted in the weatherproof service vestibule. Unit shall be complete with all safety and operating controls factory installed and wired except for remote mounted operating panel, which must be field installed by the contractor.
- B. Shall have power terminal block for single point 460 volt power supply with factory mounted branch circuit fuses for all circuits. A second terminal block shall be furnished for 120 volt convenience outlet. The electrical contractor shall be responsible for external power wiring to these 2 power terminal blocks.
- C. Shall have a phase failure monitor and low voltage protection relay.
- D. Shall have compressor and condenser fan motor starters, thermal trip overloads and refrigeration operating and safety controls.
- E. Shall have dry contacts provided for alarm, blower interlock, heating, auxiliary pool water heater, outdoor air damper, exhaust fan and system on.
- F. Shall have a 24-volt control transformer and 24 volt field wiring control terminal strip. Terminals numbered for field connection of all controls in accordance with the wiring diagram. All wiring shall be numbered and/or color-coded
- G. All wiring shall be installed in accordance with UL or CSA safety electrical code regulations, and shall be in accordance with NFPA. All components used shall be UL or CSA listed.
- H. Shall have pressure transducers for refrigerant high pressure and suction pressure provided for each compressor circuit.
- I. Shall have an airflow switch and dry contact for alarm.
- J. Shall have unit power and control wiring diagrams laminated to the door of the control panel.

#### 2.14 MICROPROCESSOR CONTROL

- A. Unit shall be provided with a fully self-diagnostic minimum 512K of FLASH memory, 512K of battery backed up RAM, 8-bit and 22.1 Mhz microprocessor controller. All set points and adjustments shall be preprogrammed at the factory during full quality control and test operation. The microprocessor program shall be able to be field updated via FLASH memory. Program shall also be able to be updated via an internet connection.

- B. The controller shall have as a minimum: 11 Analog inputs, 4 Analog outputs, 24 Digital inputs and 16 Digital outputs.
- C. Controller shall have four (4) serial interface ports including one each of RS232 and RS485. The controller shall also 10 base-T Ethernet port with RJ-45 connector complete with link and activity LEDs.
- D. Controller shall have a BAS interface via Bacnet IP.
- E. Controller shall have a real time clock to time stamp unit operation log. Time clock shall have programmable 7-day occupied/unoccupied scheduling capabilities.
- F. Control board shall include hardware watchdog supervisor to ensure failsafe operation. The control board shall operate at -40 deg C to +70 deg C.
- G. Keypad and Display panel shall have a 122 by 32 pixel backlit graphic Liquid Crystal Display (LCD). There shall be 7 system status LEDs. The user shall be able to browse the screen using UP, DOWN, LEFT, RIGHT and ENTER keys. The panel shall have 3 soft keys that change functions based on where the user is in the software.
- H. Shall be provided with a remote OPERATOR panel that is connected with an RJ-11 4 wire (telephone) cable. The remote OPERATOR panel shall be identical to unit mounted panel and allow the operator all the same features.
- I. Unit shall have pressure transducers monitoring the refrigerant high and low pressures. The refrigeration circuit shall accessible for diagnostics, adjustment and servicing without the need of service manifold gauges.
- J. The following status LEDs shall be on the controller.
  - 1. Dehumidification - Indicates that the system is dehumidifying the space.
  - 2. Cooling - Indicates that the air-conditioning mode is in operation.
  - 3. Pool Heating - Indicates that the system is heating the pool water with recycled energy.
  - 4. Space Heat - Indicates that the space heating is operating.
  - 5. Alarm - indicates there has been a failure requiring service.
- K. The following setpoints shall be accessible and adjustable from either display panel:
  - 1. Space temperature.
  - 2. Space relative humidity.
  - 3. Pool water temperature.
- L. The following sensors shall be unit mounted and monitored at either of the unit's display panels:
  - 1. Refrigerant high pressure: Circuit 1-2.
  - 2. Refrigerant low pressure: Circuit 1-2.
  - 3. Return air temperature.
  - 4. Supply air temperature.
  - 5. Return air relative humidity.
  - 6. Outdoor air temperature.
  - 7. Entering pool water temperature.
  - 8. Leaving pool water temperature.
  - 9. Evaporator leaving air temperature: Circuit 1-2.

- M. System Status - Shall indicate in a text message to the display what systems require attention or servicing. Built-in monitoring and diagnostics shall allow the user to view the following:

1. Voltage - Phase Imbalance fault.
2. Dirty air filter.
3. Refrigerant high and low pressure.
4. Freezestat.
5. System off.
6. Blower off.

## 2.15 AIR FILTERS

- A. The filter section includes UL Class 2, 2" thick, 30% efficiency panel type filters. Filters are face loaded with access for filter maintenance through a full height walk-in service door on the side of the unit.

## 2.16 DAMPERS

- A. Unit shall be provided with a power open and spring return outside air and damper. Dampers adjust between 0% to 100% open position.
- B. Outdoor air damper shall be opposed blade, power open and spring return. Dampers blades shall be 3/4" insulated type made from extruded anodized Aluminum with neoprene double seal tips to minimize leakage. Damper leakage shall be less than 1% of maximum flow at 4-inch W.C. differential. Damper blades shall be mounted on steel rods which rotate on nylon bushings. All damper hardware shall be corrosion resistant.
- C. Internal dampers shall be opposed blade and made from extruded anodized Aluminum with neoprene double seal tips s to minimize leakage. Damper blades shall be mounted on steel rods which rotate on nylon bushings. All damper hardware shall be corrosion resistant.

## 2.17 SPACE HEATING - NATURAL GAS WATER HEATER WITH PUMP/COIL SYSTEM

- A. Hot water space heating coil and control valve shall be factory provided, wired and piped to a natural gas fired flash water heater. The water heater shall have an integral finned copper coil with quick release brass or bronze water ways.
- B. The heater shall have onboard solid state controls, monitoring inlet and outlet water temperatures.
- C. Heater shall include:
1. Ground fault interrupter.
  2. Inline fusing.
  3. Spark ignition and sensor system.
  4. Aluminized stainless steel burner.
  5. Built in freeze protection.
  6. Manual reset high limit.
  7. Flame sensor.

- D. An inline pumping system shall circulate hot water between the water heater and hot water space heating coil. The factory installed control valve shall modulate based on the heating output signal from the unit microprocessor.

## 2.18 AIR-COOLED AIR CONDITIONING

- A. Unit shall be equipped with air conditioning mode where excess compressor heat is rejected to the outdoor air-cooled condenser. The outdoor air-cooled condenser shall be capable of rejecting 100% of the compressor heat rejection with an air on temperature at summer design conditions.
- B. All refrigerant piping shall be installed and tested in the factory prior to shipment of the complete unit.
- C. The air-cooled condenser coils shall be a minimum of four rows deep and have copper tubes expanded into a maximum of ten aluminum fins per inch. Coils shall be tested at 425 PSIG and mounted vertically for complete surface utilization. Coils shall be counter flow with a minimum of 10 degrees of liquid sub-cooling and have adequate capacity to dissipate the total heat rejection of the system at design conditions. Condensers shall have guards to protect the coils from vandalism and weather related damage.
- D. Condenser fans shall be coated steel and have a steel hub locked on a stainless steel motor shaft with a keyway and square head set screws. Fans shall have a radius spun type venturi for efficient performance. Fans shall have vinyl coated external guards capable of being removed for service without removing the fan motor.
- E. Fans shall be direct driven by NEMA constructed, three phase motors operating at 1140 RPM. Each motor shall have a shaft slinger to prevent water seepage into the motor.
- F. Refrigeration circuit shall include solenoid refrigerant valves, receiver with pressure relief valve set at 400 psig, pressure control valve and pressure differential valve, and two manual shutoff valves to isolate the outdoor condenser. Each refrigerant circuit shall be provided with a receiver and 2 refrigerant level (max and min) viewing sight glasses to facilitate system charge verification.

## 2.19 FACTORY PERFORMANCE TESTING

- A. The unit shall operate in all modes at the factory for a full performance and Quality Control inspection. A copy of the test report shall be submitted to the Engineer for review and record.
- B. Microprocessor controls shall be factory adjusted and preset to the design conditions during testing.

## PART 3 - EXECUTION

### 3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle unit carefully to prevent damage, breaking, denting and scoring. Damaged units or damaged components shall not be installed. Replace all damaged parts with new parts from the manufacturer.

- B. If unit is to be stored prior to installation store in a clean, dry place. Protect from weather, dirt, fumes, water, construction, and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading the unit and moving it to the final location.

### 3.2 START UP

- A. Factory start-up supervision and owner training shall be included. The installing Contractor's technician shall also be present during this time period.

### 3.3 INSTALLATION

- A. Execute the work in accordance with the specifications and in accordance with the manufacturer's instructions and only by workmen experienced in this type of work.

END OF SECTION 237416

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January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 238123 - COMPUTER ROOM AIR CONDITIONING UNIT

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 230500.
- B. Provide components and controls for cooling, humidification, dehumidification, and high efficiency air cleaning capacities and sizes scheduled and in locations as shown on drawings and as specified herein.

#### 1.2 SYSTEM DESCRIPTION

- A. The system shall be a glycol, direct expansion, or chilled water type as scheduled.

#### 1.3 RELATED WORK

- A. Section 232000: HVAC Piping
- B. Section 232300: Refrigeration Piping System
- C. Division 26: Electrical

#### 1.4 QUALITY ASSURANCE

- A. Provide unit consisting of U.L. listed components, factory tested to conform to ASHRAE and ARI standards.

#### 1.5 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Liebert
- B. Airedale
- C. HiRoss
- D. DataAire

E. Compu-Aire

2.2 EQUIPMENT REQUIREMENTS

A. Indoor unit: Factory wired and piped, containing the following items:

1. Frame and decorative insulated and sound proofed side panels constructed of welded structurally formed 11 gauge steel, with corners braced and coated with rust resisting paint.
2. Decorative outer front side and rear removable panels constructed of 16 gauge steel and painted in a standard textured gray finish, insulated and sound proofed.
3. Center front return air panel constructed of aluminum with a non-glare anodized finish.
4. Service access at the front of the unit only.
5. Filter section consisting of a set of prefilters and high efficiency filters with an N.B.S. rating of not less than 90% efficiency using ASHRAE 52-76.
6. Filter clog switch which senses and indicates dirty filters at a pilot light on the panel.
7. Fan section which contains a D.W.D.I. forward curve centrifugal fan arranged for down flow discharges into the raised floor. Drive motor mounted on an adjustable base and connected with an adjustable "U" belt drive.
8. Cooling coil drain pan section constructed of stainless steel.
9. Cooling coil not less than five rows deep constructed of copper tubes and aluminum fins.
10. Electrical starter-relay panel in the units, completely prewired and prefused, with starters, contactors, relays, and terminal strips furnished, mounted, and wired.
11. Twenty-four volt control transformer for controls.
12. Automatic thermostats, humidistats, relays, switches, pilot lights, and name tags with a system on-off switch on the indicating light panel strip.
13. "SERVICE" alarm arrangement in the control system to indicate compressor overload, refrigerant high pressure conditions, fan motor overload, air failure, and room-hi-temperature conditions. This "SERVICE" alarm system shall contain a service pilot light and audible alarm bell with silencing switch.
14. Hot water, hot gas, or electric reheat coil, as scheduled, located on the leaving side of the cooling coil.
15. Refrigerant safety circuit with a separate high and low pressure cutout with a manual reset on the high side.
16. Built-in humidifier for space humidification by means of a controlled electric heater water vapor system using city water at a 1/4 inch size valved connection.
17. Compressor section consisting of two independent hermetic compressors operating on Refrigerant R-22. Provide compressors with internal motor protection, heavy duty motor, built-in muffler, internal spring vibration mounts, discharge and suction service valves, anti-slug device and crankcase heaters. Mount compressors on a heavy gauge steel drip pan.
18. Refrigerant receiver, with service valves and relief valves, and a pumpdown capacity sufficient for the piping system shown.
19. Modulating capacity control (hot gas bypass) in the refrigerant circuit to maintain design conditions at reduced loads of down to 25%. Include a solenoid valve and adjustable modulating valve pre-piped to evaporator coil and prewired.

B. Outdoor unit (condenser): Factory wired and piped containing the following items.

1. Coils with aluminum fins and apertures
2. Fan motors: Weatherproof
3. Fans: Direct drive and made of noncorrosive material

4. Winter operation, head pressure control valve designed to operate continually at down to -10 degrees F. ambient

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions, as modified by drawings, in locations shown on drawings.
- B. Install electrical connections under Division 26.
- C. Coordinate installation of temperature controls.
- D. Charge system and place in operational condition.

#### 3.2 START-UP AND TEST

- A. Start-up unit, test for proper operation and capacity, check for proper control operation.
- B. Demonstrate performance of unit to the maintenance personnel.
- C. Instruct maintenance personnel in use and operation of equipment.
- D. Provide maintenance and operations manuals and parts list.

END OF SECTION 238123

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 238239 - UNIT HEATERS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Install the following equipment in locations and sizes as shown on drawings and as specified herein:
  - 1. Electric unit heaters.

#### 1.2 RELATED WORK

- A. Division 26: Electrical.

#### 1.3 QUALITY ASSURANCE

- A. Provide U.L. listing on all units.
- B. Provide AGA approval on gas fired units.

#### 1.4 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Trane.
- B. Modine.
- C. Dunham Bush.
- D. Air Therm.
- E. Sterling.
- F. American Air.

#### 2.2 EQUIPMENT REQUIREMENTS

- A. Electric: Trane Model UHVA with the following features:

1. Casing, heater element, circuit subdivision and fusing where required.
2. Cabinet enclosure with directional discharge louvers.
3. Wall mounted line voltage thermostat.
4. Five year heater element warranty.
5. Fan motor, totally enclosed, with thermal overload protection and permanently lubricated.
6. High temperature cut out with manual reset.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions in locations scheduled on drawings.
- B. Coordinate electrical connections.
- C. Provide access covers as required for access to piping.

#### 3.2 START-UP, TEST, DEMONSTRATION

- A. Start-up and test equipment for proper operation.
- B. Demonstrate operation of equipment to maintenance personnel.

END OF SECTION 238239

## SECTION 238413 - HUMIDIFIERS

### PART 1 - GENERAL

#### 1.1 RELATED WORK

- A. Section 230700: HVAC Insulation.
- B. Section 232000: HVAC Piping.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

#### 1.3 WORK INCLUDED

- A. Complete and operable humidification system which meets applicable building codes.
- B. Equipment start-up and project inspection by qualified factory trained representative.

#### 1.4 QUALITY ASSURANCE

- A. CSA Certified.
- B. ISO 9001-2008.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. ARI 640, "Standard for Commercial and Industrial Humidifiers.
- E. Products shall be supported with a warranty that ensures the product will be free from defects in materials and workmanship for a period of two years after installation or 30 months from manufacturer's ship date, whichever is earlier. The heat exchanger(s) will have an additional warranty that ensures the heat exchanger will be free from defects in materials and workmanship for an additional year, for a total period of 3 years from installation or 40 months from the manufacturer's ship date, whichever is earlier.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Armstrong Machine.
- B. Stultz.

- C. DriSteam.
- D. Pure Steam.
- E. Nortec.

## 2.2 EQUIPMENT

### A. Unit(s) to be Complete with:

1. Enclosed cabinet, powder painted steel construction and air gap between cabinet and insulated humidifier tank ensures safe surface temperature.
2. All internal components compatible with De-Ionized (DI), Reverse Osmosis (RO), potable and softened water.
3. All tank surfaces shall be insulated with minimum 1" (25 mm) thick insulation and enclosed within unit cabinetry to ensure safe surface temperature, high overall efficiency, and fast unit response time. Units with exposed insulation shall not be acceptable.
4. Standard internal drain water cooler to ensure drain water tempering to 140 deg F (60 deg C). If external drain water cooler required, provide factory cross-braced unit stand and factory supplied stainless steel p-trap.
5. Blow-down p-trap, factory installed, enclosed in cabinet, prevents steam leakage to drain. Field installation not acceptable.
6. Humidifier to prevent "back-siphoning" using an internal air gap for supply water, to meet local plumbing codes.
7. Drain line to include a vacuum breaker to prevent siphon drainage of the tank.
8. Stainless Steel combustion chamber(s)/heat exchanger(s) shall have flat surfaces to retard scale build-up. Tubular heat exchangers are not acceptable.
9. Stainless Steel combustion chamber(s)/heat exchanger(s) shall be heat treated to protect against possible stress corrosion cracking. Combustion chamber(s)/heat exchanger(s) that are not heat treated stainless steel are not acceptable.
10. Each burner, capable of true modulation will provide steam production of 25 to 105 lbs/hr (11 to 48 kg/hr). Time proportioning modulation is not acceptable.
11. Combustion efficiency of 83.7% based on the higher heating value and 94.5% based on the lower heating value.
12. Gas system with gas valve(s), explosion proof, premix combustion air blower(s), microprocessor controlled ignition, flame sensing and fault indicator light(s), 100% premix infrared burner(s), hot surface igniters(s) and heat transfer efficiency maintained overall operating ranges.
13. A secondary combustion air safety, in addition to blower speed monitoring, utilizing a mechanical pressure differential switch, used with each blower to ensure combustion air is entering the pre-mix blower properly.
14. Removable cover at front of unit facilitates easy cleaning (when applicable) with complete access to tank and heat exchanger surfaces.
15. Automatic water level control within a separate float chamber, isolated from the boiling action, to prevent false water level indication.
16. Dual magnetic electronic float system, located outside of the boiling water to ensure accurate water level control and reduced maintenance. Cool fill water is to be supplied into the sensing chamber to keep the device cool. Systems using conductivity probes or floats located within hot reservoir water are not acceptable.
17. Humidifier shall have a dual fill valve to feed water to the tank and float chamber, to reduce scaling and mineral build up on the magnetic floats.
18. Float chamber to include LED indication of five possible water level indications.
19. Pre-cleaning flushing feature shall be provided to reduce maintenance time.

20. End of season blow-down feature to evacuate contained water and minerals after 72 hours with no demand for humidification.
21. Standard Modbus protocol communication capability with BACnet, LonWorks, and Johnson N2 adaptability.
22. Keep warm function allows the water temperature in the cylinder to be maintained at a high temperature for quick response of the unit to a call for humidity.
23. Total Controller microprocessor with alphanumeric backlit display.

B. Provide multiple tube dispersion assembly.

1. Acceptable Manufacturers: Armstrong Humidpak, DriStream RapidSorb, Nortec SAM
2. Provide complete assembly with the following:
  - a. Fabricated stainless steel horizontal header/separator at bottom of assembly, sloped for sufficient drainage.
  - b. Vertical stainless steel dispersion tubes with top support connections.
  - c. Steam dispersion tube orifice or bubblelet inserts sized for scheduled capacity.
  - d. Short Absorption Header:
    - 1) All piping, and connections, made of Stainless Steel.
    - 2) 95% of exposed surface insulated.
    - 3) Pre-engineered holes to stick the Tubes in.
    - 4) Grommets to provide color.
    - 5) Round shape to minimize Pressure Drop.
    - 6) Condensate Separation with drain connection.
  - e. Steam Tube:
    - 1) All piping, and connections, made of Stainless Steel.
    - 2) Pre-engineered holes to stick the Tubes in.
  - f. Mounting Frame:
    - 1) Stainless Steel.
    - 2) Telescopic adjustable.
  - g. Steam Inlet
  - h. Insulation:
    - 1) Covering Header and Tubes.
    - 2) Stainless Steel.

C. Ultrasonic Humidification for IT Server Room

1. System to include:
  - a. Humidifiers shall be adiabatic type: ultrasonic.
  - b. Humidifiers shall be mounted in the unit as a single piece rack with multiple tiers but only one water hookup.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Insulate humidifier in accordance with manufacturer's written recommendations and as specified in Section 230700.
- B. Install humidifiers in ductwork with recommended distance from elbows, transitions, and offsets to ensure absorption of steam into air stream.
- C. Install humidifiers and limit humidistat in strict accordance with manufacturer's written instructions.

### 3.2 START-UP AND TESTING

- A. Start-up and test for satisfactory operation, humidifiers and humidistats as part of steam/condensate system and control system. Check to ensure all valves are open and that humidifier responds to humidistat over selected ranges. Check high limit humidistat for proper operation.
- B. Demonstrate and instruct facility engineering personnel in system operation.
- C. Provide manufacturer's operation and maintenance manuals and parts list as required by Section 230500.

END OF SECTION 238413

## SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Basic materials and methods, along with Division 01, General Requirements, that are applicable to Division 26 sections.
- B. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification Sections apply to all Division 26 sections.

#### 1.2 QUALITY ASSURANCE

- A. Comply with applicable local, state, and federal codes.
- B. Warrant electrical Work against faulty material or Workmanship in accordance with Division 01. If the Project is occupied or the systems placed in operation in several phases at the request of the Owner's Representative, then the warranty of each system or piece of equipment used, shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner's Representative. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.
- C. Equipment and material provided under this Division shall be periodically inspected and serviced by competent mechanics. This function becomes the responsibility of the Owner's Representative when the system is accepted by the Owner's Representative. The one year material and Workmanship warranty is not intended to supplant normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items such as periodic lubrication and adjustment due to normal use, nor to correct without charge, breakage, maladjustment, and other trouble caused by improper maintenance.
- D. Turn over electrical equipment provided under this Division to the Owner's Representative in lubricated condition. Include instructions on further lubrication in the operating manual.
- E. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain premises neat and clean. Protect and preserve access to energized equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. Use only factory supplied paints of matching color and formula. Schedule an off-hour shutdown of all electrical equipment during the 2-week period preceding substantial completion. During this shut down, clean all buses and insulators inside all switchgear, switchboards, bus ducts, collector buses and panelboards located inside or adjacent to the project limits.

### 1.3 REGULATORY REQUIREMENTS

- A. Perform Work specified in Division 26 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect,.
1. NFPA 20: Standard for the Installation of Stationary Pumps for Fire Protection
  2. NFPA 30: Flammable and Combustible Liquids Code
  3. NFPA 50: Standard for Bulk Oxygen Systems and Consumer Site
  4. NFPA 70: National Electrical Code
  5. NFPA 72: National Fire Alarm Code
  6. NFPA 75: Standard for Protection of Information Technology Equipment
  7. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems
  8. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems
  9. NFPA 92A: Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences
  10. NFPA 92B: Standard for Smoke Management Systems in Malls, Atria, and Large Spaces
  11. NFPA 101: Life Safety Code
  12. NFPA 110: Standard for Emergency and Standby Power Systems
  13. NFPA 111: Standard on Stored Electrical Energy Emergency and Standby Power Systems
  14. NFPA 241: Standard for Safeguarding Building Construction, Alterations, and Demolition Operations
  15. CalGreen Code
  16. NFPA 780: Standard for the Installation of Lightning Protection Systems
  17. NFPA 5000: Building Construction and Safety Code
  18. ANSI A17.1: Elevators, Dumbwaiters, Escalators and Moving Walks
  19. ANSI Handicapped Code-A117.1
  20. ASTM E814-08B: Standard Test Method for Fire Tests Penetration Firestop Systems.
  21. U.L. Fire Resistance Index.
  22. UL White Book: General information for electrical construction, hazardous location, and electrical heating and air conditioning equipment
  23. International Building Code
  24. State of California Electrical Code with El Segundo Amendments
  25. State of California Building Code
  26. ASHRAE 90.1
  27. All applicable Occupational Safety and Health Administration (OSHA) Publications, Rules and Regulations.
  28. Americans with Disabilities Act (ADA)
  29. NFPA 96: Standard for Ventilation Control and Fire Protection for Commercial Cooking Operations (2008)

### 1.4 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting
- C. Flashing of conduits into roofing and outside walls

- D. Heating, ventilating, and air conditioning equipment
- E. Plumbing equipment
- F. Fireproofing
- G. Elevators
- H. Automatic Doors
- I. Cutting and patching for electrical Work, except for errors and omissions under this Division.

1.5 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

- A. Kitchen equipment
- B. Laboratory equipment
- C. Television system equipment
- D. Dictation system equipment
- E. Intercommunication system equipment
- F. Music/paging system equipment
- G. Security System Equipment
- H. Data Processing System Equipment

1.6 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Submit product data, equipment details, capacities, and shop drawings as specified in sections of this Division.
- C. Submit fire alarm point-to-point drawings with product data submission.
- D. Submit dimensioned equipment room layouts.
  - 1. Show location of all electrical equipment in rooms including but not limited to:
    - a. Electrical rooms and closets
    - b. Generator Room
    - c. Fire pump room
    - d. Mechanical Rooms
  - 2. Draw room layouts to 1/4" scale, with equipment locations shown therein. Clearances shall be in accordance with NEC and local codes. Indicate on drawing the mechanical equipment and mechanical and sprinkler pipe routing.

3. Electrical equipment submittals will be rejected without dimensioned equipment room or equipment location layouts and the completed power systems study..

#### 1.7 OPERATING AND MAINTENANCE MANUALS

- A. Provide manuals in accordance with Division 01.
- B. In addition to required submittals, include copies of all test reports required in Part 3, "Execution" of section 260500.
- C. Provide completed warranty certificates for systems and equipment.
- D. Provide tabulation of overload heaters, including each motor identified, nameplate data and o/l heater part number.

#### 1.8 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where this is not practical, cover items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage. Evidence of damage from water or other contaminants will be cause for rejection.

#### 1.9 RECORD DRAWINGS

- A. Comply with provisions of Division 01.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Equipment and materials furnished shall be listed by UL or other nationally accredited testing laboratory where available. When listing is not available for a piece of equipment, it shall be submitted in accordance with Drawings and Specifications and shall be approved by the authorities having jurisdiction.
- B. Specifications and Drawings indicate name, type and/or catalog number of materials and equipment to establish standards of quality. Submittals shall be based on the standards specified. The standards should not be construed as limiting competition.
- C. If materials and equipment other than specified herein are intended to be submitted, a letter providing a list of all the suggested alternates by section number, brand and series or model shall be submitted to the Architect for review and approval. Submit in accordance with Division 01 and a minimum of 14 days prior to submission of bids.

- D. In accordance with International Building Code and the applicable project seismic qualification requirements, manufacturer of electrical equipment shall test or analyze equipment components and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by Engineer and by the building official. Qualification shall be by an actual test on a shake table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces, by the use of experience data or by a more rigorous analysis providing for equivalent safety. Refer the IBC and ASCE 7-05 for complete requirements.

## 2.2 FUSES

- A. Provide fuses as scheduled on Drawings for switchboards, power panelboards and disconnecting switches.
- B. Acceptable manufacturers: Bussmann; Gould Shawmut; Littelfuse, Inc
- C. Provide fuses of one manufacturer only. Place the same type fuse in each pole of a switch.
- D. Use these types:
  - 1. Class L-601A-6000A; Switchboards, all load types
  - 2. Class J-Time Delay-1A-600A; Switchboards, motor loads
  - 3. Class J-Fast Acting-1A-600A; Switchboards, other loads
  - 4. Class RK5-Time Delay-1/10A-600A; Power panels and fusible switches, motor loads
  - 5. Class RK1-Fast Acting-1A-600A; Power panels and fusible switches, other loads
- E. Provide a manufactured fuse storage cabinet, mounted on wall in main electrical room, complete with one set (3 fuses) of spare fuses for each type and rating installed in this Project.

## 2.3 PIPE FREEZE PROTECTION

- A. Comply with provisions of Divisions 21, 22 and 23.
- B. Furnish and install heating cable to prevent freezing of water in piping exposed to outdoor temperatures.
- C. Acceptable manufacturers: Chromalox, Raychem.
- D. Select cable according to pipe size and pipe insulation employed.
  - 1. Domestic water and drain piping
    - a. 1/2-1 inch dia. - 3 watts per lineal foot
    - b. 1-1/4 - 2 inch dia. - 5 watts per lineal foot
- E. Heat cable shall be 120 volt for plug-in to receptacle and shall be controlled by integral thermostat preset to energize tape at 38 degrees F.
- F. Install heat cable direct to pipe, under insulation, spiraled along piping. Do not cross tape with itself. Do not cut factory lengths. Install first six inches of tape exposed, outside insulating wrap.
- G. Provide weatherproof receptacles, GFIC type, at locations required by tape installation.

## 2.4 WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
1. Size: 16" X 16" minimum, as indicated, or as required to allow inspection, service and removal of items served
  2. 14 gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction
  3. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas
  4. Prime painted or rust inhibitive paint finish
  5. UL labeled when in fire-rated construction, 1 1/2 hour rating
  6. Provide in walls, floors, and ceilings to permit access to all equipment and junction boxes.
  7. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
  8. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers. Use panels equal to Milcor Style M for masonry and drywall construction; equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile

## PART 3 - EXECUTION

### 3.1 COORDINATION

- A. Install equipment in accordance with manufacturer's recommendations. Where conflicts occur between Contract Documents and these recommendations, request a ruling before proceeding with such Work.
- B. Visit site and observe conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work required by these documents.
- C. Examine Specifications and Drawings to be familiar with items which require electrical connections and coordination. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes.
- D. Prior to commencement of installation, prepare coordination drawings for work under this division, as specified in Division 01 and as called for herein. Coordinate work under other divisions, including but not limited to mechanical, plumbing, fire protection, telecommunication and miscellaneous steel to develop these coordination drawings that will serve as the agreed upon plan for a coordinated installation of work for all trades. Include electrical equipment, switchgear, panelboards, starters, disconnect switches, cable tray, conduit racks and conduits 3" and larger on drawings confirming coordination with other trades. Incorporate the information onto the coordination drawings required under Division 01 and 23 to develop master coordination drawings. Account for lighting fixture depths in the coordination. Inform Design Professional of conflicts that cannot be resolved.
- E. Do NOT submit coordination drawings to Architect for review. Keep a copy on site for reference purposes. Notify Architect of conflicts that cannot be resolved.

### 3.2 FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

### 3.3 TEMPORARY LIGHTS AND POWER

- A. Comply with provisions of Division 01.
- B. Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the following requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary Work shall be installed in a neat and safe manner in accordance with the National Electrical Code, Article 305, NFPA 241, and as required by OSHA or applicable local safety codes.
- C. Provide one pigtail socket with 150 watt lamp, CFL medium base, for every 1,000 square feet of floor area, evenly distributed throughout the building and with minimum of one pigtail socket per room.
- D. Provide suitable guards for temporary lights to prevent accidental contact with lamps.
- E. Provide a minimum of one GFCI-protected duplex power outlet for every 1,500 square feet of floor area, evenly distributed throughout the building. Power outlets shall be GFCI-protected duplex 20 amp, 120 volt.
- F. Provide feeders, disconnects, connections, etc., required for construction equipment, eg: cranes, pumps, etc.
- G. Prior to installation, determine if any lighting or power outlets over the minimum quantity noted above are required and if so, provide them.
- H. Provide service and panelboards required for above lighting and power outlets.
- I. Requirement for payment of utility bills during construction are specified in Division 01.
- J. Provide single phase and three phase service as required by Project.
- K. Remove temporary wiring upon completion of use.

### 3.4 CUTTING AND PATCHING

- A. Comply with provisions of Division 01
- B. Repair or replace routine damage caused by cutting in performance of Work under this Division.
- C. Correct unnecessary damage caused due to installation of electrical Work, brought about through carelessness or lack of coordination.
- D. Holes cut through floor slabs shall be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs between floors shall be properly sealed, fire proofed and water proofed.

- E. Holes cut through walls shall be drilled or cut with tools designed for the purpose. All openings, sleeves and holes in walls that extend to underside of floor above shall be properly sealed and fire proofed.
- F. Repairs shall be performed with materials which match existing materials and be installed in accordance with appropriate sections of these Specifications.
- G. Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect.

### 3.5 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

- A. Comply with provisions of Division 31.
- B. Provide trenching, excavation, and backfilling necessary for performance of Work under this Division.
- C. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition for Work to be performed.
- D. Trenching and excavation shall be unclassified. No extra will be paid in event that rock is encountered.

### 3.6 FOUNDATIONS AND PADS

- A. Provide concrete foundations and pads for equipment per the requirements Division 03. Locate and size foundations, pads, and anchor bolts as required for equipment in this Division.
- B. Provide concrete foundations and pads as required for electrical utility company's equipment such as transformers, CT cabinets, metering cabinets, switches, fused disconnects, and circuit breakers. All work shall be in compliance with the utility company's specifications.

### 3.7 CONTROL SYSTEMS AND INTERLOCK WIRING

- A. Control systems, components and control and interlock wiring for mechanical equipment will be furnished under Divisions 21, 22 and 23. Control devices including, but not limited to VFD's, thermostats, fan speed and level control switches, relays and electro-pneumatic switches shall be furnished under Divisions 22 and 23.
- B. Provide magnetic starters per section 262913.
- C. Provide manual motor starters per Section 262913.
- D. Provide power wiring to starters and contactors under Division 26. Power wiring to magnetic starters shall consist of wiring to the line side terminals of the magnetic starter or contactor and wiring away from the load side terminals to the equipment, except where such wiring is installed pre-wired by the equipment vendor.

1. Power wiring to 120V, 1-phase, 60 Hz and 277V, 1-phase, 60 Hz volt fans, unit heaters, fan-coil units, VAV boxes, pumps and other equipment shall include all portions of the branch circuit, except for wiring inside an automatic temperature control panel (ATC) or Direct Digital Control Panel (DDC), Building Automation System panels, equipment control panels, or magnetic starters. Such internal wiring shall be furnished under Divisions 21, 22 and 23.

E. Under Division 28:

1. Furnish duct mounted smoke detectors.
2. Provide wiring among detectors, fire alarm system, magnetic starters and relays, ATC panels and DDC panels

F. See Building Automation System sections of Division 23.

### 3.8 UTILITY COMPANY COORDINATION

- A. Coordinate with the serving utility company as to all types of work required to be done by the contractor for utility equipment.
- B. Confirm exact location of point of common coupling, duct banks, pads, etc.
- C. Obtain copies of all pertinent utility company specifications relating to duct banks, concrete pads, raceways, and cable that are contractor installed for the utility company use. Maintain copies at project site.
- D. Install at components in compliance with utility company specifications and project specifications.

### 3.9 TESTING ELECTRICAL SYSTEMS

- A. On completion of work, installation shall be completely operational and entirely free from grounds, short circuits, and open circuits. Perform operational tests as required to demonstrate substantial completion of the Work. Balance circuits so that feeders to panels are not more than 10% out of balance between phases with all available load energized and operating. Furnish all labor, materials and instruments for above tests. All ampere readings shall be made with a true RMS reading meter.
- B. Perform megger tests of all service entrance circuits, feeder and branch circuits size #4 AWG and larger. Provide a report of all such megger test results.
- C. Furnish the Architect a copy of test reports and required certification including but not limited to the following:
  1. Service ground resistance test
  2. Switchboard and panelboard load test - include ampere readings of all panels and major circuit breakers
  3. Generator load and operations test
  4. Ground Fault Test
  5. Fire Alarm System Certification
  6. Megger test results

7. Power System Analysis Report

- D. Prior to final observation and acceptance test, install all electrical systems and equipment complete and in satisfactory operating condition.

END OF SECTION 260500

## SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Sections 26 05 00.
- B. Provide a complete system of conductors for lighting, power, and systems throughout the project.

#### 1.2 RELATED WORK

- A. Section 260500: Common Work Results for Electrical
- B. Section 260533: Raceways and Boxes for Electrical Systems
- C. Section 260543: Underground Ducts and Raceways for Electrical Systems

#### 1.3 REFERENCES

- A. NEMA WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- B. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- C. ANSI/UL 83 - Thermoplastic-Insulated Wire and Cables
- D. NFPA 70 - National Electrical Code, latest edition

#### 1.4 SUBMITTALS

- A. Submit the data sheets for products furnished under this Section.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-wrapped waterproof flexible barrier material for covering wire and cable wood reels, where applicable, and weather resistant fiberboard containers for factory packaging of cable, wire and connectors, to protect against physical damage in transit. Damaged cable, wire or connectors shall be removed from project site.
- B. In their factory-furnished coverings, store cable, wire and connectors in a clean, dry indoor space which provides protection against the weather.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. American Insulated Wire
- B. United Copper
- C. Encore
- D. Pyrotenax (Mineral Insulated applications)
- E. Republic Wire
- F. Southwire
- G. Superior Essex
- H. Cerrowire
- I. Okonite
- J. General Cable

### 2.2 CONDUCTORS

- A. Provide 98% conductivity copper conductors with 600V insulation.
- B. For conductors No. 12 AWG and No. 10 AWG, provide solid type THWN or THHN.
- C. For conductors No. 14 AWG and smaller, provide solid type THHN.
- D. For conductors No. 8 AWG and larger, provide stranded type THHN, or THWN applied consistently with insulation ratings and NEC requirements.
- E. Conductors used in cable tray and other places indicated on drawings shall be multi-conductor flame-retardant Ethylene Propylene Rubber (FR-EPR) UL Type TC.
- F. Provide white or gray colored neutral conductors; provide color coded phase conductors.
- G. Minimum conductor size shall be:
  - 1. #12 for power wiring
  - 2. #14 for hard wired controls unless otherwise specified
- H. Fire alarm wire and cable shall meet the requirements of NFPA 70, Article 760. Where required by code and other sections of the specification, fire alarm wire and cable shall be UL listed as Fire Alarm Circuit Integrity Cable (CI Cable).
- I. Provide digital communication, network cabling, and other low voltage systems wiring as directed elsewhere in this specification.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Conductors shall be continuous from origin to panel or equipment termination without splices. Where splices and taps are necessary or required, they shall be made in splice boxes.
- B. Install pull boxes in circuits or feeders over 100' long.
- C. Make splices and connections only in outlet, pull or junction boxes. Twist conductors together before installing wire nuts or connectors.
- D. Multi-wire branch circuits shall not be used. Install a separate grounded conductor, (neutral) for each circuit.
- E. Use powdered soapstone or pulling compound to pull conductors.
- F. Deliver conductors to jobsite new and in original wrapping, package or reel.
- G. Conductors and connections shall test free of grounds, shorts, and opens.
- H. Provide No. 10 wire in lieu of No. 12 wire for any branch circuit in excess of 100 feet (120V) or 150 feet (277V) of circuit length to farthest device to prevent excessive voltage drop.
- I. Use Ideal wire nuts, Scotchlok Type Y, R, G, or B connectors for fixture connections at outlet boxes.
- J. Make feeder taps and joints with approved compression sleeves. Insulate sleeves with heat shrink tubing, rated 600V, 90 degree C, containing factory applied sealant.
- K. Leave a minimum of 8" slack wire in every outlet box whether it be in use or left for future use.
- L. Color code conductors as follows:
  - 1. 120/208 Volt Systems:
    - a. Phase A - Black
    - b. Phase B - Red
    - c. Phase C - Blue
    - d. Neutral - White
    - e. Ground - Green
    - f. Isolated Ground - Green with Yellow stripe
  - 2. 277/480 Volt Systems:
    - a. Phase A - Brown
    - b. Phase B - Orange
    - c. Phase B - Purple
    - d. Phase C - Yellow
    - e. Neutral - Gray
    - f. Ground - Green

- M. Use factory color coded conductors where commercially available. If not available, use black conductors and band with color tape.
- N. Install in each branch-circuit panelboard a legend explaining color code for ungrounded conductors.
- O. Complete conduit system, including bushings, before pulling wire and cable.
- P. Maintain separation of electric light, power, Class 1, 2 and 3 wiring throughout raceway systems. Comply with requirements of NFPA-70, paragraphs 300-3, 725-15 and 725-54.

### 3.2 FIELD TESTING

- A. Visually check wire, cable, and connectors for physical damage and proper installation.
- B. Check continuity of wire and cable using a low voltage DC tester.
- C. Check for proper torque on all mechanical connections.
- D. Perform a 1000 VDC megger test on all 600 volt insulated wire or cable #4 AWG and larger. Check each wire to ground and to all other wires in the same cable or conduit by connecting each wire not under test together and to ground. Wire or cable shall be disconnected at each end and protected from current leakage during testing.
  - 1. Service entrance circuits and feeder (800A & larger) circuits
    - a. Use a motor driven megger such as Biddle MJ359 or equal
    - b. Perform a polarization index test using a 10-minute test period. Record the megohm readings at 1 minute and at 10 minutes. Calculate the polarization index (10 min / 1 min readings) and record.
  - 2. Feeder (600A & smaller) circuits and branch circuits
    - a. Use either a motor driven (Biddle 359) or a hand crank (Biddle MJ159) megger
    - b. Perform a dielectric absorption ratio test using a 60-second test period. Record the megohm readings at 30 seconds and 60 seconds. Calculate the dielectric absorption ratio (60 sec / 30 sec readings) and record
- E. Provide 8 copies of the megger test report to the Engineer. The report shall be in a tabulated format and shall include the following as a minimum.
  - 1. Circuit identification
  - 2. Type of raceway
  - 3. Approximate length of circuit
  - 4. Megohm readings
  - 5. Polarization index or dielectric absorption ratio
  - 6. Ambient temperature
  - 7. Approximate humidity (dry, average, or humid)
- F. Results
  - 1. Acceptable

- a. Megohms greater than  $(1.6 \times 1000 / \text{length})$
  - b. Polarization index greater than 2.0 or a dielectric absorption ratio greater than 1.4
- 2. Questionable (must be discussed with Engineer)
  - a. Polarization index range  $1.0 < 2.0$  or a dielectric absorption ratio range  $1.0 < 1.4$
- 3. Unacceptable (wire or cable must be replaced)
  - a. Megohms less than  $(1.6 \times 1000 / \text{length})$
  - b. Polarization index less than 1.0 or a dielectric absorption ratio less than 1.0

END OF SECTION 260519

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Los Angeles, CA  
RA Project No. 2014-015

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. The entire system of raceways and equipment shall be grounded in accordance with Articles 250 and 517 of the National Electrical Code and any local regulation or governing authority.

#### 1.2 SUBMITTALS

- A. Submittals are not required for products in this Section.

### PART 2 - PRODUCTS

#### 2.1 REQUIREMENTS

- A. Ground Clamps: OZ-Gedney, Type "CG", or equal by Steel City or Appleton.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION REQUIREMENTS

##### A. General

1. Clean all conductive surfaces on equipment to be grounded, to ensure good electrical continuity.
2. Effectively bond all grounding conductors to grounding electrodes, equipment enclosures and ground buses.
3. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.
4. All conduits shall have separate ground wire installed in accordance with Table 250.122 of the National Electrical Code.

##### B. Service Equipment/Building Ground:

1. Bond service equipment to the grounding electrode system in accordance with Article 250.50 of National Electrical Code. One or more of the grounding electrodes described in 250.52 shall be installed. Where more than one is present, all shall be bonded together. Particular care shall be taken to ensure that all concrete foundations that qualify as a "UFER" type electrode are bonded to the grounding system. Where isolated anchor bolts are used for structural steel members; install a bonding jumper from structural steel to foundation rebar. All metal piping systems and exposed structural steel shall be bonded

in accordance with 250.104. Coordinate bonding of gas piping with the gas company to ensure proper separation of premise piping and supply piping. Size bonding conductor in accordance with Table 250.66 of National Electrical Code unless larger conductor is indicated on the drawings. Install in accordance with 250.53. Conductors shall be insulated except in earth, where they shall be bare.

2. Where the grounding electrode system described above has a resistance to earth higher than 10 ohms, a grounding electrode conductor shall be run to a tri-pod ground rod system driven in ground outside foundation of building. System shall consist of three 3/4" x 10' copperweld ground rods driven in ground in an equilateral triangular configuration with a minimum of 25 feet spacing between each. Size conductor in accordance with Table 250.66 of the NEC, unless larger conductor is indicated on the drawings. Connection of each ground rod to one another shall be made using a conductor of same size. Conductors shall be insulated except in earth, where they shall be bare.
3. Building steel shall be connected to grounding system with a conductor the same as specified above.
4. Grounding electrode conductors specified herein shall be installed without conduit, in general. Where exposed to potential physical damage, install the conductor in Schedule 80 PVC.

C. Feeder/Branch Circuits:

1. Provide a separate green grounding conductor in the conduit of feeder circuits for the following equipment, sized in accordance with Table 250.122 of the National Electrical Code:
  - a. Panelboards
  - b. Switchboards
  - c. Transfer switches
2. Install a separate green grounding conductor in same conduit as phase and neutral conductor from panel ground bus to device for branch circuits. Install an equal number of grounding and neutral conductors. Size the grounding conductor in accordance with Table 250.122 of the National Electrical Code.
3. Bond the receptacle ground pin to its box using a bonding jumper, except where isolated ground receptacles are required.
4. Flexible conduit will not be approved as a grounding means. Flexible conduit shall have a jumper wire sized to ampacity of branch breaker and connected to conduit system on both ends. This applies to fixtures, motors, controls and other devices.

D. Transformers:

1. Provide a copper bonding jumper to ground the secondary neutral of transformers. Provide a grounding electrode conductor (sized in accordance with National Electrical Code Table 250.66 for the derived phase conductors) to bond the secondary ground of the transformer to the grounding electrode system including the grounding conductor of the primary feeder, the building steel and a cold water main, 1-1/2 inch or larger. Bond across any dielectric unions between point of connection and domestic water entrance.

E. Emergency Generator

1. Ground the engine generator frame and enclosure using an equipment grounding conductor sized in accordance with the NEC. Ground generator neutral as indicated on drawings.

F. Telephone System:

1. Provide grounding means for the telephone system in accordance with Article 800-100 of the National Electrical Code, and the system manufacturer's recommendations.
2. Main telephone service equipment grounding means shall include but not be limited to a No. 4 AWG, green, insulated, copper grounding conductor connected to the main electrical service equipment ground bus. Terminate this conductor at the telephone equipment location with an ILSCO NB-350-42-R16 grounding bus mounted on the plywood backboard.
3. Telephone terminal boards and other remote telephone equipment grounding means shall include but not be limited to a minimum No. 6 AWG, green, insulated, copper conductor connected to the equipment ground bus in the low voltage panelboard serving the telephone equipment or branch circuits in the immediate vicinity. Terminate these conductors to an ILSCO NB-350-12-R16 grounding bus mounted on the plywood backboard.
4. Route the telephone equipment grounding conductors in 3/4 inch conduit by the most direct means from the telephone equipment ground bus to the electrical equipment grounding system.
5. Provide permanent, engraved labels at the telephone equipment ground busses identifying these as the equipment grounding means and identifying the location of connection of the grounding conductors to the electrical equipment grounding system.

3.2 TEST

- A. The main service grounding electrode system shall be tested using test equipment similar to a "Biddle" tester. Test data shall be submitted to Owner for approval and such approved test data shall become a part of the Operating and Maintenance Instruction Manual. Additional ground rods or other acceptable grounding electrodes shall be employed when measured resistance exceeds 10 OHMS. IEEE "Fall of Potential" method shall be used on large grounding systems to ensure accurate readings. If additional electrodes do not decrease the grounding resistance to below 10 OHMS, discuss with Engineer for possible wavier. Under no event shall grounding resistance exceed 25 OHMS.

END OF SECTION 260526

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## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Sections 26 05 00.
- B. Provide a system of supporting devices and hangers for support or bracing of conduit, electrical equipment, including safety switches, fixtures, panelboards, outlet boxes, junction boxes, and cabinets.

#### 1.2 RELATED WORK

- A. Section 260533: Raceways and Conduit Systems
- B. Section 260534: Pull and Junction Boxes
- C. Section 260535: Outlet Boxes
- D. Section 260548: Seismic Restraint and Vibration Isolation for Electrical Systems

#### 1.3 SUBMITTALS

- A. Submittals are not required.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Erico Products, Inc
- B. Steel City
- C. Minerallac
- D. Rayco Fasteners

#### 2.2 TYPES OF SUPPORTING DEVICES

- A. Provide seismic bracing and support as required and as detailed on Drawings.

- B. Provide appropriate supporting means as detailed on Drawings.
- C. Unless otherwise directed in Specifications or Drawings, provide appropriate supporting devices and hangers for electrical equipment from this list of Caddy fasteners:
  - 1. "Z" purlin clips - 1-1/4" maximum conduit
  - 2. Conduit clips - 2" maximum conduit
  - 3. Beam clamps (rod hanger clamps and vertical flange clamps) for support of threaded rods
  - 4. Beam clamps (set screw type) - 2" maximum conduit
  - 5. Beam clamps (universal) for support of boxes and combination conduit hanger clamps
  - 6. Combination push-in conduit clips - 1" maximum conduit
  - 7. Combination conduit hanger clamps - 2" maximum conduit
  - 8. Flexible conduit clips - 1" maximum flexible conduit
  - 9. Special combination conduit clips - 1" maximum conduit
  - 10. One hole steel straps
  - 11. Conduit hangers - 4" maximum conduit
  - 12. Combination box/conduit hangers for supporting conduit within 3'-0" of a box are not acceptable

### PART 3 - EXECUTION

#### 3.1 INSTALLATION REQUIREMENTS

- A. Secure conduits to within 3 feet of each outlet box, junction box, cabinet and fitting and at intervals not to exceed ten feet in accordance with current edition of the National Electrical Code.
- B. In seismic zones, support conduits 1 inch and smaller at six foot intervals.
- C. Install clamps secured to structure for feeder and other conduits routed against the structure. Use drop rods and hangers to support conduits run apart from the structure.
- D. Provide and install suitable angle iron, channel iron or steel metal framing with accessories to support or brace electrical equipment including safety switches, fixtures and panelboards.
- E. Paint all supporting metal not otherwise protected, with rust inhibiting primer and then with a finish coat if appropriate to match the surrounding metal surfaces. (Prepainted or galvanized support material is not required to be painted or repainted.)
- F. Use of chains, perforated iron strap, baling wire, or tie wire for supporting conduit runs will not be permitted.
- G. Use of Caddy clips to support conduit to top of t-bar ceiling grid will not be permitted.
- H. For support of low voltage wiring not required to be in conduit, Contractor shall bundle cables together in a neat manner using approved nylon cable ties. Bundled cables shall be supported with "J" hooks on telephone type bridle rings, a minimum of six feet on centers.

1. Use UL listed cable ties for plenum use in plenum areas.
2. Maximum supported weight rating of "J" hooks shall not be exceeded.
3. Identify differing types of cables and tag them with tape indicating service, i.e. telephone.
4. Identification tape shall be provided at minimum intervals of 25 feet on center and within each individual space.

END OF SECTION 260529

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## SECTION 260533 - RACEWAYS AND CONDUIT SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Sections 26 05 00.
- B. Provide a complete conduit system with associated couplings, connectors, and fittings.

#### 1.2 RELATED WORK

- A. Section 260529: Hangers and Supports for Electrical Systems

#### 1.3 SUBMITTALS

- A. Submittal of products furnished under this Section are not required.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. EMT and IMC shall be steel (ferrous) with a protective coating, and RMC conduit shall be steel (ferrous) with a protective coating or aluminum (non-ferrous) by Allied, General Electric, Republic, Triangle, or Wheatland. Special use may be red brass or stainless steel.
- B. PVC conduit shall be Prime Conduit, Inc, or Allied Tube & Conduit, Schedule 40 or Schedule 80, 90 degrees rated.
- C. Surface metal raceways shall be Wiremold.
- D. Fiberglass conduit shall be Champion fiberglass.
- E. EMT, IMC, or RSC couplings, connectors, and fittings shall be steel or malleable iron as manufactured by Raco or equivalent.
- F. RAC couplings, connectors, and fittings shall be aluminum.
- G. Erickson couplings shall be used where neither length of conduit can be rotated.
- H. EMT box connectors and couplings shall be compression or set screw type..
- I. Conduit, connectors, couplings and fittings shall be UL listed and labeled.

## 2.2 ELECTRICAL METALLIC TUBING (EMT)

A. Use Electric Metallic Tubing (EMT) where shown on drawings or for:

1. Concealed in walls
2. Installed above suspended ceilings
3. Installed exposed, above 6 feet

## 2.3 INTERMEDIATE METAL CONDUIT (IMC)

A. Use Intermediate Metal Conduit (IMC) where shown on drawings or for:

1. Installed for feeders
2. Installed in hazardous areas
3. Installed in concrete slabs on grade to serve floor boxes, freestanding casework, etc
4. Installed exposed below 6 feet
5. Installed in wet locations

## 2.4 RIGID STEEL CONDUIT (RSC)

A. Use rigid steel conduit where shown on drawings or for:

1. Installed underground
2. Above ground service entrance
3. Medium voltage circuits
4. For emergency feeders and critical branch circuits
5. Where protection from EMI is required
6. Exposed to severe mechanical damage

## 2.5 RIGID ALUMINUM CONDUIT (RAC)

A. Use rigid aluminum conduit, RAC, where shown on the drawings or for:

1. In coastal areas where saltwater vapor is present
2. As a substitute for rigid steel conduit when approved by engineer

## 2.6 POLYVINYL CHLORIDE (PVC)

A. Use PVC where shown on drawings or for:

1. Underground service entrance conduits for power
2. Underground service entrance conduits for telephone
3. Exterior branch circuits installed underground
4. Concrete encased ductbanks

## 2.7 FIBERGLASS

A. Use fiberglass where shown on drawings or for:

1. Where corrosive vapors or agents are present
2. In coastal areas where saltwater vapor is present
3. As a substitute for PVC where indicated on drawings

## 2.8 STAINLESS STEEL RIGID CONDUIT

- A. Use stainless steel rigid conduit where shown on drawings or for:
1. Severe corrosive atmospheric conditions
  2. In coastal areas where exposed directly to saltwater or severe saltwater vapors

## 2.9 FLEXIBLE METAL CONDUIT

- A. Provide flexible metal conduit for termination at equipment subject to motion and vibration.
- B. Conduit shall be electrically continuous from outlet or conduit end to utilization equipment.
- C. Length shall not exceed 6 feet.
- D. Maximum length concealed in walls shall be 3 feet.
- E. Where exposed to continuous or intermittent moisture, conduit shall be liquid tight.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Minimum size of conduits shall be 3/4"
- B. Conduit joints shall be cut square, threaded, reamed smooth, and drawn up tight so conduit ends will butt in couplings, connectors and fittings.
- C. Make bends or offsets with standard factory bends or field bends with an approved bender. Use of heat and other non-approved methods will not be accepted. An approved factory built and UL tested PVC bender using heat is acceptable.
- D. Medium voltage conduits shall use long radius bends and fittings with a minimum radius of at least 12 times the diameter of the installed cables.
- E. Run concealed conduits in direct line with long radius bends or offsets. Run exposed conduits parallel to and at right angles to building lines. Group multiple conduit runs in banks and maintain proper separation to prevent any derating of cable.
- F. Conduit systems shall be electrically and mechanically continuous.
- G. For interior locations where NEMA 1 enclosures are used, secure conduits to boxes and cabinets with double locknuts and bushing.

- H. For interior locations where NEMA 12 enclosures are used, secure conduits to boxes and cabinets with sealing locknuts and bushing.
- I. For damp or wet locations, indoor or outdoor locations where NEMA 4 or 4X enclosures are used, secure conduits to boxes and cabinets with Myers Scru-Tite hub.
- J. Cap ends of conduits to prevent entrance of water and other foreign material during construction.
- K. Complete conduit systems before pulling conductors.
- L. Support conduits as specified in Section 260529 and in accordance with National Electrical Code.
- M. Provide cable supports in conduits rising vertically in accordance with the National Electrical Code, Article 300.
- N. Provide insulated bushing on both ends of empty conduits.
- O. Conduits which pass through floor slabs (except ground floor) shall be sealed with UL listed fire-stopping materials. Seal around conduits or other wiring materials passing through partitions, which extend to the underside of the slab above, and those passing through smoke partitions and fire rated walls. Use U.L. listed materials to prevent passage of smoke or fire. See Division 07 for specific materials required.
- P. Conduits which enter crawl spaces, tunnels, and basements from outside the building shall be grouted-in to prevent entry of gases, vapors, insects or rodents to these spaces from street mains.
- Q. When four or more, 2 inch or larger conduits, are banked together below the ground floor slab they shall be supported and separated using Carlon, Snap-Loc type spacers. Backfill below, between, and above ducts in such a manner to prevent erosion and restore sub-grade preparation prior to concrete slab pour.
- R. Conduit not serving elevator equipment shall not be permitted to pass through elevator shafts or elevator equipment rooms.
- S. Where IMC or RMC conduit is connected to a panelboard, switchboard, cabinet, junction box, pull box or auxiliary gutter, conductors shall be protected by insulated bushings. Locknuts shall be installed on conduit outside and inside enclosure.
- T. Where conduits stub up in conduit space beneath switchboards or switchgear and do not connect directly to equipment enclosures, install malleable iron nylon insulated ground bushing complete with bonding connection and bond to switchboard ground bus.
- U. Install seal-off fittings in conduits entering hazardous areas and conduits entering cold temperature areas, such as freezers and refrigerators.
- V. Use expansion fittings or flexible conduit, properly bonded, to ensure ground continuity across expansion joints in floors and ceilings.

- W. Terminate conduits for feeders and branch circuits directly into panelboard enclosures from which they are served without the use of pull boxes, junction boxes, wire ways, or auxiliary gutters. If the panelboard enclosure does not provide sufficient surface area for all conduits, notify the Engineer and request directions.
- X. Failure to route conduit through building without interfering with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit, and fixtures shall fit into available spaces in building and shall not be introduced into building at such times and manner as to cause damage to structure. Equipment requiring servicing shall be readily accessible.
- Y. Provide 1/4" nylon pull rope in all primary power and incoming telephone service entrance conduits.
- Z. No PVC shall emerge from the ground, concrete slab, or concrete encasement. PVC shall convert to galvanized rigid steel conduit at least 6 inches before exiting concrete slab or concrete encasement. Schedule 80 PVC shall be used if shown on drawing.
- AA. Where feeder or branch conduits enter pull boxes or junction boxes, clearly mark on conduit on the entering and leaving side of each box the panel name and circuit number(s) contained within the conduit using a permanent black marker.
- BB. Conduits routed horizontally on roof tops shall be supported by 5" high supports as manufactured by Dura\_Blok, "DB Series" or equal. Supports shall be spaced as required by the NEC. Conduits shall be continuously marked on two sides with a 1" reflective tape as manufactured by Seton, Style No M9562.

### 3.2 PVC

- A. Provide 1/4" nylon pull rope in all primary power and incoming telephone service entrance conduits.
- B. Use rigid, PVC schedule 40 , encased in concrete where called for on drawings.
- C. No PVC shall emerge from the ground or the concrete slab or encasement. PVC shall convert to galvanized rigid metal at least 6 inches before exiting concrete slab or concrete encasement.
- D. Make bends with standard bends or with an approved bender. Heat shall not be used. A UL listed PVC bending using heat is acceptable.

### 3.3 FLEXIBLE METAL CONDUIT

- A. Conduits shall be 3/8" minimum size for lighting fixtures and 1/2" minimum size for utilization equipment other than lighting fixtures.
- B. Fittings shall be made of either steel, or malleable iron only.
- C. A copper ground wire shall be installed as a jumper around flexible conduit. The jumper may be installed inside of flexible conduit or outside of conduit to ensure continuity of ground.

- D. Recessed lighting fixtures shall be connected with flexible metallic conduit from outlet box to fixture.
- E. Install liquid tight flexible conduit in such a manner as to prevent liquids from running on the surface toward fittings.
- F. Allow sufficient slack conduit to reduce the effect of vibration.

END OF SECTION 260533

## SECTION 260534 - PULL AND JUNCTION BOXES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Sections 26 05 00.
- B. Provide pull and junction boxes of appropriate size and depth as indicated on the drawings and as specified hereinafter.

#### 1.2 RELATED WORK

- A. Section 260529: Hangers and Supports for Electrical Systems.
- B. Section 260533: Raceways and Conduit Systems.
- C. Section 260553: Identification for Electrical Systems.

#### 1.3 SUBMITTALS

- A. Submit product data for each type of box used in exterior work.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. For interior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, 3/4" flanges and screw covers.
- B. For exterior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, 3/4" flanges, bolted covers with full gaskets forming a completely rain-tight assembly, equal to Keystone 19000 and 37900 Series.
- C. For exterior work in graded areas outside the building, provide heavy duty sidewalk junction boxes externally flanged for flush mounting. Covers shall be fully gasketed, water-tight and secured with stainless steel screws or bolts equal to Quazite Type PC.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION REQUIREMENTS

- A. Provide junction boxes as shown on drawings and otherwise where required, sized according to number of conductors in box or type of service to be provided. Minimum junction box size 4" square and 2-1/8" deep.

- B. Provide screw covers for junction boxes.
- C. Install boxes in conduit runs wherever necessary to avoid excessive runs or bends. Do not exceed 100' runs without pull boxes.
- D. Rigidly secure boxes to walls or ceilings. Conduit runs will not be considered as adequate support.
- E. Install boxes with covers in accessible locations. Size boxes in accordance with Articles 314 of the National Electrical Code.
- F. Do not install pull or junction boxes for joint use of line voltage and signal or low voltage controls unless all conductors are insulated for the highest voltage being used in the same box.
- G. Color code pull and junction boxes and identify feeders and circuits entering pull and junction boxes as called for in Section 260553.

END OF SECTION 260534

## SECTION 260535 - OUTLET BOXES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide each fixture, switch, receptacle, and other wiring device with a galvanized outlet box of appropriate size and depth for its particular location and use.

#### 1.2 RELATED WORK

- A. Section 260529: Hangers and Supports for Electrical Systems.
- B. Section 260533: Raceways and Conduit Systems.
- C. Section 260553: Identification for Electrical Systems.

#### 1.3 SUBMITTALS

- A. Submittal of products furnished under this Section is not required.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. National
- B. Appleton.
- C. Raco.
- D. General Electric.
- E. Steel City.

#### 2.2 SUPPORTING DEVICES

- A. Provide appropriate supporting devices for outlet boxes by Caddy Fasteners or equal as follows:
  - 1. "RB" box mounting brackets.
  - 2. Screw gun box brackets.
  - 3. "H" box mounting brackets.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Locate boxes to prevent moisture from entering or accumulating within them.
- B. Support outlet boxes independently of conduit, as required by the National Electrical Code.
- C. Provide 4" octagonal x 1-1/2" deep ceiling outlet boxes. For increased cubic capacity, provide 4" octagonal x 2-1/8" , 4" square x 1-1/2" or 4-11/16" square x 2-1/8" ceiling outlet boxes.
- D. Provide 4" square X 1-1/2" deep boxes for switch and receptacle outlets in drywall partitions. Use square cut plaster rings installed within 1/4" of finished wall.
- E. Provide 4" square x 2-1/2" deep boxes for telephone/data outlets in drywall partitions. Use square cut plastic rings installed within 1/4" of finished wall.
- F. Where required to hang a specified fixture, provide a fixture stud of the no-bolt, self-locking type on ceiling outlets.
- G. Provide 2-1/2" x 3-3/4" one gang masonry boxes for switches and receptacles installed in concrete block walls not plastered. For increased cubic capacity, provide 3-1/2" x 3-3/4" one gang masonry boxes. Where more than two conduits enter the box from one direction, provide 4" square boxes with square cut device covers not less than 1" deep specifically designed for this purpose. Use round edge plaster rings only if the block walls are to be plastered. Use sectional or gangable type outlet boxes only in drywall construction.
- H. Provide 4-11/16" square X 2" deep outlet boxes with square cut device corners for block walls or round edge plaster rings for plastered walls for telephone outlets, data outlets, and private intercom interphones. Single gang device boxes are not acceptable.
- I. Provide fittings with threaded hubs for screw connections and with the proper type covers for switches and receptacles served by exposed conduit. Use pressed steel outlets only for ceiling fixture outlets. Provide condulets with threaded hubs and covers and with proper configurations for all changes of direction of exposed conduits. Standard conduit ells may be used if they do not interfere, damage, or mar the appearance of the installation.
- J. Use boxes of sufficient cubic capacity to accommodate the number of conductors to be installed in compliance with Article 314 of the NEC.
- K. Effectively close unused openings in boxes with metal plugs or plates.
- L. Set boxes so that front edges of device extensions, plaster rings, etc are flush with finished surfaces.
- M. Caddy "H" type box mounting brackets shall not be used on exterior walls, chase walls, or in any other installation where the backside of the stud wall will not be finished. Do not use 4" brackets in thicker stud walls which will not provide adequate bracing.
- N. Secure boxes to surfaces upon which they are mounted or embed boxes in concrete masonry. Support boxes from structural members with approved braces.

- O. Install blank device plates on outlet boxes left for future use.
  - P. Provide bushings in holes through which cords or conductors pass.
  - Q. Install boxes so that the covers will be accessible at all times.
  - R. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space, that openings do not exceed sixteen square inches and that boxes on opposite faces of a partition are separated horizontally not less than 24 inches. All clearances between such outlet boxes and the gypsum board shall be completely filled with joint compound or approved fire-resistive compound. The wall shall be built around outlet boxes larger than sixteen square inches so as not to interfere with the wall rating.
- 3.2 Color code boxes and identify circuits in conduits entering boxes as called for in Section 260553.
- 3.3 Install outlet boxes on opposite sides of the same wall offset to avoid back to back mounting where possible.

END OF SECTION 260535

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## SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with provisions of Sections 26 05 00.
- B. Concrete encased underground non-metallic conduit duct bank.

#### 1.2 REFERENCES

- A. ANSI C2-97, National Electrical Safety Code.
- B. NEMA TC 2-90, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- C. NEMA TC 3-90, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- D. UL 651\_89, UL Standard for Safety - Schedule 40 and 80 Rigid PVC Conduit.

#### 1.3 SUBMITTALS

- A. Products furnished from listed manufacturers are pre-approved and require no submittal.
- B. Submit proposed substitutions for approval.
- C. Submit for information as-built drawings indicating accurate routing of underground duct banks.

#### 1.4 REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by UL as suitable for purpose specified and shown.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products. Protect on-site storage from weather.
- B. Accept conduit on-site. Inspect for damage.
- C. Protect nonmetallic conduit from entrance of debris, and provide appropriate covering to protect from sunlight.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Prime Conduit, Inc
- B. Allied Tube and Conduit

### 2.2 RIGID NON-METALLIC CONDUIT

- A. Rigid PVC Conduit: NEMA TC 2; UL 651 listed; Schedule 40.
- B. Fittings and Conduit Bodies: NEMA TC 3.

### 2.3 CAST-IN-PLACE CONCRETE

- A. Concrete: Refer to Division 03.
- B. Concrete shall have minimum 28-day strength of 3,000 psi.
- C. Reinforcement: Duct banks under concrete or pavement and subject to traffic shall be reinforced. The reinforcement shall extend a minimum of 10 feet from edge of concrete or pavement.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify routing and termination locations of conduit duct bank prior to excavation.
- B. Verify field measurements.
- C. Verify conduit is anchored prior to placing concrete.

### 3.2 PREPARATION

- A. Excavate, trench, and prepare site for underground conduit duct bank installation.

### 3.3 INSTALLATION

- A. Where necessary to cut conduit, use saw or pipe cutter; ream cut ends. Bring conduit to shoulder of fittings; fasten securely.
- B. Join nonmetallic conduit using cement recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

- C. Use suitable separators and chairs installed not greater than 4 ft on centers. Band conduit together with suitable banding devices. Anchor conduit to prevent movement during concrete placement.
- D. Stagger conduit joints in concrete encasement 6 in. min, vertically.
- E. Install conduit with minimum grade of 3-inches/100 ft. (Only required where conduit terminates at a manhole.)
- F. Depth: Per ANSI C2; top of duct bank 18 in. minimum, 30 inches maximum below finished grade unless approved by the Engineer.
- G. Terminate conduits with Termi-Duct type end bells at manhole entries.
- H. Use suitable caps to protect installed conduit from entrance of dirt and moisture.
- I. Duct banks installed under grass and other non-traffic areas do not require any additional reinforcement steel. Duct banks installed below load bearing building concrete slabs may need to be reinforced and must be coordinated with the general contractor.
- J. Duct banks installed under concrete or pavement subject to vehicular traffic shall be reinforced in the following manner.
  - 1. Place #4 steel rebar in the top and both sides of the duct bank in the horizontal plane and lengthwise direction. There shall be one rebar in each corner with a maximum distance of 8 inches between rebars.
  - 2. Place a "U" shaped stirrup fabricated from #4 rebar in the vertical plane every 3 feet in the lengthwise direction.
  - 3. Rebar shall be tied together in an acceptable manner using standard steel tie wire.
  - 4. All rebar shall have a minimum concrete cover of 2 inches.
- K. Pour concrete into formed bank of conduits. Provide a minimum of 3 inches of concrete cover at bottom, top, and sides of conduit duct bank. Vibrate concrete with a mechanical vibrator to ensure proper concrete fill and elimination of voids.
- L. Uniformly dust red iron oxide over top of freshly poured concrete at the rate of 1 lb/yd of surface.
- M. Duct banks shall be backfilled in the following manner:
  - 1. Duct banks installed under grass and other non-traffic areas shall be backfilled with clean suitable earth. The earth shall be compacted sufficiently to prevent any settlement.
  - 2. Duct banks installed under concrete or pavement subject to vehicular traffic shall be backfilled with #57 (3/4") washed limestone gravel. The gravel shall be compacted sufficiently to prevent any settlement. Coordinate with general contractor to ensure suitability for the concrete or pavement cover.

END OF SECTION 260543

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## SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Refer to Section 260500, General Conditions, Supplementary Conditions and applicable parts of Division 01 for other general requirements.

#### 1.2 SCOPE

- A. Provide labor, materials, equipment, services and transportation for vibration isolation and seismic restraint systems for electrical equipment, conduit, bus duct, cable tray, and other wiring systems as indicated on Contract Drawings and specified herein, including but not limited to following:
  - 1. Vibration Isolators
  - 2. Seismic restraint systems, including equipment bolts and welding.
  - 3. Flexible connections.
  - 4. Equipment bases.
- B. Vibration isolation shall be by manufacturer with 10 years experience in designing and manufacturing isolation devices. Seismic devices shall be by manufacturer with 10 years experience in designing and manufacturing seismic devices.

#### 1.3 REFERENCES

- A. International Building Code
- B. SMACNA

#### 1.4 SHOP DRAWINGS AND OTHER SUBMITTALS

- A. Submit for review shop drawings on every product and material furnished under this Section.
- B. Shop drawings shall include:
  - 1. Itemized list detailing the electrical systems and components to be isolated, associated isolator to be used, isolator loading and deflection, and reference to specific drawings showing base and construction where applicable. List shall include number and location of isolators for each piece of equipment.
  - 2. Itemized list detailing electrical systems and components to be seismically restrained, associated seismic restraint system to be used, device loading and deflection, and reference to specific drawings showing base and construction where applicable. List shall include number and location of seismic restraints and anchors for each piece of equipment.

3. Itemized list detailing electrical systems and components which are to be neither isolated nor seismically restrained.
4. Seismic restraint calculations.
5. Structural engineer's seal verifying design and calculations for seismic restraining systems; including calculation information that verifies snubber capacities for isolated equipment.
6. Detail drawings on equipment bases including dimensions, structural member sizes, support point locations, maximum loading at each location, and concrete and steel details such as anchor bolt locations.
7. Detail drawings on vibration isolation and seismic restraint systems for conduit, busway, cable tray and other wiring systems, including methods of suspension, support guides, and maximum loading at each location.
8. Load-versus-deflection curves, by manufacturer, for each vibration isolator.

C. In addition to other requirements for approval of substitutions:

1. Contractor must provide substitute systems which meet the deflection and structural design of systems specified.
2. Requests for substitution of "internally isolated" electrical equipment in lieu of specified isolation and restraint systems must include certification by equipment manufacturer that equipment supports meet specified isolation and seismic restraint criteria. Certification must be sealed by structural engineer.

D. Shop drawing for equipment shall include bolt points and diameter of inserts, certified by civil or structural engineer.

E. Submit record of static deflection as designed and as measured in the field.

F. Submit four copies of manufacturer's installation instructions and drawings.

G. Submit four copies of final inspection report which includes:

1. Manufacturer's report(s) indicating isolation and restraint devices as properly installed or requiring correction. Correction measures shall be detailed.
2. Contractor report detailing steps taken to properly complete the isolation work.

## 1.5 GUARANTEE

- A. Manufacturer of vibration isolation and seismic control equipment shall guarantee performance of vibration isolation and seismic restraint systems including specified isolation system deflection.

## PART 2 - PRODUCTS

### 2.1 SEISMIC RESTRAINT SYSTEMS - GENERAL

- A. Systems shall meet all applicable codes and standards.

- B. Systems shall meet (SMACNA) Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, published by the Sheet Metal Industry Fund of Los Angeles, California, and the Plumbing and Piping Industry Council Inc., Los Angeles, California; Los Angeles, 1982.
- C. Systems for normal electrical systems (i.e., equipment, conduit, bus duct, cable tray, and wiring systems) shall be capable of safely accepting 0.5 "G" external force in any direction, without failure and without permanent displacement of system being restrained.
- D. Systems shall maintain electrical equipment, conduit, busway, cable tray and other wiring systems in a captive position. Systems shall not short circuit vibration isolation systems and shall not transmit objectionable vibration or noise.

## 2.2 VIBRATION ISOLATION SYSTEMS - GENERAL

- A. Isolators shall have either known non-deflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified to determine if the load is within the proper range of the device and if the correct degree of vibration isolation is being provided according to the design.
- B. Isolators shall operate in the linear portion of their load- versus-deflection curve. Load-versus-deflection curves shall be linear over a deflection range of not less than 50% above the design deflection.
- C. Theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness shall not differ from the design objectives for the equipment as a whole by more than +/- 10%.
- D. Neoprene mounting shall have a Shore hardness of 30 to 60 +/-5, after minimum aging of 20 days or corresponding oven-aging.

## 2.3 SEISMIC RESTRAINT & COMBINATION ISOLATION/SEISMIC RESTRAINTS PRODUCTS

- A. Refer to paragraph 2.1 above for general requirements.
- B. Seismic Restraint, Type SR-PM:
  - 1. Shall be plate structural members or square metal tubing in welded assembly with resilient pads; with minimum 5/8" thick pad limit stops in all directions; for use on each corner or side of equipment being restrained.
  - 2. Shall be field bolted to structural deck.
  - 3. Shall be Mason Industries "Type Z-1011" and "Type Z-1225" or equal.
- C. Seismic Restraint, type SR-C:
  - 1. Shall be metal cable type with end fastening devices.
  - 2. Shall be field bolted to structure; using two sided beam clamps for overhead steel or appropriately designed insert for concrete deck. Cables and clamps shall be furnished by manufacturer of restraint device.
  - 3. Shall be used for four-point independent bracing of systems (equipment, ductwork or piping) which are suspended from structure.

4. Shall be installed taut for non-isolated systems; shall be installed slack with 1/2" cable deflection for isolated systems.
5. Shall be Mason Industries "Type SCB" seismic restraining system, or equal.

- D. Seismic Restraint, Type SR-B, for non-isolated equipment: Equipment shall be field bolted or welded as required to resist seismic forces. Powder shot attachment is not acceptable.

## 2.4 VIBRATION ISOLATION AND COMBINATION ISOLATION/SEISMIC RESTRAINT PRODUCTS

### A. Vibration Isolation, Type VI-RLAS:

1. Shall be roller lobe air springs, manufactured with upper and lower steel sections connected by replaceable flexible nylon-reinforced neoprene element. Air spring configuration shall be rolling lobe, single or multiple bellows.
2. Shall be linked either to the building air supply or to a supplemental air supply, with three leveling valves to maintain leveling within +1/8".
3. Shall be Mason Industries "Type MAS-5200" springs with Mason Industries "Type LV" leveling valves, or equal.

## 2.5 EQUIPMENT BASES AND RAILS

### A. Scope

1. For floor mounted vibration isolated equipment, provide steel rails, steel frames or concrete inertia blocks, supported by vibration isolators.
2. For ceiling-suspended vibration-isolated equipment, provide steel frames suspended from vibration isolators. Isolators shall be installed in hanger rods and positioned vertically unless equipment frame is suitably rigid to span between isolators and is approved for such application by equipment manufacturer.
3. For roof-mounted equipment, provide roof curbs, secured to roof structure and equipment.

### B. General

1. Units shall meet seismic restraint criteria specified in paragraph 2.1, SEISMIC RESTRAINT SYSTEMS - GENERAL. Units shall form a rigid support structure which will not twist, rack, deform or deflect so as to negatively affect operation of supported equipment or performance of vibration isolation.
2. Units shall support basic equipment units and motors, pipe and duct elbow supports, electrical control elements and other components requiring resilient support, so as to prevent vibration transfer from equipment to building structure.

## 2.6 Steel Frames:

- A. For floor-mounted equipment requiring supplemental base (e.g., fans, etc.): frame shall have structural steel sections and side mounting brackets for attachment to vibration isolators for equipment and for associated piping.

- B. For ceiling-suspended equipment, frames shall have structural steel sections and suspension rods for attachment to vibration isolators for equipment and for associated piping.

2.7 Concrete Inertia Blocks for floor-mounted unbalanced equipment:

- A. Inertia blocks shall be formed of stone-aggregate concrete (150 pcf) cast between appropriate steel reinforcing perimeter structural steel channels.
- B. Inertia block thickness shall be minimum of 1/12 longest dimension of mounted equipment or equipment assembly.
- C. Inertia block shall have side-mounting brackets for attachment of vibration isolators.

2.8 Rails for floor-mounted equipment not requiring supplemental base:

- A. Rail type R-IC:
  - 1. Shall be inverted channel type.
  - 2. Shall be Mason Industries "Type MC" or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Furnish services of isolation manufacturer for field supervision of installation of vibration isolation units, associated hangers and bases. Obtain copy of manufacturer's installation instructions and drawings, for Contractor use during installation.
- B. Install devices in accordance with manufacturer's written instructions. Vibration isolators must not cause any change of position of equipment or wiring resulting in wiring stresses or misalignment.
- C. Locate vibration isolation devices for ease of inspection and adjustment as well as for proper operation.
- D. Position vibration isolation hangers so that hanger housing may rotate 360 degrees without contacting any object.
- E. Piping, ductwork and conduit shall not be suspended from one another and shall not physically contact one another, under any circumstances. Vibrating systems shall be kept free from non-vibrating systems.
- F. Install equipment with flexibility in wiring connection.
- G. For overhead suspended non-isolated systems, install seismic restraint system taut. For isolated systems, install seismic restraint system slack with 1/2" cable deflection.

### 3.2 INSTALLATION OF EQUIPMENT BASES AND SUPPORTS

- A. With concrete base, provide supports for conduit bends at equipment connections. Where concrete base is non-rectangular, "T" shaped, or "L" shaped, locate mountings under projections and main body of concrete base, to eliminate cantilevering of projections.
- B. If equipment is mounted on housekeeping pads, pads shall be properly doweled or expansion shielded to structural deck to meet seismic restraint criteria.
- C. Operating clearance between the isolated equipment's support (frame, rigid steel base, or concrete inertia block) and the housekeeping pad or floor shall be 2" minimum.
- D. Where base anchoring is insufficient to resist seismic forces, supplementary restraints shall be installed. Restraints shall be attached to equipment at point(s) above the equipment's center of gravity, as required. Equipment with high center of gravity may require this additional restraint.
- E. Equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to installation of isolators or equipment.
  - 1. Isolators shall be installed without raising equipment and frame assembly.
  - 2. After installation is under full operational load, isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When isolators are properly adjusted, blocks or shims shall be barely free and shall be removed.
- F. Ensure that overhead supported equipment does not over-stress the building structure. This might be accomplished by bracing from:
  - 1. Flanges of structural beams.
  - 2. Upper or lower truss chords in bar joist construction at the panel points.
  - 3. Cast-in-place inserts or drilled and shielded inserts in concrete structures.
- G. Verify that isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4".
- H. Prior to start-up, remove foreign matter between bases and equipment.

### 3.3 INSTALLATION OF CONDUIT SUPPORTS

- A. Conduit connected to vibration isolated equipment shall be installed so that isolators are not strained nor forced out of alignment and so that equipment "floats" freely on isolators.
- B. Conduit connected to vibration isolated equipment shall be isolated from building structure, non-isolated systems and non-isolated systems and non-isolated components.
- C. Conduit bends at connections to isolated equipment shall be supported from below and shall be braced to unit base above vibration isolators. Conduit shall be supported by appropriate isolation units for 50 feet minimum distance in direction away from base.
- D. Vertical risers passing through floors shall be secured above and below each floor with riser clamps.

- E. Isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, the structure. Isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted. Hanger rods shall be aligned to clear the hanger box.
- F. When required, supplementary steel shall be sized for a maximum deflection of 0.08 inches at center span.

### 3.4 ISOLATION AND SEISMIC RESTRAINT SCHEDULE

- A. Seismic restraint shall be provided on following wiring systems at turns of more than 4 feet and throughout entire run; where wiring system is supported by hangers longer than 12", as measured from top of wiring system to bottom of supporting structure. Restraint type and maximum spacing of restraints shall be as follows:
  - 1. Conduit 1-1/4" & Larger; Seismic restraint type: SR-C; Maximum Transverse spacing: 40'-0"; Maximum Longitudinal spacing: 80'-0"
  - 2. Other systems that support 3 or more conduits; Seismic Restraint Type: SR-C; Maximum Transverse spacing: 40'-0"; Maximum Longitudinal spacing: 80'-0".
  - 3. Other systems that support multiple wiring runs; Seismic Restraint Type: SR-C; Maximum Transverse spacing: 40'-0"; Maximum Longitudinal spacing: 80'-0".
- B. Seismic restraint shall be provided on electrical equipment. Vibration isolation shall be provided on electrical equipment where indicated. Isolation and restraint device types and minimum deflections if applicable shall be as follows:
  - 1. Generator:
    - a. Isolator Type: VI-RLAS
    - b. Seismic Restraint Type: SR-PM
  - 2. Switchgear:
    - a. Seismic Restraint Type: SR-B
  - 3. Panelboard:
    - a. Seismic Restraint Type: SR-B
  - 4. Transformer:
    - a. Seismic Restraint Type: SR-B
  - 5. Floor mounted non-isolated equipment if not specified elsewhere:
    - a. Seismic Restraint Type: SR-B
  - 6. Roof-mounted non-isolated equipment, if not specified elsewhere:
    - a. Seismic Restraint Type: SR-B
  - 7. Wall-mounted non-isolated equipment, if not specified elsewhere:

a. Seismic Restraint Type: SR-B

8. Non-isolated equipment suspended from structure, if not specified elsewhere:

a. Seismic Restraint Type: SR-C

### 3.5 WELDING PROCEDURES

- A. Welding shall be done by experienced ASME-certified welders, qualified under ASME "Boiler and Pressure Vessel Code" Section IX and acceptable to Owner's Representative. Furnish welding certificates if requested by Owner's Representative or Architect.

### 3.6 INSPECTION

- A. Furnish services of manufacturer to inspect the completed system and to verify that there are not isolation short circuits in equipment mounting/bases, isolators or seismic restraints. Manufacturer shall furnish written report on installation detailing errors, improperly selected isolation devices, or other faults that could affect the system performance; refer to paragraph 1.3.F, 1.3.G.
- B. After correction of problems by Contractor manufacturer shall reinspect system and shall redo report.

END OF SECTION 260548

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Requirements for identification of electrical equipment, circuit identification, system color coding and warning signs.

#### 1.2 RELATED WORK

- A. Section 260500: Common Work Results for Electrical

#### 1.3 SUBMITTALS

- A. Submittal of product furnished under this section is not required.

### PART 2 - PRODUCTS

#### 2.1 IDENTIFICATION OF EQUIPMENT

- A. Identify electrical equipment with permanently attached phenolic plates with 1/4" white or black engraved lettering on the face of each, attached with two sheet metal screws. Provide nameplate colors as specified in other parts of this section.
- B. Include the following information on panelboard identification plates:
  - 1. Panel Name
  - 2. Name of panel serving it
  - 3. Voltage and Phase
  - 4. Branch of electrical system
  - 5. On service equipment, legibly mark in the field the maximum available fault current and the date that the fault current calculation was performed per NEC 120.24, 2011.

#### 2.2 CIRCUIT IDENTIFICATION

- A. Identify feeder j-boxes and pull boxes with designation of panelboard/switchboard source as "FROM" and load served as "TO" with permanent labels.
- B. Identify pull and junction boxes with the designation of panelboard and the circuit number of each circuit contained therein, with permanent marker. Clearly mark information on or in the box, not on the cover, so that the information is easily identifiable.
- C. Identify circuits in conduits entering outlet boxes with the designation of panelboard and the circuit number of each circuit contained therein, with permanent marker.

## 2.3 COLOR CODE IDENTIFICATION

- A. Color code phenolic plates utilized to identify electrical equipment according to which branch of the electrical system the equipment is connected to as follows:
  - 1. Normal - Black with white letters.
  - 2. Fire Alarm - Red with white letters.
  - 3. Emergency - Yellow with black letters.
- B. The color code as outlined below shall be used. In addition, on each panelboard, pull box, control cabinet, or other electrical enclosure that contains circuits from more than one system, provide an engraved phenolic plate and identify the circuit conductors with the following color code: 208Y/120, Phase A, black, Phase B, red, Phase C, blue, grounded conductor, white, equipment grounding conductor, green, isolated equipment grounding conductor, green/yellow stripe. 480Y/277, Phase A, brown, Phase B, orange, Phase C, yellow, grounded conductor, gray, equipment grounding conductor, green, isolated equipment grounding conductor, green/red stripe.

## 2.4 WARNING SIGNS

- A. Provide warning signs called for by NFPA 70, NFPA 70E, OSHA, and the list included below.
- B. Use Seton Name Plate Company products, 10" x 7" size, pressure-sensitive (PSPL) for indoor use, 30 ga. baked enamel for outdoor use (30 BE) with style numbers shown below.
- C. Danger - Electrical Hazard - Authorized Personnel Only, Style No. 161.
  - 1. Main electrical room(s),
  - 2. Electrical equipment closet(s).
- D. Danger - High Voltage - Keep Out., Style No. 265S.
  - 1. Pull and junction boxes used on systems operated over 600 volts nominal.
  - 2. Main electrical room(s),
  - 3. Electrical equipment space(s).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Identify the following electrical equipment as called for herein:
  - 1. Switchboards, switchgear, and individual devices installed in them.
  - 2. Panelboards.
  - 3. Safety switches and disconnects.
  - 4. Contactors and motor starters.
  - 5. Transfer switches.
  - 6. Cabinets:
    - a. Telephone Cabinets

- b. Fire Alarm Cabinets
  - c. Lighting Control Cabinets
- 7. Individually mounted circuit breakers.
- 8. Relays.
- 9. Shunt trip pushbuttons:
  - a. Main Service Disconnects.
  - b. Computer Power
  - c. Computer HVAC power.
- 10. Transformers, motor starters, VFDs and relays connected under this Division shall be identified whether furnished under this Division or under other Divisions.

END OF SECTION 260553

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## SECTION 260573 - POWER SYSTEM ANALYSIS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or a professional electrical engineering firm.
- B. The studies shall include all new electrical distribution equipment supplied under this contract.
  - 1. Include emergency power system distribution equipment.

#### 1.2 RELATED SECTIONS

- A. Section 260500: Common Work for Electrical
- B. Section 262413: Switchboards
- C. Section 262416: Panelboards

#### 1.3 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  - 2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  - 3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
  - 4. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
  - 5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
  - 6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
  - 1. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  - 2. ANSI C37.13 - Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  - 3. ANSI C37.010 - Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  - 4. ANSI C 37.41 - Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories
- C. The National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code
2. NFPA 70E - Standard for Electrical Safety in the Workplace

#### 1.4 SUBMITTALS FOR REVIEW/APPROVAL

- A. Submit a preliminary short-circuit and protective device coordination study to the design engineer prior to receiving final approval of the shop drawings and/or prior to release of equipment drawings for manufacturing. The preliminary study shall provide sufficient data to ensure that the selection of equipment will have adequate ratings and the protective device trip characteristics will be satisfactory.
- B. Submit the final short-circuit and protective device coordination analysis at the end of the construction cycle when circuits are installed and all equipment is on site and/or installed such that complete and accurate data may be obtained.

#### 1.5 SUBMITTALS FOR CONSTRUCTION

- A. The results of the final short-circuit and protective device coordination analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies of the short-circuit input and output data, where required, shall be provided on CD in PDF format.
- B. At the owner's option, the contractor is required to provide the study project files to the Owner in electronic format including all project files, libraries, etc to allow the owner to update and to print additional copies, labels, etc.
- C. If the owner does not use the applicable computer program, a copy of the computer analysis software viewer program is required to accompany the electronic project files, to allow the Owner to review all aspects of the project and print arc flash labels, one line diagrams, etc.
- D. The report shall include the following sections:
  1. Executive Summary.
  2. Descriptions, purpose, basis and scope of the study.
  3. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties.
  4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, and fuse selection.
  5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
  6. Recommendations for system improvements, where needed.
  7. One line diagram.
- E. If the power systems study submittal is not approved following the second submittal, the contractor shall pay the Project Engineer \$200.00 per hour to review additional submittals until the study is approved.

## 1.6 QUALIFICATIONS

- A. The short-circuit and protective device coordination studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be a full-time employee of the electrical equipment manufacturer or a professional electrical engineering firm.
- C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
- D. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting a detailed plan outlining the steps to be taken to ensure a proper outcome (if required).

## 1.7 COMPUTER ANALYSIS SOFTWARE

- A. The studies shall be performed using the latest revision of the SKM Systems Analysis Power\*Tools for Windows (PTW) software program. Other commercially available products may be considered under certain circumstances.

## PART 2 - PRODUCT

### 2.1 STUDIES

- A. Furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or a professional electrical engineering firm.

### 2.2 DATA COLLECTION

- A. Electrical Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit and protective device coordination studies shall furnish the Electrical Contractor with a list of required data immediately after award of the contract. The Electrical Contractor shall expedite collection of the data to ensure completion of the studies as required.
- B. The engineer performing the study shall make at least one job site visit before completion of the final study to familiarize himself/herself with the project to ensure that the provided data is accurate.
- C. Source contribution shall include present and future motors and generators.
- D. Load data utilized shall include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
- E. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

## 2.3 SHORT-CIRCUIT STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141.
- B. Estimated conductor lengths, typical generator, transformer, motor, and utility data may be used for the preliminary study.
- C. Actual installed conductor lengths, test and/or nameplate data for all generators, transformers, motors 50 HP and larger, capacitors, reactors, or other equipment that may affect the study must be used for the final study.
- D. Actual utility fault current and X/R ratio shall be used. Infinite bus calculation is not acceptable.
- E. The pre-fault bus voltage shall be the highest reported by the utility for past 5 years. If unavailable, 1.5 per unit shall be used.
- F. Provide the following:
  - 1. Calculation methods and assumptions.
  - 2. Selected base per unit quantities.
  - 3. One line diagram of the system being evaluated.
  - 4. Utility impedance data, including the maximum and minimum 3 phase and line-to-ground fault current available, nominal, maximum, and minimum voltage, 3 phase X/R ratio, and line-to-ground X/R ratio.
  - 5. Utility protective device settings including recloser if used.
  - 6. Motor fault contribution characteristics.
  - 7. Generator fault contribution characteristics.
  - 8. Tabulations of calculated quantities.
  - 9. Results, conclusions, and recommendations.
- G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
  - 1. Electric utility's supply termination point
  - 2. Incoming switchgear
  - 3. Unit substation primary and secondary terminals
  - 4. Low voltage switchgear.
  - 5. Motor control centers.
  - 6. Standby generators and automatic transfer switches.
  - 7. Branch circuit panelboards.
  - 8. Other significant locations throughout the system.
- H. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- I. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to short circuit ratings.
  - 2. Adequacy of switchgear, switchboards, disconnects, transfer switches, motor control centers, and panelboard bus bars to withstand short-circuit stresses.
  - 3. Notify Owner, in writing, of any existing circuit protective devices improperly rated for the calculated available fault current.

## 2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs. No more than 5 devices shall be shown on any plot.
- B. Include on each TCC graph, a complete title, applicable notes, and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
  - 1. Electric utility's overcurrent protective device.
  - 2. Medium voltage equipment overcurrent relays.
  - 3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
  - 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands.
  - 5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves. The frequent fault portion of the damage curve should not be shown unless the transformer feeds overhead lines. The shifted curve for line-to-ground faults on the secondary side shall be shown on the ground fault plot.
  - 6. Conductor damage curves.
  - 7. Ground fault protective devices shall be shown on separate TCC plots. The first phase overcurrent relay and any negative sequence relays on the primary side of a delta-wye transformer shall be shown.
  - 8. Pertinent motor starting characteristics, motor damage points, and overload relay. Motors larger than 500 HP shall have a thermal damage curve.
  - 9. Pertinent generator short-circuit decrement curve and generator damage point. Generators larger than 1250 kW shall have a thermal damage curve.
  - 10. The largest feeder circuit breaker in each motor control center and applicable panelboard.
  - 11. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

## 2.5 REPORT SECTIONS

- A. Input data shall include, but not be limited to the following:
  - 1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
  - 2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, KVA rating, impedance, % taps and phase shift.
  - 3. Reactor data, including voltage rating, and impedance.
  - 4. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance ( $X''_d$ ), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.

5. Motor contribution data (induction motors and synchronous motors), including short circuit reactance, rated horsepower or KVA, rated voltage, and X/R ratio.
- B. Short-Circuit Output Data shall include, but not be limited to the following reports:
1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Equivalent impedance
  2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Calculated asymmetrical fault currents
  3. Based on fault point X/R ratio
  4. Based on calculated symmetrical value multiplied by 1.6
  5. Based on calculated symmetrical value multiplied by 2.7
    - a. Equivalent impedance
  6. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. No AC Decrement (NACD) Ratio
    - e. Equivalent impedance
    - f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
    - g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
  7. Equipment evaluation table including but not limited to AIC rating, X/R ratio, actual fault current, percent of actual-to-rated fault current, derated value.
- C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
    - a. Current transformer ratio
    - b. Current setting
    - c. Time setting
    - d. Instantaneous setting
    - e. Recommendations on improved relaying systems, if applicable.
  2. Special purpose relays

- a. Provide settings for all functions provided by special purpose relays such differential, reverse power, directional overcurrent, negative sequence, current unbalance, and multi-function relays for main and tie circuit breakers, generator management, transformer protection, feeder protection, motor protection, etc.
- 3. Circuit Breakers:
  - a. Adjustable pickups and time delays (long time, short time, ground)
  - b. Adjustable time-current characteristic
  - c. Adjustable instantaneous pickup
  - d. Recommendations on improved trip systems, if applicable.

### PART 3 - EXECUTION

#### 3.1 FIELD ADJUSTMENT

- A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the electrical contractor in conjunction with Power Systems Analysis engineer.
- B. Make minor modifications to equipment as required to provide for conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.

END OF SECTION 260573

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 260800 - ELECTRICAL COMMISSIONING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Commissioning is a systematic process of ensuring that the building systems perform according to the design intent.
- B. Refer to Section 019100 Commissioning Requirements.

#### 1.2 RELATED DOCUMENTATION

- A. Contract drawings, Division 00, Conditions of the Contract, and Division, General Requirements, apply to the Work of this Section.

#### 1.3 RELATED SECTIONS

- A. Form - Product Substitution.
- B. Section 013300 Submittal Procedures.
- C. Section 019100 Commissioning Requirements.

#### 1.4 SYSTEM TO BE COMMISSIONED

- A. Electrical Systems:
  - 1. Interior Lighting Systems (excluding hotel guest rooms).
  - 2. Exterior Lighting Systems.
  - 3. Lighting Controls Systems for above listed systems.

### PART 2 - PRODUCTS

- A. Refer to Section 019100 Commissioning Requirements.

### PART 3 - EXECUTION

- A. Refer to Section 019100 Commissioning Requirements.

END OF SECTION 260800

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 260943 - NETWORK LIGHTING CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Furnish and install a complete Philips lighting control system, details indicated on the drawings. System shall include Class 2 transformer/lighting control relays and micro-processor based programmable lighting controllers. Include other control devices required to meet LEED lighting guidelines, as well as wire, conduit and other materials required for a complete installation.

#### 1.2 RELATED WORK

- A. Section 260519: Low Voltage Electrical Power Conductors
- B. Section 260533: Raceways and Conduit Systems
- C. Section 260534: Pull and Junction Boxes

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings for review. Submittal shall include:
  - 1. Dimensional drawings of all equipment.
  - 2. One-line diagram of the system configuration in sufficient detail to show the relative placement of all equipment and interconnection with equipment supplied by this and other manufacturers.
  - 3. Typical wiring diagrams for all components. Detailed interconnection diagrams are required only if proper interwiring of components is not clearly indicated on typical wiring diagrams.
  - 4. Data sheets on all components of the system. These shall describe all hardware and software items provided. A detailed line by line specification compliance shall also be included.
  - 5. Bill of Material - an itemized list of all materials being supplied to meet the specifications.
  - 6. Graphics Screens - Manufacturer shall submit graphic screens required in a two step approval process. The initial step shall provide conceptual screens showing how the system will operate. This is required prior to manufacture of the hardware. A second submittal shall be provided at time of commissioning to show final screen layouts incorporating "as wired" conditions. Allow for 8 custom screens in bid cost.
- B. Arrange a pre-submittal conference among Owner, Architect and Contractor, prior to submitting any data or drawings. Discuss and agree upon lighting control sequences, pre-set scenes and graphics required to facilitate Owner's operations.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Philips.

### 2.2 EQUIPMENT REQUIREMENTS

- A. The lighting control system shall be UL listed under UL916 - Energy Management Equipment, and UL 924 for Emergency Circuit use. Panels shall be factory assembled and tested as U.L. listed assemblies.
- B. All lighting control equipment shall be in compliance with FCC Emission Standards specified in Part 15 Subpart J for Class A applications.
- C. Lighting control panels shall have relay capacity as scheduled on drawings. Provide the quantity of active and spare transformer/relays shown in schedules on drawings. Provide the corresponding capacity in the microprocessor(s).
- D. System manufacturer shall have five (5) years of experience manufacturing this specific system.

### 2.3 PANEL HARDWARE

- A. Backbox - It shall be shipped separate from the remainder of the equipment to allow for rough in of all conduits. It shall be made of code gauge steel and contain no knockouts. Labels shall indicate the areas restricted to low voltage wiring.
- B. Chassis - It shall be pre-assembled and contain all relays, electronics and the power supply. The sheet metal chassis shall divide the panel into line voltage and low voltage compartments.
- C. Trim - A surface mounted trim shall be provided that is painted the manufacturer's standard color. The trim shall contain a window for viewing the status LED's inside the panel. It shall contain a hinged, lockable door that, when open, gives access only to the low voltage portion of the panel. A directory card shall be attached to the rear of the door. All doors shall be keyed alike.
- D. Power Supply -The incoming line power shall connect to a single dual rated 120/277 VAC, 60 Hz, +10%, -15% power supply transformer that shall provide all power for the panel. Incoming power shall be fused with a replaceable time delay fuse. Output shall be line filtered to reduce noise emissions and power line spikes. A secondary On/Off switch shall be provided to disconnect the control power from the panel for maintenance purposes.
- E. Relays - Each controlled circuit shall be connected through a single pole, single throw mechanically latching relay, MicroLite part number MLR-020.
  - 1. The relay shall contain a single solenoid coil that toggles the load contacts to the opposite position with each operation.
  - 2. An actuator button shall extend out of the rear of the solenoid case to allow manual operation of the contacts.

3. The actuator button shall also provide visual indication of the contact state. A red band shall be visible only when the contacts are closed.
4. The load contacts shall be rated as follows: 20A, 125 VAC Tungsten; 20 A, 277 VAC Ballast; 1.0 HP, 125 VAC; 1.5 HP, 250 VAC.
5. Dual poke home holes that will accept #10 - #14AWG wires shall be provided for power wiring.
6. Auxiliary contacts rated 0.16A, 28 VDC shall be provided for pilot lights and feedback.
7. Mechanical action shall be suitable for zero cross control.
8. All control wires shall terminate in a modular connector that attaches to the chassis electronics.

## 2.4 PANEL ELECTRONICS

- A. Each panel shall contain an electronic chassis with removable circuit cards that provides the capabilities specified below.
1. Relay Output Modules (ROM). Each panel shall contain one or two ROM.
    - a. Each ROM shall provide the ability to control 24 loads.
    - b. It shall continuously monitor the position of its associated loads, providing true status indication, and command failure and unexpected change alarms.
    - c. An LED shall indicate the position of each connected load.
  2. Switch Input Modules (SIM). Each panel shall contain one or two SIM.
    - a. Each SIM shall provide the ability to read 24 dry contact closures from wall switches, building automation systems, photo controllers or occupancy sensors.
    - b. Each input shall be self-powered with no external transformer required.
    - c. Each input shall be user selectable in one of 7 modes.
    - d. An LED shall indicate when each input is closed.
  3. Network Control Module (NCM). Each panel shall contain one NCM.
    - a. The NCM shall contain the micro-processor that controls each panel.
    - b. It shall contain the necessary circuitry to communicate with other panels on the network.
    - c. It shall contain the operating firmware to allow each panel to operate independently should a network failure occur. All time schedules and switch input assignments shall reside in the NCM. Failure of the network shall not prevent the operation of time schedules residing in any panel.

## 2.5 CONTROL CAPABILITIES

- A. Each panel shall provide the following features as an integral part of its firmware.
1. Positive Load Feedback - The system shall continuously monitor the position of all loads to provide position indication. It shall alarm all unexpected changes of state and command failures.
  2. Selectable Switch Inputs - Each switch input shall be user definable as one of 7 modes.

- a. Maintained Input - The load is turned on when it closes, and turned off when it opens.
  - b. Momentary Input - The load toggles to the opposite state with each closure. No action is taken on opening.
  - c. Time Delay - The load turns on when the switch closes and remains on for the pre-programmed period of time, after which it automatically turns off.
  - d. Pulse Accumulator - When connected to an energy meter containing output pulse contacts, this input records the number of pulses received, corresponding to the amount of energy used.
  - e. External - This input is broadcast over the network. It allows loads in this panel and anywhere in the network to respond to a switch input.
  - f. Alarm - This input is a momentary input that causes an alarm to be raised at the operator's station and adds an entry into the alarm log each time it is operated.
  - g. Interlock - This input is used for cleaning crews. It will turn on its associated load. When the next interlocked load is activated, the previous one is turned off. Interlocked loads shall not cancel a time schedule or occupant override.
3. Memory Loss Protection - Memory shall be protected by lithium battery backed non-volatile memory in the event of a power failure. Backup time shall be ten years.
  4. Power Fail Recovery - The micro-processor shall operate whenever incoming power is within rated voltage tolerance. When incoming power fails, the micro-processor shall automatically halt program execution in a safe manner. Upon return of power, the micro-processor shall automatically reboot and return the system to normal operation. Any time schedule events that should have occurred during the power outage shall be automatically updated.
  5. Real Time Clock - A digital clock shall be provide time of day, day of week and date. Automatic leap year adjustment and selectable daylight savings time adjustments shall be provided.
  6. Astronomical Clock - The clock shall automatically calculate sunrise and sunset based on the date and geographic location. Selectable offset of 0 to 120 minutes before and after either sunrise and sunset shall be programmable.
  7. Time/Event Scheduling - Schedule capacity shall be large enough to allow each of the up to 48 loads in each panel to be uniquely programmable with any combination of up to 12 "On" or "Off" events per day. Separate schedules shall be provided for each of the seven days of the week and for three special day schedules. Each special day shall be programmable up five occurrences in advance, with each occurrence lasting from one to fourteen consecutive days.
  8. Programmable Matrixing - All switch inputs shall be programmable to control any load or combination of loads even if they exist in different switch groups (group overlapping). Any switch input shall be able to control loads anywhere in the network. All programming changes shall be made via programming. No rewiring of switches shall be required to accomplish these functions.
  9. Occupant Warning - Each load shall be programmable to provide a warning blink prior to each scheduled "Off" time. Once the warning has occurred, the occupant may cancel the upcoming "Off" command by operating a local override switch. The load shall remain "On" until expiration of the time out period, or another "Off" command is received. Occupant warning time shall be adjustable between 5 and 30 minutes.
  10. Load Sequencing - Multiple loads shall not operate simultaneously, even when triggered by the same switch input or time schedule. Each load operation shall be staggered to reduce the inrush effects on the power system. Sequencing choices shall be 1, 5, 10, 15, 20, 30 or 60 loads per second.

11. Load Priority - To avoid unnecessary confusion to the users, the system shall use a "last action" priority scheme. Time schedules and switch input overrides shall each cancel the action of each other. Momentary and maintained switches operating on the same load shall also cancel each other's actions.

## 2.6 NETWORK REQUIREMENTS

- A. The lighting control system shall be a distributed intelligence system, consisting of multiple panels that operate on a network.
  1. Independent Operation - Network communications, time of day schedules, and input and load control, shall reside in each panel. Each panel shall continue to function independently of other panels if a network failure occurs.
  2. Network Capacity - Up to 500 panels shall be able to be connected to the network of up to 7500 ft maximum length. The network shall be self-powered. No external power supply shall be allowed. No network repeaters shall be allowed.
  3. Network Cable - Panels shall be interconnected with a single twisted, shielded pair cable (Beldon #9463 or equivalent).

## 2.7 LIGHTING CONTROL COMPUTER

- A. An IBM compatible PC provided with facility management system will be used for programming and monitoring of the lighting control system.

## 2.8 SOFTWARE

- A. The lighting control computer shall be supplied by the manufacturer complete with the following software factory preloaded:
  1. Lighting Management Software (LMS) - A Windows-based software program shall be supplied that provides for programming and monitoring of the lighting control system.
    - a. The software shall be fully Windows compliant, complete with multiple windows, point and click operation, dialog boxes, menu bar, scroll bars, status bar, control buttons, and context sensitive help screens.
    - b. The software shall be icon driven with each button corresponding to a major function of the lighting control system. Icons for optional features shall be enabled if the option is installed in the panel being accessed.
    - c. Security codes shall be assignable so that different operators shall have different levels of access to the system. Different security levels shall be provided for monitoring, override, programming and administrator access to the system.
    - d. Configuration dialog boxes shall be provided that allow assignment of descriptions to individual loads and inputs. These descriptions shall be carried over automatically to other screens.
    - e. A time schedule editor shall be provided that allows time schedules for multiple loads to be viewed and edited on the same screen.
    - f. A monitor and override screen shall be provided that shows each load in the system, its current status and the reason for the last change in operation. From this screen it shall be possible to manually turn loads On and Off.

- g. A grouping function shall be provided that allows assigning of a time schedule or switch input to multiple loads located anywhere in the system. Once defined, schedules for all loads can be changed by simply changing the group schedule. The software shall automatically update the database in each lighting control panel.
- 2. Graphics Control Software (GCS) - An additional software package shall be supplied that provides a graphical interface.
  - a. The software shall operate under Windows 3.11 or higher and be fully compatible with other lighting control software installed. It shall be object oriented with pull down menus and built in help screens.
  - b. The operator shall be able to individually control any lighting load connected to the system. The operator shall be able to control the load by activating the graphic symbol representing the load or by activating control buttons.
  - c. An opening screen shall be provided that illustrates the overall building. When the cursor is moved to a portion of the building corresponding to a detail screen, the screen area shall become highlighted. Clicking the mouse while within the highlighted area shall automatically bring up the corresponding detail area screen. Movement between screens shall also be possible by using control buttons.
  - d. Load status shall be indicated by changing the color of the load icon. Yellow shall indicate the load is On; Black shall indicate the load is Off.

## 2.9 OPTIONS

### A. Provide the following:

- 1. Low-Voltage Relay Module (LRM) - An LRM/LRT set shall be provided to interface the lighting control system with other low voltage systems.
  - a. The LRM shall consist of 24 or 48 low voltage relays with Form A contacts rated 1A, 30 vdc, one for each load in the panel.
  - b. Each LRM circuit shall mirror the position its associated load, providing an isolated contact.
  - c. A Low Voltage Termination Module (LRT) for each LRM shall be provided. All terminations shall be made on the LRT.
- 2. Photo Controller - A photo controller with exterior photocell shall be provided to control exterior circuits.
  - a. An exterior weatherproof photocell shall be mounted on the roof facing a northerly direction, pointing away from any existing sources of light.
  - b. A low voltage photo controller shall be mounted adjacent to one of the lighting control panels containing exterior circuits.
- 3. Remote Operator Control Station - Provide touch screen monitors (or LCD display) to operate as a remote operator control stations.
  - a. The monitor shall display commonly used lighting control presets, or looks, which can be activated with the touch of a finger.
  - b. Each control station shall connect to the lighting control system through a single twisted pair data line.

- c. The manufacturer shall furnish a custom screen for each control station. It shall be possible to modify the screens without changing any hardware should usage patterns in the controlled area change.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General - Install the lighting control equipment according to the manufacturer's written instructions.

### 3.2 CONTROL WIRING INSTALLATION

- A. Provide and install all wiring between control devices as indicated in the contract drawings, details, and/or indicated in the manufacturer's submittal package. Install wiring among components in conduit.

### 3.3 Bundle, train and support wiring in enclosures.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services - Arrange and pay for the services of factory-authorized service representatives to commission, test and program the lighting control system.
- B. Reports - Prepare written reports of tests and observations. Report defective materials and unsatisfactory test results. Record repairs and adjustments made.
- C. Test Labeling - Upon satisfactory completion of tests and inspections, apply a label to tested panels indicating test results, date and testing organization and person.

### 3.5 CLEANING

- A. Cleaning - The Contractor shall remove all paint spatters and other spots, dirt and debris from the equipment. Clean equipment and devices internally and externally using methods and materials recommended by the manufacturer.

### 3.6 COMMISSIONING

- A. Operational Tests - The electrical contractor shall provide a complete set of "as wired" drawings of the lighting control system to the Owner. These drawings shall be prepared and verified prior to commissioning of the system. Any extra expenses incurred in commissioning the system due to inaccurate or incomplete wiring shall be borne by the electrical contractor.
- B. Training - Arrange and pay for the services of factory-authorized service technicians to demonstrate the lighting control system and train owner's maintenance personnel. Provide 2 weeks notice of training dates.

- C. Programming - Arrange and pay for the services of factory authorized service technicians to install an initial lighting control program into the system. Coordinate schedules with the owner so that a complete schedule is available at the time of commissioning. The electrical contractor shall be responsible for schedule updates until system is turned over to Owner. Provide two complete programming revisions to follow on-site test of initial sequence.
- D. Provide operation and maintenance manuals to Owner including full documentation of software programs.
- E. Technical support - The manufacturer shall supply telephone support at no additional cost to the Owner for the duration of the warranty period.
- F. Replacement Components - The manufacturer shall be able to ship replacement parts within 24 hours for any component that fails during the warranty period.
- G. Graphic Screens - The electrical contractor shall provide the manufacturer with reflected ceiling plans for all areas being controlled by the lighting control system. These shall reflect "as wired" conditions and will be the basis for the detail screens for the graphic computer screens. It is the electrical contractor's responsibility to insure their accuracy.

### 3.7 WARRANTY

- A. Installation Warranty - A written warranty shall be supplied by the installing contractor agreeing to provide the labor and materials to replace any portion of the lighting control system equipment or wiring that fails due to materials or workmanship for a period of twelve months.
- B. Manufacturer's Warranty - A written warranty shall be supplied by the manufacturer agreeing to replace any equipment that fails due to materials or workmanship for a period of twelve months.

END OF SECTION 260943

## SECTION 262213 - LOW VOLTAGE DISTRIBUTION TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Sections 26 05 00.
- B. Provide dry type transformers as required and/or as shown on drawings.

#### 1.2 RELATED SECTIONS

- A. Section 260526: Grounding and Bonding for Electrical Systems
- B. Section 260553: Identification for Electrical Systems.

#### 1.3 REFERENCES

- A. ANSI/IEEE C57.96 - Distribution and Power Transformers, Guide for Loading Dry-Type (appendix to ANSI C57.12 standards)
- B. ANSI/IEEE C89.2 - Dry Type Transformers for General Applications
- C. ANSI/NFPA 70 - National Electrical Code
- D. IEEE C57.12.1 - General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and / or Resin-Encapsulated Windings
- E. IEEE C57.12.91 - Test Code for Dry-Type Distribution and Power Transformers
- F. NEMA ST 20 - Dry Type Transformers for General Applications
- G. UL 506 - Specialty Transformers

#### 1.4 SUBMITTALS

- A. Submit products for review.
- B. Submit dimensioned equipment location layouts in accordance with section 260500.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Square D

- B. Eaton/Cutler-Hammer
- C. General Electric
- D. Siemens

## 2.2 EQUIPMENT REQUIREMENTS

- A. Provide general purpose, self cooled dry type transformers designed for 60 Hz operation. Voltage and rating as required. Transformers to be designed, manufactured and tested in accordance with the latest ANSI, NEMA and IEEE Standards. Transformers to be listed and labeled in accordance with UL 1561.
- B. Transformers to be compliant with NEMA TP-1 energy efficiency requirements per EPA Act 2005/CFR 10 Part 431.

## 2.3 INSULATION SYSTEM

- A. Provide ventilated type transformers for 15 KVA and larger with a UL recognized 220 degree insulation system. Base the KVA ratings on an allowable 150 degree C winding temperature rise above a 30 degree hot spot.
- B. Transformer design KVA Rating shall be suitable for a 30 degree C average and 40 degree C maximum ambient temperature.

## 2.4 CORE AND COIL

- A. Core construction to be of non-aging electrical grade grain-oriented silicon steel to minimize hysteresis and eddy current losses. Core lamination shall be tightly assembled.
- B. Provide windings wound of high quality copper .
- C. Arrange ventilated windings to brace coil layers and provide maximum ventilation. Construct core and coil assemblies to provide short circuit withstand capability as defined by ANSI and NEMA standards. Securely bolt complete assembly to the enclosure base using vibration dampening pads to reduce noise.
- D. The complete core and coil shall be impregnated with non-hydroscopic, thermo-setting polyester varnish to provide a high dielectric and flame retardant seal. The shield of varnish to the coils shall effectively impregnate the entire core and coil assembly that results in a unit which is virtually impermeable to moisture, dust, salt air and other contaminants. Cast encapsulated core and windings in a resin compound to provide a moisture-proof, shock-resistant, high dielectric seal.
- E. Provide full capacity taps in the high-voltage windings of transformers. For 3 phase transformers rated below 15 KVA, provide two 5% full capacity below normal taps . For 3 phase transformers rated 15 KVA and above, provide two 2.5% full capacity above normal taps and four 2.5% full capacity below normal taps

## 2.5 ENCLOSURES

- A. Provide NEMA 1 ventilated enclosures of heavy gauge steel construction for indoor transformers. Provide weather shields for ventilated transformers installed outdoors conforming to the requirements of NEMA 250, Type 3R. Finish enclosures in ANSI 61 gray paint.
- B. Unless otherwise specified, sound levels shall be in accordance with values allowed by NEMA ST-20.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Provide flexible conduit to and from transformer.
- B. Install transformers in accordance with manufacturer's recommendations.
- C. Provide vibration isolation devices whether floor mounted or hung from structure as follows:
  - 1. Install floor mounted transformers on two (2) layer, one (1) inch thick, rubber neoprene pads with galvanized shims (Mason Super "W" or equal).
  - 2. For suspended transformers provide spring hangers (Mason 30N or equal) with double neoprene elements at the top of the device with spring seated neoprene cups at the base of the device for sway bracing purposes.
- D. Provide working clearances around transformers in accordance with Article 110 of the National Electrical Code.
- E. Provide separation and clearance around transformers in accordance with manufacturer's recommendation to allow adequate cooling.
- F. Ground transformers in accordance with Articles 250 and 450 of the National Electrical Code.

### 3.2 FIELD TESTING

- A. Torque all connections to manufacturer's recommendation.
- B. Check the insulation resistance of primary and secondary windings with a 1000 vdc "megger". Minimum acceptable value is 3 megohms.
- C. Clean all construction debris, trash, and dust from enclosure, windings, and area around transformer. Use industrial type vacuum cleaner to remove dust from windings.
- D. Clean or replace all filters associated with cooling air intake.

END OF SECTION 262213

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## SECTION 262413 - SWITCHBOARDS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. The Contractor shall furnish and install a complete system of Low Voltage, Type 1, Type 2, and/or Type 3 switchboards with circuit breakers and/or fusible switches for mains, ties, and feeders as specified below and as indicated on the drawings.
  - 1. Where used on an emergency system in a health care facility subject to NEC Article 517, all ground fault functions shall be alarm only with no trip function.
- B. Type 3 switchboards shall be rear-accessible, metal-enclosed switchboards with draw-out or fixed power circuit breakers, insulated case circuit breakers, and/or bolted pressure switches. Switchboards shall be single ended or double ended as indicated on drawings. Double-ended shall be a main-tie-main arrangement. Where indicated on drawings, double-ended switchboards shall have an automatic transfer scheme.
- C. Type 3 switchboards shall be provided as a complete unit substation where indicated on the drawings.
- D. The requirements of the Contract, Division 01 and Division 26, apply to work in this section.

#### 1.2 RELATED SECTIONS

- A. Section 260500: Common Work Results for Electrical
- B. Section 264313: Transient Voltage Surge Suppression

#### 1.3 REFERENCES

- A. The low voltage switchboards and protection devices in this specification are designed and manufactured according to latest revision of the following applicable standards.
  - 1. ANSI C37.16, Low Voltage Power Circuit Breakers and AC Power Circuit Protectors, Preferred Ratings, Related Requirements and Application Recommendations for
  - 2. ANSI/IEEE C37.13. Low-voltage AC power circuit breakers used in enclosures.
  - 3. ANSI/NEMA PB 2, Deadfront Distribution Switchboards
  - 4. ANSI/NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less
  - 5. ANSI/NFPA 70, National Electrical Code
  - 6. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches
  - 7. NEMA KS 1, Fused and Non - Fused Switches
  - 8. UL 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures
  - 9. UL 891, Dead Front Switchboards
  - 10. UL 98, Enclosed and Dead Front Switches
  - 11. UL 1066, Low Voltage AC and DC Circuit Breakers Used in Enclosures

12. UL 977, Fused Power Circuit Devices

1.4 DEFINITIONS

- A. Insulated Case Circuit Breaker: Molded case circuit breaker built and listed to UL489 requirements. Insulated case circuit breakers are distinguished from normal molded case circuit breakers by the stored energy mechanism employed to open and close and the inclusion of internal motor operators when electrical operation is required.
- B. Low Voltage Power Circuit Breaker: Also typically referred to as "air circuit breaker", "metal frame circuit breaker," or "ANSI circuit breaker". Differentiated from molded case and insulated case circuit breakers by many characteristics defined in the applicable UL and ANSI standards, including but not exclusively, significant 30 cycle withstand ratings, single pole ratings, and ease of maintenance.
- C. Bolted Pressure Switch: Also referred to as high pressure contact switches. A type of switch with a spring loaded mechanism to close or open the circuit and a method of applying high pressure to the contacts to ensure high ampacity similar to a bolted bus joint.
- D. Front-Accessible Only: Shall be as defined by UL 891 standard which requires that all line and load connections for phase, neutral, and ground conductors be accessible front the front of the switchboard allowing it to be mounted against a wall.

1.5 SYSTEM DESCRIPTION

- A. The power system feeding the switchboard shall be 277/480 volt, solidly grounded wye unless noted otherwise on the drawings.
- B. Switchboard(s) shall have front access and rear alignment for mounting against a wall or rear access as indicated on the drawings.

1.6 SUBMITTALS

- A. Manufacturer shall provide minimum of 8 copies of the following documents, where applicable, to owner for review and evaluation in accordance with general requirements of Division 01 and Division 26:
  - 1. Front view and floor plan of switchboard
  - 2. Switchboard anchoring locations
  - 3. Conduit and busway entry / exit locations
  - 4. Location of shipping splits
  - 5. Three-line diagram of switchboard bus and protective devices
  - 6. Switchboard ratings including:
    - a. Short circuit rating
    - b. System voltage rating
    - c. Continuous current rating
  - 7. Protective device schedule including:

- a. Device type
    - b. Sensor and trip rating
    - c. Location within the switchboard
    - d. Cable quantity and size capabilities for each device
  - 8. Panel drawing showing all major protection, instrumentation, and control devices mounted within the switchboard
  - 9. Schematic diagram showing power, metering, and control circuits for the switchboard and circuit breakers
  - 10. Bill of Material listing (including quantity, location, catalog number, and ratings) of all major protection, instrumentation and control devices
  - 11. Switchboard nameplate schedule
- B. Contractor furnished seismic calculations and anchoring recommendations for equipment and seismic requirements defined in these specifications. Report shall be signed by a structural or civil engineer registered in the state where the equipment is to be installed.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Manufacturer shall submit minimum 8 copies:
- 1. Include as built record drawings as follows:
    - a. Front View
    - b. Floor Plan
    - c. Elementary Diagram showing power, metering and control circuits
    - d. Switchgear internal wiring diagrams
    - e. Bill of Material
    - f. One Line Diagram
    - g. Three Line Diagram
  - 2. Instruction books on major components
  - 3. Installation drawings
  - 4. Certified test reports
  - 5. Recommended renewal parts information

#### 1.8 INSTALLATION, OPERATION AND MAINTENANCE DATA

- A. Manufacturer shall provide minimum 8 copies of installation, operation, and maintenance procedures to owner in accordance with general requirements of Division 01 and Division 26.
- B. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product.

#### 1.9 QUALITY ASSURANCE QUALIFICATIONS

- A. Manufacturer shall have specialized in the manufacture and assembly of low voltage switchboards for 25 years.

- B. Manufacturer shall have available for review, if requested by the engineer, a certificate of ISO 9002 Compliance.

#### 1.10 REGULATORY REQUIREMENTS

- A. Low voltage switchboards shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in paragraph 1.3 of this specification and shall bear UL labels in accordance with those standards.
- B. Switchboards shall be qualified for use in seismic loading UBC zone that is appropriate for the site location as defined in IEEE 693.
- C. Where used as service entrance equipment, it shall be listed as a service entrance switchboard.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
- B. Ship each switchboard section in individual shipping splits for ease of handling. Each section shall be mounted on shipping skids and wrapped for protection.
- C. Contractor shall inspect and report concealed damage to carrier within 48 hours.
- D. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Provide heat in the enclosures to prevent condensation.
- E. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.

#### 1.12 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

- A. Follow applicable NEMA, ANSI, and NECA standard practices before, during, and after switchboard installation.
- B. Indoor switchboards shall be located in well-ventilated areas, free from excess humidity, dust, and dirt and away from hazardous materials. Ambient temperature of area will be between 0 and plus 40 degrees C.
- C. Outdoor switchboards shall be located in well-ventilated areas, and away from hazardous materials. Ambient temperature of area will be between minus 30 and plus 40 degrees C.

#### 1.13 SEQUENCING AND SCHEDULING

- A. Provide a written detailed description of scheduled installation, testing, and startup dates.

#### 1.14 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of acceptance by the owner or 18 months from date of delivery, whichever occurs first.

#### 1.15 EXTRA MATERIALS

- A. When draw-out circuit breakers are provided, a breaker-lifting device shall be provided suitable for all Insulated Case and Low Voltage Power Circuit Breakers used.
- B. When draw-out circuit breakers are provided, provide a remote racking device with a 25 ft cord.
- C. For Type 3 switchboards, provide a complete set of spare fuses of all sizes and rating for all control fuses used in the switchboard.
- D. Provide a fuse cabinet to house the fuses required in "C".

#### 1.16 FIELD MEASUREMENTS

- A. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Approved manufacturers are:
  - 1. General Electric
  - 2. Eaton/Cutler Hammer
  - 3. Siemens Energy Automation
  - 4. Square D
- B. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents. Request for approval shall be submitted 10 business days before bid date. Substitutions will not be considered after this date.

#### 2.2 EQUIPMENT

- A. Furnish Low Voltage Switchboards with molded case, insulated case, steel frame power circuit breakers, fusible switches, and/or bolted pressure switches as indicated on drawings and in this specification.
- B. Provide unit substation transformers where indicated on the drawings and as specified in transformer specifications.

## 2.3 COMPONENTS

- A. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.
- B. General
  - 1. The low voltage switchboards shall be rated 480/277 volts, 3 phase, 4-wire with 100 percent neutral, 60 Hz unless indicated otherwise on the drawings.
  - 2. Switchboards shall include all protective devices and equipment listed on drawings with necessary interconnections, instrumentation, and control wiring.
  - 3. Provide a modified or partial differential ground fault protection on Type 3 main-tie-main and other multiple source systems with multiple point grounding, including on site generation, to ensure proper operation of the power system.
- C. Enclosure
  - 1. Indoor switchgear shall be furnished with an NEMA 1 enclosure and outdoor switchgear with a NEMA 3R non walk-in enclosure unless indicated otherwise on the drawings.
- D. Structure (Type 1 & 2)
  - 1. Switchboards shall be fully self-supporting structures with 90 inch tall vertical sections (excluding lifting eyes and pull boxes) bolted together to form required arrangement.
  - 2. Switchboard frame shall be die formed, 12 gauge steel with reinforced corner gussets. Frame shall be rigidly bolted to support cover plates (code gauge steel), bus bars, and installed devices during shipment and installation.
  - 3. All sections may be rolled, moved, or lifted into position. Switchboards shall be capable of being bolted directly to the floor without the use of floor sills.
  - 4. All switchboard sections shall have open bottoms and removable top plate(s) to install conduit.
  - 5. Type 1 front-access only switchboards shall be rear aligned for placement against a wall or free standing. Type 2 front/rear-access switchboards shall be front and rear aligned for free standing.
  - 6. Switchboards shall be UL listed.
  - 7. All covers shall be fastened by hex head bolts.
  - 8. Provide hinged doors over metering compartments and individually mounted device compartments. All doors shall have concealed hinges and be fastened by hex head bolts.
  - 9. Switchboard protective devices shall be furnished as listed on drawings and specified herein, including interconnections, instrumentation, and control wiring. Switchboards and devices shall be rated for the voltage and frequency listed on the drawings.
  - 10. Switchboard current ratings, including all devices, shall be based on a maximum ambient temperature of 25 degree C per UL Standard 891. With no de-rating required, temperature rise of switchboards and devices shall not exceed 65 degrees C in a 25 degree C ambient environment.
- E. Structure (Type 3)

1. Switchboard shall be completely self-supporting, forming a single metal enclosed structure. Sides, top, and rear covers shall be code gauge steel bolted to the switchboard structure. Frame structure members shall be die-formed, 11 gauge steel, minimum, bolted together and reinforced at corners. Sides, front and rear covers shall be minimum 13-gauge steel.
2. Switchboard frames shall be provided with adequate lifting means and be capable of being rolled or moved into position, and bolted directly to the floor without the use of floor sills.
3. Switchboard shall be front and rear aligned for free standing.
4. The switchboard shall be furnished with individually mounted main, tie and feeder circuit breakers or bolted pressure switches. Access to the load terminations shall be from the rear of the switchboard. The switchboard cable and bus compartment shall be isolated from the front-accessible protective device compartments by rigid glass-reinforced polyester barriers. Feeder breakers or switches shall have insulated load bus extensions to the rear cable compartment. It shall be possible to make up the outgoing feeder cable terminations without reaching into or over the switchboard horizontal or vertical busses. Rear covers shall be bolted.
5. The sides of each breaker and instrument compartment shall be isolated from adjacent compartments by a combination of steel and glass-reinforced polyester barriers. The top and bottom of each compartment shall be isolated with glass-reinforced polyester barriers. Cubicle doors for insulated case circuit breakers and for power circuit breakers used as main or tie breakers shall be hinged and provided with a quarter-turn latches. Breaker cubicle door latches shall have padlocking provisions.
6. Provide shutters in draw-out breaker compartments to cover breaker primary line and load disconnects when the breaker is removed from the compartment.
7. Switchboard sections shall have open bottoms in the cable compartment and removable top plates for installing conduits. Cable lashing bars shall be provided in each vertical section.
8. Pull boxes shall be provided on each switchboard section where indicated on the drawings. Pull box shall extend entire width and depth of cable compartment, shall have removable covers front and back. Rigid insulating barriers shall be provided at the bottom of the pull box.
9. Provide hinged doors over metering compartments and individually mounted device compartments. All doors shall have concealed hinges and be fastened by hex head bolts.
10. Switchboard protective devices shall be furnished as listed on drawings and specified herein, including interconnections, instrumentation, and control wiring. Switchboards and devices shall be rated for the voltage and frequency listed on the drawings.
11. Switchboard current ratings, including all devices, shall be based on a maximum ambient temperature of 25 degree C per UL Standard 891. With no de-rating required, temperature rise of switchboards and devices shall not exceed 65 degrees C in a 25 degree C ambient environment.

**F. Bus Bars**

1. Bus bars shall be tin-plated copper. The bus bars shall have sufficient cross sectional area to meet UL 891 temperature rise requirements through actual tests. Phase and neutral bus ampacity shall be as indicated on the drawings. The neutral bus shall have the same ampacity as the phase bus.
2. Bus bars shall be mounted on high impact, non-tracking insulated supports. Joints in the vertical bus are not permitted.
3. Bus bars shall be braced to withstand mechanical forces exerted during short circuit conditions as indicated in drawings, but in no case less than 65 kA RMS SYM. In addition, the main horizontal and section vertical bus of Type 3 switchboards shall have a 30-cycle short circuit withstand rating same as above.

4. A-B-C bus arrangement (left to right, top to bottom, and front to rear) shall be used throughout to assure convenient and safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.
5. All feeder device line and load connection straps shall be rated to carry current rating of device frame (not trip rating).
6. The main incoming bus bars shall be rated for the main protective device frame size or main incoming conductors, if there is no main device.
7. Main horizontal bus bars shall be fully rated and arranged for future extensions.
8. All draw-out breaker primary connections shall be silver-plated. Breaker primary connections for stationary-mounted breakers shall have the same plating as the main bus.
9. The main bus and riser bus shall be fully isolated from the circuit breaker, instrument, and auxiliary compartments. The vertical bus shall be mounted on supports of high impact, non-tracking, flame-retardant, molded glass-reinforced polyester. Vertical bus in molded case breaker sections shall be extended to all compartments in the section including blank compartments that may be at the top and / or bottom of the section.
10. A copper ground bus, 1.0 sq inches minimum, shall be secured to the rear frame of each vertical section and shall extend through the entire length of the switchboard. The ground bus shall be provided with a 4/0 terminal for connection to the electrical system ground. A lug strap shall be provided for each vertical section for feeder ground cable terminations.
11. All bus hardware shall be high tensile strength, grade 5, zinc-plated steel. All bolted bus joints shall be provided with split-type lock washers.
12. Type 3 switchboard feeder sections shall employ an insulated and isolated bus system that fully insulates the horizontal main bus and isolates each phase of the vertical riser bus. Main bus bars shall be insulated by a fluidized epoxy coating. Replaceable covers shall provide accessibility to main bus joints. No live connections shall be accessible from the rear except the breaker load side terminals in feeder sections, or around feeder circuit breakers. Taping of buss or joints will not be acceptable. Main and tie sections shall employ similar insulation as required.
13. Type 3 vertical and horizontal busses shall be isolated from the cable compartment by glass-reinforced polyester barriers or similar rigid insulating barriers. No live connections shall be accessible from the rear except the load side terminations.
14. For Type 3, provide barriers that enclose the depth and height of the rear of the switchboard section and isolate the bus and cable compartments of adjacent switchboard sections. Barriers between the cable compartment and the vertical bus shall be glass-reinforced polyester or similar insulating material with slots to fit around the bus bars. Barriers between cable compartments shall be steel panels.

G. Service Entrance

1. Switchboard Service Entrance sections shall comply with UL Service Entrance requirements including a UL service entrance label, incoming line isolation barriers, and a removable neutral bond to switchboard ground for solidly grounded wye systems.

H. Incoming Line Section

1. Incoming line section shall be the ampacity, wiring system, and type of connection as shown on the drawings.
2. Incoming line shall be directly connected to the transformer on unit substations.

I. Breaker Compartment

1. Type 1 Switchboards

- a. Switchboards rated 1200 amperes or less shall have group mounted main and group mounted feeder devices.
  - b. Switchboards 1600 amperes and larger shall have individually mounted main device and group mounted feeder devices.
  - c. Circuit breakers 1200 ampere and below shall be molded case circuit breakers.
  - d. Circuit breakers 1600 amperes and larger shall be insulated case circuit breakers.
  - e. Switches 1200 ampere and below shall be fusible switches.
  - f. Switches 1600 ampere and larger shall be bolted pressure switches.
2. Class 2 Switchboards.
  - a. Switchboards rated 1200 amperes or less shall have individually mounted main device and group mounted feeder devices.
  - b. Switchboards 1600 amperes and larger shall have individually mounted main device and group mounted feeder devices.
  - c. Circuit breakers 1200 ampere and below shall be molded case circuit breakers.
  - d. Circuit breakers 1600 amperes and larger shall be insulated case circuit breakers.
  - e. Switches 1200 ampere and below shall be fusible switches.
  - f. Switches 1600 ampere and larger shall be bolted pressure switches
3. Class 3 Switchboards
  - a. Main, Tie, and Feeder devices shall be individually mounted
  - b. Main and tie circuit breakers shall be Insulated Case Circuit Breaker
  - c. Feeder devices
  - d. Circuit breakers 1200 ampere and below shall be molded case circuit breakers.
  - e. Circuit breakers 1600 amperes and larger shall be insulated case circuit breakers.
  - f. Switches 1200 ampere and below shall be fusible switches.
  - g. Switches 1600 ampere and larger shall be bolted pressure switches.

J. Utility Metering Section

1. Provide utility metering section where indicated on drawings. Pull section and metering compartment shall comply with requirements of the serving utility.
2. Compartment shall be separated from the rest of the section, have a hinged lockable front cover, removable bus links with provisions for mounting current transformers, and when required, provisions for mounting voltage transformers. Current and voltage transformers shall be supplied and installed by the utility company.

K. Metering Transformers

1. All instrument transformers shall be UL listed and classified as indicated in drawings.
2. Current Transformers shall be as required with burden and accuracy to support connected meters and relays as required by ANSI/IEEE C57.13.
3. Potential transformers shall be provided where indicated on drawings with burden and accuracy to support connected meters and relays as required by ANSI/IEEE C57.13.

## 2.4 CIRCUIT BREAKERS & FUSIBLE SWITCHES

A. Molded Case Circuit Breakers

1. Group mounted breakers shall be connected to the vertical bus by bolted connections.

2. Individually mounted molded case circuit breakers shall be stationary mounted.
3. Circuit breaker frames shall be constructed of a high-strength, molded, glass-reinforced polyester case and cover. Breakers shall have an over center, toggle handle-operated, trip free mechanism with quick make, quick break action independent of the speed of the toggle handle operation. The design shall provide common tripping of all poles. Breakers shall be suitable for reverse feeding.
4. Breakers shall have ON and OFF position clearly marked on escutcheon. Breakers shall include a trip-to-test means on the escutcheon for manually tripping the breaker and exercising the mechanism and trip latch.
5. Breakers shall include factory installed mechanical lugs. Lugs shall be UL listed and rated 75 degrees C.
6. Breakers 150 amperes and smaller shall have a electronic trip unit with true digital RMS sensing trip units and an interchangeable rating plug to determine the breaker trip rating. They shall have an adjustable instantaneous with short time tracking function.
7. Breakers 225 amperes and larger shall have digital electronic trip units as described in paragraph 2.5.
8. Breakers shall be UL listed as 100 percent continuous duty rated unless noted otherwise on the drawings.

B. Insulated Case Circuit Breakers

1. Insulated case circuit breakers shall be individually mounted.
2. Main and tie breakers shall be manually or electrically operated, stationary or draw-out as indicated on drawings. Feeder breakers larger than 1200 amps shall be manually or electrically operated stationary or draw-out as indicated on drawings.
3. Breakers shall be constructed of a high dielectric strength, glass reinforced insulating case. The interrupting mechanism shall be arc chutes. Steel vent grids shall be used to suppress arcs and cool vented gases. Interphase barriers shall to isolate completely each pole.
4. Breakers shall contain a true two-step stored energy operating mechanism which shall provide quick make, quick break operation with a maximum five-cycle closing time. Breakers shall be trip free at all times. Common tripping of all poles shall be standard.
5. Insulated Case circuit breakers shall be rated to carry 100 percent of their frame ampacity continuously.
6. A charging handle, close push-button, open push-button, and Off/On/Charge indicator shall be located on the breaker escutcheon and shall be visible with the breaker compartment door closed.
7. Where draw-out breakers are specified, the draw-out design shall permit the breaker to be withdrawn from an engaged position, to a test position, and to a disengaged position.
8. Breaker digital electronic trip units shall be as described in paragraph 2.5.

C. Low Voltage Power Circuit Breakers

D. Circuit breakers shall be individually mounted, draw-out, low voltage devices, metal frame construction, manually or electrically operated as indicated on drawings with features and accessories as described in this specification.

1. Interrupting mechanism shall contain arc chutes to suppress arcs and cool vented gases. Breaker cubicles shall not require "flash shields".
2. Inter-phase barriers of insulating material shall isolate each breaker pole.
3. The breaker front shall have standard padlocking provisions to lock the breaker open and mechanically trip-free. The padlock provision shall accept up to three padlocks with one-quarter to three-eighth inch diameter shanks.

4. Each draw-out breaker shall have provisions for up to 72 dedicated secondary disconnects.
5. All breaker control circuits and trip unit inputs / outputs shall be wired through the secondary disconnects.
6. Secondary disconnects shall be self-aligning. They shall automatically couple with mating points in the breaker cubicle with the breaker in the 'test' or 'connect' position.
7. Circuit breakers shall have a rejection system that will only allow breakers of the correct ampere rating to be installed in the cubicle. A breaker with a higher short circuit rating may be mounted in the cubicle, if it has the same frame rating. Integrally fused breakers shall not be allowed to be mounted in cubicles for non-fused breakers.
8. Breakers shall have a rugged guide bar that ensures alignment of primary and secondary disconnects as the breaker is racked into the 'test' or 'connect' position.
9. Draw-out breakers shall have wheels to allow rolling the breaker into the cubicle, once it is installed on the draw-out rails.
10. Complete breaker operating status shall be available at the front of the breaker. Indicators in the breaker escutcheon shall provide closing spring status (charge / discharge), breaker main contact status (open / closed) and breaker draw-out position (connect / test / disconnect).
11. Circuit breakers shall be rated to carry 100 percent of the breaker current rating continuously. Provide breakers with current ratings as indicated on drawings.
12. Interrupting ratings shall be as shown on the drawings with a minimum of 65 kA.
13. Circuit breakers shall have true 30-cycle withstand capability equal to the breaker short time interrupting rating.
14. The circuit breaker shall not have a hidden instantaneous or a making current release to achieve short time withstand ratings.
15. Control voltage for electrically operated breakers 120 volts AC unless indicated otherwise on drawings.
16. Provide a true two-step, stored energy mechanism which shall provide quick-make and quick-break operation, including charge-after-close operation.
17. Closing springs shall be able to be discharged without closing main contacts.
18. Maximum closing time shall be 5 cycles at nominal control voltage.
19. Each breaker shall have a flush-mounted, retractable charging handle and close / open pushbuttons. The handle shall be able to completely charge an electrically operated breaker, if control power is lost during the charging operation.
20. All manual charge / close / open control operators shall be accessible from the breaker cubicle front with the breaker installed and the cubicle door closed.
21. Mechanical interlocks shall prevent moving the breaker from the 'connect', 'test', or 'disconnect' position unless the main breaker contacts are open.
22. The breaker shall be prevented from closing during any racking operation and shall remain trip free except in the 'test' or 'connect' position.
23. A mechanical interlock shall discharge the energy in the closing springs before the breaker is withdrawn from the cubicle.
24. The 'test' position shall permit operating the breaker while disconnected from power circuits.
25. Breaker digital electronic trip units shall be as described in paragraph 2.5.

E. Individually Mounted Fusible Switches

1. Bolted Pressure Switches shall be butt type contact construction with multiple, spring-loaded main arms and an arcing arm per pole. An over-center toggle mechanism shall provide quick make, quick break operation.
2. Switches shall have a molded insulating case and cover with integrally molded interphase partitions. All current carrying parts shall be silver plated copper.

3. Fusible switches shall be equipped with mounting provisions for UL class L fuses. Switches shall have an interrupting rating of 200 KAIC RMS SYM at 600V when used with class L fuses. Provide a complete set of UL class L fuses for each switch. (K rated when feeding a motor)
4. Switches shall be rated for making and breaking 12 times nameplate rated current at 600 VAC. Switches shall be rated to carry 100 percent of their frame ampacity continuously.
5. Switches shall be manually operated and stationary mounted. Switches shall have a front mounted operating handle for charging the closing springs and closing the switch and a push-button for opening the switch. Switches shall include a visible external ON - OFF indicator.
6. Switches shall have defeatable, front access, coin proof interlocks. Interlocks shall prevent opening switch door when switch is ON and prevent turning switch ON when door is open. Switches shall include provisions for padlocking the switch in the open position.

## 2.5 CIRCUIT BREAKER TRIP UNITS

- A. Provide power management digital electronic trip unit for main and tie circuit breakers and feeder protection digital electronic trip unit for feeder circuit breakers as indicated on drawings and as specified below.
- B. The trip unit shall provide protection from overload, short circuit, ground fault, and other optional functions as indicated on the drawings or specified. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.
- C. As a minimum, the trip unit shall have the following protective functions:
  1. Adjustable current setting or long time pickup
  2. Adjustable long time delay
  3. Adjustable instantaneous pickup (Shall have OFF-ON function so it can be turned off for normal operation and on for maintenance to reduce ARC FLASH hazards)
  4. Adjustable ground fault pickup and delay with a switchable I squared t ramp
    - a. Do not provide ground fault on 120/208 volt systems
    - b. Adjustable short time pickup and delay with a switchable I squared t ramp
- D. As a minimum, the trip unit shall include the following features:
  1. Long time and short time protective functions, shall have true RMS sensing technology
  2. Ground fault protective function, if provided, shall contain a memory circuit to integrate low level arcing fault currents with time, to sum the intermittent ground fault spikes
  3. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays
  4. Multi-button keypad to provide local setup and readout of all trip settings on the LCD
  5. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug
  6. An integral test jack for testing via a portable test set and connection to a battery source
  7. A mechanism for sealing the rating plug and the trip unit
  8. Noise immunity shall meet the requirements of IEEE C37.90
  9. Display trip targets for long time, short time, and ground fault, if included

- E. The feeder protection trip unit shall include the following metering functions, which shall be displayed on the LCD (if the manufacturers trip unit cannot incorporate the specified functions, separate device(s) with equal functions shall be provided for each breaker):
  - 1. Current, RMS, each phase
- F. The main and tie breaker power management trip unit shall include the following metering functions, which shall be displayed on the LCD (if the manufacturers trip unit cannot incorporate the specified functions, separate device(s) with equal functions shall be provided for each breaker):
  - 1. Current, RMS, each phase
  - 2. Voltage, RMS, line - to - line, or line - to - neutral
  - 3. Energy, KWH, total
  - 4. Demand KWH, over an adjustable time period of 5 to 60 minutes
  - 5. Peak demand, KW, user resettable
  - 6. Real power, KW, line - to - line, line - to - neutral
  - 7. Total (apparent) power, KVA, line to - line, line - to - neutral

## 2.6 WIRING

- A. All control wire shall be type SIS. Control wiring shall be #14 AWG for control circuits, #12 AWG for close, trip, and potential transformer circuits, and #10 AWG for current transformer circuits. Ring type terminals shall be used on all CT, PT, close, and trip circuits. Wire bundles shall be secured with nylon ties and anchored to the assembly with the use of pre-punched wire lances or nylon non-adhesive anchors. All current transformer secondary leads shall first be connected to conveniently accessible shorting terminal blocks before connecting to any other device. Shorting screws with provisions for storage shall be provided. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips and provisions for #10 AWG field connections. Each control wire shall be marked to the origin zone/wire name/destination zone over the entire length of the wire using a UV cured ink process. Provide wire markers at each end of all control wiring. Plug-in terminal blocks shall be provided for all shipping split wires. Terminal connections to remote devices or sources shall be front accessible via doors above each circuit breaker.
- B. Furnish fuse holders in switchgear when required.
- C. Terminal blocks for external connections shall be heavy duty, molded, one-piece type, rated 600 volts, 50 amperes.
- D. Terminal blocks shall be mounted in the rear cable compartment, easily accessible, away from the runbacks and cable terminals.
- E. Furnish a bolted steel cover to enclose the terminal blocks.
- F. NEMA 2-hole, long barrel crimp- type lugs shall be provided for all line and load terminations suitable for copper cable rated for 90 degrees C of the size indicated on the drawings.
- G. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

- H. Insulated, locking spade terminals shall be used on all #14 AWG terminations.
- I. Insulated, ring terminals shall be used on all #12 and # 10 AWG terminations.

## 2.7 ACCESSORIES

### A. Fuses

- 1. Manufacturer: Gould - Shawmut or equal.
- 2. Interrupting Rating of all fuses shall be 200,000 RMS amperes.

### B. Individually Mounted Fusible Switch Accessories

- 1. Provide the following UL listed accessories where indicated on the drawings:
  - a. 120 VAC Electric trip and control power transformer
  - b. Blown - fuse Protector
  - c. Provision for Key Interlock
  - d. Auxiliary Switches with one single-pole, double-throw elements
  - e. Integral, self-powered ground fault protection relay with mechanical ground fault indicator, test function, adjustable current pick - up and time delay, and current sensors as required. Ground fault relay shall have an internal memory circuit that integrates intermittent arcing ground faults with time.

### C. Furnish adhesive plastic strip mimic bus for switchboards.

### D. Furnish nameplates for each device as indicated in drawings. Color schemes shall be as indicated on drawings.

### E. Provide Transient Voltage Surge Suppression system where indicated on drawings and as specified in Section 264313.

## 2.8 FACTORY TESTING

- A. Perform all tests recommended by NEMA, IEEE and ANSI standards
- B. Perform complete operational checkout of all functions.

## 2.9 FINISH

- A. All steel surfaces shall be chemically cleaned prior to painting.
- B. Exterior paint color shall be ANSI 61 Light Gray over phosphate - type rust inhibitor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. The following procedures shall be performed by the Contractor:
  - 1. Examine installation area to ensure there is enough clearance to install switchboard.
  - 2. Check concrete pads for uniformity and level surface.
  - 3. Verify that switchboards are ready to install.
  - 4. Verify field measurements are as shown on Drawings.
  - 5. Verify that required utilities are available, in proper location and ready for use.
  - 6. Beginning of installation means installer accepts conditions.

### 3.2 INSTALLATION

- A. Contractor shall furnish and completely install all switchgear required and per manufacturer's instruction books
- B. Install required safety labels including arc flash requirements.
- C. All necessary hardware to secure the assembly in place shall be provided by the Contractor.
- D. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but is not limited to the following:
  - 1. Checking to ensure that all relays and/or protective devices are set properly
  - 2. Checking to ensure that the pad location is level to within 0.125 inches per three foot of distance in any direction
  - 3. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations
  - 4. Assembling all shipping sections, removing all shipping braces, and connecting all shipping split mechanical and electrical connections
  - 5. Securing assemblies to foundation or floor channels
  - 6. Measuring and recording Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four wire systems only).
  - 7. Measuring and recording the impedance of the equipment to the building grounding electrode.
  - 8. Inspecting and installing all circuit breakers in their proper compartments.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect installed switchboards for anchoring, alignment, grounding, and physical damage.
- B. Check tightness of all accessible electrical connections with a calibrated torque wrench. Minimum acceptable values are as specified in manufacturer's instruction manual.
- C. Check any key interlock system for proper functioning.

### 3.4 ADJUSTING

- A. Refer to manufacturer's instruction book to make adjustments to circuit breakers, doors, handles, etc., as required.
- B. Set trip units as per engineer's recommendations.
- C. Provide services of qualified factory trained field engineer to supervise installation and check out of Class 3 switchboards. Particular attention shall be paid to the automatic transfer scheme, (if provided) to ensure proper operation.

### 3.5 FIELD TESTING

- A. Perform all tests required and/or recommended by the commissioning specification, NETA, ANSI Standards, and the manufacturer.
- B. Perform complete operational checkout of all functions.
- C. Perform primary injection current testing of all circuit breakers 400 amperes and larger to ensure proper settings and tripping functions.

### 3.6 CLEANING

- A. Clean interiors of switchgear to remove construction debris, dirt, and shipping materials.
- B. Repaint scratched or marred exterior surfaces to match original finish.

### 3.7 TRAINING

- A. Provide services of qualified factory trained field engineer for training on Type 3 switchboards. Particular attention shall be paid to the automatic transfer scheme, (if provided) to ensure proper operation.

END OF SECTION 262413

## SECTION 262416 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide circuit breaker type panelboards as indicated on drawings and as specified hereinafter.

#### 1.2 RELATED SECTIONS

- A. Section 260519: Low-Voltage Electrical Power Conductors and Cables.
- B. Section 260526: Grounding and Bonding for Electrical Systems.
- C. Section 260553: Identification for Electrical Systems.
- D. Section 260573: Power System Studies.

#### 1.3 REFERENCES

- A. UL 67 Panelboards.
- B. UL 50 Cabinets and Boxes.
- C. NEMA PB 1.
- D. Federal Spec W-P-115C.

#### 1.4 SUBMITTALS

- A. Submit the following product data for review:
  - 1. Shop drawings showing circuit breaker or fusible switch layout, dimensions, voltage, phasing, continuous current capacity, short circuit rating, series rating (if applicable).
  - 2. Conduit entry location, cable termination sizes, mounting.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Square D.
- B. General Electric.

- C. Eaton/Cutler-Hammer.
- D. Siemens Energy and Automation.

## 2.2 PANELBOARD TYPES

- A. Circuit breaker type lighting and appliance panelboards for 120/208 volts, 3-phase, 4-wire service shall be equipped with circuit breakers having AIC ratings as indicated on the drawings, but not less than 10,000 AIC. Panelboards shall be equal to:
  - 1. Square D, "N" series.
  - 2. General Electric, Type AQ.
  - 3. Eaton/Cutler-Hammer, type PRL1A.
  - 4. Siemens, type P1.
- B. Circuit breaker type lighting and appliance panelboards for 277/480 volts, 3-phase, 4-wire service shall be equipped with circuit breakers having AIC ratings as indicated on the drawings, but not less than 14,000 AIC. Panelboards shall be equal to:
  - 1. Square D, "N" series.
  - 2. General Electric, Type AE.
  - 3. Eaton/Cutler-Hammer, type PRL2A.
  - 4. Siemens, type P2.
- C. Circuit breaker type power distribution panelboards for 120/208 volts, 3-phase, 4-wire service shall be equipped with circuit breakers having AIC rating as indicated on the drawings. Where AIC ratings are not shown on drawings obtain the rating requirements from the Architect. Panelboards shall be equal to:
  - 1. Square D, "I-Line" series distribution type.
  - 2. General Electric, "Spectra" series distribution type.
  - 3. Eaton/Cutler-Hammer, "PRL4B" distribution type.
  - 4. Siemens, type P4 or P5, depending upon panelboard ampacity.
- D. Circuit breaker type power distribution panelboards for 277/480 volts, 3-phase, 4-wire service shall be equipped with circuit breakers having AIC rating as indicated on the drawings. Where AIC ratings are not shown on drawings, obtain the rating requirements from the Architect. Panelboards shall be equal to:
  - 1. Square D, "I-Line" series distribution type.
  - 2. General Electric, "Spectra" series distribution type.
  - 3. Eaton/Cutler-Hammer, "PRL4B" distribution type.
  - 4. Siemens, type P4 or P5 depending upon panelboard ampacity.
- E. Where a power study is required by other sections and the results indicate that higher AIC ratings are required than shown on drawings, furnish panelboards and circuit breakers with AIC ratings in accordance with the power study.
- F. Fusible switch type power distribution panelboards shall be Square D Type QMB, Eaton PRL4F, GE Spectra Series and Siemens Type P4/P5.

- G. Provide fuses for fusible switch type distribution panelboards as specified in 26 05 00 and as shown on drawings. Provide R-clips in switches where Class R fuses are used.
- H. Bus bars shall be copper.
- I. Power distribution panelboards shall be a minimum 36" in width.
- J. Power distribution panelboards shall be furnished with full-height bussing.

## 2.3 REQUIRED FEATURES

- A. Provide circuit breakers with lugs (both main and branch circuit lugs) suitable and UL listed for both aluminum and copper conductors and rated for minimum 75 degrees C.
- B. Provide electrically isolated factory installed neutral bus. Neutral bus shall have at least 100% connection points based on panel circuit rating.
- C. Provide a second, fully rated electrically isolated factory installed, neutral bus where called for on the drawings.
- D. Provide separate ground bars complete with lugs or connectors on bar. Provide an additional copper isolated/insulated ground bar where indicated on drawings.
- E. Panelboard assembly shall be enclosed in a steel cabinet. The size of the wiring gutters shall be in accordance with U.L. Standard 67. Fronts shall have door with matching trim, be of code gauge full finished steel with rust inhibiting primer and baked enamel finish.
- F. Cabinets shall be equipped with spring latch and tumbler lock on door of trim. Doors over 48" long shall be equipped with three point latch and vault lock. All locks shall be keyed alike.
- G. Surface mounted panelboards shall be provided with hinged trims such that devices, lugs, and gutters may be exposed without completely removing trim. Flush mounted panelboards shall have "easy-to-remove" or "door-in-door" covers.
- H. Provide thermal magnetic circuit breakers which are fully rated and temperature rated for a 40 degrees C ambient. Breakers shall be quick-make, quick-break type with trip indication shown by handle position other than ON or OFF and with a common trip on all multi-pole breakers.
- I. Refer to drawings for numbers of branch circuits, their ratings, number of poles and arrangements.
- J. Exposed external surfaces of the enclosure and cover shall be properly cleaned and painted gray, ANSI 61.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Install per manufacturer's recommendations and contract documents.

- B. Ground separate ground bars to panel boxes and to the main service entrance ground bus with a code-sized equipment grounding conductor installed in the same conduit as the phase and neutral conductors.
- C. Install branch circuits using a separate neutral for each circuit. Multi-wire circuits are not acceptable.
- D. Provide six circuit breaker handle lock-on devices for each branch-circuit panelboard, installed as directed by Owner's Representative, to prevent unauthorized personnel from turning off circuits to controls, unit heaters, clocks, night lights. Turn spare lock-on devices over to the Owner's Representative.
- E. Provide typed directory cards under plastic on the doors of branch circuit panelboards. Directories shall indicate devices being served including space numbers or space names in which devices or fixtures are located. Space names and numbers shall match the graphics installed if different from the space names and numbers on the drawings.
- F. Provide shunt trip circuit breakers for elevator feeders.
- G. Provide shunt trip circuit breakers for kitchen equipment branch circuits under range hoods.
- H. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.
- I. Check all installed panels for proper grounding, fastening, and alignment.
- J. Remove debris from panelboards and wipe dust and dirt from all components.
- K. Repaint marred and scratched surfaces with touch-up paint to match original finish.
- L. Where panelboards are installed flush mounted, provide a minimum of (6)-1" spare conduits stubbed out above ceiling for future use by owner.
- M. Where multiple panels are flush mounted in public areas, provide enclosures and covers of matching dimensions.

END OF SECTION 262416

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide switches, receptacles, and other wiring devices as indicated on drawings.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Arrow Hart.
- B. Eagle.
- C. Hubbell.
- D. Leviton.
- E. Pass and Seymour.
- F. Novitas, Inc.
- G. Hubbell numbers are used unless otherwise noted, but products of equivalent quality by named manufacturers will be acceptable.

#### 2.2 DEVICE COLORS

- A. Provide IVORY colored devices where available, unless otherwise noted.
- B. Provide RED colored devices where available when connected to the emergency power system, unless otherwise noted. If red devices are not available, use a black device with a red plate.

#### 2.3 SWITCHES

- A. 15-Amp, 120/277 VAC, Heavy Duty Specification Grade:

1. Single pole toggle: Hubbell No. HBL1201I (normal), HBL1201R (emergency).
2. Double pole toggle: Hubbell No. HBL1202I (normal), HBL1222R (emergency).
3. Three-way toggle: Hubbell No. HBL1203I (normal), HBL1223R (emergency).
4. Four-way toggle: Hubbell No. HBL1204I (normal), HBL1224R (emergency).
5. Single pole toggle, weatherproof: Hubbell No. HBL1201I (normal), HBL1201R (emergency) with Hubbell No. HBL1795 weatherproof plate.
6. Single pole illuminated toggle with light on with load off, 120/277 VAC: Hubbell No. HBL1201IL (normal), HBL1221ILR (emergency).
7. Single pole illuminated toggle with light on with load on, 120/277 VAC: Hubbell No. HBL1201PLC (normal), HBL1221PL (emergency).

B. 20-Amp, 120/277 VAC, Heavy Duty, Specification Grade:

1. Single pole toggle: Hubbell No. HBL1221I (normal), HBL1221R (emergency).
2. Double pole toggle: Hubbell No. HBL1222I (normal), HBL1222R (emergency).
3. Three-way toggle: Hubbell No. HBL1223I (normal), HBL1223R (emergency).
4. Four-way toggle: Hubbell No. HBL1224I (normal), HBL1224R (emergency).
5. Single pole toggle, weatherproof: Hubbell No. HBL1221I (normal), HBL1221R (emergency) with Hubbell No. HBL1795 weatherproof plate.
6. Single pole illuminated toggle with light on with load off, 120/277 VAC: Hubbell No. HBL1221IL (normal), HBL1221ILR (emergency).
7. Single pole illuminated toggle with light on with load off, 120/277 VAC: Hubbell No. HBL1221IL (normal), HBL1221ILR (emergency).

C. Incandescent Dimmers:

1. Preset slide control: Hubbell "AS" Series, 120-volt, 800, 1000, 1500, or 2000 watts as required for load.
2. Rotary Model: Hubbell "AR" Series, 120-volt, 800, 1000, 1500, or 2000 watts as required for load.

D. Occupancy Sensor Switches, 120/277 VAC:

1. Wall mounted, automatic on/manual on, passive infrared with ambient light sensing, minimum 1000 s.f. room coverage and 500 s.f. desktop activity coverage, 800 W @ 120V and 1200 W @ 277V: Leviton No. ODS10-ID.

## 2.4 RECEPTACLES

A. 15-Amp, 125 VAC, Heavy Duty, Specification Grade:

1. Ground fault circuit interrupter, tamper & weather resistant: Hubbell No. GFR5262ITR (normal) GFR5262RTR (emergency).
2. Duplex, tamper resistant: Hubbell No. HBL8200SGIA (normal), HBL8200SGRA (emergency).
3. Duplex, Hubbell HBL5262I (normal), HBL5262R (emergency).
4. Duplex, weather resistant, Hubbell HBL5262IWR (normal), HBL5262RWR (emergency).
5. Duplex, isolated ground, Hubbell IG5262 (normal), IG5262R (emergency).
6. Single outlet, Hubbell HBL5261I, (normal), HBL5261BK unless red is available, use a red plate (emergency)..

B. 20-Amp, 125 VAC:

1. Duplex type: Hubbell No. HBL5362I (normal), HBL5362R (emergency).
2. Ground fault circuit interrupter, tamper & weather resistant: Hubbell No. GF5362ITR (normal), GF5362RTR (emergency).
3. Duplex, tamper resistant: Hubbell No. HBL8300SGIA (normal), HBL8300SGRA (emergency).
4. Duplex, weather resistant, Hubbell HBL5362IWR (normal), HBL5362RWR (emergency).
5. Duplex, isolated ground, Hubbell IG5362 (normal), IG5362R (emergency).
6. Single outlet, Hubbell HBL5361I, (normal), HBL5361BK unless red is available, use a red plate (emergency).
7. Duplex, load controlled, permanently marked: Hubbell BR20C1 (split wired) or BR20C2. Provide with CU300HD control units as required for interface with occupancy sensors.

C. Weatherproof Type Cover:

1. Damp location and outdoors protected from weather: Hubbell No. WP8V, WP8H, WP26V, or WP26H.
2. Wet location and outdoors exposed to weather: Hubbell No. WP26E, WP26EH, or WP262EH.

D. Miscellaneous Receptacles:

1. Single 20-amp, 125/250 VAC, 3 pole, 4 wire, grounding, NEMA 14-20R: Hubbell No. HBL8410.
2. Single 20-amp, 250 VAC, 3 pole, 4 wire, 3 phase, grounding, NEMA 15-20R: Hubbell No. HBL8420.
3. Single 30-amp, 125 VAC, 3 pole, 3W, grounding, NEMA 5-30R: Hubbell No. HBL9308.
4. Single 30-amp, 125/250 VAC, 3 pole, 4W, grounding, NEMA 14-30R: Hubbell No. HBL9430A.
5. Single 50-amp, 125/250 VAC, 3 pole, 4W, grounding, NEMA 14-50R: Hubbell No. HBL9450A.
6. Clock outlet with clock hanger: Hubbell No. HBL5235. Install outlet so that top of clock is 12" below finished ceiling.

E. Floor Mounted:

1. Standard Floor Box, 1 to 3 gang:
  - a. Cast Iron (slab on grade applications): Walker No. 880CS-1 series.
  - b. Stamped Steel (elevated slab applications): Walker No. 880S series.
  - c. Combination Carpet & Tile Flange: Brass - Walker No. 817B (1 gang), Black - Walker No. 817PCC-BLK (1 gang) or Brown - Walker No. 817PCC-BRN (1 gang).
  - d. Cover Plate with Flip Lids: Brass - Walker No. 828R (1gang), Black - Walker No. 828PR-BLK (1 gang) or Brown - Walker No. 828PR-BRN (1 gang).
2. Floor Box, Multi-service, 4 compartment:
  - a. Cast Iron (slab on grade applications): Walker No. RFB4-CI-1.
  - b. Stamped Steel (elevated slab applications): Walker No. RFB4.
  - c. Flanged Cover and Trim Ring: Walker No. S36CCTC with Aluminum, Black or Brass finish.
3. Flush mounted, fire-rated poke-through fitting power and voice/data service:

- a. Flush Service Fitting with 1-20amp receptacle and 2 communication outlets: Hubbell No. FRF.
  - b. Through-Floor Fitting: Hubbell No. PT7FSD.
  - c. Finish Color: Brass, Black, Gray, Ivory or Brown.
- 4. Furniture Feed, fire-rated, poke-thru device for power and voice/data service:
  - a. Service Fitting: Hubbell No. FRF3.
  - b. Through-Floor Fitting: Hubbell No. PT73SD.
  - c. Finish Color: Gray or Ivory.
- 5. Pedestal type, 2 gang, fire-rated poke-through device for power and voice/data:
  - a. Pedestal Housing and Faceplates: Hubbell No. FR280GY with SS2309DGY and SS2309SLG faceplates.
  - b. Through-Floor Fitting: Hubbell No. PT27A.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION REQUIREMENTS

- A. Install weather resistant receptacles in damp and wet locations.
- B. Mounting:
  - 1. Mount switches 46" above the finished floor to center line of switch unless noted otherwise.
  - 2. Mount receptacles 18" above the finished floor to center line of receptacle unless noted otherwise.
  - 3. Install receptacles shown on the drawings as "special mounting height" at mounting height indicated on drawings. Where no mounting height is given and receptacles are above counters, mount receptacles with centers 4" above top of counter. If the counter has a backsplash, receptacles shall be mounted with centers 4" above top of backsplash. Where special mounting height receptacles are not above counters and no mounting height is indicated, receptacle mounting heights shall match adjacent light switches or above counter receptacles. Coordinate the installation of all special mounting height receptacles with architectural design.
  - 4. Work devices to nearest block course using proper type outlet boxes as specified under Section 260535. Check architectural and furniture drawings for counter (desk, special booth, etc.) locations. Mount devices above work counters. Verify other special mounting conditions and locate devices as required.
- C. Polarity: Wire receptacles so that the hot wire, neutral wire and ground wire connect to the proper terminals.
- D. Wiring: Spade type insulated terminals shall be used on stranded wire. Feed thru feature shall not be used. Feed thru circuits shall be connected using proper wire nuts with a jumper wire connection to receptacle.
- E. Terminal connection: Push-in type wire connections shall not be used. All terminations shall be made using the screw terminals with proper torque.

- F. Grounding: Install a No. 12 green ground wire from device grounding terminal back to grounding bus in panelboard.
- G. Install floor boxes or poke-through fittings where shown on drawings with receptacle and/or communication outlet quantities as shown on drawings.
  - 1. Install one 3/4" conduit from power compartment to a junction box above accessible ceiling for each floor box. Box configuration to allow interconnection from end power compartment to opposite end power compartment.
  - 2. Install one dedicated 1" conduit from each communications compartment, stubbed out above accessible ceiling for each floor box.
- H. Install receptacles with ground pin up.
- I. For GFCI receptacles, do not utilize feed-thru feature, unless indicated so by drawings. If feed-thru is used, all downstream receptacles must have a GFCI Protected label on them.
- J. The feed-thru connection of the receptacle shall not be used when 15 ampere receptacles are installed on a 20 ampere circuit. The feed-thru circuit and incoming circuit must be connected with proper wire nuts with a pigtail out to the receptacle.
- K. The push in connection shall not be used. All connections shall be made using screw type terminals.
- L. Where stranded wire is used, proper sized, spade type, insulated terminals shall be used.
- M. A single receptacle installed on an individual branch circuit shall have an ampere rating of not less than that of the branch circuit.
- N. For emergency circuits, receptacles and cover plates shall be identified by a distinctive color, (red), consistent throughout the facility. If red device(s) are not available, use a black device with a red plate.

END OF SECTION 262726

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 262727 - WIRING DEVICE PLATES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide device plates on switches, receptacles, telephone outlets and miscellaneous devices.

#### 1.2 RELATED SECTIONS

- A. Section 262726: Wiring Devices.

#### 1.3 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Arrow Hart.
- B. Eagle.
- C. Hubbell.
- D. Leviton.
- E. Pass & Seymour.
- F. Novitas, Inc.

#### 2.2 PRODUCTS

- A. Provide specification grade nylon device plates from the wiring device manufacturer. Provide device plates in colors to match the associated devices.
- B. Provide cast alloy or stamped metal plates on surface mounted switches, receptacles, and other devices.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Install device plates in full contact with wall surface. Plates shall not project out from the wall.
- B. Install device plates in full contact with surface mounted box. Plates shall not project out from the edge of the box.
- C. Install plates for tamper resistant type receptacles with tamper resistant screws.

END OF SECTION 262727

## SECTION 262816 - ENCLOSED SWITCHES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Sections 26 05 00.
- B. Provide safety switches with the number of poles and fuses as shown on the drawings and/or as required by the National Electrical Code.

#### 1.2 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. General Electric
- C. Eaton/Cutler-Hammer
- D. Siemens Energy Automation

#### 2.2 CONSTRUCTION

- A. Switches shall be heavy duty, 240 or 600 volt, horsepower rated, quick make, quick break, fusible type.
- B. Switches shall have arc shields, be of enclosed construction with lugs suitable for 75 degrees C copper or aluminum conductors.
- C. Switches shall have the number of poles as shown or as required by the application. Provide six-pole safety switches for part-winding, delta-wye start, or two-speed motors requiring a remote disconnect between the controller and the motor.
- D. Switches shall have a factory installed equipment grounding lug kit. Switches shall be lockable in the open, (off) or closed (on) position.
- E. Switches shall have close and withstand rating, switch interrupting rating, and fuse interrupting rating as required by the application, load current, and short circuit current available at the point of use.

- F. Enclosure shall be NEMA 1 for general indoor use, NEMA 12 for dusty locations, NEMA 4 for damp and wet locations and outdoor use, and NEMA 4X for corrosive locations. Hazardous locations shall be the Class and Type as required by NEC Article 500 through Article 516.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION REQUIREMENTS

- A. Install a safety switch at all remote motor locations as indicated on drawings and/or as required by NEC Article 430.
- B. Identify safety switches with Bakelite nameplates in accordance with Section 260500.
- C. Switch shall be installed within sight of the controller and/or the motor as required by NEC Article 430.102.
- D. Switches used for service equipment shall be Heavy Duty type, UL listed for service equipment use.

END OF SECTION 262816

## SECTION 262817 - COMPANY SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Division 26 Common Work Results for Electrical applies to work of this section.

#### 1.2 SUMMARY

- A. Provide company switches with sizes as indicated on the drawings.
- B. Company switch shall be completely factory assembled as a unit.
- C. Company switch shall be manufactured by ESL Power Systems, Union Connector, or approved equal.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data on the company switches.
- B. Switch Product Data: Include construction details, material, dimensions and descriptions of individual components.
- C. Wiring Diagrams showing all internal wiring.
- D. Submit sample UL Listing label.

#### 1.4 QUALITY ASSURANCE

- A. All equipment shall be in compliance with codes and standards referenced in Section 260500 titled "Common Work Results for Electrical."
- B. UL Compliance: Comply with requirements of UL 891, "Switchboards". Provide company switches which have been UL listed and labeled.
- C. UL Compliance: Comply with requirements of UL 498, "Attachment Plugs and Receptacles." Provide receptacles which have been UL listed and labeled.
- D. Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", including, but not limited to, tightening of electrical connectors to torque values indicated.

## PART 2 - PRODUCTS

### 2.1 COMPANY SWITCHES

- A. Company switches shall be dead front construction with integral main breaker and Cam-Lok type receptacles. All wiring within the company switch shall all be stranded copper and shall terminate at a copper bus.
- B. All company switches shall be NEMA 1 enclosed in interior locations. Provide NEMA 3R weather proof enclosures where indicated on the drawings or exposed to exterior or damp locations. Provide 100A, 200A and 400A as indicated on drawing:
  - 1. 100A: ESL CS1-100C-208Y/120/120-65-311-LS-CW1.
  - 2. 200A: ESL CS2-200C-208Y/120/120-65-311-LS-CW1.
  - 3. 400A: ESL CS4-400C-208Y/120/120-65-311-LS-CW1.
- C. All company switches shall have a direct cable connection chamber. Chamber shall be lockable.
  - 1. Connection chamber shall accommodate dual rated mechanical lugs for connection of bare ended copper cables.
  - 2. Provide strain relief connection points for bare ended copper cable connections.
  - 3. Provide hinged trap door for cable access that can be secured with a latch only accessible from the inside of the enclosure.
- D. Slots shall be provided between each of the receptacles to prevent hysteresis currents.
- E. Provide either surface or recessed mounting as indicated on the drawings.
- F. Wire bending space as required by the NEC.
- G. Company switch shall have UL label fixed to the exterior of the housing.
- H. Features:
  - 1. Phase indicator LED lights identifying when power is connected at each phase and to indicated ground integrity.
  - 2. Conduit knockouts.
  - 3. Placard on each company switch indicating the connection and disconnection order as required by NEC 520.53 K (3).

### 2.2 RECEPTACLES

- A. Furnish single pole Cam-Lok type receptacles in each company switch as indicated on the drawings. Each company switch shall accommodate three phase connections, a ground connection and a neutral connection.
- B. Receptacles shall have the following properties:
  - 1. Rated at 600 Volts.
  - 2. NEMA 3R.
  - 3. Insulated housing.

4. High impact resistant thermoplastic housing.
5. Color coated:
  - a. Phase A: Black.
  - b. Phase B: Red.
  - c. Phase C: Blue.
  - d. Neutral: White.
  - e. Ground: Green.
6. Receptacles shall be of the following type:
  - a. J-Series 1016 type double cam brass connector.
  - b. Posi-Lock UL E67181 sequential interlocking features requiring connection and disconnection in series.

C. Provide one set of matching plugs (turn around) for each company switch.

## 2.3 MAIN BREAKER

- A. Main breaker shall be UL listed 100% rated molded case type, fully rated at 65 kAIC at 240 Volts. The breaker shall be manually operated type frame and be stationary mounted.
- B. Main breaker handle shall be accessible from the front of the company switch without opening any doors or compartments.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF COMPANY SWITCHES

- A. Install company switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's Standards of Installation. and in accordance with recognized industry practices.
- B. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.
- C. Coordinate company switch installation work with electrical raceway and cable work, as necessary for proper interface.
- D. Provide engraved, plastic laminate labels for all company switches indicating name, voltage, phase, wire and short circuit rating. Refer to Section 260553 for more information.

### 3.2 GROUNDING

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground for electrical company switches.
- B. Refer to Section 260526 for additional grounding requirements.

### 3.3 FIELD QUALITY CONTROL

- A. Tests shall conform to International Electrical Testing Association (INETA) Standard ATS, "Acceptance Testing Specifications for Electrical Power Distribution Equipment."
- B. Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.
- C. Infrared Inspection (After Energized):
  - 1. The scan is to include all electrical company switch field connections to buss bars and loads.
  - 2. All equipment should be energized at normal load levels for at least 1 to 2 hours prior to being scanned.
  - 3. Access covers are to be removed and reinstalled by the electrical contractor for the Engineer to inspect and scan all electrical junctions, buss, and cable.
  - 4. The IR Scan will be made using an AGEMA 720 camera. The camera shall provide infrared photos clearly indicating problem areas.
  - 5. All problem areas will be noted as to location, description, and recommended solution by providing a typed report including infrared and Polaroid pictures of all problem areas.

END OF SECTION 262817

## SECTION 262913 - MOTOR STARTERS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Motor starters.
- B. Provide wiring in accordance with Section 260500.

#### 1.2 RELATED SECTIONS

- A. Division 23: HVAC.
- B. Section 260519: Low Voltage Electrical Power Conductors.
- C. Section 260533: Raceways and Conduit Systems.
- D. Section 260553: Identification for Electrical Systems.

#### 1.3 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Allen Bradley.
- B. Eaton.
- C. General Electric.
- D. Siemens Automation.
- E. Square D.

#### 2.2 STARTERS

- A. Design: NEMA standard, UL listed and CSA approved.
- B. Ratings: A/C symmetrical ratings of 50,000 amps for 460 volt equipment and 35000 amps for equipment of lower voltages. Provide higher ratings where available fault current exceeds these ratings and as called for on drawings.

- C. Size: In accordance with NEMA standards.
- D. Provide the number of auxiliary contacts as required as required for proper system operation including all necessary interlock wiring. A minimum of one NO and one NC contacts in addition to the seal in contact shall be provided.
- E. Starters shall include solid state, adjustable overloads in each phase with loss of phase protection. The relays shall be Class 20 unless noted otherwise on the drawings and/or power system study.
- F. Provide starters mounted in NEMA 1 general purpose enclosures, unless location of starter dictates other NEMA enclosure. For example, provide NEMA Type 4 enclosures for damp or wet locations, indoor or outdoor use, NEMA 4X for corrosive areas, and NEMA Type 7 or Type 9 enclosures for hazardous areas.
- G. Provide Hand-Off-Automatic selector switches in each starter.
- H. Provide reduced voltage starters as shown on the drawings.
  - 1. Auto Transformer: Closed transition, 50%, 65%, 80%, taps, set at 65%.
  - 2. Wye-Delta starters: Closed transition type.
  - 3. Solid State: The controller shall include soft start, soft stop, current limiting, adjustable initial torque, kick start, full voltage and coast-to-rest starting and stopping modes.
- I. Provide 120 volt control transformers in each starter, individually fused from the line side of the starter using two cartridge fuses and one fuse in the secondary. Size transformers to carry the holding coil circuit and other connected devices.
- J. Provide lockable combination starters with motor circuit protectors sized in accordance with the NEC Article 430.
- K. Provide built-in power factor correction capacitors on motors 50 horsepower and larger to correct the power factor to 95%. Connect capacitors between the contactor and overload relays.
- L. Pushbutton station, selector switches, and pilot lights:
  - 1. Oiltight, manufacturer's standard unit.
  - 2. Pushbutton station: Momentary contact type with green start button, red stop button, and legend plate.
  - 3. Selector switches: Standard knob maintained contact type with legend plate.
  - 4. Pilot lights: 120 volt lamps with green glass color cap.
- M. Manual Motor Controller
  - 1. The controller shall be marked with a horsepower rating equal to or greater than the motor nameplate rating.
  - 2. Provide melting alloy type overload relays sized per the motor nameplate full load current.
  - 3. Provide controller mounted in NEMA 1 general purpose enclosures, unless location of controller dictates other NEMA enclosure. For example, provide NEMA Type 4 enclosures for damp or wet locations, indoor or outdoor use, NEMA 4X for corrosive areas, and NEMA Type 7 or Type 9 enclosures for hazardous areas. Provision for padlocking shall be provided.

N. Motor Rated Switch

1. The switch shall be marked with a horsepower rating equal to or greater than the motor nameplate rating.
2. Provide a NEMA 1 enclosure with a padlocking provision.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. Install motor starters in accordance with manufacturer's recommendations and requirements of NEC.
- B. Adjust thermal overloads at system startup to motor nameplate full load current in accordance manufacturer's recommendation for specific application.
- C. Connect Divisions 21, 22 and 23 equipment ready for operation.
- D. Coordinate equipment locations and starter sizes with Divisions 21, 22 and 23 Contract Documents, submittals, and shop drawings.
- E. Verify phase rotation of motors with Divisions 21, 22 and 23.
- F. Identify starters and controls as required by Section 260500.

END OF SECTION 262913

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 263005 - UTILITY FLOOR BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. Provide complete assembly for electrical power, A/V and telephone/data in a concrete tight, water-tight, non-corrosive enclosure suitable for flush floor installation in vehicular traffic areas with concentrated loads.
- B. The Contractor shall furnish all conduit, wire, connectors, hardware, pipe, fittings, and other incidental items necessary for the complete and properly functioning devices as described herein and shown on the plans.
- C. The Contractor shall coordinate the mounting of the utility boxes among all associated trades.

#### 1.3 SUBMITTALS

- A. Shop drawings shall be submitted for approval in accordance with division 1 requirements:
  - 1. Bill of Materials.
  - 2. Catalog Cut Sheets of all components (breakers, receptacles, etc.)
  - 3. Shop Drawings detailing all mechanical and electrical equipment including internal wiring, and physical dimensions. Include all hardware items supplied.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer's products shall be listed by Underwriters Laboratories, UL508 electrical assembly, ETL 3043274 and IAPMO.
- B. Equipment specified herein shall be the coordinated product of a single manufacturer. All trims, frames, covers, enclosures, electrical, plumbing and cabinet fabrication must be by one manufacturer.
- C. Manufacturer shall supply full testing documentation. Boxes shall be certified and stamped by a structural engineer and include all test results based on loads.

#### 1.5 WARRANTIES

- A. All equipment shall be warranted free of defects in materials and workmanship for a period of one year from date of acceptance of the project by the Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Boxes shall be the standard product of a company regularly engaged in the manufacture of combined utility boxes. Basis of design is CUB.

### 2.2 LOAD RATING

- A. The lid shall be capable of bearing the following loading conditions for 20 minutes without permanent deformation:
  - 1. A solid tire forklift with a lifting capacity of 30,000 pounds and a dead weight of 34,000 pounds. The maximum total load on the two front wheels is 62,000 pounds and on one wheel is 30,000 pounds. The solid tire foot-print is assumed to be 16 inches by 1 inch.
  - 2. A six-wheel pneumatic tired vehicle with a lifting capacity of 62,000 pounds and a dead load weight of 80,600 pounds. The maximum total load on four front wheels is 142,600 pounds and on one wheel is 35,650 pounds. The assumed foot-print is 16 inches by 15 inches, based on 150 P.S.I. tire pressure. The dual wheels are spaced 20 inches on center.
  - 3. Minimum safety factor: 1.65.
  - 4. Minimum load rating for the lid shall be 32,000 pounds.

### 2.3 UTILITY BOXES

- A. Trim:
  - 1. The Trim shall be fabricated from 1/4" carbon steel, ASTM.
  - 2. Galvanize trim after fabrication.
- B. Frame:
  - 1. A cast, A356-T6 aluminum frame shall mount flush with the trim, cover, and floor.
  - 2. The finish is to be sand cast with flat square pattern and groves to form the pattern, should be 1/16" x 1/16" cross sections, spaced 1/2" apart.
  - 3. Aluminum castings shall be Aluminum Association No. A356-T6 minimum with a yield stress of greater than 20,000 PSI minimum.
  - 4. Frame shall have hold down anchor holes to secure the frame during the concrete pour.
- C. Cover:
  - 1. Covers shall be cast, A356-T6 aluminum.
  - 2. Finish shall be the same grooved, square pattern as the frame. Patterns shall be continuous.
  - 3. Maximum weight is 37 pounds.
  - 4. Each cover shall have two cable doors and one self-retracting inside/outside handle.
  - 5. Mating surfaces shall be gasketed.
  - 6. Aluminum castings shall be Aluminum Association No. A356-T6 minimum with a yield stress of +20,000 PSI minimum.

7. Covers will have double handles that will operate from the interior and exterior of the cover depending on if the cover is open or closed.
8. Cable access doors shall have break away friction hinges that will keep them in either open or closed position when the cover is opened. Metal hinges that do not retain position will not be approved.
9. Covers, when opened, shall allow full access to all plug devices without obstruction of the cover's frame.
10. Covers must be able to be fully closed even when devices have been plugged-in. Covers that require their removal when in use will not be allowed, exception type "M".

D. Enclosure:

1. Box shall be fabricated from 3/8" PVC or 304 stainless steel.
2. Partitions shall be welded in place to form watertight joints.
3. Openings in box shall be cut in the field by others.
4. Box shall be removable after installed in the concrete without having to cut the concrete. Removal demonstration shall be required by the Specifying Engineer prior to approval.
5. Provide provisions for a pilot drain. Drain shall be connected and piped to indirect drain within the building.

E. Dead Front:

1. Dead front sub-panel for electrical components shall be fabricated from 304 stainless steel.
2. Dead fronts shall be held in place by captive screws.
3. All devices on dead fronts shall be furnished with gasketed covers.

F. Assembly:

1. Finished assembly of trim, frame and covers are to be flat and level with the floor within 1/8".
2. Sub-panels fasteners shall be captive stainless steel.
3. Gaskets shall be 1/8" thick neoprene and resistant to oil, acids, abrasive, aging and oxidation. Gaskets to be held in place with adhesive.
4. Nameplates shall be white with black letters.
5. Each receptacle and each breaker shall be labeled with amperage and phases per IEEE recommended practice.

## 2.4 ELECTRICAL (BOXES PER PLANS)

A. Devices:

1. Electrical components shall be U.L. Listed.
2. Lugs rated minimum 75 degrees C.
3. Refer to section 262726 for device requirements.

B. Wiring:

1. Wiring shall be 75 degree C THWN or XHHW.
2. Color Code:
  - a. Ground - Green.

- b. Neutral - White or Grey.
- c. A phase - Black.
- d. B phase - Red.
- e. C phase - Blue.

C. Receptacles:

- 1. Refer to drawings and details.

D. Telecommunications (per plans and as follows)

- 1. Category V, triplex, RJR-45 connectors, back box only (2) (device by others).
- 2. Data Connectors back box only (2) (device by others).
- 3. Cover.
- 4. Wiring by others.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Provide temporary covers for use during construction.
- B. Install per manufacturers recommendations.
- C. Provide documentation consisting of engineering test reports, drawings, bill of materials, and spare parts list.

END OF SECTION 263005

## SECTION 263213 - EMERGENCY ENGINE AND GENERATOR SYSTEM

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. This section defines requirements for an emergency engine generator system. Provide system complete for automatic, unattended operation for the duration of any loss of normal utility power as defined herein. Include the following features and accessories with the system:
  - 1. Engine-generator set.
  - 2. Battery charger.
  - 3. Base mounted fuel oil tank.
  - 4. Silencer.
  - 5. Remote annunciator.
  - 6. Starting batteries.

#### 1.2 RELATED SECTIONS

- A. Section 231113: Facility Fuel Oil Piping.
- B. Section 233319: Sound Attenuators.
- C. Section 263600: Transfer Switches.

#### 1.3 REFERENCES

- A. The engine-generator set and components are designed, manufactured, and installed in accordance with the latest issue of the following codes and standards:
  - 1. NFPA-30 - Flammable and Combustible Liquids Code.
  - 2. NFPA-37 - Standard for the Installation and Use of Stationary Combustible Engines and Gas Turbines.
  - 3. NFPA-70 - National Electrical Code.
  - 4. NFPA-99 - Standard for Healthcare Facilities.
  - 5. NFPA-101 - Life Safety Code.
  - 6. NFPA- 110- Standard for Emergency and Standby Power Systems.
  - 7. EPA- Non-road Compression-Ignition Engines -- Exhaust Emission Standards.
  - 8. CFR Title 40 Part 1039, Subpart B.

#### 1.4 SUBMITTALS

- A. Include the following Product Data
  - 1. Features, components, ratings, & performance.

2. Dimensioned outline and elevation drawing for all components.
3. Thermal damage & decrement curves, positive, negative, & zero sequence impedances, sub-transient & transient reactance, X/R ratio, and time constraints.
4. Time-current characteristic curves for generator protective device.
5. Cost per kWh generated when running at full load and 0.8 PF when running on 100% fuel oil and on 75% natural gas and 25% fuel oil.

B. Shop Drawings

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, and location and size of each field connection.
2. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
3. Design calculations signed and sealed by a qualified professional engineer. Calculate requirements for selecting isolators and seismic restraints and for designing vibration isolation bases.
4. Vibration base details providing detail of fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
5. Wiring diagrams of all power, signal and control wiring indicating factory and field wiring.
6. Provide all drawings in an 11" x 17" minimum size.
7. Provide all drawings on a CD in AutoCAD format.

C. Test Reports

1. Report of factory test on units to be shipped for this project, showing evidence of compliance with specified requirements.
2. Exhaust emissions test.
3. Sound measurement test.
4. Full load test at 0.8 power factor per NFPA 110.

D. Maintenance Data

1. List of tools and parts recommended being stored at site.
2. Recommended monthly and yearly maintenance items.
3. Emergency phones numbers.

E. Motor Starting Data

1. Provide a computerized motor starting analysis indicating voltage drop at each stage using load schedule provided by Engineer.

F. Sequence of Operation

1. Partial loss of utility power and return to utility power.
2. Complete loss of utility power and return to utility power.
3. Load addition program.
4. Load shed program.
5. One or more generators out of services.

## 1.5 PROJECT RECORD DOCUMENTS

- A. Submit a minimum 8 copies of record information including:
  - 1. As-built record drawings as follows:
    - a. Front View.
    - b. Floor Plan.
    - c. Elementary Diagram showing power, metering and control circuits.
    - d. Bill of Material.
    - e. One Line Diagram.
    - f. Three Line Diagram.
  - 2. Instruction books on major components.
  - 3. Installation drawings.
  - 4. Installation acceptance as required by NFPA 110, section 7.13.
  - 5. Recommended renewal parts information.

## 1.6 OPERATION AND MAINTENANCE DATA

- A. Provide minimum 8 copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 01 and Division 26.
- B. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product.

## 1.7 QUALITY ASSURANCE

- A. Engine-generators shall be completely factory assembled and tested. The engine-generator set shall be the product of a single manufacturer.
- B. Only manufacturers who have specialized in the manufacture and assembly of diesel engine-generator sets for 25 years will be considered.
- C. Manufacturer's Certificate of ISO 9002 Compliance.

## 1.8 REGULATORY REQUIREMENTS

- A. In accordance with International Building Code, manufacturer shall test or analyze the engine-generator components and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by Engineer and by the building official. Qualification shall be by an actual test on a shake table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces, by the use of experience data or by a more rigorous analysis providing for equivalent safety. Refer the IBC and ASCE 7-05 for complete requirements.
- B. Low voltage circuit breakers and equipment shall be listed by Underwriters Laboratories in accordance with standards listed in Article 1.4 of this specification and shall bear the UL label.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to the designated job site and unload on the designated concrete pad.
- B. Provide proper and adequate protection during construction to protect all components from dust, moisture, and physical damage.

1.10 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate with Division 23 for installation of exhaust muffler and piping. Piping and installation requirements are specified in Division 23. The muffler is provided under Division 26.
- C. Coordinate with Division 23 for installation of fuel system including day tank, main fuel tank and piping. The main fuel tank, piping and installation requirements are specified in Division 23. The day tank is provided under Division 26.

1.11 MAINTENANCE SERVICE

- A. After acceptance by owner, begin a 12 month full service maintenance contract. Provide a minimum of quarterly exercising to check for proper starting, load pick up, load shedding, running under load. Perform routine preventive maintenance as recommended by the manufacturer and adjusting as required for proper operation. Provide all parts and supplies as required.

1.12 EXTRA MATERIALS

- A. Provide extra materials described below that match installed products and that are packaged with a protective cover and identified with labels.
  - 1. Fuses: One for every ten of each type and rating, but not less than three of each.
  - 2. Indicator Lamps: Two for every six of each type, but not less than two of each.
  - 3. Filters: One set of each, lubricating oil, fuel, and combustion air.

1.13 WARRANTY

- A. General Warranty
  - 1. Provide written warranty executed by manufacturer, agreeing to repair or replace the engine, generator, and associated components that fail in materials or workmanship for a period of one year from date of Owner's acceptance of equipment.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Engine generator unit:
  - 1. Caterpillar.
  - 2. Cummins.
  - 3. Kohler/Mitsubishi.

### 2.2 ENGINE-GENERATOR SET

- A. Provide engine-generator set that is a coordinated assembly of compatible components with engine and generator manufactured by the same manufacturer or by two manufacturers with a working agreement in place.
- B. Classification: Suitable for use on a Level 2, Type 10, Class 6 EPPS.
- C. Power Output Ratings: Nominal KW and voltage ratings as indicated on drawings with standby duty rating.
- D. Output Connections: Three phase, four wire.
- E. Safety Standard: Comply with ASME B15.1.
- F. Engine Exhaust Emissions: Comply with EPA Non-road Compression-Ignition Engines -- Exhaust Emission Standards, and any additional emissions requirements by state or local authorities for non-road reciprocating compression ignition engines as applied by state and local authorities having jurisdiction (AHJ).
  - 1. When used as a emergency standby unit, all engines must meet the following requirements as a minimum:
    - a. 450 kW and below: Tier 3.
    - b. 500 kW and larger: Tier 2.
  - 2. When used as a prime or continuous unit, all engines must meet the following requirements as a minimum:
  - 3. All sizes: Tier 4.
- G. Ship unit with nameplates attached to each major system component. Identify manufacturer's name, address, model and serial number for each component.
- H. Fabricate engine-generator set mounting frame and attachment of components to resist generator set movement during a seismic event when generator set mounting frame is anchored to building structure.
- I. Mount engine-generator on a frame with adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments on frame arranged for lifting with slings without damaging components.

1. Inscribe on metal plate permanently attached to mounting frame to indicate location and lifting capacity of lifting attachment and generator set center of gravity.

## 2.3 GENERATOR SET PERFORMANCE

- A. Steady-State Voltage Regulation: Plus or minus 1% from no load to full load with steady state modulation of 1/2%.
- B. Transient Voltage Regulation: Not more than 35% variation upon application of full load with recovery to steady state conditions within 5 seconds.
- C. Steady-State Frequency Regulation: Plus or minus 1/2%.
- D. Transient Frequency Regulation: Not more than 20% variation upon application of full load with recovery less than 5 seconds.
- E. Sustained Short Circuit Current: Capable of supplying a minimum of 300% of rated full load current for a minimum 10 seconds for a three-phase bolted short circuit with automatic clearing of the fault without damage to winding insulation or other generator system components.
- F. Start Time: Capable of reaching operating voltage and frequency within the shortest time practicable and within eight (8) seconds.
- G. Oversizing generator compared with the rated output of the engine is permissible to meet specified performance. Show ratings required on the contract documents rather than the ratings that would normally be applied to the generator size on the nameplate data.

## 2.4 SERVICE CONDITIONS

- A. Environmental Conditions: Provide system capable of operating within the following environmental conditions without mechanical or electrical damage or degradation of performance:
  1. Ambient Temperatures: minus 20 to 104 deg F.
  2. Relative Humidity: 0 to 95 percent.
  3. Altitude: sea level to 1000 feet or altitude of actual Project site if higher than 1000 feet
  4. The ambient temperature in the EPS equipment room or outdoor housing containing Level 1 EPS rotating equipment shall be not less than 40 degrees F.

## 2.5 ENGINE REQUIREMENTS

- A. Fuel: Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1800 rpm.
- C. Four cycle engine with maximum piston speed of 2250 fpm.
- D. Lubrication System: Pressurized by a positive displacement, engine driven pump. Includes the following items:

1. Filter & Strainer: Rated to remove 90% of particles, 5 micrometers and smaller while passing full fuel flow.
  2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Provide unit capable of full flow, designed to be fail-safe.
  3. Crankcase Drain: Arranged for complete gravity drainage to an easy removable container without any disassembly and without use of pumps or siphons or special tools.
- E. Engine Fuel System: Complies with NFPA 37 and is grade DF-2. Includes the following items:
1. Fuel Pump: Engine mounted and ensures adequate primary fuel flow under starting and full load conditions.
  2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Provide engine with thermostatically controlled, 120 volt, water jacket heaters to maintain minimum 90 degrees F water jacket temperature under ambient conditions. Control jacket heaters off when the engine is running. Consult with, and coordinate special and extreme cold weather needs with Engineer.
- G. Governor: Electronic.

## 2.6 ENGINE COOLING SYSTEM

- A. Closed loop, liquid cooled with factory mounted radiator and engine driven fan, jacket water pump, and fan guard. Equip radiator with air discharge duct adaptor. Direct air to the outside through a duct system as indicated on drawings. Furnish and install radiator duct and flexible connection under Division 23.
- B. Coolant: Anti-freeze coolant, 50% ethylene-glycol and 50% water mixture, with anticorrosion additives as recommended by engine manufacturer, supplied by the Contractor at start-up.
- C. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.
- D. Fuel Oil Cooler: Equip radiator with a factory installed, radiator mounted fuel oil cooler sized per manufacturer's recommendation.

## 2.7 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30.
- B. Base Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
1. Tank level indicator with contact to indicate "low level alarm".
  2. Capacity: Fuel for 6 hours continuous operation at 100 percent rated power output
  3. Vandal resistant fuel cap.
  4. Containment Provisions: Provide double wall tank with leak containment capability, able to contain full volume of fuel tank in containment section.
  5. Provide a 36 inch wide walkway with metal railings and steps to grade on both sides of the generator enclosure to facilitate maintenance.

## 2.8 ENGINE EXHAUST SYSTEM

- A. Silencer: Critical zone - Provide dual inlet, single outlet configuration for Vee-type engines. Provide flanged n.p.t. connections for all fittings.
- B. Silencer Mounting: Equip silencer with mounting brackets for horizontal mounting from the structure above.
- C. Condensate Drain: Install condensate trap and petcock drain in silencer and connect with schedule 40, black steel pipe. Extend drain and drain plug beyond insulation to facilitate draining.
- D. Connection from Engine to Exhaust System: Install a stainless steel, bellows type, flexible section of a minimum 36 inches between the exhaust manifold and the exhaust silencer.
- E. System Insulation: Fully insulate exhaust systems (under Division 23) that are installed inside structures. Install sleeves for lines passing through walls to pass through.

## 2.9 COMBUSTION AIR INTAKE

- A. Combustion Air Intake: Heavy duty, engine mounted air cleaner with replaceable dry filter and pre-filter, and a "blocked filter" indicator.

## 2.10 STARTING SYSTEM

- A. Starter Motors: Dual heavy duty starter motors connected in parallel, each capable of cranking the engine for 45 seconds continuous and for 3 cycles for 75 seconds, (15 seconds cranking, 15 seconds at rest.), with the other starter out of service.
- B. Starting Batteries: Provide batteries capable of starting unit in time specified under installed conditions and capable of 45 seconds of continuous engine cranking and 3 cranking cycles for 75 seconds, (15 seconds cranking, 15 seconds at rest.) Install batteries in steel, insulated rack(s). Provide heavy-duty long life, lead-acid or nickel-cadmium type batteries with plastic case. Engine manufacturer to size and furnish battery cables.
- C. Automatic Battery Charger: Current limiting, automatic equalizing and float charging type with the following features:
  - 1. Operation: Equalizing charging rate of 10 A, initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Once achieved, automatically switch to lower float-charging mode until battery is discharged again.
  - 2. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperatures from minus 40 deg F to plus 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - 3. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
  - 4. Ammeter and Voltmeter: Flush mounted in door, providing indication of charging rates.
  - 5. Safety Functions: Sense low battery voltage and battery charger failure. Provide contacts to indicate either alarm condition on system control panel and remote alarm monitoring panel.

6. Enclosure and Mounting: NEMA Type 1, wall mounted cabinet.

## 2.11 GENERATOR, EXCITER AND VOLTAGE REGULATOR

- A. Drive: Direct connect generator and engine shafts.
- B. Enclosure: Drip proof.
- C. Four pole revolving field, 1800 rpm, 2/3 to 5/6 pitch, form wound, permanent magnet type, single bearing, brushless type, with six leads. Two or more generators that will be paralleled shall have identical pitch, impedances, and 3rd harmonic voltages. Where one or more generators will be paralleled with an existing generator(s), the pitch, impedances, and 3rd harmonic voltages will be optimized for best possible performance. When used in the southern coastal states, tropical type insulation shall be used.
- D. Class F insulation system or better with temperature rise maintained within NEMA MG-1-22.40 standards for all nameplate voltages at fully rated load.
- E. All load connections shall be made up in rear mounted terminal box.
- F. Construct terminal box to allow load connections to be made on top, bottom or either side of junction box. Provide room for mounting of differential current transformers.
- G. Rotating rectifier shall employ three phase sensing.
- H. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- I. Voltage Regulator: Static type with a voltage adjusting rheostat furnished in the control panel.

## 2.12 CONTROL AND MONITORING

- A. Functional Description: The mode selector switch will determine the system operation as follows:
  - 1. Mode selector switch in "AUTO" position: Starting and stopping of the generator will be initiated by remote control contacts in one or more separate automatic transfer switches.
  - 2. Mode selector switch in "ON" position: The generator set starts and runs.
  - 3. Mode selector switch in "OFF" position: Initiates generator set shut-down.
  - 4. When generator is running, specified system or equipment failures automatically shut down the generator set regardless of switch position. Operation of a remote emergency stop switch also shuts down the generator set.
- B. Generator Control Panel: Panel of NEMA 1, dead front construction including the following meters, monitoring lights or controls:
  - 1. A.C. ammeter (2%), with phase selector switch.
  - 2. A.C. voltmeter (2%), with phase selector switch.
  - 3. Frequency meter (2%), dial type.
  - 4. Elapsed time meter.
  - 5. Panel illumination lamps.

6. Voltage adjusting rheostat.
  7. Governor speed control switch.
  8. Automatic, solid state, start/stop control system with a cranking cycle of 3 cycles of 15 seconds cranking with 15 seconds rest and a engine shutdown after 3 cycles.
  9. Mode selector switch or switches for "off", "manual", "automatic", "reset"
  10. Automatic engine shutdown device with indicating lamps to indicate that a shutdown took place for:
    - a. Overcrank (failed to start).
    - b. Overspeed.
    - c. Low lubricating oil pressure.
    - d. Excessive engine temperature.
    - e. Differential current trip. (600 kW and larger).
  11. Engine oil pressure gauge.
  12. Engine water temperature gauge.
  13. Visual pre-alarm warning devices to indicate:
    - a. Low oil pressure.
    - b. High engine temperature.
    - c. Low water temperature.
    - d. Low fuel level.
    - e. Mode selector switch not in "automatic" position.
    - f. Battery charger failure.
    - g. Low battery voltage.
  14. Provide lamp test, alarm horn and silence switch.
  15. Provide a dry contact for an output trip signal to a remotely mounted circuit breaker for any circumstance where it is desirable to trip the generator load circuit breaker.
  16. Shock mount generator control panel on unit unless indicated otherwise on drawings.
- C. Remote Annunciator Panel: Solid state, 120 volt panel with battery powered back up. Locate and mount panel where indicated on drawings and include indicating lamps with lamp test, alarm horn and silence switch for:
1. Low oil pressure (shut-down).
  2. Low oil pressure (pre-alarm).
  3. Low water temperature (warning).
  4. Excessive engine temperature (shut-down).
  5. Excessive engine temperature (pre-alarm).
  6. Low fuel level.
  7. Overspeed (shutdown).
  8. Overcrank (failed to start).
  9. Differential current trip. (600 kW and larger).
  10. Indicating lamp for generator carrying load.
  11. Red lamp to indicate when mode selector switch is in a position other than "automatic".
  12. Indicating lamp for ground fault sensed on system (only if generator circuit breaker is 1000 A or larger).
- D. Furnish and install a remote emergency stop station for engine- generator(s). Locate where indicated on drawings or as required by local authorities. Use a red, mushroom head, push-button with a breakable glass enclosure.

- E. Provide remote "emergency start" device in fire command room.

## 2.13 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: 600 volt, Insulated case, electronic trip type, 100 percent rated, complying with UL 489. Note: Circuit breaker not required if generator output terminates onto switchgear with a main circuit breaker properly sized to protect the generator.
  - 1. Tripping characteristics: Adjustable long-time, short-time and instantaneous, and ground fault alarm. Instantaneous must have a time delay setting.
  - 2. Trip settings: Matched to generator thermal damage curve as closely as possible. Trip settings must not exceed the generator current decrement curve.
  - 3. Shunt trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Generator differential current protection. (600 kW and larger).
  - 5. Mounting: Adjacent or integral with control panel.
- B. Ground Fault indication: Comply with NFPA 70, Article 700-7(d) for systems with circuit breakers 1000 amp or larger. Provide a ground fault detector and alarm system, including ground fault sensor, adjustable time delay relay, test circuit, alarm light and audible signal, silence-auto-test selector switch and fused control circuit transformer. Annunciate audible signal and illuminate alarm light upon detection. Install a placard at each breaker as follows: "Upon detection of a ground fault, immediately notify electrical personnel that a ground fault exists. Investigate and clear ground fault after utility power is restored."

## 2.14 OUTDOOR ENCLOSURE FOR OUTDOOR INSTALLATIONS

- A. Provide an outdoor rated enclosure for housing this complete system. Provide acoustically insulated, sound attenuated enclosure with the following:
  - 1. Weather resistant steel enclosure with polyester powder baked paint
  - 2. The enclosure shall have insulated walls, roof, and floor with door gaskets and powered louvers designed such that the inside ambient air can be maintained at 40 degrees F or higher with an outdoor ambient temperature of 0 degrees F. Fans also shall be provided with power intake air louvers designed to maintain the inside air temperature to approximately the outside air temperature.
  - 3. Sound attenuation performance equal to or better than 75db at 23 feet from unit unless otherwise noted on plans.
  - 4. Safety glass, control panel viewing glass.
  - 5. Stainless steel locks and hinges and zinc coated hardware.
  - 6. Double wall tank built into the skid. Refer to "Fuel Supply System" for requirements.
  - 7. Enclosure designed for single point lift.
  - 8. Provide battery heating pads, water jacket and day tank heaters.
  - 9. Provide lighting fixtures for task illumination, battery-powered lighting units (minimum 2), and receptacles for maintenance.
  - 10. Rodent and insect screens. When used in the southern coastal states, tropicalization of the enclosure shall be provided.
- B. Install one single phase, 120/240 volt load center within enclosure to serve:
  - 1. Water jacket heater.

2. Battery heating pads.
3. Duplex receptacle and maintenance lights.
4. Battery charger.
5. Strip heater in alternator enclosure.
6. Day tank fuel heater (where design temp. below 0 deg F.).

## 2.15 SOURCE QUALITY CONTROL

- A. Project Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
  1. Full load run with 0.80 PF in accordance with NFPA 110, paragraph 7.13.
  2. Maximum power.
  3. Voltage regulation.
  4. Transient and steady-state governing.
  5. Single-step load pickup.
  6. Safety shutdown.
- B. Observation of Factory Tests: Provide 14 days advanced notice of tests and opportunity for observation of tests by Owner's representative.
- C. Report factory test results within 10 days of completion of tests.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install entire unit in accordance with manufacturer's recommendations and in compliance with NFPA 110.
- B. Ground the engine generator frame and enclosure using an equipment grounding conductor sized in accordance with the NEC. For an outdoor installation this conductor may be required to be a grounding electrode conductor depending on where the generator neutral is bonded.
- C. Neutral connection: Solidly grounded system neutral. The location of the neutral connection shall be as shown on the drawings. If the generator is located outside the building, it is considered a derived system by the NEC and the generator neutral point must be bonded to a grounding electrode before the 1st overcurrent device. A grounding electrode must be in close proximity to the generator.
- D. Terminate fuel oil lines and lube oil drain in base. Extend lube oil drain line out to beyond the base to facilitate changing of the oil. Install flexible fuel line sections (18 inches long) between base and fuel lines.
- E. Install packaged engine generator to provide access without removing connections or accessories for periodic maintenance.
- F. Install heavy-duty, steel spring vibration isolators between the base and mounting pad. Size and locate isolators as recommended by generator manufacturer.

- G. Install seismic restraints, suitable for the job site, as recommended by manufacturer.
- H. Engage the services of a factory trained engineer for periodic jobsite visits during installation to ensure that the system is being installed in accordance with manufacturer's recommendations. Have factory engineer coordinate with the switchgear field engineer to ensure proper application of the load shedding and load adding program.
- I. Receive, store, uncrate and temporarily connect resistive type load bank(s) for full load testing of the system. After completion of testing, disconnect, crate and load for shipment.
- J. Provide fuel as required to satisfy testing requirements. Turn equipment over to Owner with fuel tank full, complete with additives as recommended by manufacturer.

### 3.2 TESTING REQUIREMENTS

- A. Engage a factory-authorized service representative to test the system as detailed in NFPA 110, paragraph 7.13, and record the results. Furnish certifications required by NFPA 110, paragraph 7.13.11.
  - 1. Furnish and connect temporary load banks under this Division if required. Building load may be used if available and approved by Owner.
  - 2. Include test data in the Owner's Representative's manuals.
- B. Engage a factory-authorized service representative to perform a complete operational sequence test as directed by the Engineer or as included in the commissioning documents. Test shall include all the requirements of NFPA 110, paragraph 7.13. Coordinate this performance test with testing of automatic transfer switches.
- C. Engage a factory-authorized service representative to perform a complete operational sequence test as directed by the Engineer or as included in the commissioning documents. Coordinate this performance test with testing of paralleling switchgear and automatic transfer switches.
- D. Invite the authority having jurisdiction to witness the test procedures.

### 3.3 TRAINING REQUIREMENTS

- A. Provide field engineer for 5 days of owner training on the system operation. Schedule the training one month in advance with Owner. Prepare an agenda combining class time with hands on demonstrations and experience. Send the agenda to the Owner prior to training for review.

END OF SECTION 263213

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 263353 - STATIC UNINTERRUPTIBLE POWER SUPPLY

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. The requirements of the Contract, Division 01, and Division 26 apply to work in this Section.
- B. Furnish and install Uninterruptible Power Supply systems as specified herein and hereafter referred to as the "UPS", to provide continuous, regulated AC power to critical loads under normal and abnormal conditions, including loss of the utility AC power.
- C. The KVA rating of the UPS shall be as shown on the drawings.

#### 1.2 RELATED SECTIONS

- A. Section 260553: Identification of Electrical Systems.
- B. Section 260519: Low-voltage Electrical Power Conductors and Cables.

#### 1.3 REFERENCES

- A. Uninterruptible power systems in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).
- B. UL 1778 - Uninterruptible Power Supply Equipment.
- C. NFPA 70 - National Electrical Code.
- D. IEEE 446 - Recommended Practice for Standby Power Systems.
- E. IEEE 587/ANSI C62.41 - Recommended Practice for Surge Withstandability.
- F. NEMA PE 1 - Uninterruptible Power Systems.
- G. OSHA - Occupational Safety and Health Association.
- H. FCC Class A, Part 15.

#### 1.4 SUBMITTALS

- A. Manufacturer shall provide 8 copies of following documents to owner for review and approval.
  - 1. Catalog cuts describing the proposed equipment shall be submitted. All deviations to this specification shall be listed and included with the proposal.
  - 2. System configuration with single line and three line diagrams. Each circuit breaker shall be identified by location, frame size, trip rating, AIC, and manufacturer with type number.

3. Weight, dimensions, and heat dissipation.
4. Installation drawings with conduit entry locations, customer connections, and minimum clearances required on all sides.
5. Front View.
6. Plan View.
7. Elementary Diagrams.
8. Bill of Material.
9. Battery type, amp-hour rating, cell voltage discharge voltage, and time to recharge to 95% voltage.

## 1.5 PROJECT RECORD DOCUMENTS

### A. Manufacturer shall submit minimum 8 copies:

1. Include as built record drawings as follows:
  - a. Front View.
  - b. Floor Plan.
  - c. Elementary Diagram showing power, metering and control circuits.
  - d. UPS internal wiring diagrams.
  - e. Bill of Material.
  - f. One Line Diagram.
  - g. Three Line Diagram.
2. Instruction books on major components.
3. Installation drawings.
4. Certified test reports.
5. Recommended renewal parts information.

## 1.6 DEFINITIONS

- A. UPS Module: The portion of the UPS system which contains the rectifier/charger, inverter, static bypass switch, maintenance bypass switch, controls, monitoring, and indicators.
- B. Rectifier/Charger: The portion of the UPS module which converts the normal source AC input power to DC power for the inverter input and for charging the battery.
- C. Inverter: The portion of the UPS module which converts DC power, from either the rectifier/charger or the battery, to regulated and filtered AC power which is supplied to the critical load.
- D. Automatic Bypass Switch: The portion of the UPS module which automatically transfers the critical loads, without interruption, from the inverter output to the bypass AC power source in the event of an overload or degradation of the inverter's performance.
- E. Maintenance Bypass Switch: The portion of the UPS module which is used to connect the bypass AC power source to the critical loads while electrically isolating the static bypass switch, rectifier/charger, and inverter for maintenance purposes.
- F. Battery: The battery system that provides DC power to the inverter input when the normal AC input power to the UPS module fails or in the event that the rectifier/charger should fail.

- G. Critical Loads: Those loads that require regulated continuous AC power and which are connected to the output of the UPS module.

#### 1.7 SYSTEM DESCRIPTION

- A. The power system feeding the UPS, unless indicated otherwise on the drawings is a 480 volt, 60 Hertz, 3 phase, 4 wire, solidly grounded wye.

#### 1.8 OPERATION AND MAINTENANCE DATA

- A. Manufacturer shall provide 8 copies of an Operations and Maintenance Manual to owner upon delivery of the equipment and shall include as a minimum the following.
  - 1. General information.
  - 2. Safety precautions.
  - 3. Operating instructions.
  - 4. One certified copy of the factory test report shall be furnished upon request.
  - 5. After Installation of Equipment: A signed service report describing start-up and on-site testing shall be furnished after start-up of the equipment.

#### 1.9 QUALITY ASSURANCE

- A. The manufacturer shall have a quality assurance program with checks on incoming parts, modular assemblies, and final products. This quality program shall meet ISO-9001 requirements.
- B. The UPS module shall be "burned-in" without failure for a minimum of eight hours.
- C. A final test procedure for the product shall include a check of performance specifications before and after the 8-hour "burn-in."
- D. An on-site test procedure shall include a check of controls and indicators after installation of the equipment.

#### 1.10 REGULATORY REQUIREMENTS

- A. Comply with all applicable requirements of:
  - 1. Underwriters Laboratories.
  - 2. National Electrical Code.
  - 3. Factory Mutual.
  - 4. State and local codes.
- B. In accordance with International Building Code, manufacturer shall test or analyze the UPS components and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by Engineer and by the building official. Qualification shall be by an actual test on a shake table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces, by the use of experience data or by a more rigorous analysis providing for equivalent safety. Refer the IBC and ASCE 7-05 for complete

requirements.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's installation and maintenance manuals.
- B. Ship each UPS section in individual shipping splits for ease of handling (max 48"). Each section shall be mounted on shipping skids and wrapped for protection.
- C. Contractor shall inspect and report concealed damage to carrier within 48 hours.
- D. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Provide heat in the enclosures to prevent condensation.
- E. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.

#### 1.12 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

- A. UPS shall be located in well-ventilated areas, free from excess humidity, dust, and dirt and away from hazardous materials. The UPS shall be designed for indoor installation with ambient temperatures from 32 deg " 104 deg F (0 " 40 deg C), 77 deg F " 5 deg F (25 deg C) for the battery and relative humidity from 0 - 95% non-condensing.
- B. The UPS shall be designed for operation at an altitude of up to 1000 meters without derating.

#### 1.13 SEQUENCING AND SCHEDULING

- A. Provide a detailed installation, testing, and operational schedule for each UPS.

#### 1.14 WARRANTY

- A. The manufacturer shall state his warranty of the equipment. In no case shall it be less than twelve (12) months after start-up or eighteen (18) months after shipment, whichever occurs first.
- B. The battery cell manufacturer's standard warranty shall be passed through to the end user.

#### 1.15 EXTRA MATERIALS

- A. Provide a list of recommended spare parts with the proposal.
- B. Provide a cost adder to provide recommended spare parts.

## 1.16 FIELD MEASUREMENTS

- A. Make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Liebert.
- B. Toshiba.
- C. Schneider Electric/MGE.
- D. Eaton/Cutler Hammer.
- E. General Electric.
- F. MITSUBISHI.

### 2.2 EQUIPMENT

- A. Furnish Uninterruptible Power Supplies as described in this specification and as indicated on drawings.

### 2.3 COMPONENTS

- A. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.
- B. The UPS system shall consist of the appropriate number of UPS units, as indicated on drawings, for capacity and/or redundancy. Each UPS unit shall consist of a UPS module and a battery. The AC output of the UPS module shall be connected to the critical loads. The battery shall be connected to the DC input of the UPS. All UPS modules are to be operating simultaneously and sharing the load. The UPS configuration shall be a single module or multiple paralleled UPS modules rated to supply the load as specified herein. Special paralleling cabinets, control cabinets, and bypass circuits shall not be required for parallel systems. Up to eight modules may be paralleled in any combination for capacity or redundancy.
- C. UPS modules rated at 10kVA and 20kVA shall be available with internal or external batteries. The internal batteries (if included) shall be rated 14 minutes for 10kVA and 5 minutes for 20kVA. Longer runtimes will require an external battery, and the internal battery will be omitted.
- D. UPS modules rated at 30kVA and above shall have external batteries only.

- E. Maintenance and servicing of UPS shall not be restricted by proprietary software or external interface devices. Any factory trained service provider shall be capable of performing maintenance and repair of the UPS. Calibration and diagnostics of the UPS shall be capable either remotely or thru the front display and shall be facilitated thru programmable parameters only.
- F. Enclosure: The UPS electronics shall be housed in a standard indoor enclosure. The enclosure shall be primed and painted inside and outside with manufacturer's standard paint. The enclosure shall be freestanding.
- G. Mobility: The equipment shall be suitable for location directly on computer room raised flooring. Maximum dimensions (not including batteries) shall be as indicated on the drawings.
- H. Layout: Modules and subassemblies shall be mounted in open construction style so that each may be easily serviced or replaced from the front of the enclosure. The equipment shall be constructed so that each power assembly can be replaced without a soldering iron or special tools. Cable and conduit connections shall be through the top or bottom of the UPS enclosure.
- I. Material and Workmanship:
  - 1. Workmanship shall be accordance with industry standards.
  - 2. All material shall be new and of best industrial grade.
  - 3. Internal wiring conductors shall be combined into cables or bundles, and shall be tied securely together.
  - 4. All bundled wiring shall be identified by color codes or by wire numbers. Power cables shall be identified at each end.

## 2.4 ELECTRICAL CHARACTERISTICS

- A. UPS Module Input:
  - 1. Voltage: As indicated on drawings.
  - 2. Voltage Range: -20% to +15% without discharging the battery.
  - 3. Frequency: 60-Hertz 10% continuous.
  - 4. Current Walk-In: 20% to 100% of full load rating over 30 seconds.
  - 5. Maximum Input Current: 115% of nominal full load current.
  - 6. Power Factor: > 0.92 lagging at nominal input voltage.
  - 7. Current harmonics: < 7% THD on 350 KVA and smaller units and < 5% THD on 400 KVA and larger units at nominal conditions and at full UPS rating (100% nonlinear load).
  - 8. Input transient protection: ANSI C62.41, Category A & B compliance.
  - 9. EMI filter: FCC Class A, Subpart J of Part 15 compliance.
- B. UPS Module Output:
  - 1. Voltage: As indicated on drawings.
  - 2. Frequency: 60 Hz.
  - 3. Power rating: As indicated on drawings.
  - 4. Voltage regulation: 1% of nominal for any of the combined effects:
    - a. No load to full load.
    - b. Minimum to maximum output power factor.
    - c. Minimum to maximum AC input voltage.

- d. Minimum to maximum DC input voltage.
- e. 0 to 40° C ambient temperature.
- 5. Dynamic regulation: 3% from nominal for 100% step load. 2% from nominal for 50% step load. Recovering to within 1% in less than one cycle.
- 6. Voltage adjustability: 5%.
- 7. Voltage unbalance: 3% of nominal for 100% unbalanced loads.
- 8. Phase separation:
  - a. 120° 1% of nominal for 100% balanced loads.
  - b. 120° 2% of nominal for 100% unbalanced loads.
- 9. Voltage distortion (Linear load) : < 2% THD at 100% load.
- 10. Voltage distortion (Non-linear load - IEC62040) : < 3% THD at 100% load.
- 11. Frequency stability: 60 HZ 0.01% free running.
- 12. Phase-lock window: 60 HZ, 4% (adjustable).
- 13. Frequency slew rate: 0.1 Hz to 20 Hz/second, selectable in 0.1 Hz increments.
- 14. Overload capability.

a. Inverter:

- 1) 125% for 10 minutes.
- 2) 150% for 60 seconds ( < 500 KVA).
- 3) 150% for 10 seconds ( > 500 KVA).

b. Automatic bypass:

- 1) 110% continuously.
- 2) 200% for 5 minutes.

15. Fault clearing capability.

a. Inverter:

- 1) 220% for 100 milliseconds.
- 2) 700% for 1.2 milliseconds.

b. Static bypass: 1000% for 1/2 cycle (non-repetitive).

16. Crest factor: 3:1.

C. System Efficiency

1. 300 KVA & larger units:

- a. 100% load: 0.94.
- b. 75% load: 0.92.
- c. 50% load: 0.90.

2. 250 KVA & smaller units:

- a. 100% load: 0.92.
- b. 75% load: 0.90.

- c. 50% load: 0.88.

D. Battery

1. Voltage: 480VDC nominal (240 cells).
2. End of discharge voltage: 396VDC, adjustable.
3. Run time: 15 minutes at 100% of UPS rated load unless noted otherwise.
4. Recharge time: 10 times discharge to 95%.
5. Type: lead-acid or nickel-cadmium.

2.5 RECTIFIER/CHARGER

- A. The rectifier/charger shall consist of an input switch, an input EMI/transient suppressor network, output filter and a solid-state, three-phase rectifier with control circuitry to provide constant voltage/constant current regulation and a current walk-in on start-up of the rectifier/charger. The rectifier/charger shall be a full wave controlled type using SCRs in both the positive and negative legs to eliminate even ordered harmonics.

B. Overcurrent/Transient Protection

1. The input of the rectifier/charger shall be protected from noise and transients by an input EMI/transient suppressor network. The suppressor network shall be fused in order to minimize damage to the UPS in the event that input transients exceed the rating of the suppression network.
2. The rectifier/charger shall be electronically regulated and current limited to protect the connections to the inverter input and to prevent damage to the battery.

C. Control Circuitry

1. The rectifier/charger shall be equipped with Digital Signal Processor (DSP) control circuitry to provide constant DC voltage regulation of  $\pm 1\%$  for  $\pm 15\%$  AC input voltage change, for  $\pm 10\%$  input frequency change, or for 0% to 100% load variations. The rectifier shall be capable of operating at minus 20% AC input voltage without discharging the battery.
2. Battery charge current is normally limited to the lesser of the following to ensure minimal battery recharge time while ensuring maximum battery life by limiting charge current to a safe level.
  - a. 20% of the battery amp-hour rating (expressed in amps) and
  - b. The difference in maximum rectifier output current and actual inverter input current.
3. Allowable battery charge current may be increased beyond 20% of the battery amp-hour rating for those applications requiring faster recharge times. Actual available charge current will still depend on output load level and power factor.
4. Battery charging may be disabled via external contact closure, signaling operation on engine generator.
5. The control circuitry shall enable continuous rectifier/charger operation from an engine generator with output frequency transients of up to 5 Hz.
6. Whenever AC power is applied to the rectifier/charger, the current limiting control circuitry shall walk-in over a period of at least 15 seconds to allow gradual loading of the normal input AC power source.

7. The control circuitry shall automatically provide battery recharge at a pre-selected elevated voltage after return from failure of the normal input AC power. The control circuitry shall monitor the battery charging current and automatically return to a pre-selected float voltage when the battery current decreases to a preset level thus preventing overcharging or undercharging the battery.
8. The control circuitry shall automatically turn off the rectifier/charger without opening circuit breakers if any of the following conditions occur:
  - a. High DC voltage.
  - b. AC over voltage of 110% of normal AC input.
  - c. Loss of a phase on normal AC input.
  - d. Loss of normal AC input.

D. Input Filter

1. The rectifier/charger shall be furnished with input filtering to reduce reflected harmonic currents from the UPS input to less than 7% for 300 KVA and smaller sizes and to 5% for 400 KVA and larger sizes THD at full UPS load (nonlinear) and to improve the input power factor to 0.90 lagging. This input filter shall be programmable to automatically disconnect from the input source at reduced load levels or when signaled from the UPS controller for coordination with engine-generator operation. This input filter will be located inside the main UPS enclosure and shall not increase the required footprint.

E. Output Filter

1. The rectifier/charger shall be furnished with output filtering to limit output ripple voltage to 1% RMS for 0 to 100% load.

F. Capacity

1. The rectifier/charger shall have sufficient capacity to supply the inverter at 100%, 0.8 PF load plus recharge a battery (sized for up to 30 minutes) to 95% of full capacity within ten (10) times the discharge time.

## 2.6 INVERTER

- A. The inverter shall utilize fast-switching IGBT transistors, pulse width modulation (PWM) and space vector modulation (SVM). It shall consist of a switching bridge, DC input, output filter and control circuitry to provide precise AC voltage regulation, harmonic cancellation/conditioning, and superior transient response.

B. Control Circuitry

1. The inverter shall be provided with Digital Signal Processor (DSP) control circuitry to provide constant AC voltage regulation and transient response as specified. The high-speed DSP controls shall sample the output continuously to provide precise voltage control.
2. The high-speed DSP control shall determine the phase and amplitude of the output voltage 5th, 7th, 11th, and 13th harmonic components. The results shall be used by a software harmonic conditioner algorithm in controlling the inverter by injecting into or withholding energy from the output to develop a clean output AC voltage sine wave when driving non-linear loads.

3. The circuitry shall provide low voltage initial start-up of the inverter and ramp-up to full voltage.
4. The control circuitry shall automatically synchronize and phase lock the inverter output to the bypass AC power source as long as the bypass source is within the synchronization range. The synchronization range shall be adjustable from 1/8 Hz to 5 Hz, selectable in maximum increments of 0.1 Hz. If the bypass AC power source is not within these preset limits, then the control circuitry shall break synchronization and lock to an internal crystal oscillator.
5. The control circuitry shall automatically send a signal to the static bypass switch to transfer to the bypass AC source and then turn off the inverter for any of the following conditions:
  - a. Blown inverter fuse.
  - b. Over-temperature.
  - c. Overloads per specified limits.
  - d. High/low DC voltage.
  - e. Inverter over voltage or under voltage condition of 5% (adjustable).
6. The control circuitry shall automatically turn off the inverter when the battery reaches the end of discharge. The UPS shall automatically restart and return to normal when input AC power returns. The user shall be able to disable this feature.

C. Inverter Output Transformer

1. The inverter output shall be furnished with a three-phase, delta / zig-zag wye isolation type output transformer.
2. The transformer windings shall be vacuum impregnated to reduce audible noise and increase heat dissipation.
3. The transformer shall have a UL recognized insulation system and shall be so located within the equipment to ensure that the hottest spot shall not exceed the rated insulation temperature and to ensure a low center of gravity.

## 2.7 AUTOMATIC BYPASS

- A. The input of the automatic bypass shall be protected from noise and transients by an input EMI/transient suppressor network. The suppressor network shall be fused in order to minimize damage to the UPS in the event that input transients exceed the rating of the suppression network.
- B. The automatic bypass shall consist of one pair of Silicon Controlled Rectifiers (SCRs) per phase (with each pair connected in inverse parallel) with a parallel-connected contactor, and shall be rated to continuously carry a minimum of 110% of the UPS's rated output current. The automatic bypass shall be connected between the bypass (input) AC power source and the inverter output.
- C. Inverter Failure: If the inverter is out of normal limits due to under voltage or over voltage, or is shut down for any reason, the automatic bypass switch shall turn on to provide power to the load from the bypass AC power source without interruption.

- D. Retransfer to Inverter: The automatic bypass switch shall be capable of automatically retransferring the load back to the inverter after the inverter has returned to normal conditions and stabilized for a preset period of time. Retransfer shall not occur if the two sources are not synchronized.
- E. Automatic Retransfer Lockout: In the event of multiple transfer - retransfer operations within a short time period (adjustable up to 5 minutes), the automatic bypass switch shall lock to the bypass AC power source after the third transfer. The lock period shall also be adjustable up to 5 minutes. The UPS shall return to normal operation after the lock period has expired. The user shall be able to disable the lockout feature, and/or modify its function to enable lock to inverter instead of bypass.
- F. Overload: If an inverter overload is detected, the automatic bypass switch shall operate as described in inverter section above. A transfer shall not occur unless the inverter overload ratings and time duration described in inverter overload capability section above are exceeded.  
Overcurrent Protection
  - 1. Input over current protection shall be provided upstream from the UPS.
  - 2. The automatic bypass switch shall be rated to carry 200% of the UPS's rated output current for five minutes and 1000% of the UPS's rated output current for one-half cycle.
- G. Transfer Conditions
  - 1. The automatic bypass switch shall transfer the critical load from the output of the inverter to the bypass AC power source for the following conditions:
    - a. Inverter voltage less than 95% of nominal (adjustable).
    - b. Inverter voltage greater than 105% of nominal (adjustable).
    - c. Inverter overload period expired.
    - d. Inverter shutdown for any reason.
  - 2. The automatic bypass switch shall inhibit transfer to the bypass AC power source for the following conditions:
    - a. Bypass AC power source voltage less than 90% of nominal (adjustable).
    - b. Bypass AC power source voltage greater than 110% of nominal (adjustable).
    - c. Inverter not phase-locked to the bypass AC source.
- H. Automatic Retransfer Conditions: The system shall automatically retransfer the load to the inverter provided all of the following conditions are met:
  - 1. The inverter logic and the bypass AC power source are synchronized and in phase.
  - 2. Inverter conditions are normal.
  - 3. The UPS output is not overloaded.
- I. Transfer Time: Maximum transfer time to switch from inverter to bypass AC power source shall be 100 microseconds.
- J. Dual Input Configuration: The rectifier and internal bypass (automatic bypass switch and maintenance bypass) shall be connected to the AC power source through separate terminals at the UPS input. This dual input configuration shall enable the UPS primary and bypass AC power sources to be provided from separate input feeds for redundancy. The bypass AC power source shall match the UPS output in voltage, frequency, phase rotation sequence, and

configuration.

## 2.8 MAINTENANCE BYPASS SWITCH

- A. The input of the maintenance bypass switch shall be protected from noise and transients by an input EMI/transient suppressor network. The suppressor network shall be fused in order to minimize damage to the UPS in the event that input transients exceed the rating of the suppression network.
- B. An internal, manually operated maintenance bypass switch shall be provided to enable bypassing the critical loads to the bypass AC power source without interruption of power to those loads. The maintenance bypass switching arrangements electrically isolates the static bypass switch, rectifier/charger, and inverter from the bypass AC power source. The switch shall be physically isolated from the electronics within the UPS enclosure to ensure safety during maintenance.

## 2.9 FRONT PANEL AND USER INTERFACE

- A. The UPS front panel shall include a mimic diagram with active LED indicators showing the actual power path through the UPS.
- B. The front panel shall also include the following LED indicators:
  - 1. Summary Alarm.
  - 2. Service Check.
  - 3. Stop Operation.
  - 4. Battery Level (bar graph).
  - 5. Load Level (bar graph).
- C. The front panel shall include the following buttons for system operation and control of the LCD display:
  - 1. System operation buttons:
    - a. Inverter ON.
    - b. Inverter OFF.
    - c. Mute (Alarm Silence).
    - d. Test.
    - e. Load OFF.
  - 2. LCD display control buttons:
    - a. Metering.
    - b. Alarms.
    - c. Parameters.
      - 1) Plus.
      - 2) Minus.
      - 3) OK.

- D. The UPS shall include an audible alarm-warning device. This alarm shall sound whenever any abnormal condition occurs. Pressing the Mute button shall silence the audible alarm. Any subsequent alarm shall cause reactivation of the status indicator and audible alarm.
- E. The following parameters shall be measured and displayed by an alphanumeric LCD display on the Front Panel. Each display shall have the nomenclature of the parameter indicated with the associated value. AC voltage and current values shall be measured in true RMS units.
  - 1. Battery Display:
    - a. Battery voltage.
    - b. Battery current with flow direction.
    - c. Battery temperature.
    - d. Battery charge level.
    - e. Estimated backup time at present load.
  - 2. Bypass AC Display:
    - a. Bypass AC voltage - phase to phase.
    - b. Bypass frequency.
  - 3. Rectifier Display:
    - a. AC input voltage - phase to phase.
    - b. DC output current.
    - c. Input frequency.
  - 4. Inverter Display:
    - a. Voltage - phase to neutral.
    - b. Output frequency.
    - c. Synchronization status.
  - 5. Load status display:
    - a. Overall load KVA.
    - b. Overall percentage load.
    - c. Load on Bypass/Inverter.
  - 6. Phase load display 1:
    - a. Voltage - phase to neutral.
    - b. Phase current – amperes.
    - c. Phase current – percentage.
  - 7. Phase load display 2:
    - a. Phase kW.
    - b. Phase KVA.
  - 8. Miscellaneous display:
    - a. Heatsink temperature.

- b. UPS operating hours.
  - c. Inverter operating hours.
- 9. Utility/Load fault display:
  - a. Total minor utility faults.
  - b. Total major utility faults.
  - c. Total overloads.
- F. UPS alarm/event history shall be available through the alphanumeric display on the front panel. The event history shall store a minimum of 256 previous status and alarm events with the date and time of each occurrence. No software or external remote monitoring equipment shall be necessary to access the alarm/event history.

## 2.10 EXTERNAL INTERFACE

- A. The UPS shall have 12 alarm contacts for remote signaling. These alarm contacts shall each be programmable with any of the following signals:
  - 1. No information.
  - 2. Audible alarm.
  - 3. Summary alarm.
  - 4. Load on utility.
  - 5. Stop operation.
  - 6. Load on inverter.
  - 7. Utility failure.
  - 8. DC over voltage.
  - 9. Low battery.
  - 10. Overload.
  - 11. Over temperature.
  - 12. Inverter not synched.
  - 13. Bypass locked.
  - 14. Bypass utility failure.
  - 15. Rectifier utility failure.
  - 16. Battery discharge.
  - 17. Manual bypass on.
  - 18. Rectifier on.
  - 19. Inverter on.
  - 20. Boost charge.
  - 21. Battery ground fault.
  - 22. Battery fault.
  - 23. User input 1.
  - 24. User input 2.
- B. Programming of the alarm contacts requires access with the appropriate password. The alarm contacts shall be accessible through a 37-pin plug or a standard wiring terminal block.
- C. The UPS shall have two inputs for connection to external contact closures. The status of these external contacts can be monitored from the front panel of the UPS. The default configuration for these external signals shall be as follows:
  - 1. Aux. Input No. 1 - On Generator.

2. Aux. Input No. 2 - not defined.

- D. The 'On Generator' signal shall be used to optimize operation of the UPS while AC power is being supplied from an engine-generator. The following parameters shall be programmable in this mode:
1. Inverter synchronization with generator (enable/disable): This parameter (disabled) shall protect the critical load from all frequency transients associated with engine-generator operation.
  2. Automatic bypass to generator (enable/disable): This parameter shall allow the user to prevent transfer of the critical load directly to the output of the engine-generator.
  3. Inverter output frequency slew-rate: This parameter shall allow the user to specify the maximum frequency rate-of-change when the inverter is phase-locked to an engine-generator. Adjustment range shall be 0.1 to 20.0 Hz/second, in 0.1 increments. This adjustment shall be independent of normal operation slew-rate.
  4. Recharge capability (enable/disable/delay): This parameter shall allow the user to select whether or not, and/or when the battery will be recharged while the UPS is powered from an engine-generator. This parameter shall be programmable directly in minutes, with zero disabling battery charging. This will conserve fuel and allow closer sizing of the engine-generator. The UPS rectifier shall also include a soft-start circuit to limit inrush current and apply load to the engine-generator gradually.
  5. The input current distortion filter shall be programmable to disconnect when the UPS AC source is the output of an engine-generator.

## 2.11 RS232 COMMUNICATIONS PORTS

- A. The UPS shall include two RS-232 ports. These ports shall allow full remote monitoring, control and management of the UPS system. All access to control functions through these ports shall be protected from unauthorized access.
1. Port 1 shall allow access to critical UPS measurements, functions, and historical data through the optional IRIS or PowerJUMP Universal Management software. This software shall also enable access through the internet, enabling the UPS to notify service personnel of any problems.
  2. Port 2 shall allow access to critical UPS measurements, functions, and historical data via direct connection or modem using the optional ARGUS Control Network software. This port shall also allow connection to a LAN through an optional LINC box and SNMP adaptor. Connection to a serial printer shall be allowed for local access to internal system parameters and measurements.

## 2.12 DESIGN

- A. Parameters: In order to increase accuracy and reduce Mean Time To Repair (MTTR) the UPS must be fully adjustable and have the ability to be calibrated with the use of programmable parameters. Access to these parameters shall be available remotely to facilitate remote servicing and diagnostics or thru the front display. Manual adjustments using potentiometers or dipswitches will not be acceptable. The parameters shall have different levels of access with each level being password protected. Special interfacing equipment or proprietary software shall not be required for UPS service or maintenance.

- B. Maintenance: Control circuits shall be capable of being tested while the critical loads are bypassed to the bypass AC power source. All adjustments and tests shall be possible from the front of the UPS with the use of standard test equipment (volt-ohm-milliampere meter and oscilloscope). Control circuits shall utilize plug-in connections for ease and speed of repairs. Special extender boards shall not be required. All control logic shall be contained on a single control board for ease of troubleshooting and to minimize spare parts requirements.
- C. Maintenance and servicing of the UPS shall not be restricted by proprietary software or external interface devices. Any factory trained service provider shall be capable of performing maintenance and repair of the UPS. Calibration and diagnostics of the UPS shall be performed either remotely or thru the front display and shall be facilitated thru programmable parameters. Potentiometers shall not be used for calibration.
- D. Logic Power Supply: The logic power supply shall receive power from the battery and AC power sources. It shall be capable of supplying logic power from any of the available sources.

## 2.13 SINGLE MODULE SYSTEM OPERATION

- A. Normal: The inverter shall supply AC power continuously to the critical loads. The inverter output shall be synchronized with the bypass AC power source provided that the bypass AC power source is within the specified frequency range. The rectifier/charger shall convert the normal AC input power to DC power for the inverter and for charging the battery.
- B. Loss of Normal AC Input Power: The battery shall supply DC power to the inverter so that there is no interruption of AC power to the critical loads whenever the normal AC input power source of the UPS module deviates from the specified tolerances or fails completely. The battery shall continue to supply power to the inverter for the specified protection time.
- C. Return of Normal AC Input Power Source: The rectifier/charger shall start and assume the DC load from the battery when the normal AC input power source returns. The rectifier/charger shall then simultaneously supply the inverter with DC power and recharge the battery. This shall be an automatic function and shall cause no disturbance to the critical load.
- D. Transfer to Bypass AC Power Source: If the control circuitry senses an overload, an inverter shutdown signal, or degradation of the inverter output, then it shall automatically transfer the critical loads from the inverter output to the bypass AC power source without an interruption of power. If the bypass AC power source is above or below normal voltage limits, then the transfer shall be inhibited.
- E. Retransfer to Inverter: The automatic bypass switch shall be capable of automatically retransferring the load back to the inverter after the inverter has returned to normal conditions. Retransfer shall not occur if the two sources are not synchronized. The automatic bypass control circuit shall have the ability to lock the critical load to either the inverter output or the bypass source (selectable) after multiple transfer-retransfer operations. This lockout condition shall be reset automatically (after an adjustable delay period) or under manual command through remote communications software.
- F. Downgrade: If the battery is taken out of service for maintenance, it shall be disconnected from the rectifier/charger and inverter. The UPS shall continue to function and meet the performance criteria specified herein except for the battery reserve time and step load performance.

## 2.14 MULTIPLE MODULE SYSTEM OPERATION

- A. Configuration: The UPS system shall be capable of operating with up to eight UPS modules in parallel. This parallel configuration shall not require special paralleling switchgear, external control cabinets, external static bypass, or external maintenance bypass. Redundant communication cables shall be used between modules to ensure reliability.
- B. Redundant control electronics: Each UPS module shall have its own totally independent controller. The individual controllers will intercommunicate continuously to manage the overall system in a democratic way. A programmed "Master-Slave" arrangement shall not be used. If any module's controller malfunctions, the remaining controllers shall manage the UPS system's operation.
- C. Synchronization: Enhanced high speed, high precision tracking shall maintain the synchronization error between UPS modules and between the modules and the bypass source to no more than 0.05 milliseconds.
- D. Decentralized bypass: Each UPS module shall contain its own automatic and maintenance bypass circuits. Operation of each UPS module's automatic bypass circuit shall be controlled as a system level (not module level) event. External, centralized static bypass circuits shall not be used.
- E. Failure handling: Functionality and redundancy shall be maintained at the sub-system level. If a given UPS module suffers a sub-system malfunction, other sub-systems within the module will remain active and available for system operation. An automatic bypass failure in a given module shall not remove that module's inverter from system operation, nor shall an inverter failure remove a module's automatic bypass from system operation.
- F. Energy Management: An optional energy-saving mode shall be available to the user. Individual inverters that are not required in order to support the actual load or programmed redundancy level shall be automatically switched off to conserve energy. This feature shall be fully programmable, with individual inverters being switched off cyclically to balance operating hours over a period of time. The energy management feature shall be programmable to minimize energy consumption during non-critical hours by reducing or eliminating redundancy or switching the UPS system to off-line operation. The user shall be able to choose the level of load protection and redundancy under this mode of operation.

## 2.15 COOLING

- A. The UPS shall be forced air-cooled with redundant fans. Inlet air temperature shall be monitored and displayed. The cooling shall be adequate for operation at altitudes up to 1,000 meters (3,281 feet).

## 2.16 NOISE REDUCTION

- A. The UPS shall be designed and constructed such that the audible noise level is reduced to a typical 65 decibel, measured on the A scale at 5 feet (1.5 meters) from the front of the cabinet.

## 2.17 BATTERY

- A. The UPS shall be designed to operate with any common lead-acid or nickel-cadmium battery type. The installed battery type and rating shall be programmed into the UPS at start-up, and the UPS rectifier shall select the proper charging regimen based on the actual installed battery type. This will maximize the life of the battery. The UPS shall include a programmable battery test feature. This test will perform a partial discharge of the battery with the UPS on line in order to isolate open or weak battery cells. Pass or fail results of test will be logged into the history of the UPS and failures will activate an alarm on the front panel. The user shall have the ability to enable fully automatic, as well as manual battery testing.

## 2.18 EMERGENCY POWER OFF

- A. The UPS shall include an Emergency Power Off (EPO) circuit. Activating this circuit shall cause immediate shutdown of all UPS operations. This operation will shut down the critical load.
- B. The UPS module shall include provisions to activate the EPO circuit remotely by a contact closure.

## 2.19 FACTORY TESTING

- A. Perform all tests recommended by NEMA, IEEE and ANSI standards.
- B. Perform complete operational checkout of all functions.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verify that UPS modules are ready to install.
- B. Verify field measurements are as shown on Drawings and/or as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location and ready for use.
- D. Beginning of installation means installer accepts conditions.

## 3.2 INSTALLATION

- A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.
- C. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to following:

1. Checking to ensure that all relays and/or protective devices are set and operating properly.
2. Checking to ensure that the pad location is level to within 0.125 inches per three foot of distance in any direction.
3. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations.
4. Checking to ensure that battery voltage and electrolytic levels are correct (where appropriate).
5. Checking to ensure that AC input voltage, rectifier/charger DC output voltage, and inverter AC output voltage are correct.
6. Assembling all shipping sections, removing all shipping braces, and connecting all shipping split mechanical and electrical connections.
7. Securing UPS to foundation or floor as required.
8. Measuring and recording Megger readings phase-to-phase, phase-to-ground, and neutral.
9. Measuring and recording the impedance of the equipment to the building grounding electrode.

### 3.3 FIELD QUALITY CONTROL

- A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section for a period of 5 working days. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections, and adjustments, and testing of the assembly and components contained therein.
- B. The manufacturer's representative shall provide inspection of the final installation. The manufacturer's representative shall perform site start-up and functional checkout of the UPS system. Upon completion of the manufacturer's start-up and checkout, the manufacturer shall demonstrate to the customer all the automated sequences of operation as specified herein.
- C. The manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.
- D. The Contractor shall provide eight (8) copies of the manufacturer's field start-up report.

### 3.4 FIELD TESTING

- A. Perform all field-testing required in the commissioning documents and/or recommended by NETA, ANSI standards, and the manufacturer.
- B. Perform complete operational checkout of all functions.
- C. Perform a harmonic spectrum analysis to ensure the output voltage is correct in magnitude, phase angle, and essentially sinusoidal.

### 3.5 ADJUSTING

- A. Refer to manufacturer's instruction book to make adjustments to UPS, as required.

### 3.6 CLEANING

- A. Clean interiors to remove construction debris, dirt, and shipping materials.
- B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION 263353

## SECTION 263600 - TRANSFER SWITCHES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with provisions of Section 260500.
  - 1. Automatic and non-automatic transfer switches.
  - 2. Bypass isolation switches.
  - 3. 3-pole and 4-pole transfer switches.
  - 4. Closed or open transition switches.
  - 5. Delayed transition (programmed neutral) switches.
- B. Provide transfer switches and generator as a complete functioning emergency power system through a single vendor.

#### 1.2 RELATED SECTIONS

- A. Section 213113: Electric-Drive Centrifugal Fire Pump.
- B. Section 260553: Identification for Electrical Systems.
- C. Section 263213: Emergency Engine & Generator System.

#### 1.3 REFERENCES

- A. The equipment and components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted).
  - 1. UL 1008: Underwriters Laboratories Standard for Automatic Transfer Switches.
  - 2. NFPA 70: National Electrical Code including use in Emergency and Standby Systems in accordance with Articles 517, 700, 701, 702.
  - 3. NFPA 99: Essential Electrical Systems for Health Care Facilities.
  - 4. NFPA 101: Life Safety Code.
  - 5. NFPA 110: Standard for Emergency and Standby Power Systems.
  - 6. IEEE 241: I.E.E.E. Recommended Practice for Electrical Power Systems in Commercial Buildings.
  - 7. IEEE 446: I.E.E.E. Recommended Practice for Emergency and Standby Power Systems.
  - 8. NEMA ICS10: AC Automatic Transfer Switch Equipment.
  - 9. UL 50/508: Enclosures.
  - 10. IEEE 472 (ANSI C37.90A): Ringing Wave Immunity.

#### 1.4 SUBMITTALS

- A. Submit the following:

1. Product data: Product data sheets for each switch including rated capacities, weights, operating characteristics, furnished specialties and accessories.
2. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
3. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources and load showing interlocking provisions for each combined transfer switch and bypass/isolation switch.
4. Features and operating sequences, both automatic and manual.
5. Manufacturer Seismic Qualification Certification: Submit certificate of compliance for seismic requirements per IBC and other sections of the Project Manual.
  - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - b. The term withstand means the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
  - c. Dimensioned Outline Drawings of Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - d. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Field quality-control test reports.

#### 1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Provide minimum 8 copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 01 and Division 26.
- B. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product. Include factory setting of relays, relay setting, and calibration instructions.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Source Limitations: Obtain transfer switches, annunciators and other equipment defined in this section through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.8 REGULATORY REQUIREMENTS

- A. In accordance with International Building Code, manufacturer shall test or analyze the transfer switch components and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by Engineer and by the building official. Qualification shall be by an actual test on a shake table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces, by the use of experience data or by a more rigorous analysis providing for equivalent safety. Refer the IBC and ASCE 7-05 for complete requirements.

## 1.9 DELIVERY, STORAGE AND HANDLING

- A. Transfer switches shall be provided with adequate lifting means and shall be able to be rolled or moved into installation position and bolted directly to floor without using floor sills.
- B. Deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's installation and maintenance manuals.
- C. Inspect and report concealed damage to carrier within specified time.
- D. Store in a clean, dry space. Maintain factory protection or cover with heavy-duty plastic, minimum 6 mil, to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.
- E. Handle transfer switches in accordance with manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting provisions.

## 1.10 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

- A. Follow applicable NEMA, ANSI, and NECA standard practices before, during, and after installation.
- B. Transfer switches shall be located in well-ventilated areas, free from excess humidity, dust, and dirt and away from hazardous materials. Ambient temperature of area will be between minus [30] and plus [40] degrees C. Indoor locations shall be protected to prevent moisture from entering enclosure.

## 1.11 SEQUENCING AND SCHEDULING

- A. Provide a written detailed description of scheduled installation, testing, and startup dates.

## 1.12 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of delivery, whichever occurs first.

### 1.13 EXTRA MATERIALS

- A. Provide spare parts as recommended by manufacturer and as indicated on the drawings.
- B. Provide a complete set of spare fuses of all sizes and ratings used in the switches.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Caterpillar; Engine Division.
  - 2. Emerson; ASCO Power Technologies, LP.
  - 3. GE Zenith Controls.
  - 4. Onan/Cummins Power Generation; Industrial Business Group.
  - 5. Russelectric, Inc.
  - 6. Eaton/Cutler-Hammer.

### 2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Switch Ratings: Refer to drawings for transfer switch types, voltage rating and current rating.
- B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid, electric-motor-operated mechanism, or electrically operated circuit breakers, mechanically and electrically interlocked in both directions.
- G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switch Action: Double action; mechanically held in both directions.

2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225A and higher, shall have separate arcing contacts.
  - H. Neutral Switching: Where four-pole switches are indicated, provide fully rated neutral contact on same operating mechanism as phase contacts.
  - I. Neutral Terminal: Where three pole switches are indicated on the drawings, provide a solid and fully rated neutral, unless otherwise indicated.
  - J. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversized neutral shall be double the nominal rating of circuit in which switch is installed.
  - K. Motor Loads: For switches that serve motor loads, furnish one the following (refer to drawings for preferred switch type):
    1. Open transition transfer switch with in-phase monitor.
    2. Closed transition transfer switch with in-phase monitor.
    3. Delayed transition transfer switch.
  - L. Indicating Lights: All indicating lights on front of transfer switch to be LED type.
  - M. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
  - N. Annunciation, Control, and Programming Interface Components: Provide communication capability with the generator paralleling switchgear for devices at transfer switches that communicate with remote programming devices, annunciators, or annunciator and control panels. Provide all switches with necessary accessories to provide a complete, integrated and functioning emergency paralleling power system.
  - O. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Electrical Identification."
    1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
    2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
    3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
  - P. Enclosures: General-purpose NEMA 1 complying with NEMA ICS 6 and UL 508, unless otherwise indicated.
- 2.3 MICROPROCESSOR CONTROLLER
- A. Furnish a built-in microprocessor to provide sensing and logic for control of the switch with the ability to communicate serially through a serial communication module or Ethernet connectivity module.

- B. Provide controller with 12 selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Provide true RMS voltage sensing, accurate to + 1% of nominal voltage and frequency sensing accurate to + 0.2%. Provide controller capable of operating over a temperature range of -20 to +60 degrees C. and storage from -55 to +85 degrees C.
- C. Store default setup information and calibration data on nonvolatile EPROM.
- D. Controller Display and Keypad: Provide a four-line, 20 character LCD display and 5 x 5, tactile keypad as an integral part of the controller for viewing all available data and setting desired operational parameters.

## 2.4 METERING

- A. Provide a three phase digital ammeter with current transformers and shorting blocks. Sense current on the LOAD conductors.
- B. Provide a three phase, digital voltmeter.

## 2.5 ELECTRONIC CIRCUIT MONITOR

- A. Provide electronic circuit monitors on all switches unless otherwise noted. The monitor shall be accurate to 0.075% of reading plus 0.025% of full scale for voltage and current sensing, and 0.15% of reading plus 0.025% of full scale for power and energy, accurate through the 63rd harmonic.
  - 1. These accuracies shall be maintained for both light and full loads.
  - 2. No annual recalibration by users shall be required to maintain these accuracies.
  - 3. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy.
- B. The circuit monitors shall be UL listed per UL 508, CSA recognized under C22.2, CE compliant, and tested for EMC in accordance with the IEC 1000-2, 1000-4, 1000-5 series of electrical tests (level 4), FCC compliant per FCC Part 15, Class A, and vibration and temperature tested. The meter module shall be rated for an operating temperature range of -25 degree C to 70 degree C.
- C. The circuit monitor metering inputs shall utilize current transformers for the current inputs. It shall be rated 5A nominal and 10A full scale. In addition, it shall be industrially and utility hardened to have an overload withstand rating of 15A continuous and 500A for 1 second.
- D. The device shall not require potential transformers or control power transformers when applied at 600V or less. The data monitor shall accept control power over a range of 100-415Vac, 50, 60, or 400 HZ, or 100-300Vdc.
- E. The monitor shall be capable of interfacing with an optional communications module to permit information to be sent to a central location for display, analysis and logging.
- F. All information shall be available from the display or via RS-485 Ethernet or other industry standard open communications protocol. It shall be possible to perform the setup via the display. No dip switches or other hardware adjustments shall be required for setup.

- G. Circuit monitors shall be equipped with a backlit, LCD display capable of displaying three phases and neutral values at the same time.
- H. Circuit monitors shall provide diagnostics to troubleshoot mis-wired installations.
- I. Position of the transfer switch shall be monitored using (2) discrete inputs provided on the data monitor.
- J. The information, capabilities and metered values provided by the data monitor shall include the following:
  - 1. Current, per-phase.
  - 2. Neutral current measurements.
  - 3. Voltage, phase-to-phase & phase-neutral.
  - 4. Real Power (kW), per phase & three-phase total.
  - 5. Reactive Power (kVAR), per phase & three phase total.
  - 6. Apparent Power (kVA), per phase & three phase total.
  - 7. Power Factor (true), per-phase & three-phase total.
  - 8. Frequency readings.
  - 9. Real Energy (kWh), three phase total.
  - 10. Reactive Energy (kVARh), three phase total.
  - 11. Apparent Energy (kVAh), three phase total.
  - 12. Energy Accumulation modes, signed, absolute, energy in, energy out.
  - 13. Demand Current, per phase & neutral, present & peak.
  - 14. Real Power Demand (kVARd) readings, three phase total, present & peak.
  - 15. Reactive Power Demand (kVARd) readings, three phase total, present & peak.
  - 16. Apparent Power Demand (kVAd) readings, three phase total, present & peak.
  - 17. Total Harmonic Distortion (THD) readings, voltage & current, per phase.
  - 18. Date and time stamping, peak demands, power up/restart and resets.
  - 19. Onboard alarms for over/under voltages (per phase L-L, L-N), over/under currents (per phase, neutral), over/under frequency, current unbalance (per phase), and voltage unbalance (per phase L-L, L-N).
  - 20. Minimum and maximum readings - I,V,F,PF.
  - 21. 800K Onboard memory provided.
  - 22. Advanced demand calculations shall include:
    - a. User defined demand intervals.
    - b. User defined sliding or rolling block demand.
    - c. Synchronization of demand interval to utility pulse.
    - d. Predicted power demand for real, reactive and apparent power.
  - 23. Relay output capability provided.

## 2.6 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-action type, incapable of pauses or intermediate position stops during normal functioning, except for delayed transition switches. Provide open, closed or delayed transition switches as indicated on drawings.
- C. Manual Switch Operation:

1. Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
  2. Unloaded, control circuit automatically disconnects from electrical operator during manual operation.
- D. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:
1. Fully automatic make-before-break operation.
  2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
  3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
    - a. Initiation occurs without active control generator.
    - b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
  4. Failure of power source serving load initiates automatic break-before-make transfer.
  5. If transfer does not take place within selected time frame (5 - 60 minutes) switch to revert to open transition with delay mode.
- E. Delayed Transition Switch: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.
- F. Automatic Transfer-Switch Features:
1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pick at 90 percent and dropout at 85 percent.
  2. In-Phase Monitor: Provide in-phase monitors on all automatic switches except for delayed transition switches, unless otherwise indicated on drawings. Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 10 electrical degrees, and only if transfer can be completed with 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
  3. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
  4. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
  5. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes. Switch set to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

6. Test Switch: Simulate normal-source failure.
7. Switch-Position Pilot Lights: Indicate source to which load is connected.
8. Source-Available Indicating Lights: Supervise sources via transfer-switch normal-and emergency-source sensing circuits.
  - a. Normal Power Supervision: Green light with nameplate engraved " Normal Source Available."
  - b. Emergency Power Supervision: Red light with nameplate engraved " Emergency Source Available."
9. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
10. Signal-Before-Transfer Contacts: Two sets of normally open/normally closed dry contacts, one that operates in advance of retransfer to normal source and one the operates in advance of transfer to emergency source in the test mode. Interval is adjustable from 1 to 30 seconds.
11. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
12. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
13. Load shed feature. Provide for a load shed input signal from the generator control system to allow for programmed load shedding.
14. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
15. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
16. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
17. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-days exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
  - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
  - b. Push-button programming control with digital display of settings.
  - c. Integral battery operation of time switch when normal control power is not available.

## 2.7 BYPASS/ISOLATION SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Provide Bypass/Isolation option to transfer switches as indicated on drawings.
- C. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:

1. Means to lock Bypass/Isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
  2. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing maintenance operations.
  3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
  4. Contact temperatures of Bypass/Isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
  5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less while the door is closed.
  6. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
  7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
- D. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

## 2.8 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Electrical Supports and Seismic Restraints."
- B. Floor-Mounting Switch: Anchor to floor by bolting.
1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. In the event switches include components that roll out, eliminate the housekeeping pad to facilitate the movement of components. Construct concrete bases according to Section 260548 "Seismic Restraint & Vibration Isolation for Electrical Systems."
- C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- D. Identify components according to Section 260553.

- E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- F. Furnish and install all necessary interconnecting control and monitoring wiring between switches, generators, annunciators and elevator controllers as required for a complete operating system.

### 3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Section 260526.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
  - 2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
  - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    - a. Check for electrical continuity of circuits and for short circuits.
    - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    - c. Verify that manual transfer warnings are properly placed.
    - d. Perform manual transfer operation.
  - 5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    - c. Verify time-delay settings.
    - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

- f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
  - 6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
    - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.

#### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative for a minimum 2 days to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

## SECTION 264113 - LIGHTNING PROTECTION SYSTEMS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide labor, materials and equipment required for completion of a functional system of air terminals, conductors, grounds, and other components necessary for protection against damage by lightning.
- C. System shall be concealed, with only air terminals and roof conductors visible.
- D. Provide a UL Inspection Certificate upon completion of work.

#### 1.2 RELATED SECTIONS

- A. Division 07: Roofing and flashing.
- B. Section 260526: Grounding and Bonding for Electrical Systems

#### 1.3 REFERENCES

- A. The lightning protection system shall comply with the latest issue of the following standards.
  - 1. NFPA 780 Standard for the Installation of Lightning Protection Systems.
  - 2. UL 96A Installation Requirements for Lightning Protection Systems.
  - 3. LPI-175 Lightning Protection Institute.

#### 1.4 SUBMITTALS

- A. Provide shop drawings, list of material, and details to Engineers for approval prior to commencement of the installation. The drawings shall show the extent of the system layout designed specifically for the contract project.

#### 1.5 QUALITY ASSURANCE

- A. The lightning protection system shall be installed by a UL listed or Lightning Protection Institute Master Installer contractor.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers:

1. Heary Brothers Lightning Protection, Inc.
2. Thompson Lightning Protection, Inc.
3. Robbins Lightning Protection, Inc
4. Harger Lightning & Grounding.
5. ERICO, INC.

### 2.2 MATERIALS

- A. All materials used in the installation shall be new and shall comply in weight, size and composition as required by UL 96A and NFPA 780 and shall be labeled or listed by Underwriters Laboratories Inc. for use in lightning protection systems. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment. The manufacturer shall be listed by UL as a recognized manufacturer of lightning protection components.
- B. Class I materials shall be used on structures that do not exceed 75 feet in height and Class II materials shall be used on structures that are 75 feet or higher above average grade.
- C. Copper materials shall not be mounted on aluminum surfaces including Galvalume, galvanized steel and zinc; this includes these materials that have been painted.
- D. Aluminum materials shall not come into contact with earth or where rapid deterioration is possible. Aluminum materials shall not come into contact with copper surfaces.

### 2.3 AIR TERMINALS

- A. Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20'-0" along ridges and along the perimeter of flat or gently sloping roofs (flat or gently sloping roofs include roofs that have a pitch less than 3:12). Flat or gently sloping roofs exceeding 50'-0" in width shall be protected with additional air terminals located at intervals not exceeding 50'. Air terminals shall be located within two feet of roof edges and outside corners of protected areas.
- B. Air terminals shall be installed on stacks, flues, mechanical units and other metallic objects not located within a zone of protection and which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specified standards using main size conductor and bonding plates having a minimum of 3 square inches of surface contact area.
- C. Air terminal bases shall be securely fastened to the structure in accordance with the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.

- D. Main conductors shall be sized in accordance with the specified standards for Class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connections with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than either 90 degrees nor have a radius of bend less than 8 inches.
- E. Down conductors shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors. Where down conductors are installed exposed on the exterior of a structure and are subject to physical damage or displacement, guards shall be bonded at each end.
- F. In case of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals not exceeding 100 feet along the perimeter of the structure.

## 2.4 ROOF PENETRATIONS

- A. Roof penetrations required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through the roof. The roofing contractor shall furnish and install the materials required to properly seal all roof penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning conductor runs to assure compatibility with the warranty for the roof including roof pads that may be required to protect the roof under each of the lightning protection components.

## 2.5 GROUND TERMINATIONS

- A. Ground electrodes shall be copper and a minimum 3/4" diameter and 10 feet long. A ground electrode shall be provided for each down conductor. The down conductor shall be connected to the ground electrode using a bronze ground rod clamp having a minimum of 1-1/2" contact between the ground electrode and the conductor measured parallel to the axis of the ground electrode, or by an Ultraweld exothermically welded connection. Ground electrodes shall be located a minimum of 2 feet below grade and shall be installed below the frost line where possible (excluding shallow topsoil conditions).
- B. Where the structural steel framework is utilized as the down conductor for the system, ground terminals shall be connected to columns around the perimeter of the structure at intervals averaging not more than 60 feet apart. Columns shall be grounded using either bonding plates have 8 square inches of surface contact area or by Ultraweld exothermically welded connections.
- C. All ground electrodes shall be interconnected with a ground loop conductor on structures that exceed 60 feet in height. The ground loop conductor shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor.

## 2.6 EQUIPOTENTIAL GROUNDING

- A. Common interconnection of all grounded systems within the building shall be ensured by interconnecting to the lightning protection system using main size conductor and fittings.
- B. This interconnection shall include but is not limited to the electrical service, telephone and antenna system grounds as well as all underground metallic piping systems including water, gas and sewer. Interconnection to a gas or water line shall be made on the customer's side of the meter. Connection to gas line must be approved by the gas utility.
- C. Grounded metal bodies located within the required bonding distance as determined by the bonding distance formula in the latest edition of NFPA-780 Standard for the Installation of Lightning Protection Systems shall be bonded to the lightning protection system using the required bonding conductors and connections.

## 2.7 SURGE PROTECTION

- A. Surge suppression shall be provided at all power service entrances and at entrances of conductive signal, data and communication services.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The installation shall be installed by an UL listed or Lightning Protection Institute Master Installer lightning protection installation company that is licensed as a lightning protection installer in the project state (where such licensing is available and required).

### 3.2 COORDINATION

- A. Coordinate the installation of the lightning protection system with other trades.
- B. Coordinate all roof penetrations, fasteners and adhesive with the roofing contractor prior to installing any materials on the roof.

### 3.3 INSPECTION AND CERTIFICATION

- A. New Structures:
  - 1. Upon completion of the installation of the lightning protection system the contractor shall furnish the UL Certificate of Compliance issued by Underwriters Laboratories Inc.
- B. Additions or Renovations:

1. If the protected structure is an addition to or is attached to an existing structure that does not have a functioning lightning protection system, the contractor shall certify that the new system installed complies with the specified standards and shall advise the owner on the lightning protection work required on the existing structure so that a Certificate of Compliance may be obtained.
2. If the protected structure is an addition to or is attached to an existing structure that does have a lightning protection system the contractor shall advise the owner of any additional work that may be required in order to bring the existing lightning protection system into compliance with the specified standards and thus qualify for a Certificate of Compliance from Underwriters Laboratories Inc.

END OF SECTION 264113

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 264313 - LOW VOLTAGE AC SURGE PROTECTION DEVICES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. The contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the AC surge protection may be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers (MCC). Alternately, SPDs may be mounted external to the equipment using approved methods.
- B. All SPDs must comply with UL 1149 Third Addition and service entrance SPDs must also comply with UL 96A.

#### 1.2 RELATED SECTIONS

- A. Section 260519: Low Voltage Electrical Power Conductors.
- B. Section 260526: Grounding and Bonding for Electrical System.
- C. Section 260533: Raceways and Conduit Systems.
- D. Section 262413: Switchboards.
- E. Section 262416: Panelboards.

#### 1.3 REFERENCES

- A. ANSI/IEEE C62.11 - Standard for Metal-Oxide Surge Arresters for AC Power Circuits.
- B. ANSI/IEEE C62.33 - Standard Test Specifications for Varistor Surge Protection Devices.
- C. ANSI/IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Systems.
- D. ANSI/IEEE C62.45 - IEEE Standard Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
- E. NEMA Standard LS-1 - Low-Voltage Surge Protective Devices.
- F. NFPA 70 - National Electrical Code.
- G. UL 1283 - UL Standard for Safety Electromagnetic Interference Filters.
- H. UL 1449 - UL Standard for Safety Transient Voltage Surge Suppressors.

- I. UL 96A - Standard for Installation Requirements for Lightning Protection Systems.

#### 1.4 SUBMITTALS - FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer
  - 1. Provide verification that the SPD complies with the required ANSI/UL 1449 Third Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, s long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR) and Nominal Discharge Current (In).
  - 2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
  - 3. Provide UL 96A listing file information for all service entrance SPDs.
- B. Where applicable the following additional information shall be submitted to the engineer:
  - 1. Descriptive bulletins.
  - 2. Product sheets.

#### 1.5 SUBMITTALS - FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
  - 1. Final as-built drawings and information for items listed in Section 1.4 and shall incorporate all changes made during the manufacturing process.

#### 1.6 QUALIFICATIONS

- A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

#### 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided with each SPD shipped.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton Cutler-Hammer.
- B. General Electric.
- C. Control Concepts (Liebert).
- D. Current Technology.
- E. Surge Suppression, Inc.
- F. Square D.
- G. Siemens.
- H. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

### 2.2 VOLTAGE SURGE SUPPRESSION - GENERAL

- A. Electrical Requirements
  - 1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.
  - 2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.
  - 3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) or other approved methods as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize any components that may crowbar the system voltage leading to system upset or create any environmental hazards.
  - 4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:
    - a. 3-phase, wye connected: L-N, L-G, L-L, & N-G.
    - b. 3-phase, delta connected: L-G & L-L.
    - c. Single phase: L-N, L-G, L-L, N-G.
    - d. 3-phase, high leg delta: L-N, L-G, L-L, N-G.
  - 5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
  - 6. ANSI/UL 1449 Third Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 Third Edition VPR for the device shall not exceed the following:

- a. L-N, L-G, N-G: 208Y/120, 700 volts, 240/120, 700 volts, 480Y/277, 1200 volts, 480/208, 1200 volts, 600Y/347, 1500 volts.
- b. L-L: 280Y/120, 1200 volts, 240/120, 1200 volts, 480, 1800 volts, 600Y/347, 3000 volts.

B. SPD Design

1. Maintenance Free Design - The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device is not acceptable. A test kit used to determine remaining life may be provided.
2. Balanced Suppression Platform - The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter - Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable/able to meet this specification shall not be accepted.
4. Internal Connections - No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics - Each SPD shall provide the following integral monitoring options:
  - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
  - b. Remote Status Monitor - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
  - c. Audible Alarm and Silence Button - The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
  - d. Surge Counter - The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 +/- 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
    - 1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.
6. Overcurrent Protection
  - a. The unit must pass the UL 1449 fault tests.

7. Fully Integrated Component Design - All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be acceptable.
8. Safety Requirements
  - a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

## 2.3 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
  1. Category C shall be used for the following:
    - a. Service entrance, switchgear, switchboards, and motor control centers (MCC).
  2. Category B shall be used for the following:
    - a. Distribution panelboards, emergency system panelboards, and medical equipment panelboards.
  3. Category A shall be used for the following:
    - a. Lighting panelboards, major medical equipment, and busways.
- B. Surge Current Capacity - The minimum surge current capacity the device is capable of withstanding shall be:
  1. Category C: 250 kA per phase and 125 kA per mode.
  2. Category B: 160 kA per phase and 80 kA per mode.
  3. Category A: 120 kA per phase and 60 kA per mode.
- C. SPD Type - All SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

## 2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a properly sized circuit breaker for disconnecting purposes and overcurrent protection may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the circuit breaker.
5. An external mounted SPD shall have a properly sized circuit breaker mounted as in paragraph 2.4(A(2)) and be connected using a low impedance, flexible, multi-conductor cable supplied by the SPD manufacturer and designed for use with SPDs.

B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)

1. The length shall be as short as possible and shall not exceed 36 inches, linear length or 72" circuit length, without approval from the Engineer. Minimum size shall be #10AWG. Lengths longer than 36" shall be sized to provide the equivalent impedance of #10 AWG at 36".
2. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommendation installation and wiring practices.

C. Switchgear, Switchboard, MCC and Busway Requirements

1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
2. The SPD may be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer.
3. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
4. The SPD shall be connected through a disconnect (circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible. See paragraph 2.4(B) for installation requirements.
5. The SPD may be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
6. An external mounted SPD shall have a properly sized circuit breaker mounted as in paragraph 2.4(A(2)) and be connected using a low impedance, flexible, multi-conductor cable supplied by the SPD manufacturer and designed for use with SPDs. The length shall be as short as possible and shall not exceed 36 inches without approval from the Engineer.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

## 2.5 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1 - Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
2. NEMA 4 - Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts, to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only).
3. NEMA 4X - Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only).

### PART 3 - EXECUTION

#### 3.1 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

#### 3.2 INSTALLATION

- A. The contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

#### 3.3 WARRANTY

- A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION 264313

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 265000 - ELECTRICAL ARCHITECTURAL LIGHT FIXTURES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Furnish and install a lighting fixture of the type indicated by number at each location shown on the drawings. Where multiple fixtures in a room are of the same type, the type may be indicated only once.
- B. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary of the work.
  - 1. Minor details, not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fixtures, shall be included, the same as if they were herein specified or indicated on the drawings.
  - 2. The Architect shall not be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the production of the fixtures. The responsibility of accurately fabricating the fixtures to the fulfillment of this specification rests with the Contractor.

#### 1.2 SUBMITTALS

- A. Shop Drawings
  - 1. Manufacturer's dimensioned scale drawings showing in complete detail the fabrication of all lighting fixtures including overall and detail dimensions, finishes, metal gauges, glass thickness, type, fabrication methods, support method, ballasts, transformers, sockets, switches and types of wiring, electrical and mechanical connections, welds, fasteners, joints, end conditions, targeting and locking devices for adjustable fixtures, type of shielding, reflectors, trims, hinges, gaskets, provisions for relamping, and all other information to show compliance with the Contract Documents. Indicate type and extent of inert insulating materials to prevent electrolytic corrosion at junctions of dissimilar materials. Clearly indicate work performed by others, and materials adjacent to or abutting work of this section.
  - 2. Installation instructions clearly indicating work performed by others and materials adjacent to work of this section.
  - 3. All drawings shall clearly indicate the Contract Drawing number of fixture details used as referenced in the development of the shop drawings and the name of the project, the specific location of the detail and the manufacturer's contact information.
- B. Samples
  - 1. Submit sample fixtures for each type, finish, and color of fixture specified, including full size lens patterns.

2. Submit for approval samples to the Architect when and where requested, the components tagged with the name of the project, and provided with a cord and plug, and specified lamps. Samples may not be returned. Allow two weeks from the date of receipt for thorough examination and review by the Owner's Representative.
3. Fixtures under the contract shall be identical to the approved sample fixture. No fixture used as a sample will be allowed to be installed on the project.
4. In the event the submissions are disapproved, the fixtures will be returned to the Contractor to immediately make a new submission of fixture or fixtures meeting the contract requirements.
5. All charges for these shipments are to be prepaid by the Contractor.

C. Mock-Ups

1. All custom fixtures require a submission of material finish samples, component approval, and a complete operating prototype fixture (including specified lamps) to be reviewed at the fabricator's shop prior to shipment of any material to the project.
2. Shop drawings for all lighting fixtures shall be received no later than 30 days after notice to proceed. The Contractor shall be responsible for coordinating approvals to allow timely delivery to the project site.
3. Shop drawings and samples requested shall be submitted for approval before fabrication. Any material produced prior to the approval of shop drawings or samples, and not in conformance with the Contract Documents, shall be disapproved with the Contractor bearing full responsibility and cost.
4. When required and requested by the Owner's Representative, samples submitted as per above shall be subjected to photometric, thermal, mechanical, electrical or water testing at an independent test laboratory, at no expense to the Owner.
5. No variation from the general arrangement and details indicated on the drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises, and then only with the written acceptance of the Owner's Representative. All variations must be clearly marked as such on the drawings submitted for approval.

1.3 QUALITY ASSURANCE

- A. Materials, equipment and appurtenances as well as workmanship provided under this Section shall conform to the highest commercial standards, and as specified and indicated on drawings. Fixture parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion and thermal and mechanical stresses encountered in the normal application and function of the fixtures.
- B. All fixtures shall be manufactured to a consistent level of quality. Size, color, and component parts shall be identical for all fixtures.

1.4 REFERENCE STANDARDS

- A. All fixtures and components shall be made in accordance with the National Electrical Code (NEC), and bear the Underwriter's Laboratories (UL) or Factory Mutual label.
  1. All fixtures shall be fabricated, wired, and installed in compliance with Applicable Code Requirements. Contractor to certify and provide all required labels indicating compliance with above standards, affixed to each fixture in a position concealing it from normal view.

2. All fixtures shall comply with the Certified Ballast Manufacturers Association (CBM), Illuminating Engineering Society (IES), the American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI), and the National Fire Protection Association (NFPA).

#### 1.5 QUALIFICATION OF MANUFACTURERS, FABRICATORS/INSTALLERS

- A. Manufacturers listed in the fixture schedule shall be assumed capable of supplying the listed fixtures unless exceptions are set forth in their quotations. Any such exceptions shall immediately be brought to the attention of the Owner's Representative. Manufacturers not listed must meet the following criteria:
  1. Manufacturer shall have a minimum of five years experience in design and manufacture of lighting fixtures of the type and quality shown. Submissions must include a list of completed projects and dated catalog pages or drawings indicating length of experience.
  2. Submit manufacturer's prototype sample of each fixture for review by the Owner's Representative. Prototype samples shall be sufficiently detailed and operational to allow evaluation of compliance with the salient features of the specification. Preliminary design or shop drawings shall not be accepted in place of prototype samples.
- B. The Architect shall be the sole judge in determining whether the prototype sample complies with the specifications, and shall reserve the right to disqualify any manufacturers.
- C. The fabricator/installer shall have a minimum of five years experience in fabricating and installing specialty lighting components and fixtures.

#### 1.6 GUARANTEE

- A. Furnish to Owner a written guarantee for fixture ballasts and LED fixtures against all defects in materials and workmanship for 5 years from the date of acceptance. Refer to Section 017800, CLOSE OUT SUBMITTALS for submittal form.

#### 1.7 LIGHTING PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Substitutions shall be considered only if submitted in accordance with Division 01 Section 012513. Fixtures must be operational with the specified lamp and be accompanied with the specified fixture for comparison. Alternate fixtures that do not comply with this format will not be reviewed and are considered to be rejected.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle all lighting fixtures and accessories carefully to avoid damage. Store in original protective packaging, tagged and marked as to type and location. Store under cover, out of contact with the ground, in clean, dry areas.

#### 1.9 JOBSITE CONDITIONS

- A. Install new lamps not earlier than 48 hours before the date of final inspection.

- B. Install exposed parts of fixtures after construction, painting, and general cleanup in the area have been completed.
- C. Inspect surfaces and structures to , and on, which products will be installed before the work of the Section begins, and ensure that these surfaces are capable of supporting the products. Surfaces that will be concealed by products shall be finished before products are installed.
- D. For all lensed and louvered fixtures, surfaces shall be wiped clean of all dust and material particles following installation and prior to project completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Lighting Fixtures: As described in the lighting fixture schedule. Lighting fixtures manufacturers' catalog numbers or model descriptions indicate quality, type, and style, but may not cover special required design details. Provide lighting fixtures having special details as noted in the fixture descriptions and drawings.
- B. Fixtures, in general, have been specified for the particular condition where they are being installed. Verify the ceiling system, wall, and pavement construction types and provide lighting fixtures, fittings, hangers, clamps, brackets, yokes, plaster flanges, and miscellaneous devices as required for a complete installation.
- C. Pendant Mounted Fixtures: Provide for continuous row fixtures that span the junction of adjacent fixtures and suspend fixtures using pendant stems of single piece construction. When necessary for sloping ceilings or seismic code compliance, provide swivel type pendant hangers. Locate ballasts symmetrically or provide weights as required to maintain balanced, level fixtures.

### 2.2 MATERIALS

- A. Fixtures: Provide completely factory-assembled, wired, and equipped with necessary sockets, ballasts, wiring, shielding, reflectors, channels, lenses and other parts and appurtenances necessary to complete fixture installation.
- B. All fixture submittals shall clearly state all material components, including alloys of each component and their respective characteristics relative to fixture performance and durability.

### 2.3 FABRICATION

- A. Fabricate surface mounted fixtures free of unnecessary knockouts, holes, and other gaps.
- B. Provide thickness of metal required or as specified so that all fixtures are rigid, stable and will resist deflection, twisting, warping or bending under normal installation procedures, loading, relamping, etc., or no less than as follows:

1. All steel luminaire housings minimum 20 gauge cold rolled steel for surface or suspended fluorescent fixtures, 22 gauge ribbed for recessed fluorescent fixtures, 18 gauge for incandescent and High Intensity Discharge (HID) fixtures.
  2. All aluminum extrusion housings minimum 0.090" thick.
  3. All acrylic lenses shall be minimum 0.1875" O.D. thick.
  4. All glass lenses shall be minimum 0.375" thick.
  5. All cast aluminum or bronze housings minimum of 0.375" thick.
  6. All sheet bronze, steel, aluminum or other metal plate minimum of 22 gauge.
  7. Provide neoprene or silicone gasketing, barriers, and stops where required to prevent light leaks or water and water vapor penetration.
- C. Provide finished product with ground metal edges, tight fitting connections free of light leaks, hinges and closures; clean, neat edges, trims, and frames; continuous welds, ground smooth; all exposed screws countersunk flush if exposed fasteners are allowed.
- D. Provide positive, durable means of connection at all joints as required.
- E. Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts, which must be removed during service, or for fastening electrical components and supports.
- F. All cast parts, including die-cast members, shall be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- G. Housings for LED, fluorescent and HID fixtures: Fabricate so electrical components are easily accessible and replaceable, without removing fixture body from mounting.
- H. Fasteners shall be manufactured of non-magnetic stainless steel, except in indoor applications where galvanized steel is acceptable in non-visible locations. Provide tamperproof screws in all fixtures mounted below 8 feet above finished floor. Use concealed hardware, unless noted otherwise.
- I. All adjustable fixtures shall be provided with reliable locking device to secure aiming angles of the fixture housing or lamp yoke as well as lamp and lens orientation devices to secure oval beam pattern lamps and spread lenses, as specified.

## 2.4 FINISHES

- A. Fixture finishes shall be applied in a manner that will assure a durable, wear-resistant surface.
1. Prior to finishing, all surfaces shall be free from foreign materials such as dirt, rust, oil, polishing compounds and mold release agents.
  2. Where necessary, surfaces shall be hot cleaned by accepted chemical means and shall receive corrosion inhibiting (phosphating) treatment assuring positive paint adhesion.
  3. Exposed metal surfaces used in interior areas, except chromium plated and stainless steel parts, shall be given an even coat of high grade methacrylate lacquer, or transparent epoxy with a satin finish.

4. All castings, extrusions, and spinning shall be machined, sanded or similarly treated, and given a minimum of one coat of baked-on clear methacrylate lacquer, unless a painted finish is specified, to provide a consistent texture, color, and finish throughout all exposed surfaces.
  5. Exterior metal surfaces such as extruded parts or casings, which do not otherwise receive a finishing coating, shall be machined, sanded or similarly treated. All such finished components shall be given a minimum of one coat of baked-on clear methacrylate lacquer, satin finish, unless an alternate finish is specified.
  6. Aluminum surfaces exposed to the weather shall receive a duromodic or polyester powder paint or clear methacrylate lacquer finish as specified for corrosion resistance. When in contact with concrete, aluminum shall be coated with bituminous paint, zinc chromate primer, or separated by a layer of plastic or other gasketing material. Creosote and tar coatings should not be used because of their acid contents.
  7. Sheet steel fixture housings, iron and steel parts, which have not received phosphating treatment or similar process or are to be utilized in exterior applications shall be made corrosion resistant by zinc or cadmium plating, or hot-dip zinc galvanizing after completion of all forming, welding, or drilling operations. Where aluminum parts come in contact with steel (or other metals), the steel shall be zinc plated or cadmium plated. Minimum thickness of above protective coatings shall be:
    - a. Hot galvanized zinc coating - 0.0005". ASTM A525, G90
    - b. Cadmium plating - 0.00015".
- B. Cadmium plate screws, bolts, nuts and other fastening and latching hardware in accordance with ASTM F1135. After plating, chase and finish threads intended to receive holding screws to ensure easy installation and removal of knurled-headed screws.
1. Parts operated under temperatures injurious to hot-dipped galvanizing shall be electroplated.
  2. Where aluminum parts come in contact with bronze parts, apply to both surfaces a coating guaranteed in accordance with the general requirements to prevent electrolytic action between the two metals.
- C. Reflectors and reflector bodies for fluorescent lamp fixtures having baked-on white enamel finish, shall be made of steel of the thickness specified and given a suitable primer and white color coats properly applied to meet the following requirements and tests:
1. Initial reflection factor is not less than 86 percent.
  2. After 100 hours of exposure to a fade-o-meter, reflection factor is not less than 85 percent and finish shows no visible color change.
  3. Exposure to 100 percent humidity at 110°F for 100 hours (Cook Box Test) shows no blistering or other effects.
  4. Salt spray (20 percent sodium chloride) for 150 hours causes no breakdown of film.
- D. When requested by the Owner, the Contractor shall submit a sufficient quantity of flat metal panels having the identical primer and color coats applied in the same manner as proposed for the Contract items, for subjection to any one or all of the tests listed herein by an approved independent testing laboratory. Provide panels of suitable size and drilled as necessary for a particular test procedure. The Contractor shall bear the cost of all required tests.

## 2.5 WIRING

### A. All wiring shall comply with the following:

1. Wiring between fluorescent lampholders and associated operating and starting equipment shall be of similar or heavier gauge than the leads furnished with the approved types of ballasts with equal or better insulating and heat-resistant characteristics.
2. Wire leads to the receptacle or connector of any side-prong incandescent lamp or any "cool-beam" lamp utilizing a dichroic reflector shall be SF-2 silicone rubber insulated stranded wire. Wire within housing shall be entirely covered with flexible woven fiberglass sleeve.
3. Wiring shall be protected with tape or tubing at all points where abrasion may occur. Wiring shall be concealed within the fixture construction except where design or mounting dictates otherwise.
4. Minimize splices. Make splices with approved mechanical insulated steel spring type connectors, suitable for temperature and voltage conditions to which splices are to be subjected.
5. Connections of wires to terminals of lampholders and other accessories shall be made in a neat and workmanlike manner and electrically and mechanically secure with no protruding or loose strands.
6. Wiring channels and wireways shall be free from projections and rough or sharp edges throughout, and all points or edges over which conductors must pass and may be subject to injury or wear, shall be rounded and bushed.
7. Insulated bushings shall be installed at points of entrance and exit of flexible wiring.
8. Junction boxes attached to lighting fixtures shall be manufactured in accordance with the National Electrical Code and approved for the number of conductors indicated on the drawings. Supplementary junction boxes shall be installed where required to comply with Code.
9. All exposed wire shall be jacketed with a flexible woven fiberglass sleeve or similar flexible metallic or armored cable (BX) or EMT type conduit.
10. When allowed to be exposed, all junction boxes and conduit to be painted as per the Owner's Representative's request.

## 2.6 MARKING OF FIXTURES

- A. Fixtures designed for voltages other than 110-125 volts shall be marked with operating voltage.
- B. Fixtures equipped for operation of 265 MA or 325 MA rapid start lamps shall be clearly marked to indicate the appropriate lamp type.
- C. Similarly, fixtures equipped for operation of instant start or other type lamps shall be clearly marked "USE INSTANT START LAMPS ONLY", or as appropriate for other types as required. Clearly mark multi-level output ballasts as such, and indicate proper terminals for various outposts. Markings shall be clear and located to be readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.
- D. Fixtures designed for operation of lamps below the rated enclosure maximum shall be clearly marked "Lamp Watts Not to Exceed \_\_\_\_" to maintain the design energy load.

## 2.7 SOUND TRANSMISSION

- A. Sound transmission through the light fixture units, when spaced as indicated on drawings, shall be sufficiently attenuated to maintain speech privacy between adjoining spaces. Contractor to provide insulating battens around the fixtures where sound transmission levels are unacceptable.

## 2.8 THERMAL PROTECTORS

- A. Provide thermal protectors as required by the NEC and other regulatory agencies in accordance with Section 014100. Thermal protectors shall prevent operation of lighting fixtures in enclosed spaces or adjacent to combustible materials at temperatures at or above 90°C (194°F).

## 2.9 LAMPS

- A. Provide electric lamps as shown in specifications or as modified in reviewed shop drawings plus 10 percent additional spare lamps of all types. All incandescent or quartz tungsten halogen lamps shall not be operated other than for testing prior to final inspection. Use inexpensive A-lamps during construction for all incandescent fixtures having medium base sockets.
- B. Lamps as specified for the individual luminaires or lighting equipment shall be delivered and installed in fixtures and lighting equipment leaving these completely lamped with new lamps and in normal operating condition.
- C. Tungsten halogen (quartz) lamps: Use lamps and lighting fixtures with compatible temperature ratings.
- D. Fluorescent lamps, unless otherwise designated, shall be of the rapid start type T8 and deliver not less than 3150 initial lumens for straight lamps. Fluorescent lamps are Triphosphor 3000° Kelvin unless noted otherwise. Lamps shall have reduced mercury contents that meet US Environmental Protection Agency (EPA) Toxic Characteristic Leaching Procedure (TCLP) test for non-hazardous fluorescent light waste pursuant to 22 CCR Section 66260.200 (e).
- E. Provide all incandescent lamps 130V, inside frosted, unless noted otherwise.
- F. Light Emitting Diode (LED) Lighting, wherein the LED fixture consists of a LED luminaire assembly, LED driver, and mounting hardware, fixture requirements are as described below:
  - 1. The input to the LED lighting fixture shall be 120 to 277VAC ( 10%), 60Hz or as indicated in the contract documents.
  - 2. Correlated Color Temperature (CCT) shall be minimum 2700K or as indicated in the contract documents.
  - 3. Color Rendering Index (CRI) shall be 90, and a R9 value > 50.
  - 4. A minimum of 50,000 operating hours before reaching the L70 lumen output degradations point without catastrophic failure, or as indicated in the contract documents.
  - 5. Conform with UL 8750.
  - 6. Power factor shall be 0.9.
  - 7. Lamps must fall within a 2-step MacAdam ellipse from the designated CCT.
  - 8. All LED lamps shall be capable of continuous dimming, flicker and noise free, from 1-100%.

9. The California Specification requires that the lamp be manufactured in compliance with all applicable California law regarding toxic material content and recyclability.

## 2.10 LAMPHOLDERS

- A. Lamp sockets shall be rigidly attached to fixture enclosure or husk.
- B. Incandescent and high intensity discharge lamp sockets shall be made of heavy duty heat-resistant porcelain over copper screw shells.
- C. Fluorescent lamp sockets operated with an open circuit voltage in excess of 300 volts shall be of the safety type, and open the supply circuit when the lamp is removed from the sockets.
- D. Provide nickel-plated brass or nickel-and silver-plated contacts in all lampholders for tungsten halogen lamps, lamps in outdoor fixtures, and mogul base incandescent, metal halide or mercury vapor lamps.
- E. Light Emitting Diode (LED) luminaire assembly requirements are as described below:
  1. Definition: Luminaire assembly is the LED assembly without the LED driver.
  2. Input voltage shall be 12VDC, 24VDC or as indicated in the contract documents.
  3. CCT, CRI, Minimum life and UL conformity requirements are as defined in the above section 2.09 regarding LED lighting fixtures.
- F. All lamp sockets shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all light fixture components. All adjustable sockets shall be preset at the factory for lamp specified.

## 2.11 FLUORESCENT AND HIGH INTENSITY DISCHARGE LAMP BALLASTS

- A. All fluorescent and high intensity discharge lamp ballasts shall be suitable for electrical characteristics of supply circuits to which connected, and conform to the following:
  1. All ballasts shall be "Class P" indicating approved integral ballast protection. Fuses in the primary leads shall be provided in addition to the "Class P" ballast. Install fuses readily accessible and easy to replace. Provide smallest acceptable fuses.
  2. All ballasts shall be of the high power factor type, energy saving, "super low heat" as manufactured by Universal, or equal.
  3. All HID ballasts to be encapsulated and have a maximum crest factor of 1.6.
  4. All HID ballasts shall meet UL standards for "Class H" operations (180°C) and shall be constant-wattage autotransformers (CWA) type, unless noted otherwise.
  5. UL and ANSI specifications with labels and/or symbols of approval by the UL and of certification by the Certified Ballast Manufacturers (CBM) as tested by the ETL
  6. The component parts shall be designed, fabricated, and assembled in accordance with the latest requirements of the NEC
  7. Ballasts shall provide safe and reliable operation of the specified lamps.
  8. For the operation of pre-heat, instant start, and slimline lamps, lead-lag type ballasts shall be used.
  9. Whenever possible, provide two-lamp ballasts for fixtures with two fluorescent lamps or multiples of two lamps. Three-lamp ballasts and four-lamp ballasts shall be used only as indicated.

10. Identical ballasts from the same manufacturer shall be installed within each fixture type.
11. Provide the lowest sound rating available for the lamps specified and clearly show their respective sound ratings. Ballasts found by the Architect to be unduly noisy shall be replaced without charge prior to acceptance of the Work. Inform Architect in writing if ballasts with sound rating "A" are not available.
12. Dimmer type ballasts shall be of a design recognized and approved under the UL component program. These ballasts must coordinate with the dimming control devices specified for the particular application.
13. Ballasts intended for outdoor use shall have a minimum lamp starting temperature of -20°F, except as noted otherwise.
14. Where ballasts are remote from fixture housing, provide suitable enclosures for installation with the conduit and wire from the ballast to the lamp socket clearly marked "Caution", "High Voltage". All remote ballasts shall be installed within the recommended distance from the lamp socket as per the manufacturer with access plates for maintenance and on neoprene pads for sound absorption.

B. Electronic Ballasts, Additional Requirements

1. Physically interchangeable with electromagnetic ballasts in new or existing fixtures.
2. Operate lamps at frequencies between 25 and 40 KHz from 60 Hz input source with less than 10% flicker, at ambient temperature of 50°F to 105°F with 60°C maximum case temperature during operation.
3. Maximum light regulation 5% with 10% input voltage variation.
4. Suitable for operation of 28T5, F21T5, F15T5, or F17T8, F25T8 and F32T8, one or two lamp, types as indicated or specified, designed for optimum operation of the specified lamps.
5. Solid-state consisting of rectifier, high frequency inverter, power control and regulation circuitry, in steel case, marked with manufacturer's name, part number, supply voltage, sound rating, power factor, open circuit voltage, RMS current draw, input watts, starting current, crest factor, efficiency and UL listing.
6. Ballast life to be unaffected by lamp failure.
7. Minimum ballast factor of 95%.
8. Maximum current crest factor of 1.7.
9. Maximum total harmonic distortion of 15%, maximum third harmonic distortion of 10%.
10. Minimum power factor of 90%.
11. Withstand line transients per IEEE 587, Category A.
12. Rated life of 30,000 hours based on 10 hours per day.
13. Submit with shop drawings a certified test report from an independent test laboratory-illustrating conformance with specified requirements.
14. Submit evidence with shop drawings from ballast supplier of three projects of significant magnitude, employing the proposed ballasts, in satisfactory operation for a minimum of one year. Identify projects, operating personnel familiar with the ballast performance, and frequency of ballast failure.

C. Except where noted otherwise, rigidly mount ballasts to inside top of fixture housing, with ballast surfaces and housing in complete contact for efficient conduction of ballast heat. Secure ballasts with removable fasteners (screws or bolts) instead of rivets.

D. Contractor to coordinate ballast line side voltage with branch circuit voltage as shown on Contract Drawings.

## 2.12 TRANSFORMERS (INCANDESCENT, COLD CATHODE, NEON)

- A. All transformers shall be sized to accommodate the intended load and utilized to operate lamps in a method approved by Underwriters Laboratory and shall not exceed the following:
  - 1. Neon: 9,000 volts, 60 VA.
  - 2. Cold Cathode: 500 VA.
  - 3. Incandescent: 500 VA.
- B. Provide self contained, UL listed transformers in 16 gauge steel housings with secondary and primary wiring compartments, mount all transformers securely to the fixture housings (if integral) or to the building structure (if remote) with neoprene pads to isolate vibration and noise.
- C. Provide all transformers with secondary over-current protection and a primary disconnect switch, which will automatically disconnect the primary switch when the wiring compartment cover is removed.
- D. All transformers shall be installed in accessible and ventilated locations with a maximum 100°F ambient temperature with air circulation on all sides.
- E. All winding type transformers will be high power with a maximum crest factor of 1.6.
- F. All regulating transformers shall be tested to have an output regulated to 3 percent for input variations of 15 percent to 25 percent, less than 3 percent distortion with a minimum load efficiency of 85 percent, and operating temperature of -20°C to 70°C.

## 2.13 DRIVERS (LIGHT EMITTING DIODE [LED] LIGHTING)

- A. LED driver requirements are as described below:
  - 1. Must operate input voltage between 120VAC to 277VAC ( 10%).
  - 2. Operating frequency must be 60Hz.
  - 3. Must be rated to operate between -40°C to +50°C.
  - 4. Must have a minimum efficiency of 85%.
  - 5. Self-protected including short circuit protection.

## 2.14 REFLECTORS

- A. Reflectors and reflecting cones or baffles shall be as follows:
  - 1. Absolutely free of any tooling marks including spinning lines, indentations caused by riveting or other assembly techniques.
  - 2. No rivets, springs, or other hardware visible after installation.
  - 3. First quality polished, buffed and anodized finish.
  - 4. Low iridescence for fluorescent sources.
  - 5. Specular finish color as selected by the Owner's Representative.
  - 6. All reflectors and baffles of modified elliptical contour, with no apparent brightness from above 40° above the nadir, with no lamp image or any part of the lamp visible from above 40° above the nadir.

7. Cone flange formed as an integral part of the cone and with identical color and finish, unless specified otherwise. Width of the flange covers all ceiling opening without light leaks or hardware visible.

## 2.15 LENSES

- A. All lenses secured by positive means with neoprene or silicone gasketing or washers as required to hold the lens tight within a frame or attach to a housing.
- B. All glass lenses shall be heat treated (tempered) or sealed with a clear acrylic laminate layer to provide a "safety glass" rating. All lenses which require removal for relamping or normal maintenance shall be attached to the fixture housing by a minimal length of safety chain to prohibit the lens from falling and striking surrounding surfaces. Glass edges exposed during the relamping process shall be gasketed to prevent chipping or cracking.
- C. Acrylic lenses shall be 100 percent virgin acrylic polymer, colorless, as manufactured by Rohm & Haas, Dupont or equal unless noted otherwise.

## 2.16 LOUVERS

- A. All fluorescent light fixture specular and semi-specular louvers shall be low iridescence parabolic and shall be rated at 90 percent or over on the Visual Comfort Probability (VCP) index.
- B. All plastic parabolic louvers shall be staticized before and after fabrication to insure minimum maintenance and retard dirt accumulation.
- C. All louvers shall be heat tested to withstand lamp-operating temperatures with no deformation of shape, paint blistering or discoloration.

## 2.17 FIXTURE TRIMS

- A. Provide trim details as shown on the Drawings or as specified, which are indicative of appearance and dimensional requirements. The trim finish and dimensions shall be subject to the approval of the Owner's Representative.
- B. Provide a mounting frame or ring with lock at recessed or semi-recessed light fixtures to secure the mounting frame to the ceiling and support any reflectors, trims or lenses. Ring shall be compatible with the ceiling and of sufficient strength to rigidly support the fixture and any stress applied in relamping.

## 2.18 SUPPORTS

- A. Comply with all applicable seismic codes requiring independent support for lighting fixtures.
- B. Provide plaster frames and mounting frames for fixtures as required, appropriate for ceiling construction in which installed.

- C. Provide formed, rolled, or cast metal attachment devices including brackets, plaster rings, saddle hanger and tie bars, of rigidity and strength to maintain continuous alignment of installed fixtures.
- D. Provide necessary hardware including stems, plates, plaster frames, hangers, and similar items, for safe support of fixture.
- E. Provide fastening devices of positive locking type, not requiring special tools to apply or remove. Do not use tie wires in place of fastening devices.
- F. Provide fixture supports adequate to support the weight of fixture.
  - 1. Provide surface passivated supporting members; primed or paint-dipped to resist corrosion.
  - 2. Finish exposed hanging devices to match fixture finish unless indicated otherwise.

## 2.19 LIGHTING CONTROL EQUIPMENT

- A. Requirements: Lighting control components shall be suitable for the lighting system specified and compatible for interface with other associated control devices. Lighting control components shall be rated for continuous service, and shall operate satisfactorily in every respect while the branch circuit power supply voltage to each system is within 10% of rated voltage at 60Hz.
- B. All HID lamps which are on 24 hours on time shall be programmed to have 15 minutes rest period per week. The programming of the rest period shall be done in such a way that all the circuits are not off at the same time.
- C. Photoelectric Sensor:
  - 1. Conform with UL 773.
  - 2. Provide operation in temperature range of -0°F to +110°F.
  - 3. Provide dusk-to-dawn operation, with adjustments from 2 to 50 footcandles with a five-second time delay to preclude false switching.
  - 4. Provide waterproof and tamperproof equipment.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Setting and Securing: Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved shop drawings. Conform to the requirements of NFPA 70.
- B. Mounting: Mounting heights specified or indicated are to bottom of suspended and ceiling-mounted fixtures and to center of wall-mounted fixtures.
- C. Support: Recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees if the ceiling system support rods or wires are provided with a minimum of four rods or wires per fixture and located not more than 6 inches from each corner of each fixture.

- D. Coordination: Coordinate with work specified in other sections as appropriate to properly interface installation of lighting fixtures with other work.

### 3.2 GENERAL

- A. Install fixtures complete with lamps and with equipment, materials, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames and brackets necessary to make a safe, complete, and fully operative installation.
- B. Do not install reflector cones, apertures, plates, lenses, diffuses, louvers, and decorative element of fixtures until completion of wet work, plastering, and general clean up in area of fixtures.
- C. Mount fixtures at heights and locations indicated on Drawings. Fixture locations indicated on Electrical Drawings are generalized and approximate. Carefully verify locations with the plans, reflected ceiling plans and other reference data prior to installation. Check for adequacy of headroom and non-interference with other equipment, such as ducts, pipes or openings. Bring conflicts to the Owner's Representative's attention before proceeding with work and ordering fixtures.
- D. Adequately protect housing of recessed lighting fixtures during installation by internal locking or framing to prevent discoloration of sides, and discoloration of threaded lugs; maintain perfect lug alignment and match corresponding holes in frames and rims. Insert holding screws freely without forcing, easily removable for servicing.
- E. Upon completion of installation, lighting fixtures and lighting equipment shall be in first class operating order and free from defects in condition and finish. At time of final Inspection, all fixtures and equipment shall be clean, fully lamped, and complete with required lenses; replace damaged diffusers, reflectors, side panels and other parts prior to final inspection.
- F. Support Services:
  - 1. Lighting Control System Startup: Provide factory-trained technician to confirm proper installation and operation of system components.
  - 2. Training: Provide factory trained application engineer to train Owner's personnel in operation and programming of lighting control.
  - 3. Programming: Provide following manufacturer's system programming on CD compatible with central PC:
    - a. Wiring documentation.
    - b. Programmable panel and system switch operation.
    - c. Telephone overrides.
    - d. Operating schedules.

### 3.3 COORDINATION

- A. Give ample notice of special openings required for placing equipment in building; avoid cutting completed work.

- B. Furnish materials and labor for work under this Section in ample time, and in sufficient quantities so work may be installed in proper sequence to avoid unnecessary cutting of floors and walls.

### 3.4 ACCESSIBILITY

- A. Install equipment such as junction and pull boxes, fixture housings, transformers, ballasts, switches and controls, and other apparatus that must be reached periodically for operation and maintenance, easily accessible.

### 3.5 ADJUSTMENTS

- A. Perform final focusing and adjustment, in presence of Architect of adjustable fixtures as required.

### 3.6 CLEANING

- A. Immediately prior to occupancy, clean reflector cones, reflectors aperture plates, lenses, louvers, lamps and decorative elements. Destaticize lenses after cleaning, install free of finger and dirt marks. Lamp shall also be clean and free of dust upon completion.

### 3.7 FIELD QUALITY CONTROL

- A. Tests: Upon completion of installation of lighting fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. Replacement Lamps: At the time of substantial completion and prior to field tests, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing.

END OF SECTION 265000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 265113 - INTERIOR LIGHTING FIXTURES, LAMPS AND BALLASTS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide labor, material, equipment and fixtures for interior lighting including necessary hangers and lamps. Fixtures shall be completely wired, controlled and securely attached to supports.
- C. Fixtures and associated components shall be new, of good quality and shall arrive on the jobsite in original packaging.
- D. Fixtures shall be listed by a Nationally Recognized Testing Laboratory, and shall meet required local, state and national building codes and regulations. Luminaires installed in exterior locations, unprotected from precipitation, shall be listed for wet location use. Luminaires installed in protected exterior areas or in interior areas subject to extreme humidity shall be listed for damp location use.

#### 1.2 RELATED SECTIONS

- A. Section 265600: Exterior Lighting Accessories.

#### 1.3 BIDDING AND SUBSTITUTION

- A. Comply with the provisions of Division 01.
  - 1. Bidders requesting approval of brands other than those specified by name/catalog number in that lighting fixture schedule or these specifications shall submit their requests not later than fifteen (15) business days before the scheduled bid due date. Contractors will be notified of approval in the form of an addendum to the bid documents for those products, which have been approved as equal. The Owner has no obligation to review or consider any substitutions after the bid date or pre-bid review period.
  - 2. Where indicated on schedule, substitution requests shall be accompanied by a working fixture sample - 120V, complete with lamp and cord/plug. These samples shall be shipped separately with return shipment guaranteed at the bidder's expense to the location designated by the Architect. Additional information, including names of projects and contact information (Owner, and Architect/Lighting Designer) for recently completed installations, will be required for these fixtures. If approved, these sample fixtures may not be installed on the project.
- B. Provide unit pricing for each specified or alternate fixture to include lamp, freight, and contractor mark-up.
- C. The Contractor shall be provided with entire lighting specification (including fixture illustrations and sketches). Contractor shall provide each specified manufacturer with complete information about the luminaires they will supply.

#### 1.4 SUBMITTALS

- A. Submit product data for review.
- B. Initial lighting submittal shall be complete, clearly indicating fixture manufacturer, model number, voltage, ballast manufacturer, options, finish, mounting type/special mounting details for each fixture specified on the project. The Architect reserves the right to request a shop drawing where information shown on the catalog cut sheets is incomplete. Partial submittals will not be accepted. Re-submittals, where required, may be partial as determined by the submittal review.
- C. Where custom fixtures, or row mounted fluorescent fixtures are required on the project, scaled fabrication drawings shall be submitted which indicate ballast locations, internal fixture wiring, support locations, power feed locations, materials and finishes. Contractor shall provide field dimensions for fabrication as required.
- D. Submit lamp product data for each specified lamp type.
- E. Fixture details shown on contract documents may be modified by the manufacturer if needed, providing all of the following are met:
  - 1. Fixture performance is equal or improved.
  - 2. Structural, mechanical, electrical, safety and maintenance characteristics are equal or improved.
  - 3. Cost to the Owner is reduced or equal.
  - 4. Modifications are clearly identified on the fixture submittal for Architect review and approval.
- F. Fixture submittals shall be arranged numerically as specified.

#### 1.5 SAMPLES

- A. Where indicated on schedule, provide a working fixture sample - 120V, complete with lamp and cord/plug. These samples shall be shipped separately with return shipment guaranteed at the bidder's expense to the location designated by the Architect. Sample fixtures may not be installed on the project.
- B. Samples are requested to allow the Architect to review manufacturing details, lamping, scale and finishes. Minor modifications, if any, shall be accomplished at no additional cost to the Owner's Representative.

#### 1.6 MOCK-UPS

- A. Where required by contract documents, it shall be the responsibility of the contractor to provide a mock-up of selected fixtures or lighting systems. The time period for erection of the mock-up shall be as determined by the Architect.
- B. Conditions for the mock-up installation shall as closely as possible represent the actual intended installation with respect to mounting height reflective surfaces, fixture and lamps, etc.

- C. The mock-up shall allow the architect to study the appearance, performance and effect of the lighting fixture or lighting system. Minimal variations to the mock-up may be requested during the mock-up phase. These final modifications to the mock-up, if any, shall be accomplished with no additional cost to the Owner's Representative.

## 1.7 QUALITY ASSURANCE

- A. Fixtures and workmanship shall be guaranteed free of defects and fully operational for a minimum of one year after project acceptance by the Owner. Any fixtures or workmanship found to be defective during the warranty period shall be replaced by the contractor at no cost to the owner for labor or materials.
- B. Fluorescent ballasts shall have an extended three-year manufacturer's warranty against defects in workmanship or material. HID ballasts shall have a two-year warranty against defects in workmanship or material. Warranty shall include in-warranty service program providing for payment of authorized labor charges associated with the replacement of inoperative ballasts within this warranty period.

## PART 2 - PRODUCTS

### 2.1 GENERAL MATERIAL REQUIREMENTS

- A. Acceptable Manufacturers:
  - 1. Provide light fixtures by Manufacturers indicated on fixture schedule or equal fixture by Manufacturer listed below:
    - a. Fluorescent Troffers:
      - 1) Columbia.
      - 2) Lithonia.
      - 3) LSI/Innovator.
      - 4) Metalux.
      - 5) Williams.
      - 6) Daybrite.
    - b. Downlights:
      - 1) Prescolite.
      - 2) Lithonia/Gotham.
      - 3) Spectrum.
      - 4) Omega.
      - 5) Cooper/Portfolio.
    - c. Exit Lights and Egress Lights:
      - 1) Dual-Lite.
      - 2) Lithonia.
      - 3) Emergi-lite.
      - 4) McPhilben.

- B. Luminaire hardware shall be concealed. Fasteners shall be manufactured of non-magnetic stainless steel or anodized aluminum, except in indoor applications where galvanized steel shall be acceptable.
- C. Fixtures shall be free of light leaks and shall be designed to provide sufficient ventilation of lamps and ballasts including vent holes where required. Exterior fixtures shall have wire mesh corrosion resistant screens in the vent holes.
- D. Fixture housings for linear fluorescent lamps shall be No. 22 gauge steel, bonderized or equal rust protection, or No. 16 gauge aluminum rigid construction, suitable for continuous row mounting where indicated.
- E. Fixture housings for incandescent or HID lamps shall be:
  - 1. Interior locations
    - a. No. 20 gauge steel, bonderized or equal rust protection, or
    - b. No. 16-gauge aluminum rigid construction.
  - 2. Exterior locations
    - a. No. 18 gauge steel, bonderized or equal rust protection, or
    - b. No. 14-gauge aluminum rigid construction.
- F. Fixtures shall be constructed with a minimum number of joints. Exposed metal joints shall be welded, filled with weld material, ground smooth and made free of light leaks. Unexposed joints shall be welded, screwed or bolted. Soldered joints are not acceptable. Self tapping methods or rivets for fastening removable parts used to gain access to electrical components requiring service or replacement, or for fastening electrical components or their supports, will not be acceptable.
- G. Sheet metal work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. Edges shall be finished such that no sharp edges are exposed. Miters shall be in accurate alignment. Sheet metal work shall be properly fabricated so that planes will not deform due to operating and varied weather conditions.
- H. Cast or extruded parts of luminaires shall be close grained, rigid, true to pattern, of ample weight and thickness, and properly fitted, filed, ground, and buffed to provide finished surfaces and joints free of imperfections or discolorations.
- I. Housings for fluorescent and HID fixtures shall be designed to ensure electrical components are easily accessible and replaceable, without removing the fixture body from its mounting.
- J. Finishes:
  - 1. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked paint process to prevent corrosion and discoloration of adjacent materials.

2. For weatherproof and vapor tight installations, painted finishes of fixtures and accessories shall be weatherproof enamel using proper primers or hot dipped galvanized and bonderized epoxy, in accordance with the manufacturer's requirements. Finish of painted surfaces shall have a life expectancy of not less than twenty years.
  3. Finishes for interior luminaires shall be baked enamel unless specified otherwise. Concealed interior and exterior surfaces, including hardware, yokes, brackets, etc., shall be finished matte black.
  4. Pendant hangers, where required, shall be chemically resistant, weatherproof baked enamel finish.
  5. Where aluminum parts come in contact with bronze parts, apply to both surfaces a coating material to prevent corrosion.
- K. Fixtures with an adjustable lamp and using a lamp with an asymmetrical light pattern shall have an aiming stop which can be permanently set so that the lamp shall remain correctly positioned after service or relamping.
- L. Fixtures shall be designed, manufactured and wired to conform to NEC article 300.22 where the fixtures are recessed in a hung ceiling, and the space above the ceiling is utilized for supply or return air plenum.
- M. Incandescent luminaires shall include a thermal protection device as required by NEC 410.65.

## 2.2 LAMPHOLDERS

- A. Lampholders shall be rigidly and securely attached to the luminaire and shall hold lamps securely against normal vibrations and maintenance handling. Lampholders shall be suitable for specified lamps, and set to position the lamps in optically correct spacing and relationship to lenses, reflectors, filters and baffles.
1. Lampholders for incandescent, HID and halogen lamps shall be porcelain with nickel-plated copper screw shells.
  2. Lampholders for pulse-start Metal halide shall be 4 kV pulse-start rated, porcelain with nickel-plated copper screw shells.
  3. Lampholders for fluorescent shall be white heat-resistant plastic. Lampholders intended for operation with an open circuit voltage in excess of 300 volts shall be the safety type, designed to open the supply circuit when the lamp is removed from the socket. Where fluorescent lamps are installed in unenclosed fixtures, a minimum of two lamp retaining clips per lamp shall be provided.

## 2.3 REFLECTORS

- A. Reflector Cones:
1. Provide 45 degree lamp and lamp image cut-off unless otherwise specified. In fixtures where upper reflector is separate from cone, cut-off shall be 45 degrees unless otherwise specified.
  2. Reflector cone retention devices shall not deform the cone in any manner.
  3. Plastic materials shall not be used for reflector cones or aperture plates.
  4. Fixtures, which require pressure to be applied to the finished surface of the reflector in order to remove the reflector, are not acceptable.

5. Ceiling flange shall be formed as an integral part of the cone or fixture reflector assembly and shall have identical color and finish as the cone, except as scheduled. The flange surface shall be perpendicular to the cone axis and shall be of appropriate width to adequately cover the ceiling opening without light leaks, or visibility of fixture housings.

B. Aluminum Reflectors:

1. Aluminum reflectors and reflecting cones shall be manufactured of uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy free of spin marks or other defects or blemishes caused during manufacture. No riveting or springs shall be visible after installation. The reflector inner surface shall have an anodic coating of not less than four mils thick. The inner surface shall be free of water spotting and shall maintain a reflectivity ratio of not less than 83 % on clear specular finish. The reflector shall have a low iridescent finish free from multiple colors seen from normal viewing angles.
2. Luminaires provided with tri-phosphor type lamps shall be provided with low iridescence aluminum reflectors to eliminate discoloration on aluminum reflectors.
3. The reflecting surface of the cone shall be tested for proper sealing per ASTM B136-63T.

C. Painted Reflectors:

1. Painted reflectors shall be formed before application of primer and paint. Finish process for reflectors and reflector cones for luminaires with baked white enamel finish shall meet the following requirements.
  - a. After 100 hours of exposure to fade-o-meter, reflectance shall be not less than 85%, and finish shall show no visible color change.
  - b. After 100 hours of exposure to 100% humidity at 100 degrees F, finish shall show no blistering or other degraded effects.
  - c. After 150 hours of exposure to salt spray (20% sodium chloride) shall cause not breakdown of film.

## 2.4 LENSES

- A. Lenses, louvers and other light diffusing components shall be contained in frames. Components shall be removable but positively held within the frames so that hinging or other motion of the frame will not cause the diffusing component to drop out. This safety device shall be detachable if necessary and shall not interfere with the fixture performance, maintenance, or the seating of any fixture element, and shall not be visible during normal fixture operation.

B. Fresnel:

1. Lens shall have uniform brightness throughout the entire visible area at angles from 45 degrees to 90 degrees from vertical, without bright spots or striations.
2. Lens shall have opaque risers - color as specified in schedule.
3. Finish of visible regress surface of door shall be matte baked enamel paint - color as specified in schedule.

C. Glass:

1. Flat glass lenses shall be heat tempered borosilicate glass unless otherwise noted.
2. Provide clear glass safety lens in metal halide fixtures unless noted otherwise.

- a. Glass finish (i.e. sandblasting, etching, polishing) shall be as scheduled.

D. Acrylic:

1. Lenses shall be of injection molded crystal clear 100% virgin acrylic, .125 thickness.
  - a. For lenses with female pattern, specified thickness refers to overall thickness of material. (Example: A12.125 lens refers to a .125 nominal thickness)
  - b. For lenses with male pattern of pyramids (cones), specified minimum thickness refers to distance from flat surface to base of pyramids (cones), or thickness of undisturbed material. (Example: A19 lens)
2. Lenses shall fully eliminate lamp images when viewed from all directions within the 45-degree to 90-degree angle from vertical when the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.5. Within the viewing angle from 0 to 45 degrees, the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.
3. Lenses shall produce a VCP or at least 65 based on a 30 x 30 room with 80/50/20 reflectances lit to 100 footcandles (verified by and independent laboratory.)
4. Lenses shall produce no more than 585 footlamberts of brightness in the critical 65-degree zone.
5. Finishes (i.e. sandblasting, etching, polishing) shall be as scheduled.

2.5 PARABOLIC AND FLAT BLADE LOUVERS

- A. Louvers shall be continuously bound in channel formed frame, finish and color as scheduled.
- B. Louver shall provide a minimum visual cut-off to the lamp of 45 degrees.
- C. The finish of the visible surface of the reflector shall be highly specular as described above for the Alzak process.
- D. For flat blade louvers, blade thickness shall be a minimum of .125" flat steel.

2.6 BALLASTS

A. Fluorescent:

1. Unless indicated otherwise on fixture schedule, linear fluorescent lamp ballasts shall be Programmed Start
2. Provide 2, 3 or 4-lamp ballasts as required for the number of lamps in each fixture unless indicated otherwise on drawings. Where dual switching of multiple lamp fixtures is shown on drawings to provide variable light intensities, provide multiple ballasts per fixture as required to accomplish the switching arrangement shown.
3. Acceptable Manufacturers:
  - a. Instant Start
    - 1) 20% THD-T8 lamps: Advance REL Series (120V), VEL Series (277V) or equivalent by Magnetek, Motorola, Osram/Sylvania.

- 2) 10% THD-T5/T8 lamps: Advance RCN Series (120V), VCN Series (277V) or ICN Series (dual 120/277V) or equivalent by Magnetek, Motorola, Osram/Sylvania.
- b. Programmed Start
  - 1) Advance Mark V (2F32T8) RIC-2S32.
  - 2) Advance Centium (2F28T5) RCN-2S28 or equivalent by Magnetek, Motorola, Osram/Sylvania.
- c. Rapid Start
  - 1) 20% THD-T8, T8/HO lamps: Advance GEL series or equivalent by Magnetek, Motorola, Osram/Sylvania.
  - 2) 10% THD-T8 lamps: Advance GCN Series or equivalent by Magnetek, Motorola, Osram/Sylvania.
- d. Program Rapid Start
  - 1) 10% THD-T8 lamps: Advance RCN series (120V), VCN series (277V) or equivalent by Magnetek, Motorola, Osram/Sylvania.
- e. Programmed Start Dimming
  - 1) (0-10 volt dimming) Advance Mark VII Series, Motorola Helios, Lutron Eco-10.
  - 2) (Line Voltage dimming) Advance Mark X series, Lutron Hi-Lume.
4. Ballasts shall be high frequency electronic type, and shall operate lamps above 42 kHz to avoid interference with infrared devices.
5. Ballasts shall operate from 60 Hz input source of 120 or 277 volts and be capable of withstanding sustained variations of +/- 10% in voltage and frequency without damage to ballasts. Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage. Ballasts shall provide transient immunity as recommended by ANSI C62.41.
6. Ballasts shall comply with ANSI C82.11; FCC Part 18 Non-Consumer Equipment, Class A for EMI.
7. Ballasts shall have a Class A+ sound rating.
8. Input current Total Harmonic Distortion (THD) shall not exceed 10% for non-dim primary lamp applications, and 10% for dimming applications.
9. Ballasts shall operate lamps with no visible flicker (<3% flicker index).
10. Minimum ambient temperature for lamp start shall be 0 degrees F.
11. Lamp Current Crest factor shall be 1.7 or less in accordance with lamp manufacturer recommendation for non-dim applications, and 1.6 or less for dimming applications.
12. T8 and T5 Ballasts shall have a Power Factor of .98 or greater for primary lamp applications. Dimming ballasts shall have a Power Factor of .98 or greater at full light output and greater than .90 throughout the dimming range. Compact fluorescent ballasts shall have a Power Factor of .96 or greater.
13. Ballasts shall have a minimum Ballast Factor for primary lamp applications per ANSI C82.11 as listed below:
  - a. T8 normal light output: 0.85.
  - b. T8 low wattage: 0.75.

- c. T8 High light output: 1.2.
  - d. T5 and T5HO: 1.00.
  - e. Dimming Ballasts with 0-10Volt control: range 0.88-0.05 (100% to 5% relative light output).
  - f. Dimming Ballasts with powerline control: range 1.0-0.05 (100% to 5% relative light output).
  - g. T4 and T5 Compact fluorescent 13W- 42W: 0.93.
14. Compact fluorescent, T5 and T5HO ballasts shall incorporate lamp shutdown circuitry for end of lamp life protection. Ballasts shall allow for relamping without the need to cycle power.
15. Ballasts in exterior fixtures shall be UL935 listed, Class P, Type 1 Outdoor rated.

B. HID

1. CWA.
- a. Ballasts shall be designed in accordance with all applicable ANSI specifications including C82.4. Ballasts shall be manufactured in an ISO 9002 and ISO 14001 certified facility.
  - b. Core & Coil ballasts shall be designed with class "H" (180 degree) or higher insulation system and vacuum-pressure impregnated with a silica-filled polyester resin.
  - c. Core & Coil ballasts shall be designed to operate for 60,000 hours of continuous operation at their maximum rated temperature.
  - d. Core & Coil ballast and starter combinations shall be designed to provide a reliable lamp starting down to -40 degrees C for high pressure sodium, and -30 degrees C for metal halide at nominal line voltage +/- 10%.
  - e. Ballasts shall have a nominal ballast factor of 1.0.
  - f. Ballasts shall completely enclose all live parts.
  - g. Ballast igniters shall be designed to provide six months of lamp open circuit operation without failure.
  - h. Ballast igniters shall be designed to withstand 10,000 hours of continuous pulsing.
2. Electronic (Pulse Start)
- a. Lamp Current Crest Factor shall be 1.5 or less in accordance with lamp manufacturer recommendation.
  - b. Ballast shall tolerate operation of up to 85 degrees C case temperature without damage.
  - c. Ballast shall have a nominal ballast factor of 1.0.
  - d. Input current THD shall not exceed 15% for the primary lamp.
  - e. Ballasts shall have a power factor greater than .90.
  - f. Ballast shall have a Class A sound rating. Ballast shall be acoustically isolated from housing using mounting pads to minimize vibration and noise level.
  - g. Ballast shall be thermally protected and incorporate lamp shutdown circuitry for end of lamp life protection.
  - h. Ballast shall operate in ambient temperatures as low as -20 degrees F.
  - i. Ballast shall operate lamps at a frequency of less than 200 Hz to minimize acoustic resonance inside the lamp arc tube and to minimize lamp flicker.
  - j. Ballast shall be manufactured in an ISO 9002 certified facility.

## 2.7 FIXTURE WIRING

- A. Voltage rating for conductors shall be 300 volts minimum for fixtures designed to operate at 120 Volts or less, and shall be 600 volts minimum for fixtures designed to operate above 120 volts.
- B. Wiring shall be code-approved for fixture wiring, and shall comply with the minimum temperature ratings mandated by recognized testing agency.
- C. Flexible cord wiring between fixture components or to electrical receptacle, which is not enclosed in wireway, shall have a minimum temperature rating of 105 degrees C. Cord shall be suitable for the application and shall be fitted with proper strain relief and watertight entries where required by the application.
- D. Splices within fixtures shall be made within separate splice compartments, and shall utilize nylon insulated crimped connections or quick disconnect devices. Splices to branch circuit shall be made using flame retardant thermoplastic wire nuts with fully seated helical metal spring and threaded entry.

## 2.8 LAMPS

- A. Lamps shall be as indicated on the lighting fixture schedule. Except as specified otherwise, lamps shall be of the same manufacturer throughout the project.
- B. A complete set of new lamps shall be provided for each fixture in the project. Where fixtures are installed and utilized for testing before substantial completion, the required set of new lamps shall be installed no earlier than one month before scheduled substantial completion. Contractor shall provide lamps for use if fixtures must be utilized earlier in the project.
- C. Fluorescent lamps shall be as manufactured by Philips, Osram/Sylvania or GE. Provide the same lamp color and CRI as indicated below throughout the project except as scheduled otherwise:
  - 1. 4100 degree K, 85 CRI or greater.
- D. Incandescent Lamps shall be 130 volt rated (Extended / Rough service) operated at 120 volt where available.
- E. Metal halide lamps for indoor applications shall include:
  - 1. Coated type with CRI of 70 or greater with color shift not to exceed +/- 400 degrees K for mogul base, or +/- 200 degrees K for medium base (Equal to GE, Philips, Osram, Venture).
  - 2. Stabilized color, coated with CRI greater than 80 (Equal to GE ConstantColor, Philips MasterColor).
- F. Provide pulse start lamps for pulse start fixture types.
- G. Metal Halide lamps for outdoor applications shall be clear.

## 2.9 EMERGENCY TRANSFER AND BATTERY PACKS

- A. Emergency lighting shall be provided with an emergency ballast. Ballast shall delay AC ballast operation for five seconds to prevent false tripping of AC ballast end-of-life shutdown circuits. Emergency ballast shall consist of a high-temperature, maintenance-free nickel-cadmium battery, charger and electronic circuitry contained in one galvanized steel case.
- B. A solid state charging indicator light to monitor the charger and battery, a single-pole test switch, and installation hardware shall be provided, and shall be completely assembled in the luminaire.
- C. Where emergency fixtures are installed in locations inaccessible from a 15-foot ladder, the test switch shall be installed remotely in location as determined by the Architect or as indicated on drawings.
- D. The emergency ballast shall be capable of providing the lumen output as indicated below. Acceptable manufacturer: Bodine, Iota Engineering, Side-Lite, DualLite. (Bodine model numbers are listed for quality standards.)
  - 1. 1350 total Lumens for straight lamps: Bodine B50 (High lumen output).
- E. The emergency ballast shall be capable of providing the lumen output as indicated below. Acceptable manufacturer: Bodine, Iota Engineering, Side-Lite, DualLite. (Bodine model numbers are listed for quality standards.)
- F. Where Emergency lighting is connected to a generator, but where time delay for lamp restart is not acceptable, provide short duration battery packs for indicated fixtures which will provide continuous light output until generator start-up and transfer is completed. Battery pack shall be capable of providing the lumen output as indicated below.
  - 1. 3200 lumens for a single straight or long compact fluorescent lamp: Bodine GEN1.
  - 2. 7900 total lumens for multiple straight or long compact fluorescent lamps: Bodine GEN3.
- G. Where Emergency lighting is connected to a generator, but must also be controlled locally, provide a transfer device for each fixture, which will bypass the local control upon loss of normal power source. Device shall be mounted within the associated fixture and shall be warranted by the manufacturer for five years. Unit shall be UL listed as a transfer device, equivalent to Bodine GTD or approved equal.

## 2.10 ATTIC STOCK

- A. Provide one case of each lamp type utilized in the project and turn over to owner at project completion.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Scheduling of fixture installation shall be coordinated with other trades such that the fixtures will be protected from construction and dirt/water/debris damage. Fixtures, which are damaged, shall be replaced at no cost to the owner.

- B. Fixtures shall be securely mounted as required by NEC and manufacturer recommendation.
- C. Coordinate with ceiling system contractor for the installation of ceiling support wires at two opposing corners of recessed troffer fixtures.
- D. Support fixtures in seismic zones as detailed on drawings.
- E. Fixtures shall be located and installed as shown on architectural reflected ceiling plans. Coordinate with other trades to allow fixture locations to clear diffusers, ductwork and piping.
- F. Coordinate final locations and mounting heights of fixtures within mechanical and electrical rooms with units, duct, conduit and cable tray routings for optimal performance of specified fixtures. Maintain access for servicing of luminaire components.
- G. Determine type of ceiling to be installed in each space from architectural drawings and schedules and furnish fixtures suitable for the exact ceiling type.
- H. Receive, store, uncrate, install and lamp fixtures shown in schedule on drawings or indicated to be furnished by others.
- I. Recessed fixtures in dropped ceiling areas shall be connected using flexible conduit. Conduit shall be connected to fixture and outlet box. Each piece shall have a separate insulated green grounding conductor not smaller than No. 14 for grounding continuity between fixture and conduit system. Grounding conductor shall be mechanically connected in a permanent and effective manner to fixture and conduit system and be electrically continuous. No conduit shall enter a recessed fixture directly as this method prevents removal of fixture without disturbing balance of circuit.
- J. Recessed fixtures installed in exposed or concealed tee bar ceilings may use ceiling grid to support fixtures. Fixtures shall be securely fastened to ceiling framework using approved clips per NEC.
- K. Recessed and surface fixtures in or on concealed Z-spline ceilings shall be supported from the building structure.
- L. Recessed and surface fixtures in or on plastered or drywall ceilings shall be supported from support channel spanning across main support channels and shall not depend on ceilings for support. Fixtures in plastered or dryvit ceilings shall have plaster frames.
- M. Maintain integrity of enclosures on enclosed and gasketed fixtures. Minimize number of enclosure penetrations and make such penetrations water and dust tight with appropriate gasketing and fittings.
- N. Where fixtures are served from multiple circuits (i.e. normal and night/emergency operation or large loads which are dual level switched), each branch circuits shall be provided with a separate neutral conductor back to the associated panelboard.
- O. Provide fire-rated enclosures around recessed luminaires, which are installed in fire, rated ceiling assemblies.
- P. Coordinate length of continuous-run fluorescent fixtures with actual cove, wall, coffer, partition dimensions.

- Q. Replace noisy ballasts as directed by the Architect.
- R. Parabolic luminaires shall be installed with Mylar cover over louvers. Cover shall be UL listed for temporary lighting. Upon completion of work, remove Mylar cover with white gloves.
- S. Upon final building cleaning, clean the lenses, baffles, louvers, reflector cones and bottoms of the trims of all lighting fixtures. Use soft, non-abrasive cloth and a cleaning solution as recommended by the fixture manufacturer. Luminaire components whose finishes are damaged shall be replaced at no cost to the Owner.

### 3.2 AIMING AND ADJUSTMENTS

- A. Adjustable fixtures shall be adjusted by the Contractor to illuminate intended area to the satisfaction of the Owner. Labor, equipment and other materials necessary to perform aiming shall be provided as needed.
- B. Exterior adjustable fixtures shall be adjusted at night by the Contractor to illuminate intended area to the satisfaction of the Owner. Labor, equipment and other materials necessary to perform aiming shall be provided as needed.

END OF SECTION 265113

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 265600 - EXTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 260500.
- B. Provide labor, materials, equipment and fixtures for exterior lighting, including, lamps, poles and pole bases for:
  - 1. Parking lot and access roads.
  - 2. Exterior signage.
  - 3. Walkways and exterior building lights.
- C. Refer to details and arrangements shown on drawings.
- D. Concrete bases will be installed under other Divisions. Coordinate proper size of bases, anchor bolts and conduit stub-ups.
- E. Where seismic conditions exist, provide concrete bases as indicated in the detail on drawings.
- F. Fixtures and poles shall be suitable for exterior use, shall be UL listed, and shall be a standard design for exterior application.

#### 1.2 RELATED SECTIONS

- A. Section 265113: Interior Lighting Fixtures, Lamps, and Ballasts.
- B. Division 03: Concrete.
- C. Division 09: Painting.

#### 1.3 SUBMITTALS

- A. Submit product data for review.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are those shown in lighting fixture schedule on drawings.
- B. For contactors: Square "D", General Electric, Allen-Bradley, Cutler Hammer.
- C. For Photo Cells: Tork, Model No. 2101.

## 2.2 MATERIALS

- A. Luminaires, including all components, shall be designed to meet extreme temperature (low), moisture, and wind conditions in area of project.
- B. Poles: Steel, round or square, designed for 100 MPH constant velocity wind load.
  - 1. Include base template, 4 anchor bolts, cadmium plated hardware and pole grounding lug, handhole, cast steel anchor base and bolt covers.
  - 2. Finish: Factory primed, supplier to furnish sufficient paint for adequate field painting of two coats. Application of paint shall be accomplished under Division 09.
- C. Ballast shall be UL listed high power factor, designed for -20 F starting.
- D. Diffusers shall be 100 percent virgin acrylic Plexiglas. Hardware and fasteners shall be corrosion resistant.
- E. Pole wiring from base to ballast shall be No. 12 with fuse protection by a 30 A, 600 volt Tron waterproof fuseholder, Bussmann "Limitron" fuse, size rating 3 times load current.
- F. Contactors: Mechanically held type, main contacts rated for 480 volts and ampacity required, 120 volt operating coil, designed for tungsten, fluorescent, metal halide, high pressure sodium or mercury lamp loads.
  - 1. Provide NEMA 1 enclosure.
  - 2. Square D, Class 8903.
- G. Photo Cells shall be 120 volt, enclosed, weatherproof type for outdoor application.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Install photo cells above roof with cells facing north.

END OF SECTION 265600

## SECTION 265668 - SPORTS LIGHTING FIXTURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Division-26 Common Work Results for Electrical sections apply to work specified in this section.

#### 1.2 SUMMARY

- A. This specification in conjunction with the Catwalk lighting drawings applies to sports lighting and house lighting to include lighting fixtures, lamps, drivers, brackets, mounting hardware, shop drawings and aiming prior to opening day, and recertification.
- B. The basis for this bid document is for the listed manufactures to provide the quantity of fixtures along with lamps, mounting brackets/hardware complete for complete installation by electrical contractor. The manufacturers bid submittal shall include separate cost for the following items and work activities.
  - 1. These bid documents are for LED technology.
- C. Types of sports lighting fixtures in this section include the following:
  - 1. Light Emitting Diode (LED) Sports Lights.
    - a. Type 1: 630 Watt LED, Sports lighting luminaire with high power LEDs. Individual lensing for glare controlled optics. Heavy duty cast aluminum housing, flicker free control gear, high power factor, energy conserving, 20,000 hour constant light output, stainless steel hardware, knuckle mount with vertical adjustment aiming, safety cable, beam spreads and aiming as determined computer study of the arena geometry for uniform lighting. Full DMX enabled and controlled for dynamic effects.
    - b. Type 2: 394 Watt LED, forward throw luminaire with aluminum heavy duty reflector assembly, cast aluminum housing, high power factor, energy conserving, 50,000 hour constant light output, clear tempered and impact resistant glass, stainless steel hardware, knuckle mount, safety cable, vertical adjustment aiming, beam spreads and aiming as determined by the computer study of the arena geometry for uniform lighting.
- D. The performance of the light fixture shall be guaranteed with the normal electricity supply voltage at 480 Volts plus or minus 10% at 60 HZ.
  - 1. Rodeo:
  - 2. Arena: 200"x100".
  - 3. Horizontal: 75 fc maintained average.
  - 4. Main Camera: 40 fc (vertical).
  - 5. Uniformity (Max/Min): 1.5 to 1.
  - 6. Coefficient of Variance: less than 0.21.
  - 7. Grid spacing 15"x15".

E. ICE Rink (NCAA National Broadcast Standards)

1. Rink Size: 200"x85".
2. Horizontal: 100 fc minimum average.
3. Main Camera: 100 fc (vertical) minimum average.
4. Main Camera (Max/Min): 1.7 to 1 horizontal and main camera.
5. End Camera: 60 fc (vertical) minimum average.
6. End camera (Max/Min) 2.5 to 1.
7. Grid spacing 14"x14".

F. Basketball (NCAA National Broadcast Standards)

1. Court Boundary: 94"x50".
2. Horizontal: 100 fc minimum average.
3. Main and reverse angle cameras: 100fc (vertical).
4. Baseline Cameras: 60fc (vertical).
5. Uniformity (Max/Min): 1.7 to 1 (horizontal and vertical).
6. Grid spacing: 15"x15".

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions on each type sports lighting fixture, driver and component. Product data shall include but not limited to noise level, starting current, running current, power factor and the time it takes to change from starting current to running current.
- B. Shop Drawings: The design will include aiming diagrams, illumination levels for both horizontal and vertical angles. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet.
- C. Shop Drawing Submittal:
1. Submit plans showing proposed mounting brackets using manufacturer's application software with the catwalk mounting heights, with the spacing of all fixtures on a 3"-0" grid for both horizontal and vertical.
  2. Submit computer generated photometric information as required.
  3. Array Test Points: Shall be provided covering the entire playing surface and seating bowl as required and indicated above.
  4. Computer photometrics shall be provided at 3 feet above playing surface, 20 feet above playing surface.
  5. Glare ratings, GR, shall be calculated for all calculation points on the field, seating bowl and for all camera locations.
  6. Luminaire dirt depreciation shall be utilized in the calculations.
  7. The contractor shall be responsible for installing the containing sports fixture on the catwalk, and aiming of each fixture to maintain the computer generated photometric design.
  8. The manufacturers shall submit a complete set of aiming diagrams showing the target aiming point coordinates and an alpha numeric aiming assignments on the playing surface for each luminaire, as part of the shop drawing submittal.
  9. Submit documentation depicting luminaire locations on the catwalk racks and indicate coordinate, vector and target assignments for each luminaire.

10. The engineer may visit the manufacturer prior to shop drawing approval to review and analyze the computer model for the field and seating bowl.
- D. Illumination Data: Provide isolux plot diagram of footcandles on horizontal and vertical surface which shows composite values of illuminance projected from the arrangement of light sources for indicated fixture locations and heights.
- E. Maximum spill calculation and maximum glare calculation will be required by the successful manufacturer for seating and scoreboard locations.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sports lighting fixtures of type of ratings required, whose products have been in satisfactory use in similar professional stadium and installed in the last 5 years. Only the manufacturers listed will be allowed.
- B. Codes and Standards:
  1. Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 225, 250 & 410 as applicable to installation, and construction of exterior lighting fixtures.
  2. 2NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No. LE 2 pertaining to lighting equipment.
  3. IES Compliance: Comply with IES RP-6-88, pertaining to sports lighting.
  4. UL Compliance: Comply with requirements of UL standards, including Stds 486A and 486B, pertaining to exterior lighting fixtures. Provide sports lighting fixtures and components which are UL listed and labeled.
  5. Local and State requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sports lighting in factory fabricated containers or wrapping, which properly protect fixtures from construction debris and physical damage.
- B. Store sports lighting fixtures in original wrappings in a clean dry space. Protect from weather, dirt, fumes, water, construction debris, and damages.
- C. The electrical contractor shall handle sports lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; remove units from site and replace with new.

#### 1.6 SEQUENCING AND SCHEDULING

- A. The electrical contractor shall coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface the installation of sports lighting with other work.

## 1.7 MAINTENANCE

- A. Maintenance Data: Submit maintenance data and parts list for each sports lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers include the following manufacturers:

1. Type 1: Musco LU228 with dual fixture driver.
2. Type 2: Musco LU96 with dual fixture driver.

### 2.2 SPORTS LIGHTING FIXTURES

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housing, mounting brackets, energy efficient drivers, safety chain, glass lens, and internal fitting wiring.
- B. All light fixtures and drivers shall be U.L. listed and bear the label.
- C. LED Lamps:
  1. Sources shall conform with the IESNA LM-79 and LM-80 published standards. They shall have a color temperature binning that does not exceed +/-200K. LED Lamp life shall be rated at 70% of initial lumens remaining. LED drivers shall be used @ 100% output for lumen output rating and not be underdriven or overdriven.
  2. Initial delivered lumens and thermal losses should be less than 10% when operated at a steady state at an average ambient operating temperature of 25°C, and optical losses should be less than 15%.
  3. Average Delivered Lumens and Average delivered lumens over 10,000 hours should be minimum of 100% of initial delivered lumens.
  4. LED boards, drivers and associated components shall have a Warranty of 5 years on the LEDs, 5 years on LED boards, the driver, 10 years on the paint finish, and guaranteed illumination levels for the full 15 year period from the date of product shipment.
- D. Drivers:
  1. Driver shall be capable of dimming the LED array from 20% to 100%.
  2. Driver shall have DMX input capable of dimming and controlling fixtures.
  3. Driver casing shall be constructed from aluminum.
  4. Driver shall have universal voltage input - 277 to 480 volt.
  5. All drivers shall comply with IEC 61347-2-13.
- E. Spare Components:

1. LED Boards: Furnish stock or replacement LED boards amounting to not less than 2% of each type and size board used in each type fixture. Deliver replacement stock as directed to Owner's storage space.
2. Drivers: Furnish stock or replacement drivers amounting to not less than 5% of each type and size driver used for each type fixture. Deliver replacement stock as directed to Owner's storage space.

## 2.3 CATWALK MOUNTED SPORTS LIGHTING

- A. Provide enclosed, gasketed and filtered heavy duty, narrow beam flood light which has a separate optical assembly completely enclosed by an all-aluminum housing.
- B. Each LED shall have a reflector to control light and limit glare.
- C. Driver assembly shall be remote from the optical LED assembly and have a cast aluminum housing.
- D. An adjustable yoke, or knuckle shall be secured to the luminaire housing. A calibrated indicator shall be integral to each luminaire for vertical and horizontal angular aiming. Each yoke or knuckle support shall have after relamp repositioning mechanism. Each luminaire shall have a retractable target aiming site mechanism secured to the housing.
- E. The optical assembly shall be gasketed using a continuous extruded silicone rubber at the door and lens to seal the optical assembly from dust particles.
- F. Reflector shall have door enclosure of tempered glass mounted to the reflector body by means of a hinged and secured by no less than three spring type stainless steel clamps.
- G. The door frame shall be hinged and secured by no less than three spring type stainless steel clamps.
- H. Target playing surface illumination design is based on the following photometric characteristics using lamp performance:
  1. Rated hours: Minimum 20,000 - 100,000 hours.
  2. Color Temperature: 4,500K -5,700K.
- I. The luminaire shall have a filtered airway to accommodate internal warm up and cool down pressure changes. Filter shall trap airborne particles.
- J. All external parts shall be corrosion resistant.
- K. Field Measurements:
  1. A minimum of sixty days prior to opening, a complete and comprehensive testing and final adjusting schedule shall completed by the manufacturer of the fixtures and the contractors. The goal of the testing is to permanently aim and permanently mark each fixture in the position for service. It is anticipated that two consecutive days/nights will be set aside for this testing. The electrical contractor shall conduct the tests. This will include personnel on the catwalks for aiming, marking the playing surface, providing a cosign corrected digital light meter for recording values, attendance of lighting fixture manufacturer's representative and other personnel and equipment needed to complete

the testing. The engineer shall be notified thirty days prior to testing and will be available to observe and participate in the testing. All suggestions and observations made by the engineer must be completed. At the end of the aiming, the manufacturer shall provide written documentation of the testing results for review by the engineer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF LIGHTING FIXTURES

- A. Install lighting fixtures at location and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA Standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and 486B, and the National Electrical Code.
- C. Fasten electrical lighting fixtures and brackets securely to indicated structural supports, and ensure that installed fixtures are plum and level. Provide safety cable from fixture and connect to structure.
- D. Provide a safety cable for each external glare louver, if applicable, that prevents the louver from falling when means of fastening are removed.
- E. Upon completion of installation, protect installed fixtures from damage during remainder of construction period.

#### 3.2 GROUNDING

- A. Provide equipment grounding connections for interior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

#### 3.3 FIELD QUALITY CONTROL

- A. Warranty:
  - 1. Manufacturer shall provide a fifteen year system warranty including the following:
    - a. Guaranteed light levels over the course over the warranty period.
    - b. Maintenance of all LED fixtures over the warranty period.

### 3.4 ADJUSTING AND CLEANING

- A. Aim adjustable lighting fixtures. Verify that measured illuminance values comply with computer calculated values submitted.
- B. Clean lighting fixtures of dirt and debris upon completion of installation. Two weeks prior opening, the contractor shall re-clean all fixtures which have accumulated dust, fingerprints and smudges on the reflector and lens.

### 3.5 DEMONSTRATION

- A. Upon completion of installation of sports lighting fixtures, and associated electrical supply circuitry, apply electrical energy to circuitry to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Reference field measurements section within this document for commissioning and turn over to Owner.

### 3.6 ANNUAL COMPUTER MODELING AND LIGHTING EVALUATION

- A. The successful lighting fixture manufacturer shall include in his/her formal bid the cost to perform and annual computer modeling and evaluation of the sports lighting for identification of required lamp replacement. The Owner's personnel, with assistance of the lighting fixture manufacturer, will perform illumination footcandle level readings and submit to the lighting fixture manufacturer for evaluation and recommendation.

END OF SECTION 265668

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Los Angeles, CA  
RA Project No. 2014-015

## SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide materials, labor, and methods for telecommunications grounding and bonding system in accordance with the requirements of the local access provider(s) or telecommunications cabling system installer. Work that relates to the installation of the system shall be subject to the inspection and approval of the authority having jurisdiction (AHJ).
- B. Drawings, details in other Divisions of these specifications, addenda, and other pertinent documents are considered to be a part of the technical requirements of this Division of the Specification insofar as they are applicable.
- C. The drawings and specifications requirements govern where they exceed Code and Regulation requirements.
- D. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
- E. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- F. Verify conditions on the job site applicable to this work. Notify the Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- G. The Drawings diagrammatically show arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.
- H. Materials are to be purchased new for this project.
- I. Manufacturer names are listed within the Division 27 Specification to comply with Owner requirements.
- J. During the course of construction, room names and/or room numbers may be changed. For continuity during installation the Contractor shall refer to rooms and spaces by their identities as shown on the ES series drawings. This shall apply to all correspondence, RFI's, proposal requests, and submittal packages pertaining to this Section.
- K. Materials that are listed by UL must bear the UL label. In the event UL has no published standard for a particular item, then other independent testing standards are to apply and the applicable labeling utilized.

#### 1.2 REFERENCED CODES AND STANDARDS

- A. Execute work in accordance with the following standards;

- B. TIA-568-C.1 Commercial Building Telecommunications Cabling Standard - (February 2009)
- C. TIA-569-B (October 2004): Commercial Building Standard for Telecommunications Pathways and Spaces
- D. TIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002)
- E. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, October 2002.
- F. National Electrical Code, including Article 800 Communications circuits.
- G. American National Standards Institute (ANSI).
- H. American Society of Testing and Materials (ASTM).
- I. Building Industry Consulting Services International (BICSI).
- J. National Electrical Manufacturer's Association (NEMA).
- K. National Fire Protection Association (NFPA).
- L. Underwriters Laboratories (UL).
- M. Requirements of the local Authority Having Jurisdiction (AHJ).
- N. Institute of Electrical and Electronics Engineers (IEEE), IEEE 1100 Emerald Book.

### 1.3 RELATED SECTIONS

- A. Specification sections related to the Grounding and Bonding System include:
  - 1. Division 01- General Requirements.
  - 2. Division 26: Electrical Systems.
  - 3. Division 27: Structured Cabling System.

### 1.4 DEFINITIONS

- A. Some processes, methods, and procedures, as well as spaces, rooms and structures, may be abbreviated or used interchangeably within this section. The following list is presented to reconcile these differences within this section.
  - 1. Telecommunications Space (TS) - A common area used for telecommunications cabling terminations and the location of telecommunications equipment.
  - 2. TWC Room - An environmentally controlled TS that is the primary point of interconnection between the communication facility provided by the public switched telephone company network and the building's communications facility.

3. IT Server Room - An environmentally controlled space that is the telecommunications structured cabling primary distribution point to the Telecommunications Rooms (TR) and Zone Panels. The space is designated for an exclusive purpose of housing communications equipment and related wiring that serves the building's communications.
4. Telecommunications Rooms (TR) - An environmentally controlled space that is the telecommunications structured cabling distribution point. The space is designated for an exclusive purpose of housing communications equipment and related wiring that serves a specific area of the building.
5. Zone Panel (ZP) - A ceiling mount enclosure that serves as a TR.
6. TMGB: Telecommunications Main Grounding Busbar.
7. TGB: Telecommunications Grounding Busbar.
8. TBB: Telecommunications Bonding Backbone.
9. TBC: Telecommunications Bonding Conductor.

## 1.5 SCOPE SUMMARY

- A. Bonding and grounding installed in accordance with Equipment Manufacturers and Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications. These provisions include, but are not limited to,
  1. Bonding and grounding of service entrances and conduits.
  2. Labeling of ground bus bars, ground cables and conductors in compliance with the above mentioned Standard.
- B. Installation of the Telecommunications Main Grounding Busbar (TMGB) in the MTR.
  1. Connection of the TMGB to the building's electrical service ground.
    - a. Each TGB shall be directly attached to the closest point of the building's structural steel and also bonded to the TMGB via the Telecommunications Bonding Backbone (TBB) conductor. The TMGB is, in turn, connected to the building's structural steel and also to the building's main electrical service ground via the Telecommunications Bonding Conductor (TBC).
    - b. Following
  2. Non-vertical TGBs shall be home-run connected to the TMGB via a continuous insulated copper conductor - Telecommunications Bonding Backbone (TBB).
    - a. The TBB size shall be increased according to system design and local conditions demand. See the following sizing chart.

Conductor Sizing	
Length m	Size (AWG)
Less than 4	6
4-6	4
6-8	3
8-10	2
10-13	1
13-16	1/0
16-20	2/0
Greater than 20	3/0

Bonding conductors shall be routed with a minimum number of bends. Any bends placed in the conductor shall be sweeping.

3. Limiting the distance between the telecommunications closets will include designing an optimal grounding arrangement, which minimizes intersystem grounding disturbances.
4. Busbars shall be pre-drilled with holes as per the local standard's described hole pattern for attachment of bolted compression fittings.
5. Make bonding connections with listed bolts, crimp pressure connectors, clamps, or lugs.
6. Place electro tin plated copper grounding busbars of minimum specified sizes in service entrances and telecommunications closets.
7. Install a Telecommunications Grounding Busbar (TGB) in each TR as shown on drawings, convenient to equipment location.

C. The Contractor will:

1. Provide labor, tools, transportation, and physical plant, to support the installation in accordance with the established time-line and standards.
2. Deliver Submittals, Shop Drawings and Test Records as specified herein.
3. Obtain permits, licenses, or other municipal requirements and pay any fees required for the execution of this Work.
4. Execute all Work in accordance with all applicable codes, ordinances, and regulations.
5. Supply accessories and minor equipment parts regularly required for a complete system, even if not specifically mentioned in these Specifications or on the associated telecommunications drawings, without claim for additional payment.
6. Coordinate, provision, and test the telecommunications grounding hardware as required in this section.

D. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

E. Provide other material as normally required to complete a Grounding and Bonding System and to make the Grounding and Bonding System complete and ready for use by the Owner.

F. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply systems in full working order.

G. Provide necessary labor, materials, tools to complete the installation of the Grounding and Bonding System as described in these specifications and illustrated on the associated drawings.

H. Work to also include:

1. Verification of dimensions and conditions at the job site.
2. Provision of submissions.
3. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and the AHJ (authority having jurisdiction).
4. Maintenance services; warranty.

## 1.6 PRE CONSTRUCTION SUBMITTALS

- A. Project Submittal Requirements are defined in the Project Manual. The successful Contractor must make one single, complete pre-construction Submittal package as defined and described in the General Section, with the following additional technology specific details.
1. Provide a Drawing-List of submitted drawings. Include the title of large-sheet drawings that are packaged separately. The submittal shop drawings are to be used by the Contractor as a basis for revision mark ups to create the "as-built" conditions.
    - a. Execute drawings at an appropriate scale but no smaller than 1/8".
    - b. Large-sheet drawings.
      - 1) Submit drawings rendered in AutoCAD or an AutoCAD -compatible application.
      - 2) Create drawings using a monochromatic scheme and industry-standard graphics with varied line types and weight so the attributes of the various elements of the image are readily discernible.
      - 3) Provide enlarged floor plans of Telecom Rooms with cable tray, conduits, and sleeves shown in the rooms shown to scale.
      - 4) Provide floor plan sheets that depict:
        - 5) Pathways with primary routes and room drop-off points.
        - 6) The type and quantity of pathways.
        - 7) The span distance between pathway supports.
        - 8) Depict any special installation details or unique means and methods necessary to successfully complete the telecommunications pathways installation.
      - 9) Provide a schedule of media describing the pathway types and locations.
  2. Submit examples of the proposed labels, tags and markers for pathways devices
    - a. Submit representative nomenclature with labeling as defined in TIA/EIA-606-A Class 2 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
    - b. Include font sizes and styles, an explanation of the rationale for the nomenclature, and a Key, which defines the descriptors and designators of the labeling system.
  3. Submit appropriate cut sheets and samples for products as detailed in project specifications and drawings. Submittals shall be in written and electronic PDF format.
  4. Work shall not proceed without the approval of the submitted items.
  5. No substituted materials shall be installed except by written approval. Only those products that are listed as "or equivalent" in Part 2 of this specification will be considered for substitution. Substitution requests must be submitted as defined in the Project Manual. No substitutions will be considered during the submittal process.
  6. Project Submittals Requirements: The pre-construction submittal is required to verify the Contractor will obtain the specified product, understands the processes and procedures, and understands the requirements to install, test, certify and create test record documentation for the telecommunications pathways system.
  7. The Submittal package is to be delivered for approval prior to commencement of Work, no later than twenty (20) days after issuance of Notice to Proceed.
    - a. Any submittals beyond the original submittal and one resubmittal will result in charges to the Contractor (charged for third and any subsequent reviews).

- b. Additional review fees will be at the prevailing rate in effect at the time that the additional review(s) is (are) required.

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

#### A. Telecommunication Bonding Backbone Conduit - It Server Room to TR/ZPs

- 1. Sealed at both ends after placement.
- 2. Non metallic conduits such as PVC are not acceptable.
- 3. Conduit sized in field to meet TBC size.

### 2.2 GROUNDING AND BONDING EQUIPMENT

#### A. Telecommunications Main Grounding Busbar (TMGB)

- 1. Accepts two-hole grounding lugs.
- 2. Wall mounted.
- 3. Isolating insulators between busbar and mounting surface.
- 4. UL listed.
- 5. Meets TIA-607-B requirements.
- 6. Acceptable product:

- a. Panduit GB4B06xxTPI-1 (xx= 12", 24", 28").

#### B. Telecommunications Grounding Busbar (TGB)

- 1. Accepts two-hole grounding lugs.
- 2. Wall mounted.
- 3. Isolating insulators between busbar and mounting surface.
- 4. UL listed.
- 5. Meets TIA-607-B requirements.
- 6. Acceptable product:

- a. Panduit GB2B03xxTPI-1 (xx=04", 06", 12", 14").

#### C. Ground Wire

- 1. Provide UL listed product.
- 2. Provide bare copper or THHN stranded conductors.
- 3. Provide with green band on bare copper at connection points or green jacket for insulated conductors.
- 4. Sized in accordance with J-STD-607-A.

#### D. Compression Connector, 2 Hole

- 1. Provide UL listed product.
- 2. Provide irreversible tin-plated copper connector.
- 3. Provide with J-STD-607-A hole sizing and spacing.

4. Provide crimp style, 2-hole, long barrel product.
5. Provide with inspection window.
6. Size connectors based on ground wire type and size.
7. Provide color coded connectors.
8. Acceptable product:

a. Panduit LCCXy (y=conductor size).

E. Copper Compression HTAP Kits

1. Provide UL listed product.
2. Provide with clear cover.
3. Size connectors based on ground wire type and size.
4. Acceptable product.

a. Panduit HTWCy (y=conductor size).

F. Cable shield bond connector

1. Sized accordingly.
2. Ground Wire Labels.
3. Meets J-STD-607-A requirements.
4. Provide product for use as a wrap-around or flag marker.
5. Yellow in color.

G. Grounding Hardware

1. Provide stainless steel product.
2. Provide 1/4" hardware for use with 1/4" busbar and compression connector hole sizes.
3. Provide 3/8" hardware for use with 3/8" busbar and compression connector hole sizes.
4. Provide bolt, lock washer, flat washer and nut for each compression connector.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordination: Work shall be in accordance with the requirements of the telephone/CATV/physical security installers. This shall include the requirements for pull boxes, number of conduit bends between pull boxes, and the size and type of pull cords, wires, or ropes.

### 3.2 INSTALLATION

- A. Coordinate installation of the TMGB, TGB, TBC and TBB with the Authority Having Jurisdiction (AHJ).
1. Install TMGB and TGB bus bars as specified on the drawings.
  2. Provide and install the TBB from the TMGB to each TGB location in the building. Conductor sizing of the TBB is based on the table in section 1.05 of this Specification.

3. Provide and install the TBC from the TMGB back to the service equipment (power) ground.
4. Conduit ends shall have snap in bushing at each end of conduit stubs or sleeves for cable protection.
5. Raceway for TBB shall not be shared by power or any other electrical wiring that is not part of the telecommunications grounding and bonding systems.
6. Install telecommunications bonding backbone wiring away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.
7. HTAP connectors shall used when the TBB is passing through a TR and continuing on to the next, follow manufacture recommendations for installation of a TBC with HTAP on the TBB. The TBB is not to be terminated on TGB unless it is the terminating end of a home run conductor from the TMGB.
8. Install TBC and TBB conductors without splices and avoid tight bends.
9. Install Long barrel 2-hole crimp style lugs, sized accordingly, are required for TBB and TBC connections. Two crimps are required at minimum for each ground lug. 1-hole crimp style lugs will not be accepted.
10. Clean TMGB/TGB surfaces prior to attaching grounding conductors and apply anti-oxidants to control corrosion.

### 3.3 LABELING

- A. Provide identifiers, labeling and records as required by TIA 606-A standard for telecommunications infrastructure administration.
  1. Both ends of telecommunications bonding backbone cable shall be labeled in accordance with the aforementioned standards.
  2. Mechanically print and install per drawing details.
  3. Labels shall be single line all capital letters bold font. Select font size that can be read on the applicable device or cable.
  4. Ensure all surfaces are clean prior to placing labeling products. Follow manufacturer's recommendation for cleaning.
  5. Hand written labels are unacceptable.

### 3.4 TESTING

- A. Notify the Owner in advance of performing testing of the Grounding and Bonding system.
  1. Perform a primary visual inspection of the entire Grounding and Bonding system to ensure physical connections are secure and free from corrosion.
  2. Perform a secondary two-point continuity test utilizing an earth grounding resistance tester.
  3. Use a ground impedance tester to determine the equipment grounding conductor impedance. Measurements made with a standard 3-lamp circuit tester are not acceptable.

### 3.5 CONNECTION TO BUILDING GROUND SOURCE

- A. Verify the main bonding and grounding conductor backbone is connected to the building electrical ground point by a licensed electrician.

3.6 FIELD QUALITY CONTROL

- A. Provide on-site project supervision for the duration of the project.

3.7 DAMAGES

- A. Replace any materials damaged in any way at no additional cost to the Owner.
- B. Damages to other trades materials and/or work performed as a result of this Work shall be remedied in a timely manner.

3.8 INSPECTION

- A. The Consultant will perform a final inspection of the Facility and verify that the work is complete and in accordance with the specifications.

END OF SECTION 271000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 271000 - STRUCTURED CABLING SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The intent of this Section is to ensure a successful installation of an American National Standards Institute (ANSI) and Telecommunications Industry Association (TIA) standards-based Structured Cabling System (SCS) for the Los Angeles Lakers Headquarters project.
- B. The SCS is to be constructed and tested to ANSI/TIA-568-C.2 Standards for Category 6A performance. Certification requirements shall include a minimum 20 year Manufacture Product and Application Warranty.
- C. The SCS provides the physical media for the Project's Local Area Network (LAN) and, as such, provides connectivity for:
  - 1. Data and Telecommunication Devices.
  - 2. Point of Sale (POS).
  - 3. Signage Displays.
  - 4. Security System.
  - 5. IP Video Surveillance Cameras.
  - 6. Audio Video Systems.
- D. The drawings and specifications requirements govern where they exceed code and regulation requirements. Where requirements between governing codes and regulations vary, the more restrictive provision applies.
- E. Products are to be purchased new for this project.
- F. Products that are listed by Underwriters Laboratories (UL) shall bear the UL label. In the event UL has no published standard for a particular item, then other independent testing standards shall apply and the applicable labeling utilized.
- G. Provisioning is required for labor, equipment, products, supplies and plant.

#### 1.2 REFERENCED CODES AND STANDARDS

- A. Execute work in accordance with the following list of TIA standards.
  - 1. TIA-526-14-A (OFSTP-14), Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (1998 R2003).
  - 2. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises - (February 2009).
  - 3. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard - (February 2009).
  - 4. ANSI/TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards - (August 2009).
  - 5. ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standard - (June 2008).

6. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - (October 2004).
  7. TIA-598-C Optical Fiber Cable Color Coding - (January 2005).
  8. TIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002).
  9. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications - (2002).
  10. TIA-758-A Customer-owned Outside Plant Telecommunications infrastructure Standard - (2004).
  11. TIA/TSB-140 Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems - (February 2004).
- B. Execute work in accordance with the following published design guidelines and reference manuals for recommended methods of trade, industry, institutions or governmental organizations.
1. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM), 13th Edition, 2014.
  2. BICSI Outside Plant Design Reference Manual, 4th Edition, 2007.
  3. National Electrical Contractors Association (NECA)/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling.
  4. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.
- C. Execute work in accordance with the following published codes, standards, and tests.
1. National Electrical Code (NEC), 2014 Handbook.
  2. American National Standards Institute (ANSI).
  3. Institute of Electrical and Electronic Engineers (IEEE).
  4. National Electrical Manufacturer's Association (NEMA).
  5. Underwriters Laboratories (UL).
  6. Execute work in accordance with the requirements of the local authority having jurisdiction (AHJ).
- D. Related Specifications
1. 27 05 26 - Grounding and Bonding for Communications Systems.
  2. 28 23 10 - Video Surveillance.
  3. 11 13 00 - Audio Video System.
- 1.3 PROJECT CONDITIONS
- A. Verify dimensions and conditions on the job site applicable to this work. Notify the Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and submit drawings to the Architect for approval showing how the work may be installed.

- C. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. When a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.
- D. During the course of construction, room names and/or room numbers may be changed. For continuity during installation the Contractor shall refer to rooms and spaces by their identities as shown on the SC series drawings. This shall apply to all correspondence, RFI's, proposal requests, and submittal packages pertaining to this Section.
- E. Provide temporary or permanent protection of products bearing the UL label that risk exposure to conditions that may compromise any portion of the product.

#### 1.4 DEFINITIONS

- A. In addition to those Definitions of Division 1, the following list of terms as used in this Section shall be defined as follows:
  - 1. Owner - Lakers.
  - 2. Project - Los Angeles Lakers Headquarters.
  - 3. Consultant - The Owner's Technical Representative for this Section.
  - 4. Architect - Rossetti.
  - 5. End User - Lakers.
  - 6. Furnish - To purchase, procure, acquire, and deliver complete with related accessories.
  - 7. Install - To set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, items, or equipment supplied by Contractor.
  - 8. Provide - To furnish and install.
- B. Some processes, methods, and procedures, as well as spaces, rooms and structure, may be abbreviated or used interchangeably within the Project Manual. The following list of terms as used in this Section shall be defined as follows:
  - 1. Telecommunications Space (TS) - A common area used for telecommunications cabling terminations and the location of telecommunications equipment.
  - 2. TWC Room - An environmentally controlled TS that is the primary point of interconnection between the communication facility provided by the public switched telephone company network and the building's communications facility.
  - 3. IT Server Room - An environmentally controlled space that is the telecommunications structured cabling primary distribution point to the Telecommunications Rooms (TR). The space is designated for an exclusive purpose of housing communications equipment and related wiring that serves the building's communications.
  - 4. Telecommunications Rooms (TR) - An environmentally controlled space that is the telecommunications structured cabling distribution point. The space is designated for an exclusive purpose of housing communications equipment and related wiring that serves a specific area of the building.
  - 5. Structured Cabling System (SCS) - A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.

6. Horizontal Distribution Cabling - The telecommunications cable routed between the TR and a work area outlet. Horizontal distribution cables shall include the following:
  - a. 4-pair Category 6A, 23 AWG, unshielded twisted pair (UTP) cable.
7. Work Area Outlet (WAO) - The workstation end-point of the drop, or horizontal distribution cable. A legend is provided on the related drawings to identify the type and quantity of cables terminated at the WAO.
8. Backbone - The Backbone subsystem links the IT Server Room to TRs and termination points specified on the drawings. It consists of the backbone transmission media between these locations and the associated connecting hardware for terminating the media.

#### 1.5 QUALIFICATIONS

- A. The Contractor will be a Certified Integrator/Installer factory trained and authorized to provide the SCS 20 year warranty covering the network cable and connectivity hardware products comprising this installation site.
- B. The Contractor shall be experienced in the provision of systems similar in complexity to those required for this project.
- C. The Contractor shall submit the selected SCS manufacturer installation certificate to provide the 20 year warranty. The Contractor shall maintain the selected SCS manufacturer factory trained and certified staff covering the duration of the project.
- D. The Contractor shall provide the services of a Registered Communications Distribution Designer (RCDD®) for the performance of quality control during pre construction submittals, installation, equipment placement and cable testing.
- E. The Contractor shall have five plus (5+) years experience with equipment and systems of the specified types.
- F. The Contractor shall have completed a minimum of three comparable scaled projects within the last two years.
- G. The Contractor shall have proven abilities to test and certify telecommunications cabling systems, and to create test records in compliance with the referenced standards of this Section.
- H. The Contractor shall maintain a fully staffed and equipped service facility.
- I. The Contractor shall demonstrate an adequate staff with commensurate technical experience available to complete the work.
- J. The Contractor shall demonstrate adequate plant and equipment available to complete the work.

#### 1.6 SCOPE SUMMARY

- A. Perform operations necessary to complete the installation of the SCS in accordance with this Section utilizing the related drawings.

- B. Coordinate exact location and installation of the following:
1. Conduits, wire-ways, cable trays external to the telecommunication spaces, floor boxes, wall boxes, pull boxes, and junction boxes.
  2. Slots and sleeves.
  3. Firestopping products.
  4. AC power circuits for telecommunications equipment.
  5. AC power circuits within telecommunications spaces.
  6. Plywood wall linings within telecommunications spaces.
  7. Lighting requirements within telecommunications spaces.
  8. MEP systems and equipment terminating within or intersecting telecommunications spaces.
  9. Grounding electrode system and equipment grounding system required for telecommunications spaces.
- C. Deliver Submittals, Shop Drawings and Cable Test Records as specified herein.
- D. Obtain permits, licenses, or other municipal requirements and pay any fees required for the execution of this Work.
- E. The drawings are an integral part of this Section. Details and schedules are shown on the drawings.
- F. Communications cabling shall comply with TIA 568-C Standards.
- G. Provide new backbone cabling consisting of twisted pair copper and fiber optic media as shown on the related drawings.
- H. Provide Category 6A, 500 MHz, horizontal cabling for data applications extending in a star topology from the IT Server Room to each TR and to individual work area outlets or network devices as shown on the related drawings.
- I. Provide faceplates, surface mount boxes, raceway products, copper and fiber optic inserts, blank inserts, patch panels, termination blocks, and copper and fiber optic patch cables.
- J. Provide racks to securely house telecommunications equipment and cabling termination panels.
- K. Provide power protection equipment as specified.
- L. Provide primary and branch pathway distribution systems for the support and protection of horizontal and backbone cabling.
- M. Provide bonding of equipment racks, armored cable sheaths, and cable pathway systems.
- N. Execute Work in accordance with applicable codes, ordinances, and regulations.
- O. Provide the SCS complete and ready for use by the Owner.
- P. Perform tests of the completed SCS installation to Category 6A performance in accordance with TIA-568-C.2, cited codes, standards, and procedures.

- Q. Perform installation and testing utilizing trained and certified staff to authorize the 20 year system warranty certification. The Contractor shall extend this certification on behalf of the manufacturer.
- R. Provide instructions to the Owner's designated personnel on the system documentation, proper methods of use and maintenance of the system and related components.

#### 1.7 PRE CONSTRUCTION SUBMITTALS

- A. The submittal information required by the specification is to be presented complete and as submissions noted below.
- B. Project Submittal Requirements are defined in the Project Manual.
- C. Provide the pre-construction Submittal Package(s) as described in the Project Manual.
- D. The pre-construction submittal is required to verify the Contractor will obtain the specified product, understands the processes and procedures, and understands the requirements to install, test, certify and create test record documentation for the SCS.
- E. Any submittals beyond the original submittal and one resubmittal will result in charges to the Contractor (charged for third and any subsequent reviews).
- F. Additional review fees will be at the prevailing rate in effect at the time that the additional review(s) is (are) required.
- G. Assemble and package the submittal as specified in this Section.
- H. Do not submit a copy of the Consultant's drawings without the requirements as listed in this section. Simple copies of the Consultant's drawings will not be accepted.
- I. Provide the quantity of Submittals (sets) as specified in Division 1, General Requirements, or the minimal requirement as follows:
  - 1. Three (3) sets of three-ring binders containing documents such as installation schedules, valid copies of technician certifications, product lists, product specification sheets, and small-size shop drawings.
  - 2. One set of unbound reproducible drawings and two sets of drawings printed and bound.
  - 3. The submittal reviewer will enter comments on one printed set of the drawings. These comments will be transferred to the reproducible set of drawings, which will be returned to the Contractor.
  - 4. The reviewer will retain the original mark-up set with their original comments as a record set.
  - 5. The Contractor is responsible for producing copies and distribution of the reviewed drawing.
  - 6. The title page of each binder and the large-drawing cover sheet shall be imprinted with Contractor's stamp, initialed or signed certifying that the Submittal Package offered is in compliance with the requirements of this Section, and the products are in compliance with this Section or with approved substitutions.
- J. Submittal formatting of the Submittal Package will be organized and contain information as defined by the following;

1. Letter-size submittal documents shall be bound in three-ring, D style, binder(s).
  2. Binders shall be sized for the required number of pages plus 50% more. The maximum size of any single binder shall be a three-inch spine. Use multiple volumes when necessary.
  3. The binder cover and spine shall bear the project title, submittal date, and a unique submittal number. If the submittal requires more than one binder, each binder will include a volume number, (i.e., Volume 1 of #).
  4. Provide an identical electronic version in Adobe PDF format on DVD-R(s).
- K. Preamble information shall be inserted in the binder in front of the Chapter dividers and be structured as indicated, containing information as follows;
1. Table of Contents.
  2. Provide the project title, submittal number, and submittal date as the header. Provide each chapter name, and a list of the information in each chapter. Include references to addenda or change-order numbers if applicable.
  3. List the entire contents of the binder(s).
  4. The table of contents for the entire submittal shall be included in the front of each volume and clearly delimit the contents of each volume.
  5. Large Sheet Index.
  6. Provide a "large sheet" Index of all the large drawing sheets included with the submittal.
  7. Test Equipment.
  8. Provide a technical description of the test equipment that will be utilized for test and certification of the SCS installation to Category 6A performance Standards.
  9. Identify the Manufacturer, make and model (i.e., Agilent® WireScope 350 , Fluke® MicroScanner Pro , etc.).
  10. Provide the date of the most recent calibration and company name that performed calibration.
  11. Submit an example of a test record document containing test records that have been created with the scheduled test equipment for the Category of cabling to be tested.
- L. Provide the information contained in the binder(s) segmented into "Chapters" with a "Tabbed" index sheet for each Chapter. The chapter tabbed dividers shall include the following:
1. Chapter One - Certificates
    - a. Provide copies of 'Certificates' of certified installation personnel. Certifications dated more than two years prior to the submittal date will not be considered valid. Individual certifications are preferred. Company-wide, blanket certifications satisfy this requirement if the manufacturer's warranty accepts this type certification.
  2. Chapter Two - Products
    - a. Prepare a complete products list or Bill of Materials that includes all products that will be provided for this installation.
    - b. Present the products list or Bill of Materials in the order in which the product is specified in Part 2 of this Section.
    - c. The column headings for the list shall include Section, Article, and Paragraph where the product appears in this Section, the quantity of item, a model or catalog number; and a brief product description.
    - d. Immediately following the list, insert the manufacturers' product data sheet (PDS), literature, or catalog cut-sheets, for all product.
    - e. Arrange the sheets in the same sequence and order of the list of Products.

- f. The literature shall provide sufficient detail to facilitate proper evaluation of the product's suitability for use within the Work.
    - g. Any PDS or literature sheets that provide for product options, or sheets that also include items not intended for this work, shall be clearly marked with an arrow or other appropriate symbol to indicate the model and/or option being submitted for the work.
- 3. Chapter Three - Labels, Markings, Samples
  - a. Submit examples of the proposed labels, tags and markers for all cables, patch panels, termination blocks, bus bars, fire sleeves, enclosures, racks, outlet faceplates and other components as necessary.
  - b. The label nomenclature shall correspond to the owner's directed signage and way finding program.
  - c. All labels to be permanent and non destructible.
- 4. Chapter Four - Shop Drawings
  - a. Provide a list of all submitted drawings, including a listing of separate, large-size drawings.
  - b. Large-sheet drawings;
    - 1) Submit two (2) printed copies of each drawing rendered in AutoCAD or an AutoCAD -compatible application.
    - 2) Execute drawings at an appropriate scale but no less than 1/8"=1'-0".
    - 3) Create drawings using industry-standard graphics and a monochromatic scheme with varied line types and weight so the attributes of the various elements of the image are readily discernible when printed in black and white.
    - 4) Provide enlarged floor plans and elevations of all equipment rooms with equipment and ladder runway(s) placement in the rooms, shown to scale.
    - 5) The Shop Drawings will be the source document for the As-Built drawings that the Contractor is required to provide at the close of the project.
  - c. Provide floor plan sheets that depict;
    - 1) Individual Service Areas of the facility.
    - 2) IT Server room and TR locations.
    - 3) Work area faceplate/outlet locations.
    - 4) Raceway locations.
    - 5) Media pathways with primary cable routes and room drop-off points.
    - 6) The type and quantity of cabling media in each segment of pathway.
    - 7) The span distance between cable supports.
    - 8) Horizontal cable link length based on above routing.
  - d. Provide riser diagram of all backbone media including type, quantity and routing of any inter- or intra-building backbone media.
  - e. Depict any special installation details or unique means and methods necessary to successfully complete the cabling infrastructure installation.
  - f. Provide additional detail drawings, appropriately scaled, and depicting the following:

- 1) Dimensioned plan-view drawings of individual Telecommunications Spaces depicting rack types, locations, and dimensions; rack elevations depicting equipment-mounting space in racks; rack-attached wire managers; routing and storage of horizontal distribution media 'slack'; patch cord dress-out; and rack identifiers.
- 2) Dimensioned rack elevations depicting equipment-mounting space in racks, rack-attached wire managers, routing and storage of horizontal distribution media 'slack', patch cord dress-out, and rack identifiers.
- 3) Patch panel layouts, designations, and labeling strips.
- 4) Wall elevations of all Equipment Rooms defining locations of all equipment mounted thereon.

g. Provide a schedule of media describing;

- 1) The type of media, horizontal, copper and fiber backbone, etc.
- 2) The source and destination of the media (i.e. TR to Workstation outlet, etc.)
- 3) The pathways of the media (i.e., what is in conduit, in cable tray or j-hooks).
- 4) Cable numbers for the media.

## 1.8 CLOSE-OUT SUBMITTALS

- A. Demonstrate the SCS warranty registration process has been performed in accordance with the manufacturer's program requirements and prior to substantial completion.
- B. After substantial completion of the installation, revise all drawings to reflect the actual names and numbers assigned to the spaces. Use the actual names and numbers on all cable certification reports, as-built drawings, and administration documents.
- C. Submit Close-out documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (4) sets.
- D. Segregate documents into separate binders containing data relevant to operational, maintenance and warranty issues.
- E. Appropriately duplicate data within the other separate bindings when it will reasonably clarify procedures, i.e.: operational data in maintenance binder.
- F. Document binders shall contain the following information:
  1. Test Report Binder(s)
    - a. Results of copper and fiber-optic tests specified in Part 3 of this Section.
      - 1) The test records are to be a printout of individual copper media and fiber optical media test results for each fiber-optic cable strand.
      - 2) The test record shall include information regarding the building, closet, patch panel and "port" number of the patch panel; the test device type and ID, the name of the test technician performing the test, and the date and time that the test was conducted.

- b. The test records are to be in ascending sequential order by building, closet and patch panel.
  - c. Provide an electronic file containing all individual test records and the software required to display and print the test records using a typical personal computer (PC).
- 2. Products List Binder(s)
  - a. Provide a final, complete list of products and product data sheets (PDS) in hardcopy and electronic Adobe PDF file format that have been incorporated within the Work, arranged in the same order as specified in the pre-construction submittal.
- 3. Record Drawings Binder(s)
  - a. Provide drawings showing final "owner" room numbering only. Coordinate with the architect prior to submission.
  - b. Provide "as-built" drawings of the completed cabling installation.
  - c. The as-built drawings shall indicate:
    - 1) The actual locations of the work area faceplate/outlets.
    - 2) Pathways and pathway fill.
    - 3) Media identification information at each faceplate/outlet.
    - 4) The identity information for each TS.
    - 5) Revised equipment rack layout detail drawings.
    - 6) All field changes, corrections, modifications, and updates to the shop drawings.
  - d. One (1) color/laminated half-size floor plan drawing attached to the wall of the IT Server Room and each TR to include the aforementioned information. Only the drop locations served from the IT Server Room are to be included on the color/laminated drawing in the IT Server Room. The same rule applies to each TR.
- 4. Warranty and Maintenance Binder(s)
  - a. Provide a statement explaining the terms and conditions of the Extended Product Warranty and the Application Assurance Warranty to include but not limited to the warranty commencement date, length of warranty, and the requirements for moves, adds and changes during the warranty coverage period. Provide warranty certificates issued by manufacturer.
  - b. Provide a list of contact names, telephone numbers, and hours of operation for normal warranty service.
  - c. Provide a contact name/number for 365/7/24 emergency warranty service with an explanation of limiting conditions if applicable.
  - d. Include maintenance phone number(s) and hours, maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.

## 1.9 DESCRIPTIONS AND REQUIREMENTS

- A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the SCS.

B. Standards referenced herein are subject to revision. The latest standard with revision at time of contract is a requirement for this work.

C. Cabinets, Racks and Frames

1. Provide cabinets/racks/frames in the size, quantity, and orientation required for the Project.
2. Coordinate dimensions of cabinets/racks/frames with the installed equipment.
3. Install free-standing equipment racks so that the minimum clearances are maintained to the front, rear and sides. Minimum clearances are defined as 3 feet to the front and rear of free-standing equipment and to one side of the equipment rack. Clearance is measured from the wall or from the surface of permanently installed wall mount equipment to the leading vertical surface of the rack, cable manager or installed equipment.
4. Provide a minimum of ½ inch hardware for anchoring floor-mounted equipment.
5. Install wall mounted pivoting cabinets/racks so that the minimum clearances are maintained to the front and sides. Minimum clearances for the front of cabinet are defined as 3 feet. Minimum clearance for each the side, refer to manufacturer requirements to allow cabinet to pivot open. Clearance is measured from the wall or from the surface of permanently installed wall mount equipment to the leading vertical surface of the rack.
6. Coordinate the installation of power circuits and conduit to prevent obstruction of equipment mounting rails.
7. Provide seismic bracing approved by a registered professional engineer for equipment racks/cabinets.
8. Provide a minimum #6 AWG equipment bonding conductor to each rack/cabinet.

D. Plywood Wall Lining

1. Provide A/C grade void free plywood as shown on the drawings. Install plywood with the "A" grade exposed.
2. Plywood shall be ¾-inch thick and installed 0'-06" A.F.F. to a height of 8'-06" A.F.F.
3. Plywood shall be fire-rated and painted on all surfaces with a minimum of two coats of fire retardant paint. Mask off to allow the fire-rating mark to be exposed on each sheet of plywood.
4. Plywood and paint shall be coordinated with the AHJ to meet applicable codes.

E. Termination Blocks and Patch Panels

1. Provide patch panels as specified for fiber optic cabling. Fiber optic patch panels shall house individual modular panels equipped with the specified fiber adapters. Fiber patch panels shall allow front and rear user access, provide multiple cable anchoring and entry points, provide patch cable management with bend radius protection, and accept labeling as specified with the front cover in the open and closed position.
  - a. Provide 3 feet of clear working space in front of termination patch panels and termination blocks.
  - b. Fusion splicing is required for all fiber splices and terminations.
2. Provide termination blocks specified for intra-building copper backbone cabling. Terminate both ends of the copper backbone cables on termination blocks as shown on the drawings.

- a. Provide 3 feet of clear working space in front of termination patch panels and termination blocks.
  - b. Provide a copper backbone extension patch panel as shown on the drawings. Terminating one pair of a 25-pair cable, extended from the TR's copper backbone termination field, to each port/connector, T/R pair, of a rack mount 24-port patch panel.
3. Provide patch panels as specified for the Horizontal links, Category 6A. The patch panel will meet Category 6A TIA standards. Patch panels will be equipped with cable strain relief bars.
  - a. Provide 3 feet of clear working space in front of termination patch panels and termination blocks.

F. Cable Management and Cable Runway/Tray

1. Provide 19" equipment rack vertical cable management panels at both ends of racks installed in a row and between racks installed in a row as specified.
2. Provide 19" rack horizontal wire managers as specified to accommodate customer provided network equipment.
3. Provide cable runway system within the Main Telephone Room, and TCs to accommodate horizontal cabling, backbone cabling, and bonding conductors for telecommunications. The system will include;
  - a. Cable runway sized based on a 40% calculated fill capacity utilizing the specified cable retaining posts.
  - b. Horizontal sections of cable runway installed 0'- 6" above the top of the racks, measured from the bottom of the cable runway.
  - c. Vertical sections of cable runway to support vertical cabling spans greater than 4 feet.
  - d. Vertical sections of cable runway to support specified and future cabling entering/exiting existing quantities of service entrance conduits stubbed into a TS.
  - e. Cable radius protection at each location within TS where cabling transitions from horizontal to vertical routing.
  - f. Support brackets at end points of straight horizontal sections of cable tray intersecting with structural walls.
  - g. Wall and trapeze support brackets along horizontal sections of cable tray positioned at maximum 5ft intervals.
  - h. Splice equipment, mounting brackets, bonding jumpers, end caps and related hardware required to complete the cable runway system. Size hardware so that bolts have no less than 1 and no more than 4 threads exposed when securely fastened.
  - i. Seismic bracing approved by a registered professional engineer for cable runway systems.
  - j. Manufacturer recommended touch-up paint required to repair factory painted surfaces.
4. Provide cable tray system as specified to accommodate horizontal cabling, backbone cabling, and bonding conductors for telecommunications. The system will include;
  - a. Cable tray sized based on a 40% calculated fill capacity.
  - b. Support brackets at end points of straight horizontal sections of cable tray intersecting with structural walls.

- c. Support brackets along horizontal sections of cable tray positioned at intervals as specified by the manufacture based on load rating.
- d. Splice equipment, mounting brackets, bonding jumpers, end caps and related hardware required to complete the cable tray system. Size hardware so that bolts have no less than 1 and no more than 4 threads exposed when securely fastened.
- e. Seismic bracing approved by a registered professional engineer for cable tray systems.

G. Power Protection and Power Distribution

- 1. Provide power distribution equipment within equipment racks in the size and quantities specified.

H. Backbone Cabling

1. Intra-Building Fiber Optic Backbone Cabling

- a. Provide multi-strand fiber optic multi-mode fiber backbone cable as specified and shown on the drawings.
- b. Provide the specified rack-mount fiber optic panels in the IT Server Room/TRs and in other termination points as shown on the drawings.

2. Intra-Building Copper Backbone Cabling

- a. Provide multi-pair copper backbone cable as specified and shown on the drawings.
- b. Provide the specified wall mount termination blocks in the IT Server Room/TRs and in other termination points as shown on the drawings.

I. Horizontal Cabling

- 1. Provide 24 AWG, 4-pair Category 6A horizontal cabling as specified and shown on the drawings.
- 2. Provide faceplates and connectors configured as specified and shown on the drawings.
  - a. Blue in color connectors.
  - b. All unused ports will be filled with gray in color blank inserts.
- 3. Data floor outlet, provide all bezels and adapters required to properly mount connector in floor outlet devices.

J. Patch Cords/Cables

- 1. Category 6A copper patch and fiber optic patch cables, provide in the quantities as specified.

K. Pathway Systems

- 1. Provide primary and branch pathway distribution products and related support hardware as specified and shown on the drawings. Size products based on a 40% fill ratio and calculate support loads imposed with a safety factor of at least five.
- 2. Provide mechanical and non-mechanical firestopping systems as specified.
- 3. Segregate SCS data cables within pathways from Access control, distributed television systems and Broadcast cables.

L. Labeling

1. Provide labeling in accordance with TIA-606-A Class 2 standards, numbering and ID format.
2. Provide lamacoid labels for specified equipment.
3. Provide machine generated labels for each system associated with the SCS to include but not limited to the following:
  - a. Conduit pathways including -
    - 1) Junction boxes.
    - 2) Pull boxes.
    - 3) Conduit.
  - b. Cable tray.
  - c. Grounding busbars.
4. Provide machine generated labels for each component associated with the SCS to include but not limited to the following:
  - a. Faceplates.
  - b. Floor receptacle covers.
  - c. Equipment racks and enclosures.
5. Provide machine generated labels for each cable associated with the SCS to include but not limited to the following:
  - a. Copper backbone cables.
  - b. Fiber optic backbone cables.
  - c. Horizontal premise cables.
  - d. Grounding and bonding cables.
6. Provide machine generated placards mounted on the wall as specified for the CRs .

M. Testing and Certification

1. Perform testing and certification of the SCS in accordance with the referenced standards for testing and the manufacturer's written requirements under the certification program requirements.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Ship product in its original container, to prevent damage or entrance of foreign matter.
- B. Provision for handling and shipping in accordance with manufacturer's recommendation.
- C. Provide protective covering during construction, to prevent damage or entrance of foreign matter.
- D. Provide warning placards, warning tape or protective barrier systems for temporary protection of products or personnel during installation processes to include but not limited to the following:

1. Cabling subject to foot or vehicle traffic laid on the floor/ground as a service loop.
  2. Exothermic welding of telecommunications bonding conductors.
  3. Open trench work during cabling installation.
- E. Provide a minimum temperature schedule for cold climate installations of the SCS. Do not install cabling or equipment in climate conditions less than the manufacturers recommended minimum temperature.
- F. Contractor to reel test all fiber optic cable before installation.
- G. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

#### 1.11 WARRANTY

- A. Provide a SCS Extended Product Warranty and Application Assurance Warranty as follows:
1. Extended Product Warranty
    - a. Provide replacement or repair coverage to include applicable labor for products that are found to be non compliant with the intended function of the SCS.
    - b. Provide the aforementioned warranty coverage for a period of 20 years from the date of issuance of the registration certificate or installation, whichever is earlier.
  2. Application Assurance Warranty
    - a. Provide replacement or repair coverage to include applicable labor for products that are found to be non compliant with the intended performance of the SCS.
    - b. Provide the aforementioned warranty coverage for a period of 20 years from the date of issuance of the registration certificate or installation, whichever is earlier.
- B. Provide a two year warranty for work other than the Extended Product and Application Assurance warranties.
- C. Within the two year warranty period, answer service calls within four hours and correct the deficiency within twenty-four hours.

#### PART 2 - PRODUCT

##### 2.1 GENERAL

- A. Related Divisions and articles remain applicable to the products specified herein. Any repetition of related specification is for emphasis only.
- B. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.
- C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers published specifications.

- D. Product not specifically identified within this document but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified product and equipment.
- E. Cable and wiring devices provided shall be listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.
- F. Products included in this Section are to establish performance requirements, other manufactures of products of equal or greater performance can be used on this project with Owner approval.

## 2.2 CABINETS, RACKS AND ENCLOSURES

### A. 2-post Equipment Rack

- 1. 19" W x 7' H.
- 2. Aluminum construction.
- 3. UL listed.
- 4. 1,500 pound load rating.
- 5. Black in color.
- 6. RMU markings.
- 7. #12-24 tapped mounting rails.
- 8. Acceptable product .

- a. Chatsworth 46353-X03.

### B. Wall Mounted Pivoting Equipment Rack

- 1. 19" W x 24" D X 60" H.
- 2. Steel construction with aluminum equipment rails.
- 3. UL listed.
- 4. Min. 212 pound load rating.
- 5. Solid Doors.
- 6. Black in color.
- 7. RMU markings.
- 8. Provide with vertical cable manager.
- 9. #12-24 tapped mounting rails.
- 10. Acceptable product:

- a. Chatsworth 13492-760.

### C. Network Cabinet

- 1. 32" W x 42" D x 7' H.
- 2. UL listed.
- 3. Minimum 1500 lb seismic equipment load rating.
- 4. White in color.
- 5. Front and rear perforated doors.
- 6. Integral vertical wire management.
- 7. With #12-24 tapped mounting rails.
- 8. Acceptable product:

- a. Chatsworth Z4-22N-113C-E12.

D. Security Equipment Enclosure

- 1. 24" W x 24" H x 8" D.
- 2. NEMA 4X rated.
- 3. 3-Point Latch, with lock hasp.
- 4. Fiberglass.
- 5. Provide mounting panel (21"x21").
- 6. Acceptable product:

- a. Hoffman - A24H2408GQRLP3PT.

E. Plywood Backboard (Plywood)

- 1. 4' W x 8' H x 3/4" D.
- 2. Fire-rated.
- 3. A/C grade, void-free.
- 4. Paintable.
- 5. Acceptable product:

- a. (As approved by the AHJ).

## 2.3 TERMINATION BLOCKS AND PATCH PANELS

A. Fiber Optic 1U Rack-mount Shelf

- 1. 19" rack mount.
- 2. 1 RU.
- 3. With patch cord tray cover.
- 4. Accepts a min. of (3) adapters panels.
- 5. Acceptable product:

- a. Belden AX104681.

B. Fiber Optic 4U Rack-mount Shelf

- 1. 19" rack mount.
- 2. 4 RU.
- 3. With patch cord tray cover.
- 4. Accepts a min. of (6) adapters panels.
- 5. Acceptable product:

- a. Belden AX104683.

C. Fiber Adapter Panel, 24 F

- 1. LC Adapters, 24 F, multi-mode (OM4).
- 2. Splice Cassettes.
- 3. Acceptable product.

- a. Belden FC4H12LDFS.

D. Fiber Adapter Panel, 12F

1. LC Adapters, 12 F, multi-mode (OM4).
2. Splice Cassettes.
3. Acceptable product:
  - a. Belden FC4H12MPFS.

E. Fiber Adapter Panel, KeyConnect Empty Frame 6 ports

1. KeyConnect Empty Frame 6 ports.
2. Acceptable product:
  - a. Belden AX105160.

F. 24-port Patch Panel, CAT-6A

1. TIA 19" rack mount, 1U.
2. Category 6A.
3. Accepts 568A/B wiring.
4. With cable strain relief bar.
5. Preload.
6. Acceptable product:
  - a. Belden AX103254.

G. 48-port Patch Panel, CAT-6A

1. TIA 19" rack mount, 2U.
2. Category 6A.
3. Accepts 568A/B wiring.
4. Preloaded.
5. With cable strain relief bar.
6. Acceptable product:
  - a. Belden AX103256.

2.4 CABLE MANAGEMENT AND CABLE RUNWAY

A. 12" Wide Cable Runway

1. UL Classified.
2. Black in color.
3. 1-1/2" x 3/8" tubular steel side rail (stringer).
4. 1/2" x 1" tubular steel cross member.
5. 9" cross member spacing.
6. Acceptable product:
  - a. Chatsworth 11275-712.

B. 12" Wide Cable Runway, Triangular Support Bracket

1. 100 pound load rating.
  2. Black in color Acceptable product:
    - a. Chatsworth 11746-712.
- C. 12" Wide Cable Runway, Wall Angle Support Bracket
1. Black in color Acceptable product:
    - a. Chatsworth 11421-412.
- D. Cable Runway, Radius Drop - Cross Member
1. Black in color.
  2. Acceptable product:
    - a. Chatsworth 12115-712.
- E. Cable Runway, Cable Retaining Post
1. Black in color.
  2. 6" height.
  3. Acceptable product:
    - a. Chatsworth 10596-006.
- F. Cable Runway, Butt-Splice Kit
1. UL Classified.
  2. Black in color Acceptable product:
    - a. Chatsworth 16301-001.
- G. Cable Runway, Junction-Splice Kit
1. UL Classified.
  2. Black in color.
  3. Acceptable product:
    - a. Chatsworth 16302-001.
- H. Cable Runway, Vertical Wall Bracket
1. Black in color.
  2. Acceptable product:
    - a. Chatsworth 10608-701.
- I. Cable Runway, Protective End Caps
1. Acceptable product:
    - a. Chatsworth 10642-001.

J. Cable Runway, Touch-Up Paint

1. Black in color.
2. Acceptable product:
  - a. Chatsworth 25400-700.

K. Cable Management Spool

1. White in color.
2. With screw.
3. Wall mount
4. Acceptable product:
  - a. ICC ICACSWDS10.

2.5 POWER PROTECTION AND POWER DISTRIBUTION

A. IT Closet Power Distribution Unit (PDU), Horizontal Mount

1. Monitored Power Strip, Switched, Horizontal Mount.
2. UL Listed.
3. Input plug L5-20P.
4. Output, (12) 5-20R.
5. Black in color.
  - a. Chatsworth 35693-212.

B. IT Closet Power Distribution Unit (PDU), Vertical Mount

1. Power Managed Power Strip, Switched, Vertical Mount.
2. UL Listed.
3. Input plug L5-20P.
4. Output, (24) 5-20R.
5. Black in color.
6. Mounting hardware utilized to prevent obstruction of equipment rack mounting rails.
7. Acceptable product:
  - a. Chatsworth P5-1C0A5.

C. IT/Room Power Distribution Unit (PDU), Vertical Mount

1. Power Managed Power Strip, Vertical Mount.
2. UL Listed.
3. Input plug L21-30R.
4. Output, (24) 5-20R outlets.
5. Black in color.
6. Mounting hardware utilized to prevent obstruction of equipment rack mounting rails.
7. Acceptable product:
  - a. Chatsworth P5-1P0A5.

D. UPS, Rack Mount

1. Single-phase UPS.
2. 4000W, 208V, L6-30P input, (12) 5-20R, (2) L6-20R, (1) L6-30R.
3. Runtime minimum, 12 minutes.
4. Web/SNMP enabled.
  - a. APC SUA5000R5TXFMR.

2.6 BACKBONE CABLING

A. Copper Backbone Cable

1. 25-pair UTP Cable.
2. ANSI/TIA Category 3 compliant.
3. Gray in color.
4. UL Listed CMR.
5. 24 AWG solid annealed bare copper.
6. Acceptable product:
  - a. Belden DPLN25.

B. Intra-building 12 Strand Multi-mode Fiber Optic Backbone Cable

1. 12 Strand.
2. UL Listed.
3. OM4, 50 µm multi-mode fiber.
4. Aqua in color.
5. Interlocking armor, CMP.
6. Tight buffered
7. Acceptable product:
  - a. Belden B9E242.

C. Intra-building 24 Strand Multi-mode Fiber Optic Backbone Cable

1. 24 Strand.
2. UL Listed.
3. OM4, 50 µm multi-mode fiber.
4. Aqua in color.
5. Interlocking armor, CMP.
6. Tight buffered
7. Acceptable product:
  - a. Belden B9E242.

D. Multi-mode Pigtail to LC Connector, OM4

1. Min. 1 meter in length for 100% of total quantity of OM4 installed fiber optic backbone strands.
2. Pigtail to LC duplex connection
3. Acceptable product:

- a. Belden FT4LC900PR12.

## 2.7 HORIZONTAL CABLING

### A. Copper Horizontal Cable - CAT 6A

1. Four unshielded twisted pair 23 AWG.
2. No less than ANSI/TIA Category 6A performance.
3. Support no less than IEEE 802.3af and IEEE 802.3at PoE.
4. Blue in color.
5. Plenum rated.
6. Acceptable product:

- a. Belden 10GX13152500.

### B. Copper Horizontal Dry Water Block Cable

1. Four shielded twisted pairs, 23 AWG solid annealed bare copper conductors.
2. No less than ANSI/TIA Category 6A performance.
3. Support no less than IEEE 802.3af and IEEE 802.3at PoE.
4. Black in color.
5. Indoor/outdoor rated.
6. Performance standard.

- a. Superior Essex BBDN6A.

### C. Wall Fiber Cable, Security Cameras

1. OS2, 2-strand and 12 AWG, 2 conductor.
2. Black in color.
3. Tight buffered, indoor/outdoor.
4. Cable is dry-water blocked for indoor/outdoor installations.
5. Acceptable product:

- a. Belden BEF100951.

## 2.8 FACEPLATES AND CONNECTORS

### A. Wall Phone Faceplate

1. Single gang, stainless steel, recessed.
2. Accepts one Category 6A UTP jack.
3. Equipped with mounting studs.
4. Acceptable product:

- a. Belden AX104126.

### B. 2-Position Faceplate

1. Single gang.
2. Accepts up to two Category 6A UTP jacks or Multimedia connectors.

3. Supports TIA-606-A labeling requirements.
4. Stainless Steel.
5. Acceptable product:

a. Belden AX104231.

C. 4-Position Faceplate

1. Single gang.
2. Accepts up to four Category 6A UTP jacks or Multimedia connectors.
3. Supports TIA-606-A labeling requirements.
4. Stainless Steel.
5. Acceptable product:

a. Belden AX104232.

D. Surface Mount Connecting Hardware

1. Accepts up to two Category 6A UTP jacks.
2. White in color.
3. Supports TIA/EIA-606-A labeling requirements.
4. Acceptable product:

a. Belden AX105353.

E. 106 Duplex Insert Mounting Module

1. Accepts up to four Category 6A UTP jacks.
2. 4 port.
3. Color to match project electrical outlet color as specified by Architect.
4. Acceptable product:

a. Belden AX1041xx (xx=color Almond=23, White=24, Black=25).

F. RJ45 UTP CAT 6A Connector

1. ANSI/TIA Category 6A compliant.
2. 8-position, 8-wire RJ45 receptacle.
3. Accepts 568A/B wiring.
4. Compatible with specified faceplates and surface mount hardware.
5. Blue in color.
6. Acceptable product:

a. Belden AX104156.

G. Blank Module

1. Black in color.
2. Used for open faceplate or surface mount hardware positions.
3. Acceptable product:

a. Belden AX102263.

## 2.9 PATCH CORDS/CABLES

### A. IT Server Room/TR CAT 6A Copper Patch Cords

1. 1 feet in length for 100% of total quantity of installed Category 6A cables.
2. Category 6A 23 AWG stranded UTP.
3. Blue in color.
4. Acceptable product:
  - a. Belden CA21106001.

### B. CAT 6A Work Area Outlet Copper Patch Cords

1. 7 feet in length for 20% of total quantity of installed Category 6A cables serving wall/floor/raceway outlets.
2. 10 feet in length for 40% of total quantity of installed Category 6A cables serving wall/floor/raceway outlets.
3. 15 feet in length for 40% of total quantity of installed Category 6A cables serving wall/floor/raceway outlets..
4. 100% of total quantity of installed Category 6A cables serving video surveillance cameras - coordinate required cable length with video surveillance contractor.
5. Category 6, 24 AWG stranded, UTP.
6. Blue in color.
7. Acceptable product:
  - a. Belden CA211060xx (xx=length 07=7', 10=10', 15=15').

### C. CAT 6A Copper Test Patch Cords

1. 15 feet in length.
2. Fiber Optic Patch Cords, Multi Category 6A 23 AWG stranded UTP.
3. Yellow in color.
4. Provide two test cords for each group of 100 horizontal cables installed. (ex. 320 installed cables will require eight test cords.).
5. Discard test patch cords after 100 cables tested.
6. Acceptable product:
  - a. Belden CA21106015.

### D. Multi-mode (OM4) LC Duplex Patch Cords

1. 1 meter in length for 40% of total quantity of LC fiber optic backbone connectors.
2. 2 meter in length for 40% of total quantity of LC fiber optic backbone connectors.
3. 3 meter in length for 20% of total quantity of LC fiber optic backbone connectors.
4. LC to LC duplex connector, aqua in color Acceptable product.
  - a. Belden FP4LDLD00xM (x=length 1=1m, 2=2m, 3=3m).

### E. Fiber Optic Test Patch Cords

1. 2 meters in length.
2. Fiber Optic Patch Cords, Multi-mode (OM4).
3. LC to LC duplex connector, aqua in color.

4. Discard test patch cord(s) after testing is completed.
5. Acceptable product:
  - a. Belden FP4LDLD002M.

## 2.10 PATHWAYS

### A. Primary Pathway Distribution

1. Open-top support (J-hook).
  - a. TIA-569-B compliant.
  - b. Sized accordingly based on 40% fill.
  - c. Compatible with Category 6A cabling.
  - d. Galvanized finish.
  - e. Acceptable product:
    - 1) Caddy CAT HP J-Hook.

### B. Non-mechanical Firestop Systems

1. UL classified
  - a. Fire Stop, Intumescent Pillow.
    - 1) Acceptable product:
      - a) STI SSB series.
      - b) Hilti CP 651.
  - b. Fire Stop, Intumescent Non-hardening Putty
    - 1) Acceptable product:
      - a) STI SSP series.
      - b) Hilti CP 618.

### C. Mechanical Firestop Systems

1. UL classified.
2. Acceptable product:
  - a. STI.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate the Work specified herein with other project work so as to facilitate a cohesive final product.

### 3.2 TELECOMMUNICATIONS SPACES - IT SERVER ROOM/TR

- A. Mount equipment plumb and level. Permanently installed equipment shall be firmly and safely held in place. Equipment supports shall support loads imposed with a safety factor of at least five.
- B. Provide seismic bracing for free-standing racks and for overhead cable runway sections, designed and sealed by a registered professional engineer licensed to practice in the state of California.
- C. Provide equipment associated with the SCS in accordance with industry best practices and methods and means approved by the AHJ.
- D. Provide specified plywood wall linings as shown on the drawings and secured with flush hardware to wall framework. Provide two overlapping layers of the specified plywood when covering masonry walls.
- E. Cover at minimum one manufacturer fire rating stamp prior to painting.
- F. Install the specified plywood with the fire rating stamp visible.
- G. Plywood shall be fire-rated and painted on all surfaces with a minimum of two coats of fire retardant paint. Paint shall be light in color to enhance lighting.
- H. Plywood and paint shall be coordinated with the AHJ to meet applicable codes.
- I. Racks and vertical cable organizers are required within the IT Server Room and TR to accommodate wire management and cross-connect equipment.
- J. Equipment racks are required to accommodate the horizontal distribution media patch panels.
- K. The equipment rack(s) shall be anchored to the floor and grounded to the TMGB/TGB ground bar. Utilize 1/2" hardware for rack anchoring.
- L. Mount to each side of each rack, one vertical cable organizer as specified.
- M. Provide cable runway as required to maintain cable fill ratios specified in referenced Standards, to provide routing and support of cables entering into and within the rooms and properly support cable distribution. Cable runway will be;
  - 1. Supported above the top of the equipment racks. Provide with all necessary hardware to attach the cable runway to the top of the equipment rack and anchor to the walls.
  - 2. Routed over floor-mounted racks from wall to wall unless otherwise noted.
  - 3. Mounted at a height of 7'-6" or 6" above floor mounted racks.
  - 4. Bonded at intersecting sections and to the TMGB/TGB at one end.
  - 5. Filed smooth, dressed square, and painted at each field cut.
  - 6. Painted to repair damaged areas utilizing the specified manufacturer touch-up paint.
  - 7. Installed using manufacturer's recommended cable tray splicing, support, and coupling hardware, following the manufacturer's installation directions.
  - 8. Reference the drawings for additional details of the IT Server Room and TRs.
  - 9. Installed above each equipment rack with a junction plate, elevation kit and a radius drop (waterfall).

- N. Vertical supports shall be attached to the building support structure or concrete wall or ceiling with anchors load rated for 100 lbf minimum. Down rods shall be a minimum of 3/8" diameter.
- O. Coordinate and verify final connection of related electrical power, TMGB/TGB grounding bus bar, and ground conductors.
- P. Provide ground system compliant with the authorities having jurisdiction.
- Q. Remove any finish and make-bare any metallic surface at the point where bonding conductors are connected to and or terminated on equipment frames, racks or devices. Use joint compounds at bonding conductor connection points.

### 3.3 CABLE PATHWAYS

- A. Maintain conduit bend radius listed on the drawings.
- B. Provide pathway systems to remain a minimum of (12") twelve inches from fluorescent lighting, electrical conduits or cables used for electrical power distribution, and four feet from large motors or electrical transformers.
- C. Conduit fill shall not exceed 40% of cross sectional area at any location. This fill percentage shall factor in space considerations for future cabling requirements.
- D. Provide a dedicated conduit from outlet back boxes extending to an accessible ceiling. Daisy chaining of outlets is not allowed.
- E. Each outlet shall consist of an outlet box and plate listed on the legend provided on the drawings.
- F. Conduits shall be equipped at stub-ups, pull boxes, junction boxes and back boxes with insulated connectors or nylon/plastic bushings and a 200lb test pull line.
- G. Coordinate with Architectural and Electrical drawings for locations of telecommunication outlets, junction boxes, conduits and floor boxes within the project.
- H. Outlet locations on the drawings have been designated to be routed to specific TS's. Failure to route cables to the correct designated closet or enclosure may result in exceeding the maximum allowable distance limitations.
- I. Maintain an 8 inch minimum clearance between the bottom of the cable pathway structure and the top of the ceiling.
- J. Maintain a minimum of 12 inched of vertical clearance and a minimum of 18 inches horizontal clearance on at least one sides of the cable pathway.
- K. Install horizontal pathways in such a manner that the minimum bend radius of the horizontal cables is kept within the manufacturer's specifications, both during and after installation.
- L. Cable tray shall not be installed above hard ceiling such as sheetrock unless access is provided at intervals not exceeding 8 feet. Minimum size for access panels shall be no less than 2' x 2'.

- M. Provide cable tray support systems consisting of trapeze style and wall brackets. Center hung support systems are not allowed.
- N. Cable tray and conduit fill shall not exceed 40% of cross sectional area at any location. This fill percentage shall factor in space considerations for future cabling requirements.
- O. Provide firestop products for cable pathway penetrations through floors or rated walls in accordance with TIA 569 and authorities having jurisdiction.
- P. Support wires for the ceiling grid or light fixtures are not to be utilized for support of any portion of the SCS.
- Q. Cable support devices shall not interfere with inserting or removing ceiling tiles.
- R. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with insulated grommets.
- S. Conduit ends shall have snap in bushing at each end of all conduit stubs or sleeves for cable protection.
- T. Conduit pathways are to be grounded.

### 3.4 AC POWER AND GROUNDING

- A. Coordinate and verify that final connection of the Equipment Grounding System for the building has been tested and accepted for use prior to connecting any portion of the Telecommunications Bonding Infrastructure to the Equipment Grounding System.
- B. Provide a Telecommunications Bonding Infrastructure compliant with the authorities having jurisdiction.
- C. Strip insulated ground wire in accordance with manufacturer installation instructions to ensure exposed conductors are not too long, too short or are not nicked or cut.
- D. Clean ground wire conductors in accordance with manufacturer installation instruction prior to installing irreversible compression connectors.
- E. Provide compression connectors utilizing the tool and die recommended by the compression connector manufacturer.
- F. Ensure the die index number is embossed on the connector barrel and the die index number is visible when the connector is installed.
- G. Remove any finish and make-bare any metallic surface at the point where ground wires are connected to and or terminated on equipment frames, racks, cable runway or cable tray.
- H. Provide joint compound for copper-to-copper and copper-to-steel connections in accordance with manufacturer installation instructions.

### 3.5 INTRA-BUILDING BACKBONE CABLING

- A. Install cable so that the pulling tension applied to the cable does not exceed the manufacturer's guidelines.
- B. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends (no less than six times the diameter of the cable) that could compromise the integrity of the cabling.
- C. Contractor to reel test fiber optic cable before installation and is responsible for any damage to the cable.
- D. Provide cable support for cabling installed in vertical pathways. Pathway support shall be in accordance with the manufacturer recommendations.
- E. Avoid cable stress due to cable twist during pulling or installation, tension in suspended cable runs and tightly cinched cable ties.
- F. Communications cable shall not be fastened to or supported by electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to doors, utility access panels, or service work areas.
- G. Take precaution to prevent and guard against electromagnetic and electrostatic interference and hum. Do not route cables through ventilation shafts, nor parallel with line-voltage electrical conductors.
- H. Communication cables shall not be run loose or lay upon ceiling grid or ceiling tiles.
- I. Provide cable rated for environmental air type plenum where required.
- J. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation.

### 3.6 HORIZONTAL CABLING

- A. Horizontal cable run-length shall be no greater than 280 feet from the outlet to the TS. The length of jumper cables or patch cords not to exceed 15 feet.
- B. Install cable so that the pulling tension applied to the cable does not exceed 25 lbf or the manufacturer's guidelines whichever is lesser.
- C. Install cable so that a radius bend of no less than six times the cables outside diameter is maintained.
- D. Provide proper cabling, connections, and terminations for Category 6A cabling installation, in compliance with manufacturer installation procedures.
- E. Provide station cabling extending from the TS to the designated data and telephone outlets in a star topology.

- F. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends (no less than six times the diameter of the cable) that could compromise the integrity of the cabling.
- G. Avoid cable stress due to cable twist during pulling or installation, tension in suspended cable runs and tightly cinched cable ties.
- H. Communications cable shall not be fastened to or supported by electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to doors, utility access panels, or service work areas.
- I. Take precaution to prevent and guard against electromagnetic and electrostatic interference and hum. Do not route cables through ventilation shafts, nor parallel with line-voltage electrical conductors.
- J. Communication cables shall not be run loose or lay upon ceiling grid or ceiling tiles.
- K. Provide cable rated for environmental air type plenum where required.
- L. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation.
- M. Install Category 6A cable compliant with TIA-568-C.2 with T568B pin-out termination.
- N. Strip wire jackets only as much as is required to terminate individual pairs.
- O. Pair twists are to be maintained as close as possible to the point of termination to lessen near end crosstalk (NEXT).
- P. Untwisting of pairs is not to exceed ½ inch for Category 6A UTP cable.
- Q. Install connecting hardware in a manner to provide a well-organized installation with cable management, and in accordance with manufacturer guidelines.
- R. Coordinate shall be required with electrician to properly mount Category 6A connector in the provided floor mount outlet.

### 3.7 LABELING

- A. Provide labeling in accordance with TIA-606-A standards.
  - 1. Cable labels - Brady, part number 32432-size code 517 or equivalent.
  - 2. Faceplates, racks and patch panels - P-touch labels, part number TZ-231 or equivalent.
- B. Labels will be single line, all capital letters, bold font that is easily read.
- C. Ensure surface is clean prior to final placement of labeling products. Follow manufacturer recommendations for cleaning.
- D. Hand written labels are unacceptable.
- E. Provide labeling as required for the following:

1. Telecommunication Spaces Identifier
  - a. Provide at minimum two (2) lamacoid labels within the IT Server Room and each TR located on the wall no less than 7'-0" A.F.F. unless noted otherwise, visible from anywhere within the IT Server Room/TR.
2. Telecommunications pathways
  - a. Locate permanent labels at the end of pathways entering into the IT Server Room and TRs.
  - b. Telecommunications pathways include:
    - 1) Cable Tray.
    - 2) Conduit.
3. Firestopping systems
  - a. Locate manufacturers warning label in proximity with firestopping product in accordance with industry practices.
4. Telecommunications outlets
  - a. Provide machine printed wall plate labels sized to fit on the outside of the clear plastic windows.
  - b. Label shall be black on white
5. Horizontal cabling
  - a. Locate the cable designator within 6 inches of the point of termination at the workstation and patch panel end of the horizontal cable.
  - b. Locate the cable designator within 6 inches of the end of the cable jacket for backbone terminations utilizing rack-mount patch panels or blocks.
6. Backbone cabling
  - a. Locate the cable designator within 12 inches of the end of the cable jacket for backbone terminations utilizing wall-mount patch panels or blocks.
  - b. Fiber optic labels shall be labeled at each end and inside each pull box with black on orange for multi-mode.
7. Junction boxes and pull boxes.
  - a. Terminations patch panels and blocks.
  - b. Grounding and bonding equipment.
  - c. Equipment racks and enclosures
    - 1) Locate lamacoid labels on the front and rear of equipment racks attached to the top horizontal cross-members.

### 3.8 TEST AND CERTIFICATION

- A. Prior to conducting any field-testing of the SCS the Contractor shall deliver to the project Architect a written notification of the test commencement date and the sequence of testing.
- B. If the Contractor elects to commence testing in a phased approach, prior to completion of cable installation, a test sequence schedule shall be provided.
- C. Notification shall be delivered to the Architect at least three weeks prior to the scheduled test date.
- D. Upon receipt of the notification the Architect will arrange for the Owner's technical representative to attend the commencement of testing.
- E. The purpose of the Owner's technical representative's attendance will be to observe:
  - 1. The type of test equipment being utilized compared to the scheduled test equipment.
  - 2. The test equipment can perform the tests to comply with the specified Standards.
  - 3. The Contractor's technical personnel are prepared to conduct the tests.
  - 4. The Owner's technical representative will provide an Observation Report to the Architect.
- F. Failure to provide notification as specified above will subject the Contractor to re-test any cabling that was tested prior to the Owner's technical representative review, at no additional cost to the project.
- G. Thirty days prior to start of testing the Contractor is to provide a list of test equipment make, model numbers and calibration data that will be used. Submit a manufacturer's technical data sheet or document that defines the device as capable to test to the applicable Standard.
- H. Test equipment shall be capable of measuring the performance of the installed SCS and comparing the performance to the parameters specified in the applicable TIA Standard.
- I. The following equipment list is provided to define the expected test equipment type. The test equipment is to be available for the entire test period through final System testing.
  - 1. Manufacturer - Fluke DTX series
  - 2. The most current software, firmware and appropriate launch cords shall be used.
- J. Contractor to perform validation testing on terminated Category 6A drop cables.
  - 1. An approved cable tester shall validate each cable run.
  - 2. For all 4 pair copper drop cables, an approved Level III cable tester that can measure Category 6A characteristics shall validate, at 500 MHz, each cable.
- K. The horizontal distribution cable shall be tested to perform in accordance with TIA-568-C. Cables shall meet or exceed the requirements for horizontal, unshielded twisted pair cabling as specified in TIA 568C for a "CHANNEL LINK" test.
  - 1. Primary Field Test Parameters include but are not limited to:
    - a. Wire map.
    - b. Length.
    - c. Insertion Loss (Attenuation).

- d. Near End Cross-Talk (NEXT).
  - e. Power Sum Near End Cross-Talk (PSNEXT).
  - f. Equal Level Far End Cross-Talk (ELFEXT).
  - g. Power Sum Equal Level Far End Cross-Talk (PSELFEXT).
  - h. Return Loss.
  - i. Propagation Delay.
  - j. Delay Skew.
- L. Cable certification reports shall bear the location/room number and cable identifier for each cable tested. Test results/reports in both paper and electronic copies by closet shall be delivered to the Project Manager according to the submittal procedures.
- M. Any cable, which fails any given test, shall be corrected. If it is removed, replaced, and or re-tested such activity shall be performed at no additional cost to the Owner.
- N. Contractor to perform validation testing on terminated Copper (Voice) Backbone Cabling.
- 1. For copper riser cables, an approved cable tester shall be used.
    - a. The contractor shall submit a cable certification report for each cable with test results for the following categories:
      - 1) Wiremap.
      - 2) Length.
- O. Fiber-optic cabling shall be tested to perform in accordance with TIA-568-C.3 and addendums or issued Standards.
- P. The contractor shall submit a cable certification report for each cable with test results for the following categories:
- 1. Max. Attenuation.
  - 2. Min. BW (Db/km).
  - 3. (Mhz-km).
- Q. A Pass or Fail result for each Horizontal distribution copper or fiber-optic cable parameter shall be determined by the allowable limits for that parameter. The test result of a parameter shall be marked with an asterisk (\*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer shall provide documentation as an aid to interpret results marked with asterisks.
- R. An overall Pass or Fail condition will be determined by the results of the required individual tests. Any Pass\*, Fail or Fail\* will result in an overall Fail. In order to achieve an overall Pass condition, all individual results shall be Pass.
- S. Any measurement reported by the field tester shall have a specified accuracy. Accuracy Level III is required. Accuracy is the difference between the measured values reported by the field tester from the actual value. The NEXT and attenuation of the mated connection at the test equipment shall not be included in the calculated or limit values.
- T. Field testers should be capable of reporting test data at all measured points and uploading the data to a PC/printer.

- U. Cable certification reports shall bear the location/room number and cable identifier for each cable tested. Test results/reports in both paper and electronic copies, by closet, shall be delivered according to the submittal procedures.
- V. The Contractor shall provide an electronic file containing all individual test records and the software required to display and print the test records using a typical personal computer (PC).

### 3.9 FINAL INSPECTION

- A. After completion of SCS construction inspect SCS for Contract deficiencies. Prepare written report of the inspection findings with proposed corrective action. Submit findings for review and comment per the submission requirements herein and required by the Project Manual.
- B. The Contractor shall ensure that the project management and the Architect are made aware of any issues that may prevent the Contractor from completing their work prior to the scheduled final inspection time-frame.
- C. Prior to the scheduled final inspection and test time-frame the contractor shall have:
  - 1. Completed installation, initial adjustments, tests and measurements.
  - 2. Submitted Test Results and As-Built documentation at least three weeks prior to the final inspection and test time-frame.
  - 3. Notified the Architect, in writing of the date that they will be ready for final inspection and test.
- D. During the Final Inspection and Test site-walk the Contractor shall:
  - 1. Provide a minimum of one person for inspection and two persons for testing who are familiar with all aspects of the System.
  - 2. Provision for ladders and scaffolding necessary to inspect cable in cable trays and ceiling mounted junction boxes.
  - 3. Provision for two portable business band radios for use during acceptance testing with transmission range sufficient to cover the entire project.
  - 4. Include rechargeable batteries and charger, along with "holster" for wearing radio on belt.
  - 5. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.
- E. The process of testing the system may necessitate moving and adjusting certain components.
- F. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and product required to make any necessary repairs, corrections, or adjustments.
- G. The following procedures will be performed on each System:
  - 1. Inspection of the methods and means employed to incorporate the system within the facility.
  - 2. Verification of proper operation, from controlling devices to controlled devices.
  - 3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications.
  - 4. Other tests on systems deemed appropriate.

- H. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment or failure of equipment or installation to meet specifications, and if any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner at the standard rate in effect at that time.
- I. If the Contract Documents, law, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to be inspected, tested or approved, the Contractor shall give timely notice to the Owner and the A/E of the readiness and the date arranged so they may observe such inspection, testing or approval procedure. In addition, the Owner or A/E may require special inspection, testing or approval of product or Work for compliance with the requirements of the Contract Documents. Upon direction by the Owner and the A/E, the Contractor shall promptly arrange for such special testing, inspection or approval procedure. Should the product or Work fail to comply with the requirements of the Contract Documents, the Contractor shall bear all costs to replace, fix, and/or re-terminate the failed work.
- J. Prior to energizing or testing the Systems ensure the following:
  - 1. Products are installed in proper and safe manner according to manufacturer's instructions.
  - 2. Dust, debris, wire clippings, etc. are removed.
  - 3. Cable is dressed, routed, and labeled; and connections are consistent.
  - 4. Labeling has been provided and attached.
  - 5. Temporary facilities and utilities have been properly disconnected, removed and disposed of as required.
  - 6. Products are neat, clean, unmarred and parts are securely attached.
  - 7. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and all Work debris cleaned up and discarded.
- K. Prior to energizing the Systems, verify and perform the following tests and adjustments in compliance with applicable TIA standards.
  - 1. Electronic devices are properly grounded.
  - 2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
  - 3. Systems, equipment and devices are in full and proper adjustment and operation, and properly labeled and identified.

### 3.10 INSTRUCTION OF OWNER PERSONNEL

- A. After final completion provide instruction to Owner designated personnel on the use, operation, maintenance, and care of the Systems.

END OF SECTION 271000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 276000 - BROADCAST CABLING SYSTEM

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Labor, materials, tools, transportation services, supervision, coordination, etc., necessary to complete the installation of the Broadcast Cabling Systems, as described in these specifications and illustrated on the associated drawings.
- B. Also includes:
  - 1. Verification of dimensions and conditions at the job site.
  - 2. Provision of submissions.
  - 3. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
  - 4. Instruction of operating personnel; provision of manuals.
  - 5. Maintenance services; warranty.

#### 1.2 RELATED WORK

- A. Division 26: Power and Ground Wiring.
- B. Division 26: Conduit, Raceways, and Junction Boxes

#### 1.3 REFERENCES

- A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
  - 1. American National Safety Institute (ANSI).
  - 2. Electronics Industries Association (EIA).
  - 3. National Electrical Code (NEC).
  - 4. Underwriters Laboratories (UL).
  - 5. Cable Television Technology, Kenneth T. Deschler, New York; McGraw-Hill, Inc., 1987.
  - 6. Sound System Engineering (2nd Edition), Davis and Davis, Howard W. Sams, 1987.
  - 7. Audio System - Design and Installation, Giddings, Howard W. Sams, 1990.
  - 8. ANSI S4.48-1992.
  - 9. EIA Standard RS-160.
  - 10. EIA Standard RS-219.

#### 1.4 DESCRIPTIONS AND REQUIREMENTS

- A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the Broadcast Cabling Systems.

1. Cable will be installed between the facility JBT boxes and the TV Truck Parking Area. The cabling to be the following interconnect cables:
  - a. Coax – isolated feed through barrels
  - b. SMPTE - isolated SMPTE panels with field cabling connecting directly to the panel mount connector.
  - c. Triax – isolated triax panels with field cabling connecting directly to the panel mount connector.
  - d. (12) strands of SMFO – fusion spliced in EIA/TIA fiber housings and terminated to ST panels.
  - e. Audio – utilizing punch down blocks similar to ADC terminated to breakout panel (Alternate)
  - f. UTP – Data patch bays with feed through connectors terminated to breakout panels.

B. Testing and Documentation

1. Test and document as called out in part 3 for all DR-3 cable from its source to the cross connect.
2. The second part is to test and document from the source to the TV truck TVRP interconnect. Provide a report listing any cable that does not meet cable manufacturers specifications. Identify fault location to coordinate repair.

1.5 RESPONSIBILITY AND RELATED WORK

- A. Coordinate the work with the General and Electrical Contractors, and the scheduled work of other trades.
- B. Electrical
- C. Conduit, wire ways, floor boxes, wall boxes, pull boxes, and junction boxes for the Broadcast Cabling System are provided by the Electrical Contractor. This does not relieve the Broadcast Cabling System Installer from responsibility for a complete working system. Coordination with the Electrical Contractor is required to achieve a proper conduit system.
- D. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.
- E. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Broadcast Cabling System Installer to supply systems in full working order. Notify the Owner's Representative of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires Broadcast Cabling System Installer to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.
- F. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner including any associated charges or fees.

- G. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Owner's Representative prior to bid opening, the Owner's Representative will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

## 1.6 QUALITY ASSURANCE

- A. Contractor's Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
  - 1. No less than three years experience with equipment and systems of the specified types.
  - 2. Experience with at least three comparable scale projects within the last two years.
  - 3. Be a franchised dealer and service facility for the manufacturer's products furnished.
  - 4. Provide manufacturer-certified installer for passive LAN components. Submit copies of certification.
  - 5. Maintain a fully staffed and equipped service facility.
  - 6. At the request of the Owner's Representative, demonstrate that:
    - a. Adequate plant and equipment is available to complete the work.
    - b. Adequate staff with commensurate technical experience is available.
- B. Manufacturer's Qualifications: No less than 5 years continuous experience in the production of specified types of product. Production per applicable NEMA standards.

## 1.7 SUBMITTALS

- A. The submittal information required by the specification is to be presented complete and as submissions noted below. Cost for the Owner's Representative to review secondary and re-submittals due to the Installer's failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Installer.
- B. Project Submittal:
  - 1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:
    - a. Section 1: A complete schedule of submittals.
    - b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.
  - 2. Provide for approval no later than sixty (60) days after issuance of notice to proceed and in accordance with previously submitted submittal schedule.
    - a. Section 1: Complete list of product to be incorporated within the Work.
    - b. Section 2: Manufacturer's data sheets for each product. Provide original manufacturer's data sheets in order as they appear in the specification. These data sheets are submitted for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.

- c. Section 3: Samples of field and rack panel materials.

3. Drawings:

- a. Provide drawings created on a computer aided drawing (CAD) system compatible with AutoCAD Release 2010.
- b. Installation Drawings: Provide drawings showing special details depicting methods and means specific to each product, assembly and each product manufacturer's recommended installation methods and means.
- c. Schematic Drawings: Provide drawings detailing inter-component and intra-component, on contractor assembled components or fabricated products, wiring and cabling diagram depicting cable types, designator and color codes. Give each component a unique designator and use this designator consistently throughout the project.
- d. Equipment Drawings. Provide drawings showing location of equipment in racks or other locations (JBT, JBE, JBR and JBA/R) with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
- e. Floor plan and Section Drawings. Provide drawings showing the exact location of all installed equipment on floor plans and/or sections such as, racks, service boxes, etc.
- f. Patch Panel Drawings. Provide detailed drawing of patch panel layouts and designation (labeling) strips, including color schemes.
- g. Custom Enclosures and Millwork Drawings. Provide full fabrication detail drawings indicating size, material, finish and openings for equipment.
- h. Fabricated Plates and Panels Drawings. Provide complete drawings on custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
- i. Schedule Drawings. Provide wiring schedule drawings showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location.
- j. Labeling Drawing. Provide representative equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and descriptor and designator schedule.
- k. General Detail Drawings. Provide detail drawings depicting any unique installation methods specific to each product.
- l. Any other pertinent data generated which is necessary to provide the Work.

C. Submittal Format:

- 1. Each submittal shall be bound in a three-ring D style binder sized for 150% of the material with a maximum size being a three inch spine. Use multiple volumes if necessary.
- 2. Provide each submittal with a unique number and be numbered in consecutive order.
- 3. Provide each submittal binder with a cover and a spine reflecting the project title and submittal number.
- 4. Provide each submittal with a complete table of contents with the following information:
  - a. Project title and number.
  - b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
  - c. Date of submission.
  - d. Referenced addendum or change-order number as applicable.

- e. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
  - f. Index Product Data sheets by manufacturer and model or part number.
- 5. Separate major grouping with labeled binder tabs.
  - 6. Each submission page stamped with Contractor's certification stamp, initialed or signed certifying:
    - a. Review, approval and acceptance of submission.
    - b. Certification of product compliance to specification.
    - c. Verification product may be incorporated within the work.
- 1) Arrange product data list in alpha-numeric order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer's data sheets, arranged in the same order. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
  - 2) Drawings executed at an appropriate scale, not smaller than 1/8"=1'.

D. Submittal Copies:

- 1. These requirements represent minimum project requirements; a project's general conditions may require additional copies for project distribution.
- 2. Submit one (1) unbound reproducible drawing set and two (2) bound prints of all drawings. The processed reproducible shall be returned to Contractor. Additional prints will not be reviewed they will be returned un-marked.
- 3. Submit four binders of bound materials (e.g. product submittals).
- 4. Submit three copies of product or sample finishes as required within this specification.
- 5. Submittal shall include CDR with all information, drawings, and reports in .pdf format.

E. Resubmission Requirements:

- 1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
- 2. Indicate any changes that have been made other than those requested.

1.8 PROJECT RECORD MANUAL

- A. Submit three bound original sets (this is a minimum of two for the Owner and one for the Owner's Representative; additional copies may be required by the project's general conditions) after substantial completion and prior to final inspection.
- B. The Project Record Manual shall be segregated into three separate bindings as follows:
  - 1. Operations Manual:
    - a. Product Data: Product actually incorporated within the Work:
      - 1) Manufacturer's data for each type of product conforming to the scheme above. The list shall include manufacturer's serial numbers.
      - 2) Each products Owner/Instruction Manual.

- 3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
    - 4) Manufacturer's wiring diagram for each type of product actually incorporated.
    - 5) Separately bound list by manufacturer and model or part number of all products incorporated within the Work arranged in alphanumeric order.
  - b. Record drawings: Final rendition of that specified depicting what is actually incorporated within the Work.
  - c. Test Reports: Recorded findings of testing requirements outlined in Part 3.
  - d. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
    - 1) This procedure should describe the operation of all system capabilities.
    - 2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.
2. Service & Maintenance Manual:
  - a. Provide an original copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
  - b. Manufacturer's maintenance and care instructions.
  - c. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
3. Warranty Manual:
  - a. Manufacturer's warranty statements on each product.
  - b. Date of substantial completion and ending dates for warranties for each group of products.
  - c. Software registration and licenses.
4. Record drawings:
  - a. Final rendition Shop Drawings defined in this section depicting system as installed. Provide a CD-ROM containing all CAD generated drawings prepared in conjunction with this project. Drawing files to be in both AutoCAD Release 2004 DWG format and DWF formats. Include CD(s) under a separate section in the Operations Manual.

- C. Include any other pertinent data generated during the Project or required for future service.
- D. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.
- E. Include 1 CDR of all manuals and reports in .pdf format.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Ship product in its original container, to prevent damaging or entrance of foreign matter.

- B. Handling and shipping in accordance with manufacturer's recommendation.
- C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.
- D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

#### 1.10 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Owner's Representative for approval, showing how the work may be installed.

#### 1.11 FINAL INSPECTION AND TEST

- A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Owner's Representative no earlier than two weeks after receipt of the written results.
- B. Provide a minimum of one (1) person for inspection and two (2) persons for testing familiar with aspects of the System to assist the Owner.
- C. The process of testing the System may necessitate moving and adjusting certain component parts. Perform such adjustments without claim for additional payment.
- D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.
- E. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner's Representative, at the standard rate in effect at that time.

#### 1.12 WARRANTY

- A. Warrant labor and product for twelve months following the date of the first trouble free operation, or substantial completion, whichever is later.
- B. System is to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge.

- C. This warranty shall not void specific warranties issued by the manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.
- D. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty four hours.

#### 1.13 INSTRUCTION OF OWNER PERSONNEL

- A. After final completion, provide instruction to Owner designated personnel on the use, operation, maintenance and care of the System.
- B. Develop instructional course based on the use of the System and manufacturers' recommendation. Develop course so no period will last longer than one and a half hours without a fifteen minute break. Partition course so that operational and maintenance training are independent and subsequent.
- C. Submit an outline of the course with sample instructional aids for approval thirty days prior to scheduled instructions.
- D. System installer shall be present at first event where cabling is utilized.

#### 1.14 ADD ALTERNATES

- A. The following systems are to be priced as additive alternates to the base building broadcast cabling system.
  - 1. Pricing shall include costs necessary to fully implement the system and interface it into the base building system.
  - 2. Each alternate shall be considered independent and not reliant on the acceptance of another alternate.
  - 3. Reference drawings and Part 2 of this section for extent of coverage and equipment.
- B. Alternate BC-1
- C. Alternate BC-2

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed to establish a standard of product quality.
- B. Substitution of specified products with other qualified manufacturers and products will be considered providing:
  - 1. Proper substitution procedures outline under Division 1 is adhered to.

2. Sufficient data of the products is presented for prior approval including technical data, manufacturer's specifications, samples, and, if requested, results of independent testing laboratory tests.
- C. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review. Include a list of previously installed projects using proposed equipment that are similar in nature to specified System.
- D. Provide product not specifically specified commensurate with the quality and standards established by the specified product.

## 2.2 GENERAL

- A. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.
- B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.
- C. All cable shall be compliant with NEC as applicable, and UL listed or CSA certified.
- D. Provide flooded or direct burial cable for underground conduits.
- E. Provide stainless steel mounting hardware for all panel mounting and connector mounting.

## 2.3 TRIAX/COAX CABLING

- A. Riser rated Triax Cable:
  1. Type: RG-11/U.
  2. Sweep tested to 3GHz.
  3. Acceptable Product:
    - a. Gepco VT61811.
    - b. Belden 8233A.
    - c. Clark TV7511DR.
- B. Plenum rated Triax Cable for use only within plenum spaces or as required by Code:
  1. Type: RG-11/U.
  2. Sweep tested to 3GHz.
  3. Acceptable Product:
    - a. Belden 8233P.
    - b. Gepco VT61811TK.
    - c. West Penn 258311.
- C. Underground rated Triax Cable:
  1. Type: RG-11/U.

2. Water Blocking: Blocking Tape.
3. Sweep tested to 3GHz.
4. Acceptable Product:
  - a. Gepco VT61811PEF.
  - b. Belden 8233WP.
  - c. Clark TV7511DB.

D. Riser Rated Digital Coax Cable:

1. Type: RG-6U.
2. NEC Specification: CMR Rating.
3. Solid center conductor.
4. Acceptable product:
  - a. Belden 1694A.
  - b. Gepco VSD2001.
  - c. Clark CD7506.

E. Plenum Rated Digital Coax Cable for use only within plenum spaces or as required by Code:

1. Provide precision video cable.
2. Plenum rated jacket as required by Code.
3. Solid center conductor.
4. Acceptable product:
  - a. Gepco VSD2001TS.
  - b. Belden 1695A.
  - c. Clark CD7506P.

F. Underground rated Video Cable for use only in underground conduits or as required by Code:

1. Provide precision video cable.
2. Underground rated jacket as required by Code.
3. Water Block: Blocking Tape.
4. Solid center conductor.
5. Acceptable product:
  - a. Gepco VSD2001PEF.
  - b. Belden 1694WB.
  - c. Clark CD7506DB.

## 2.4 SMPTE HYBRID CABLE

A. Riser Rated Single HD (SMPTE) Camera Cable:

1. For general use where allowed by code.
2. High Definition Television (HDTV) hybrid fiber optic camera cable.
3. Cable to provide copper and fiber connectivity for a single SMPTE line.
4. Acceptable Product:
5. Belden 7804R.

- a. Clark HFCPV.
- b. Gepco HDC920R.
- c. Mohawk M96921.

B. Plenum Rated Single HD (SMPTE) Camera Cable:

- 1. For use within plenum spaces or as required by Code.
- 2. High Definition Television (HDTV) hybrid fiber optic camera cable.
- 3. Cable to provide copper and fiber connectivity for a single SMPTE line.
- 4. Acceptable Product:
  - a. Belden 7804P.
  - b. Mohawk M96924.

C. Underground Rated Single HD (SMPTE) Camera Cable:

- 1. For use when cable is exposed to moisture and allowed by code
- 2. High Definition Television (HDTV) hybrid fiber optic camera cable.
- 3. Cable to provide copper and fiber connectivity for a single SMPTE line.
- 4. Water blocking Tape or Gel Filled.
- 5. Acceptable Product:
  - a. Belden 7804WB .

D. Riser Rated Three Channel HD (SMPTE) Camera Cable:

- 1. For general use where allowed by code.
- 2. High Definition Television (HDTV) hybrid fiber optic camera cable.
- 3. Cable to provide copper and fiber connectivity for a single SMPTE line.
- 4. Acceptable Product:
  - a. Belden 7824R.
  - b. Gepco HC3R.
  - c. Mohawk M97673.

E. Plenum Rated Three Channel HD (SMPTE) Camera Cable:

- 1. For use within plenum spaces or as required by Code.
- 2. High Definition Television (HDTV) hybrid fiber optic camera cable.
- 3. Cable to provide copper and fiber connectivity for a single SMPTE line.
- 4. Acceptable Product:
  - a. Belden 7824P.
  - b. Mohawk M97767.

F. Underground Rated Three Channel HD (SMPTE) Camera Cable:

- 1. For use when cable is exposed to moisture and allowed by code.
- 2. High Definition Television (HDTV) hybrid fiber optic camera cable.
- 3. Cable to provide copper and fiber connectivity for a single SMPTE line.
- 4. Water blocking Tape or Gel Filled.
- 5. Acceptable Product:

- a. Belden 7824WB.

## 2.5 ANALOG AUDIO CABLES

### A. Audio Cable 12 pair:

1. Provide multi-pair shielded cable. Use six-pair cabling where six or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
2. Provide two six pairs for DT-12 cabling.
3. PVC outer jacket.
4. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
5. Conductors to be 0.76mm nominal outer diameter.
6. Acceptable product:
  - a. Gepco GA61812GFC (6612HS where CMP rating is required, heat shrink each pair).
  - b. Belden 1818R or 1818P.
  - c. Clark 712 (22EPS12P where CMP rating is required).

### B. Audio Cable 6 pair:

1. Provide multi-pair shielded cable. Use six-pair cabling where six or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
2. Provide two six pairs for DT-12 cabling.
3. PVC outer jacket.
4. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
5. Conductors to be 0.76mm nominal outer diameter.
6. Acceptable product:
  - a. Gepco GA61806GFC.
  - b. Belden 1816R.
  - c. Clark 706.

### C. Plenum Rated Audio Cable 6 pair:

1. Acceptable product:
  - a. Gepco 6606HS (heat shrink each pair).
  - b. Belden 1816P.
  - c. Clark 22EPS6P.

### D. Underground Rated Audio Cable 6 pair:

1. Acceptable product:
  - a. Gepco GA61806PEF.
  - b. Belden 1816WB.
  - c. Clark 706DB.

### E. Audio Cable 4 pair:

1. Provide multi-pair shielded cable. Use four-pair cabling where six or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
  2. PVC outer jacket.
  3. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
  4. Conductors to be 0.76mm nominal outer diameter.
  5. Acceptable product:
    - a. Gepco GA61804GFC.
    - b. Belden 1815R.
    - c. Clark 704.
- F. Plenum Rated Audio Cable 4 pair:
1. Acceptable product:
    - a. Gepco 6604HS (heat shrink each pair).
    - b. Belden 1815P.
    - c. Clark 22EPS4P.
- G. Underground Rated Audio Cable 4 pair:
1. Acceptable product:
    - a. Gepco GA61804PEF.
    - b. Belden 1815WB.
    - c. Clark 704DB.
- H. Audio Cable 2 pair:
1. Provide multi-pair shielded cable. Use two-pair cabling where two or less pairs are scheduled. Neatly dress unused pairs in rear of junction box or rack.
  2. PVC outer jacket.
  3. Each pair to be individually jacketed with foil shield with drain wire and two jacketed conductors.
  4. Conductors to be 0.76mm nominal outer diameter.
  5. Acceptable product:
    - a. Gepco GA61802GFC (or 6602HS where CMP is required, heat shrink each pair).
    - b. Belden 1814R (9451DP where CMP rating required).
- I. Underground Rated Audio Cable 2 pair:
1. Acceptable product:
    - a. Gepco GA61802PEF.
    - b. Belden 1814WB.
- J. Analog Audio Cable single pair (Inner Rack Wiring):
1. Provide for inner rack wiring.
  2. PVC outer jacket.
  3. Conductors to be 0.76mm nominal outer diameter.

4. Acceptable product:
  - a. Gepco 61801EZ.
  - b. Belden 9451.
  - c. West Penn 451.
  - d. Clark SPA22GS.

## 2.6 SINGLE MODE FIBER OPTICAL CABLE

- A. Single Mode Fiber Optic Cable:
  1. Single mode gel free fiber optic cable.
  2. Provide for inside use.
  3. Cable to be provided with Appropriate NEC rating.
  4. Provide with interlocking armor to shield against damage.
- B. 6 strand single mode fiber.
  1. Acceptable Riser Rated Product:
    - a. Corning 006E8F-31131-A1.
    - b. Belden M9W230.
    - c. Clark D006SMRIA.
  2. Acceptable Plenum Rated Product:
    - a. Corning 006E8P-31131-A3.
    - b. Belden M9W240.
    - c. Clark D006SMRIA.
- C. 12 strand single mode fiber.
  1. Acceptable Riser Rated Product:
    - a. Corning 012E8F-31131-A1.
    - b. Belden B9W241.
    - c. Clark D012SMPIA.
  2. Acceptable Plenum Rated Product:
    - a. Corning 012E8P-31131-A3.
    - b. Belden B9W231.
    - c. Clark D012SMPIA.
- D. 24 strand single mode fiber.
  1. Acceptable Riser Rated Product.
    - a. Corning 024E8F-31131-A1.
    - b. Belden B9W233.
    - c. Clark D024SMPIA.

2. Acceptable Plenum Rated Product.

- a. Corning 024E8P-31131-A3.
- b. Belden B9W242.
- c. Clark D024SMPIA.

2.7 CONNECTORS

A. Receptacles:

1. XLR-3M:

- a. Connector type: XLR.
- b. Gender: Male.
- c. Style: Panel mount.
- d. Capacitance between contacts: 4 pF.
- e. Contact resistance: 5 milliohms.
- f. Rated current per contact: 16 A.
- g. Rated voltage per contact: 50 V.
- h. Wire size: maximum 2.5 mm<sup>2</sup>.
- i. Wiring: solder contacts.
- j. Mounting: Holes with M3 threads.
- k. Contact plating: 0.2  $\mu$ m gold hard alloy over 2  $\mu$ m nickel.
- l. Contacts: Brass.
- m. Shell: Zinc diecast.
- n. Shell plating: Black chromium.
- o. Acceptable product:

- 1) Neutrik NC3MDL-B-1.

2. XLR-3F:

- a. Connector type: XLR.
- b. Gender: Female.
- c. Style: Panel mount.
- d. Capacitance between contacts: 4 pF.
- e. Contact resistance: 5 milliohms.
- f. Rated current per contact: 16 A.
- g. Rated voltage per contact: 50 V.
- h. Wire size: maximum 2.5 mm<sup>2</sup>.
- i. Wiring: solder contacts.
- j. Mounting: Holes with M3 threads.
- k. Contact plating: 0.2  $\mu$ m gold hard alloy over 2  $\mu$ m nickel.
- l. Contacts: Bronze.
- m. Shell: Zinc diecast.
- n. Shell plating: Black chromium.
- o. Acceptable product:

- 1) Neutrik NC3FDL-B-1.

3. BNC Bulkhead Connectors:

- a. Connector type: 75 ohm BNC.
- b. Gender: Female.
- c. Style: Bulkhead Jack.
- d. Contact resistance: .030 ohms.
- e. Impedance: 75 ohm.
- f. Rated voltage per contact: 1500 Volts RMS.
- g. Return Loss: Better than 26 dB to 1GHz: 18 dB to 2 GHZ: 16 dB to 3 GHZ.
- h. Wiring: Bulkhead jack.
- i. Center Contact plating: 50 millionths inch gold plating MIL-G-45204 Type 1, Grade C, Class 1.
- j. Body/Bayonet: Tarnish –resistant electroless nickel plating.
- k. Corrosion (Salt Spray): MIL-STD-202 Method 101, Test Condition B.
- l. Provide with isolation washers.
- m. Acceptable product:

1) ADC BNC-BHJ-series.

4. Triax Cable Connector:

- a. Connector Type: 75 ohm Triaxial.
- b. Gender: Female.
- c. Dielectric withstanding voltage: 1500 Volts AC.
- d. Return Loss: Better than -20 dB to 1GHz; -15 dB to 2 GHZ.
- e. Wiring: Cable mount.
- f. Salt Spray: MIL-STD-202 Method 106.
- g. Center Conductor: Brass per ASTM B16 CDA Alloy 360 with 50 millionths inch Gold per MIL-G-45204 Type 1.
- h. Inner Body: Brass per ASTM B16, CDA Alloy 360 with 50 millionths inch Fold plating.
- i. Body Material: Brass per ASTM B16, CDA Alloy 360 with electroless nickel plating per QQ-N-290.
- j. Provide ADC inspection gauge. Turn over to owner at the end of the project.
- k. Provide with 6 repair kits.
- l. Refer to triax/SMPTE panel for panel mount connectors.
- m. Acceptable product:

1) Kings 7703-6.

2) ADC ProAx ATCJ-A12.

5. DT-12 Receptacle:

- a. Configuration: 12 Balanced Audio Connections.
- b. Mounting: Chassis.
- c. Insulator: Neoprene.
- d. Contacts: Mil-spec Gold Plating.
- e. Solder Contacts: 16AWG maximum wire size.
- f. Acceptable product:

1) Gepco G37FP.

6. RJ-45:

- a. Connector type: 8 conductor RJ series data.

- b. Gender: Female.
- c. Style: Panel mount.
- d. Contact resistance: 10 milliohms.
- e. Frequency range: 1 - 250 MHz.
- f. Rated current per contact: 1.5 A.
- g. Rated voltage per contact: 50 V.
- h. Transmission performance: Category 6.
- i. Standards compliance: TIA/EIA 586B, IEC11801.
- j. Wire size: 0.5 - 0.65 mm<sup>2</sup>.
- k. Wiring: Insulation displacement punch down terminals.
- l. Contact plating: 0.7  $\mu$ m gold over 1.2  $\mu$ m nickel.
- m. Contacts: Bronze.
- n. Shell: Zinc diecast.
- o. Shell plating: Black chromium.
- p. Strain relief: Stainless steel.
- q. Environmental protection: Rated to IP65.
- r. Acceptable product:

1) Neutrik NE8 series.

B. Plugs:

1. XLR-3MP:

- a. Connector type: XLR 3-pin.
- b. Gender: Male.
- c. Style: Cable mount.
- d. Capacitance between contacts: 4 pF.
- e. Contact resistance: 3 milliohms.
- f. Rated current per contact: 16 A.
- g. Rated voltage per contact: 50 V.
- h. Wire size: maximum 2.5 mm<sup>2</sup>.
- i. Wiring: solder contacts.
- j. Boot: Polyuretan.
- k. Bushing: Polyamide.
- l. Contact plating: 0.2  $\mu$ m gold hard alloy over 2  $\mu$ m nickel.
- m. Contacts: Brass.
- n. Insert: Polyamide.
- o. Shell: Zinc diecast.
- p. Shell plating: Black chromium.
- q. Strain relief: Polyacetal.
- r. Acceptable product:

1) Neutrik NC3MX-B.

2. XLR-3FP:

- a. Connector type: XLR 3-pin.
- b. Gender: Female.
- c. Style: Cable mount.
- d. Capacitance between contacts: 4 pF.
- e. Contact resistance: 3 milliohms.
- f. Rated current per contact: 16 A.
- g. Rated voltage per contact: 50 V.

- h. Wire size: maximum 2.5 mm<sup>2</sup>.
- i. Wiring: solder contacts.
- j. Boot: Polyuretan.
- k. Bushing: Polyamide.
- l. Contact plating: 0.2  $\mu$ m gold hard alloy over 2  $\mu$ m nickel.
- m. Contacts: Bronze.
- n. Insert: Polyamide.
- o. Shell: Zinc diecast.
- p. Shell plating: Black chromium.
- q. Strain relief: Polyacetal.
- r. Acceptable product:

1) Neutrik NC3FX-B.

3. BNC Straight Cable Connector:

- a. Connector type: 75 ohm BNC.
- b. Gender: Male.
- c. Style: Cable Connector.
- d. Center contact resistance: .0014 ohms.
- e. Impedance: 75 ohm.
- f. Rated voltage per contact: 500 Volts RMS.
- g. Return Loss: Better than 36 dB to 1GHz: 25 dB to 2 GHZ: 23 dB to 3 GHZ.
- h. Wiring: Bulkhead jack.
- i. Center Contact plating: 50 millionths inch gold plating MIL-G-45204 Type 1, Grade C, Class 1.
- j. Body/Bayonet: Tarnish –resistant electroless nickel plating.
- k. Corrosion (Salt Spray): MIL-STD-202 Method 101, Test Condition B.
- l. Provide with isolation washers.
- m. Acceptable product:

- 1) Kings 2064-10-9.
- 2) ADC BHFT-I2.
- 3) Trompeter UBJ28.

4. Triax Cable Connector:

- a. Connector Type: 75 ohm Triaxial.
- b. Gender: Male.
- c. Dielectric withstanding voltage: 1500 Volts AC.
- d. Return Loss: Better than -20 dB to 1GHz; -15 dB to 2 GHZ.
- e. Wiring: Cable mount.
- f. Salt Spray: MIL-STD-202 Method 106.
- g. Center Conductor: Brass per ASTM B16 CDA Alloy 360 with 50 millionths inch Gold per MIL-G-45204 Type 1.
- h. Inner Body: Brass per ASTM B16, CDA Alloy 360 with 50 millionths inch Fold plating.
- i. Body Material: Brass per ASTM B16, CDA Alloy 360 with electroless nickel plating per QQ-N-290.
- j. Provide with 6 repair kits.
- k. Refer to triax/SMPTE panel for panel mount connector.
- l. Acceptable product:

1) Kings 7705-3.

- 2) ADC PRoAx ATCP-A12.
- m. Triax Crimping Tool:
  - 1) Provide matching crimping tool matching the installed triax connector.
  - 2) Turn over to Owner at the end of the project.
  - 3) Acceptable product:
    - a) Kings recommended crimping tool with dies.
5. DT-12 Chassis Mount Plug:
  - a. Configuration: 12 Balanced Audio Connections.
  - b. Mounting: Chassis.
  - c. Backshell Shell: Hard Anodized Aluminum.
  - d. Housing Shell: Stainless Steel.
  - e. Insulator: Neoprene.
  - f. Contacts: Mil-spec Gold Plating.
  - g. Solder Contacts: 16AWG maximum wire size.
  - h. Acceptable product:
    - 1) Gepco G37MP.
6. Single Mode Fiber Optic ST Connector:
  - a. Connector Type: Single Mode Fiber ST connector.
  - b. Temperature Cycling: 0.3dB change, -40° to +75° C.
  - c. Insertion Loss Average: 0.2 dB with UniCam Tool Kit.
  - d. Reflectance: 40 dB typical.
  - e. Re-matings: minimum of 500.
  - f. Provide 25 spare connectors after turn over.
  - g. Provide with High Performance Installation Kit for ST connectors to Owner.
  - h. Acceptable product:
    - 1) Corning Pretium Performance 95-200-51
  - i. Provide with High Performance Installation Kit for ST connectors to Owner.
  - j. Acceptable product:
    - 1) Corning Pretium Toolkit TKT-UNICAM-PFC.
  - k. ST Cleaning Tool:
  - l. Acceptable product to include the following:
    - 1) Gepco SCK-SC-250 (Qty. 1).
    - 2) Gepco WST.K1.125.34 (Qty. 10).
    - 3) Gepco GEP-HFCS (Qty 1).
7. Single Mode Fiber Optic LC UPC Connector:
  - a. Connector Type: Single Mode Fiber LC connector for use with Neutrik opticalCON connector.
  - b. Temperature Cycling: 0.3dB change, -40° to +75° C.

- c. Insertion Loss Average: 0.2 dB with UniCam Tool Kit.
- d. Reflectance: 55 dB typical.
- e. Re-matings: minimum of 500.
- f. Provide 25 spare connectors after turn over.
- g. Provide with High Performance Installation Kit for LC connectors to Owner.
- h. Acceptable product:
  - 1) Corning Pretium High Performance 95-200-99.
  - 2) Gepco 951-191-111.

## 2.8 PANELS

### A. Blank Panels:

- 1. Type: Flanged.
- 2. Material: 16 gauge aluminum.
- 3. Finish: Black brushed anodized.
- 4. Acceptable product:
  - a. Middle Atlantic BL series or equal.

### B. Vent Panels:

- 1. Type: Flanged.
- 2. Material: 18 gauge steel.
- 3. Finish: Black power coat finish.
- 4. Acceptable product:
  - a. Middle Atlantic VTF series or equal.

### C. Triax/SMPTE Plug/Jack Panel:

- 1. Panel is to be a modular system type to provide flexibility between triax and SMPTE connectors.
- 2. Connectors are to be electrically isolated from the panel.
- 3. Triax connectors: Field = Kings 7702-1, Truck Interconnect = Kings 7705-1.
- 4. SMPTE hybrid connectors: Field = Canare FCS015A-FR, Truck Interconnect = Canare FCS015A-MR (part of Add Alternate BC-1).
- 5. Modules are to be nonconductive plastic.
- 6. Acceptable product:
  - a. Field (camera platform) panel:
    - 1) Clark Modular Frame MPA-ISS with MP-T Kings triax module, MP-S SMPTE module or custom Clark Telecast MX connector.
    - 2) Gepco Modular Frame HMPF with HMP-T triax module, HMP-S SMPTE module or custom Telecast MX connector.
    - 3) Whirlwind Custom.
  - b. Interconnect (rack) panel:

- 1) Clark Modular Frame MPS-OSS with MP-T Kings triax module, MP-S SMPTE module.
- 2) Gepco Modular Frame HMPF with HMP8 -T triax module, HMP-S SMPTE module or HMP-N Neutrik opticalCON module.
- 3) Whirlwind Custom.

D. Audio Panels:

1. Type; Flanged panel.
2. Material: Brush anodized aluminum panel equal to Middle Atlantic BL series.
3. Female connectors: Neutrik NC3FD-H-B.
4. Male connectors: Neutrik NC3MD-H-D.
5. Connector mounting hardware: Stainless steel.
6. Acceptable product:
  - a. Clark Wire and Cable Custom.
  - b. Gepco Custom.
  - c. Whirlwind Custom.

E. Coax Panels:

1. Type; Flanged panel.
2. Material: Brush anodized aluminum panel, equal to Middle Atlantic BL series.
3. Panel adapter: Kings 2029-22-9.
4. Acceptable product:
  - a. Clark Wire and Cable Custom.
  - b. Gepco Custom.
  - c. Whirlwind Custom.

F. SMFO Panels:

1. Type: Stainless steel front panel mounted on painted 4.5" enclosure for holding splice tray for up to 24 fused fibers.
2. Material: Brushed anodized aluminum panel, equal to Middle Atlantic BL series.
3. Front Panel: Zirconia sleeve SMFO ST feed through with metal dust caps attached to front panel with stainless steel mounting hardware.
4. Acceptable product:
  - a. Clark X-FB145-SS-STM-# (number of SMFO).
  - b. Gepco Custom.
  - c. Whirlwind Custom.

G. RJ-45 Panels:

1. Type; Flanged panel.
2. Material: Brush anodized aluminum panel equal to Middle Atlantic BL series.
3. Connector mounting hardware: Stainless steel.
4. RJ-45 connector: Neutrik etherCON NE8FDP-B chassis connector.
5. Acceptable product:
  - a. Clark Wire and Cable Custom.
  - b. Gepco Custom.

c. Whirlwind Custom.

H. Broadcast Rack Mount Screws:

1. Head Style: Large Diameter Truss Head.
2. Material: 18-8 Stainless Steel.
3. Drive type: Phillips.
4. Finish: Fully Threaded.
5. Provide for JBT, JBE JBA, Uplink and ENG pedestals and Interconnect racks.
6. Acceptable Product:

a. McMaster-Carr or equal.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.
- B. The installation recommendations contained within ASDI and TDMM are mandatory minimum standards and requirements.
- C. Mount equipment and enclosures plumb and level.
- D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five.

#### 3.2 INSTALLATION OF CABLE AND WIRING

A. Cabling and Wiring:

1. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and rigging calculations and restrictions.
2. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
3. Provide splice free wiring and cabling from origination to destination.
4. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Owner's Representative; where spade lugs are used, crimp properly with ratchet type tool.
5. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at the output of source device. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
6. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section in compliance with ASDI article 12.3.
7. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommeting.
8. Install cable so that a radius bend of no less than ten times the cables OD is maintained.

B. Housing Cabling and Wiring:

1. Provide 1'-6" minimum service loop within junction boxes to enable plates to be removed from the junction box and serviced.
2. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag.
3. Cables should be dressed to permit individual plates and panels to be removed, without disturbing adjacent plates or panels.
4. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
5. Provide plastic cable ties or lacing twine to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
6. Install with connections completely visible and labeled.

3.3 INSTALLATION OF CONNECTORS, PLATES AND PANELS

- A. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least three. Seismic bracing shall be installed on appropriate equipment where local and state codes require installation.
- B. Custom rack panels shall be 1/8 inch thick aluminum with flanges, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.
- C. Custom connector plates (speaker, microphone, etc.) are typically stainless steel, unless otherwise noted or specified. However, it is the Installer's responsibility to verify plate finish with the Owner's Representative.
- D. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
- E. All patch panels shall be wired so that signal "sources" (output from devices) appear on the upper row of a row pair and all "loads" (inputs to devices) appear on the lower row of a row pair.

3.4 INSTALLATION OF POWER AND GROUNDING

- A. Coordinate final connection of power and ground wiring to housings.

3.5 LABELING OF EQUIPMENT

- A. Provide engraved lamicoid label adjacent to the front and rear of equipment mounted in housing. Install in a plumb, level, and permanent manner. Provide rear mounted labels on equipment mounted in furniture console.
- B. Provide typed label on each patch panel designating port signal. If patch panel does not have labels provided, then provide on 80 pound paper stock utilizing 10 point block sans serif font.
- C. Provide engraved label over each user-operated control that describes the function or purpose of the control. Adjust label size to fit available space.

- D. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on System schematic drawing.
- E. Provide logical and legible cable and wiring label permanently affixed for easy identification.
- F. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style
- G. The cable label nomenclature shall correspond to the owner's directed signage and way finding program.
- H. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.
- I. Provide simple one line diagrams and floor plans with box locations and labels in each radio booth.
- J. Provide a 24 inch by 36 inch reference diagram detailing all patch panel connections for each system (e.g. Event Broadcaster, ENG and Video Replay). Diagram shall be laminated or sandwiched between Plexiglas, mounted in interconnect rooms. Diagram shall show remote input locations, patch panel normals, tie lines, and generally be a useful and informative diagram. Provide color-coding where it will enhance clarity and understanding.

### 3.6 ENGRAVING

### 3.7 INSTALLER TESTS AND ADJUSTMENTS

- A. Verify the following before beginning actual tests and adjustments on the system:
  - 1. Electronic devices are properly grounded.
  - 2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
  - 3. Insulation and shrink tubing are present where required.
  - 4. Dust, debris, solder splatter, etc. is removed.
  - 5. Cable is dressed, routed, and labeled.
  - 6. Connections are consistent with polarity.
- B. Preparation for Acceptance, prior to final inspection:
  - 1. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.
  - 2. All systems, equipment and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
  - 3. All materials shall be neat and clean, unmarred and parts securely attached.
  - 4. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc., shall be replaced or properly repaired and debris removed and discarded.
  - 5. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed by Owner.

C. Grounding System Tests:

1. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
2. Temporarily lift the technical ground from the main electrical ground, measure and record the DC resistance between them. Resistance should be at least 1000 ohms.

D. Cabling System Tests:

1. Triax Cable

- a. Low Power Tests: Utilize a Gepco TT-22 or equal for test units. Identify any wiring errors and repair.
- b. High Power Test: After low power test, perform a high voltage wiring and cabling test with a megohmmeter (Megger®) to test for the following:
- c. Center conductor to inner shield isolation: Test using 2500 volt DC for a period of not more than 2 seconds and look for high capacitance in the cable. Set the sensitivity for over-current to 50% setting.
- d. Inner shield to outer shield isolation: Test using 2500 volt DC for a period of not more than 2 seconds. The braid cabling and thin dielectric should exhibit a high capacitance. This is an important test as most triax cameras are powered over the two shields. The cameras typically operate between 160 to 240 volts DC or AC.
- e. TDR tests:
  - 1) Perform Time Domain Reflectometer (TDR) tests on triax cable to test for cable irregularities and length.
  - 2) Perform TDR test on the inner conductor and inner shield. Provide test data in graph form as part of the as built documentation provided to owner.
  - 3) Perform TDR between the inner and outer shields to check for kinks, water ingress or defects between shields. Provide test data in graph form as part of the as built documentation provided to owner.
- f. Return Loss (RL) Tests:
  - 1) Provide a dual port network analyzer with VSWR bridge and impedance matching transformers.
  - 2) Sweep cables from 5Mhz to 3GHz.
  - 3) Repair cables that do not meet manufactures Return Loss (RL). Typical return loss readings for RG-11 triax.
  - 4) From 5Mhz to 850MHz – Minimum of -20dB.
  - 5) From 850MHz to 3GHz – Minimum of -15dB.
  - 6) Provide test data in graph form as part of the as built documentation provided to owner. Provide manufacture's stated Return Loss as part of the documentation.
- g. Sweep Tests:
  - 1) Sweep triax inner conductor and inner shield using a spectrum analyzer with an internal generator. Provide a triax jumper cable to loop test signal from tracking generator back to analyzer.
  - 2) Sweep cables up to a minimum of 3GHz. Record the coax loss at 200MHz, 1.5GHz and 3GHz.

2. Video Coax

- a. Low Power Tests: Utilize a Gepco TT-22 with Triax to BNC adapters or equal for test units. Identify any wiring errors and repair.
- b. High Power Test: After low power test, perform a high voltage wiring and cabling test with a megohmmeter (Megger®) to test for the following:
  - 1) Center conductor to shield isolation: Test using 2500 volt DC for a period of not more than 2 seconds and look for high capacitance in the cable. Set the sensitivity for over-current to 50% setting.
- c. TDR tests:
  - 1) Perform Time Domain Reflectometer (TDR) tests on coax cable to test for cable irregularities and length.
  - 2) Perform TDR test on the inner conductor and shield. Provide test data in graph form as part of the as built documentation provided to owner.
- d. Or Return Loss (RL) Tests:
  - 1) Provide a dual port network analyzer with VSWR bridge and impedance matching transformers.
  - 2) Sweep cables from 5Mhz to 3GHz.
  - 3) Repair cables that do not meet manufactures Return Loss (RL). Typical return loss readings for RG-6 digital coax.
  - 4) From 5MHz to 1.6GHz – Min -21dB.
  - 5) From 1.6GHz to 3GHz – Min -20dB.
  - 6) Provide test data in graph form as part of the as built documentation provided to owner. Provide manufacture's stated Return Loss as part of the documentation.
  - 7) Sweep Tests:
    - a) Sweep using a spectrum analyzer with an internal generator. Provide a coax jumper cable to loop test signal from tracking generator back to analyzer.
    - b) Sweep cables up to a minimum of 3GHz. Record the coax loss at 200MHz, 1.5GHz and 3GHz.

3. Audio Cables

- a. Test XLR's and DT-12 (multi-connector) where they are hard split.
  - b. Test conductors and shield for shorts to building ground.
  - c. Test for shorts between conductors and shield.
  - d. Test that cable is wired to industry standard pin 2 high, pin 3 low and pin 1 screen (shield).
4. Test UTP cable at in accordance with the referenced "Standards". Provide two hard copies and computer disk of record and printouts of test results.
5. SMFO Cable
- a. Extensive testing as these are the primary cables for HD and Slo-motion cameras.
  - b. Cable Tests:

- 1) Attenuation testing from both ends.
- 2) SMFO: test at 1310 and 1550 nm.
  - a) Identify any wiring errors.
  - b) Identify any wiring errors.
  - c) Provide hard copies of attenuation tests.
  - d) Above test reports to include link attenuation = Calculated cable attenuation + connector attenuation + splice attenuation.
- c. OTDR
  - 1) Provide printed copies of the OTDR trace for records. Provide location and cable number if applicable.
6. Test Results:
  - a. Coax and Triax Cables:
  - b. List each video coax and triax cable separately with description and cable number. Include the measured length of the cable using TDR, return loss graphs and the measured sweep losses up to 3GHz using the spectrum analyzer; include the manufactures stated cable loss at 200MHz, 1.5GHz and 3GHz.
  - c. Submit graphs of TDR tests for review by the consultant.
  - d. The test results show when and where a fault was found.
7. SMFO Cables:
  - a. List each fiber strand separately with description and cable number. Include the measured length of the cable using OTDR and power attenuation.
8. Audio Cables:
  - a. List each cable separately with a description and cable number. Include DT-12 connector where applicable.
  - b. The test results show when and where a fault was found.
9. Narrative of Test Setup
  - a. Provide information of the test equipment (manufacture and model #) used for tests. Date of last calibration if applicable.
  - b. Provide a written detail and functional diagram (if it provides information that is difficult to describe) of test setup with description of test cables used (including lengths if applicable for TDR and OTDR tests) to allow duplicate tests to be performed during the consultant check out.

### 3.8 TEST EQUIPMENT

- A. Equipment listed by manufacturer and model number establishes a standard of quality; other approved equal equipment will be acceptable.
- B. Thirty days prior to start of testing, provide a list to the Owner's Representative of test equipment make, model numbers and calibration dates that will be used.

- C. Furnish the following equipment. Equipment to be available for the entire test period through final System testing.
1. Signal Level Meter.
  2. Blonder-Tongue SA-7U Variable Attenuator.
  3. Dual-trace oscilloscope: 100 MHz bandwidth, 1mV/cm sensitivity.
  4. Multimeter: measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10ma to 10A.
  5. Television signal generator. HD-SDI.
  6. 75ohm, 1 percent resistors.
  7. Megohmmeter.
  8. Ladders and scaffolding necessary to inspect cable in cable trays and ceiling mounted junction boxes.
  9. Time Domain Reflectometry (TDR).
  10. Spectrum Analyzer with internal sweep generator.
  11. Provide fiber optic test equipment meeting TIA/EIA-526-14A (1998) and TIA/EIA-526-7(1998) standards.
- D. Provide two portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project.
1. Include rechargeable batteries and recharger along with "holster" for wearing on belt.
  2. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

### 3.9 ACCEPTANCE

- A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owners' representative.
- B. Acceptance testing will include operation of each major system and any other components deemed necessary. Installer will assist in this testing and provide any test equipment required specified herein. Installer shall provide at least (1) technician available for the entire testing period (day and night) to assist in tests, adjustments, and final modifications. Tools and materials required to+ make any necessary repairs, corrections, or adjustments shall be furnished by the Installer. Testing process is estimated to take minimum of (5) days.

END OF SECTION 276000

## SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Basic materials and methods, along with Division 1, General Provisions that are applicable to Division 28 sections.
- B. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 specification Sections apply to all Division 28 sections.

#### 1.2 QUALITY ASSURANCE

- A. Comply with applicable local, state, and federal codes.
- B. Warrant Work against faulty material or Workmanship in accordance with Division 1. If the Project is occupied or the systems placed in operation in several phases at the request of the Owner's Representative, then the warranty of each system or piece of equipment used shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner's Representative. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.
- C. Equipment and material provided under this Division shall be periodically inspected and serviced by competent technicians. This function becomes the responsibility of the Owner's Representative when the system is accepted by the Owner's Representative. The one year material and Workmanship warranty is not intended to supplant normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items due to normal use, nor to correct without charge, breakage, maladjustment, and other trouble caused by improper maintenance.
- D. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain premises neat and clean. Protect and preserve access to energized equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. Use only factory supplied paints of matching color and formula. Schedule an off-hour shutdown of all electrical system equipment during the 2-week period preceding substantial completion.

#### 1.3 REFERENCES

- A. Perform Work specified in Division 28 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.
  - 1. NFPA 20: Standard for Installation of Stationary Pumps for Fire Protection.
  - 2. NFPA 70: National Electrical Code.
  - 3. NFPA 72: National Fire Alarm Code.

4. NFPA 92A: Standard for Smoke Control Systems Utilizing Barriers and Pressure Differences.
5. NFPA 92B: Standard for Smoke Management Systems in Malls, Atria, Large Areas
6. NFPA 101: Life Safety Code.
7. NFPA 110: Standard for Emergency and Standby Power Systems.
8. ANSI-A17.1: Elevators, Dumbwaiters, Escalators and Moving Walks.
9. ANSI Handicapped Code-A117.1.
10. International Building Code.
11. All applicable Occupational Safety and Health Administration (OSHA) Publications, Rules and Regulations.
12. Americans with Disabilities Act (ADA).
13. ASTM E814-08B: Standard Test Method for Fire Tests of Penetration Firestop Systems.
14. U.L. Fire Resistance Index.

#### 1.4 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
- B. Flashing of conduits into roofing and outside walls.
- C. Heating, ventilating, and air conditioning equipment.
- D. Fireproofing.
- E. Elevators.
- F. Automatic Doors.
- G. Cutting and patching for Work, except for errors and omissions under this Division.

#### 1.5 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Submit product data, equipment details, capacities, and shop drawings as specified in sections of this Division.
- C. Submit fire alarm point-to-point drawings with product data submission.

#### 1.6 OPERATING AND MAINTENANCE MANUALS

- A. Provide manuals in accordance with Division 01.
- B. In addition to required submittals, include copies of all test reports required in Part 3, "Execution" of section 260500.
- C. Provide completed warranty certificates for systems and equipment.

- D. Provide tabulation of overload heaters, including each motor identified, nameplate data and overload heater part number.

## 1.7 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where this is not practical, cover items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage. Evidence of damage from water or other contaminants will be cause for rejection.

## 1.8 RECORD DRAWINGS

- A. Comply with provisions of Division 01.

# PART 2 - PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

- A. Equipment and materials furnished shall be listed by UL or other nationally accredited testing laboratory where available. When listing is not available for a piece of equipment, it shall be submitted in accordance with Drawings and Specifications and shall be approved by the authorities having jurisdiction.
- B. Specifications and Drawings indicate name, type and/or catalog number of materials and equipment to establish standards of quality. Submittals shall be based on the standards specified. The standards should not be construed as limiting competition.
- C. If materials and equipment other than specified herein are intended to be submitted, a letter providing a list of all the suggested alternates by section number, brand and series or model shall be submitted to the prime Architect for review and approval. Submit in accordance with Division 01 or 14 days prior to bids or final pricing are to be submitted.
- D. Each item of equipment shall be designed and the entire system installed to resist lateral forces using an ICP value of not less than 0.5 and in accordance with the applicable building code.

## 2.2 WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
  - 1. Size: 16" X 16" minimum, as indicated, or as required to allow inspection, service and removal of items served.
  - 2. 14 gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.
  - 3. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.

4. Prime painted or rust inhibitive paint finish.
5. UL labeled when in fire-rated construction, 1-1/2 hour rating.
6. Provide in walls, floors, and ceilings to permit access to all equipment and junction boxes.
7. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
8. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers. Use panels equal to Milcor Style M for masonry and drywall construction; equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.

### PART 3 - EXECUTION

#### 3.1 COORDINATION

- A. Install equipment in accordance with manufacturer's recommendations. Where conflicts occur between Contract Documents and these recommendations, request a ruling before proceeding with such Work.
- B. Visit site and observe conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work required by these documents.
- C. Examine Specifications and Drawings to be familiar with items which require system connections and coordination. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes.
- D. Prior to commencement of installation, prepare coordination drawings for work under this division, as specified in Division 01 and as called for herein. Coordinate work in full cooperation with persons performing work under other divisions, including but not limited to mechanical, plumbing, fire protection, telecommunication and miscellaneous steel to develop these coordination drawings that will serve as the agreed upon plan for a coordinated installation of work for all trades. Include system equipment, conduit racks and conduits 3" and larger on drawings confirming coordination with other trades. Incorporate the information onto the coordination drawings required under Divisions 01, 21, 22, 23, 26, 27 and 28 to develop master coordination drawings. Account for lighting fixture depths in the coordination. Inform Architect of conflicts that cannot be resolved.
- E. Drawings are not to be submitted to Engineer. Submit a copy to the General Contractor and keep a copy on site for references. Notify design professional of conflicts that cannot be resolved.

#### 3.2 FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

#### 3.3 CUTTING AND PATCHING

- A. Comply with provisions of Division 01.

- B. Repair or replace routine damage caused by cutting in performance of Work under this Division.
- C. Correct unnecessary damage caused due to installation of electrical Work, brought about through carelessness or lack of coordination.
- D. Holes cut through floor slabs shall be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs between floors shall be properly sealed, fire proofed and water proofed.
- E. Holes cut through walls shall be drilled or cut with tools designed for the purpose. All openings, sleeves and holes in walls that extend to underside of floor above shall be properly sealed and fire proofed.
- F. Repairs shall be performed with materials which match existing materials and be installed in accordance with appropriate sections of these Specifications.
- G. Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect.

#### 3.4 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

- A. Comply with provisions of Division 31.
- B. Provide trenching, excavation, and backfilling necessary for performance of Work under this Division.
- C. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition for Work to be carried on.
- D. Trenching and excavation shall be unclassified. No extra will be paid in event that rock is encountered.

#### 3.5 FOUNDATIONS AND PADS

- A. Provide concrete foundations and pads for equipment per the requirements Division 03. Locate and size foundations, pads, and anchor bolts as required for equipment in this Division.

END OF SECTION 280500

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 281313 - CONSOLIDATED SECURITY SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.
- B. The General Security Requirements specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the General Security Requirements Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the General Security Requirements specification Section.

#### 1.2 DEFINITIONS

- A. AC: Alternating Current
- B. ACS: Access control system
- C. ADA: Americans with Disabilities Act
- D. API: Application programming interface
- E. ASCII: American Standard Code for Information Interchange
- F. AV: Audio Visual
- G. BACnet: Building Automation and Control network
- H. BPI: Bits Per Inch
- I. BPS: Bits Per Second
- J. CCD: Charged coupled device
- K. CCTV: Closed Circuit Television
- L. CE: European Conformity
- M. CPU: Central Processing Unit
- N. DMU: Door management unit
- O. DVR: Digital Video Recorder

P. FASC-N: Federal Agency Smart Credential Number

Q. FCC: Federal Communications Commission

R. FDA: Food and Drug Administration

S. FQRN: Fully Qualified Reference Name

T. I/O: Input/output

U. ID: Identification

V. IEC: International Electrotechnical Commission

W. IFC: Intelligent field controller

X. HD: High definition

Y. IETF: Internet Engineering Task Force

Z. IP: Internet Protocol

AA. IPS: Images per second

BB. ISO: International Organization for Standardization

CC. ITU: International Telecommunications Union

DD. LDAP: Lightweight Directory Access Protocol

EE. LED: Light Emitting Diode

FF. LED: Light-emitting diode

GG. MIS: Management Information Systems

HH. MP: Megapixel

II. MPEG: Moving Picture Experts Group

JJ. NTSC: National Television System Committee

KK. NEC: National Electrical Code

LL. NEMA: National Electrical Manufacturers Association

MM. NFPA: National Fire Protection Association

NN. ODBC: Open Database Connectivity

OO. ONVIF: Open Network Video Interface Forum

PP. PAL: Phase alternating line

- QQ. PTZ: Pan, tilt and zoom
- RR. RWC: Regional Watch Center
- SS. SCC: Security Control Center
- TT. SD: Standard definition
- UU. VMS: Video management VMSsystem
- VV. WAN: Wide Area Network

### 1.3 REFERENCES

- A. Electronics Industry Association (EIA) RS-170a standard for analog video
- B. NTSC broadcast video standard
- C. ITU PAL-B broadcast video standard (Referred to herein as simply PAL)
- D. ONVIF standards for IP video interoperability
- E. MPEG standards for video encoding / decoding
- F. ITU-T standards for video encoding / decoding
- G. National Electrical Code (NEC)
- H. NFPA 70
- I. UL 294 and UL 1076 as required where applicable
- J. FCC Rules and Regulations
- K. Part 15 Class A or B as applicable
- L. Applicable Federal, State, and Local laws, regulations and other codes
- M. CE mark, as and where applicable
- N. C-Tick mark, as and where applicable
- O. Degrees of protection provided by the controller enclosure:
  - 1. NEMA 250: minimum Type 2
  - 2. IEC 529: minimum IP 21

#### 1.4 SUMMARY OF WORK

- A. Work specified in this Section includes systems used for visual monitoring and recording of activities within the scene of view of attached cameras and associated features and functions, and equipment as necessary to support this capability.
- B. Manufacture:
  - 1. Provide Avigilon Video Surveillance and Access Control (No Substitutions )
  - 2. 1717 McKinney Ave #1590
  - 3. Dallas Texas 75201
- C. Systems shall consist of:
  - 1. Software
  - 2. Recording servers
  - 3. Management server
  - 4. Recording storage
  - 5. Client Workstations
  - 6. Cameras
  - 7. Network video encoders
  - 8. Camera housings and mounts
  - 9. Video analytics software / firmware
- D. The VMS shall provide the following functions:
  - 1. Video display as necessary for live monitoring and assessment of security incidents
  - 2. Recording of, and retrieval from, video to digital storage media for historical record
  - 3. Graphical map creation
  - 4. System administration
  - 5. Reports generation
- E. The VSS shall consist of a collection of devices by different manufacturers that are seamlessly managed by a single software package over an IP-based communications network. Video generated natively in digital IP format, as well as analog video digitized by an IP encoder shall both be supported by the VMS.
- F. The VMS shall have the capability to integrate with intelligent video analysis products for monitoring of specific activities or behaviors that occur within the scene of view of the associated camera.
- G. Multiple disparate video surveillance systems shall have the ability to be linked together in a centralized architecture, allowing cameras from any system to be viewed on any other system. The centralized architecture shall be configured and managed in a hierarchical manner.
- H. The VMS shall incorporate security measures, including advanced authentication measures and encryption of data.
- I. The VMS shall provide for redundancy of video storage using local storage at camera locations where critical or essential as indicated in the Construction Documents. Upon loss of recording server or network connectivity, the camera shall automatically buffer video to local storage, then automatically upload that video to the recording server upon restoral.

- J. Components of the VMS that use proprietary digital technologies shall have an associated software developer's kit (SDK) that is published, regularly updated, and available for other manufacturers / software vendors to write to.
- K. Work specified in this Section includes systems used for authentication of credential-holders for physical access through associated portals as well as monitoring of intrusion and other alarm information.
- L. Contractor will provide field access control equipment necessary to install card readers.
- M. Credentials may be:
  - 1. Access cards / readers
  - 2. Keypads / codes
  - 3. Biometric readers / data
- N. Systems shall consist of:
  - 1. Software
  - 2. Servers
  - 3. Workstations
  - 4. Alarm initiation / system ancillary devices
  - 5. The ACS shall provide the following functions:
    - a. Access Control
    - b. Alarm Monitoring
    - c. Cardholder management
    - d. Badge creation
    - e. System administration
    - f. Badge layout (template) creation
    - g. Screen/forms creation
    - h. Graphical map creation
    - i. Reports generation

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data on ACS components including, but not limited to, electrical specifications, mechanical specifications, rough-in diagrams, and instructions for installation, operation and maintenance, suitable for inclusion in Operation & Maintenance manuals.
- B. Shop Drawings: Provide shop drawings showing new and existing equipment locations and arrangements for the ACS to include, but not be limited to, central controllers, reader modules, card reader extenders, proximity card reading sensors, power supplies, switches, door wiring configurations and ancillary equipment. As part of the shop drawing submittal, Contractor shall provide detailed wiring diagrams indicating door wiring configurations and component connection diagrams indicating wiring for communication and control. All drawings must be submitted in hard copy and electronic format, with one submittal in American English.
- C. One Line Diagram: Submit a one-line diagram of the system configuration proposed. Submittals indicating typical riser diagrams are not acceptable. All drawings must be submitted in hard copy and electronic format.

## PART 2 - CONSOLIDATED SECURITY PLATFORM (CSP)

### 2.1 GENERAL

- A. The Consolidated Security Platform (CSP) shall be an enterprise class IP-enabled security and safety software solution.
- B. The CSP shall support the seamless unification of IP access control system (ACS), IP video management system (VMS). The CSP user interface (UI) applications shall present a consolidated security interface for the management, configuration, monitoring, and reporting of embedded ACS, and VMS systems.
- C. Functionalities available with the CSP shall include:
  - 1. Configuration of embedded systems such as ACS, and VMS systems.
  - 2. Live event monitoring.
  - 3. Live video monitoring and playback of archived video.
  - 4. Alarm management.
  - 5. Reporting, including creating custom report templates and incident reports.
  - 6. Federation for global monitoring, reporting, and alarm management of multiple remote and independent ACS and/or VMS systems spread across multiple facilities and geographic areas.
  - 7. Global cardholder management across multiple facilities and geographic areas each with their own independent ACS system.
  - 8. Microsoft Active Directory integration for synchronizing CSP user accounts and ACS cardholder accounts.
  - 9. Intrusion device and panel integration (live monitoring, reporting, and arming/disarming).
  - 10. SIP Intercom device integration for bi-directional communication.
  - 11. Integration to third party systems and databases via plug-ins (access control, video analytics, point of sale, and more).
  - 12. Dynamic graphical map viewing.
  - 13. Asset management system integration.
- D. The CSP shall be deployed in one or more of the following types of installations:
  - 1. Consolidated access, and video platform, and any combination thereof.
  - 2. Standalone access control, or video platform.
  - 3. Consolidated access and video platform that federates multiple remote ACS and VMS.
  - 4. Standalone video platform that federates multiple independent remote VMS.
  - 5. Standalone access control that federates multiple independent remote ACS.
- E. Licensing
  - 1. A single central license shall be applied centrally on the configuration server.
  - 2. There shall be no requirement to apply a license at every server computer or client workstation.
  - 3. Based on selected options, one or more embedded systems shall be enabled or disabled.

## 2.2 HARDWARE AND SOFTWARE REQUIREMENTS

- A. The CSP and embedded systems (video, license plate recognition, access control) shall be designed to run on a standard PC-based platform loaded with a Windows operating system.
- B. The server software module (SSM) shall be compatible with both 32-bit and 64-bit operating systems including Windows Vista, Windows XP, Windows 7, Windows 8/8.1, Windows Server 2003, Windows Server 2008, and Windows Server 2012. Refer to latest CSP workstation, server, and operating systems specifications for more information.
- C. The client modules shall run on Windows XP, Windows Vista, Windows 7 or Windows 8/8.1.
- D. The core client/server software shall be built in its entirety using the Microsoft .NET software framework and the C# (C-Sharp) programming language.
- E. The CSP database server(s) shall be built on Microsoft's SQL Server 2008, SQL Server 2012, including SQL Server 2008/2012 Express Editions.
- F. The CSP shall be compatible with virtual environment including VMware 5.1.
- G. The CSP shall use the latest user interface (UI) development and programming technologies such as Microsoft WPF (Windows Presentation Foundation), the XAML markup language, and .NET software framework.

## 2.3 OVERVIEW

- A. The CSP shall be based on a client/server model. The CSP shall consist of a standard Server Software Module (SSM) and Client Software Applications (CSA).
- B. The CSP shall be an IP enabled solution. All communication between the SSM and CSA shall be based on standard TCP/IP protocol and shall use encryption when enabled by the administrator.
- C. The SSM shall be a Windows service that can be configured to start when the operating system is booted and run in the background. The SSM shall automatically launch at computer startup, irrespective of whether a user is logged onto the machine or not.
- D. Users shall be able to deploy the SSM on a single server or across several servers for a distributed architecture. The CSP shall not be restricted in the number of SSM deployed.
- E. The CSP shall support the concept of Federation whereby multiple independent ACS and VMS installations can be merged into a single large virtual system for centralized monitoring, reporting, and alarm management.
- F. The CSP shall protect against potential database server failure and continue to run through standard off-the-shelf solutions.
- G. The CSP shall support one thousand instances of Client Software Applications (CSA) connected at the same time. An unrestricted number of CSA however can be installed at any time.

- H. The CSP shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
- I. The CSP shall support uninterrupted video streaming. The CSA shall keep existing video connections active in the eventuality that a SSM (except Archiver) become unavailable.

## 2.4 ROLES-BASED ARCHITECTURE

- A. The CSP shall consist of a role-based architecture, with each SSM hosting one or more roles.
- B. Each role shall execute a specific set of tasks related to either core system, video (VMS), or access control (ACS) functionalities, among many others. Installation shall be streamlined through the CSP's abilities to allow administrators to:
  - 1. Deploy one or several SSM across the network prior to activating roles.
  - 2. Activate and deactivate roles as needed on each and every SSM.
  - 3. Centralize role configuration and management.
  - 4. Support for remote configuration.
  - 5. Move roles over from one SSM to another.
- C. Each role, where needed, shall have its own database to store events and role-specific configuration information.
- D. Roles without databases (Federation, Active Directory, Global Cardholder Management) shall support near real-time standby without any third party failover software being required.

## 2.5 STANDARD ROLES

- A. Directory Role
  - 1. The Directory Role shall manage the central database that contains all the system information and component configuration of the CSP.
  - 2. The Directory Role shall authenticate users and give access to the CSP based on predefined user access rights or privileges, and security partition settings.
    - a. The Directory Role shall support the configuration/management of the following components common to the ACS, and VMS sub-systems:
      - b. Security Partitions, users and user groups.
      - c. Areas.
      - d. Zones, input/output (IO) linking rules, custom output behavior.
      - e. Alarms. Schedules, scheduled tasks.
      - f. Custom events.
      - g. Macros or custom scripts.
  - 3. The Directory Role shall support the configuration/management of the following components specific to VMS:
    - a. Video servers and their peripherals (e.g. audio, IOs, serial ports).
    - b. PTZ.
    - c. Camera sequences.
    - d. Recording and archiving schedules.

4. The Directory Role shall support the configuration/management of the following components specific to ACS:
    - a. Door controllers, input and output (IO) modules.
    - b. Doors, Elevators, Access rules.
    - c. Cardholders and cardholder groups, credentials, and badge templates.
  - B. Video Archiver Role shall be responsible for managing cameras and encoders under its control and archiving video.
  - C. Media Router Role shall be responsible for routing video and audio streams across local and wide area networks from the source (e.g. DVS) to the destination (e.g. CSA).
  - D. Access Manager Role shall be responsible for synchronizing access control hardware units under its control, such as door controllers and IO modules. It shall also be able to validate and log all access activities and events when the door controllers and IO modules are online.
  - E. Zone Manager Role shall be responsible for managing all software zones (collection of inputs) and logging associated zone events. Zones shall consist of inputs from both access control and video devices.
  - F. Health Monitoring Role shall be responsible for monitoring and logging health events and warnings from the various client applications, roles, and services that are part of the CSP. This role shall also be responsible for logging events within the Windows Event Log, generating reports on health statistics and health history.
  - G. Active Directory Role shall be responsible for synchronizing user accounts and cardholder accounts with a Microsoft Active Directory server.
  - H. Intrusion Manager Role shall be responsible for managing third party intrusion devices such as alarm panels and perimeter detection devices. Intrusion Manager Role shall also log all intrusion events in a database.
  - I. Plug-in Manager Role shall be responsible for the communications between the CSP and third party systems such as video analytics, access control and video systems, and building management systems.
  - J. RTSP Role shall allow to connect from a third party to any video stream of the system using standard RTSP protocol. RTSP shall provide access to video live as well as playback.
- 2.6 SERVER MONITORING SERVICE (WATCHDOG)
- A. The CSP shall include a Server Monitoring Service that continuously monitors the state of the Server Software Module (SSM) service.
  - B. The Server Monitoring Service shall be a Windows service that automatically launches at system startup, irrespective of whether a user is logged into his account or not.
  - C. The Server Monitoring Service shall be installed on all PCs/servers running an SSM. In the event of a malfunction or failure, the Server Monitoring Service shall restart the failed service. As a last resort, the Server Monitoring Service shall reboot the server/PC should it be unable to restart the service.

## 2.7 CLIENT SOFTWARE APPLICATIONS (CSA)

- A. The Client Software Applications (CSA) shall provide the user interface for CSP configuration and monitoring over any network, accessible locally or from a remote connection.
- B. The CSA shall consist of the Configuration UI for system configuration and the Surveillance UI for monitoring. The CSA shall be Windows based and provide an easy-to-use graphical user interface (UI).
- C. The Server Administrator shall be used to configure the server database(s). It shall be web-based and accessible locally on the SSM or across the network.
- D. The CSP shall use the latest user interface (UI) development and programming technologies such as Microsoft WPF (Windows Presentation Foundation), the XAML markup language, and the .NET software framework.
- E. All applications shall provide an authentication mechanism, which verifies the validity of the user. As such, the administrator (who has all rights and privileges) can define specific access rights and privileges for each user in the system.
- F. Logging on to a CSA shall be done either through locally stored CSP user accounts and passwords or using the operators Windows credentials when Active Directory integration is enabled.
- G. When integrated with Microsoft's Active Directory, the CSA and CSP shall authenticate users using their Windows credentials. As such, the CSP will benefit from Active Directory password authentication and strong security features.
- H. The CSA shall support multiple languages, including but not limited to the following: English, French, Arabic, Czech, Dutch, German, Hebrew, Hungarian, Italian, Japanese, Korean, Norwegian, Persian (Farsi), Polish, Portuguese (Brazilian), Simplified and Traditional Chinese, Russian, Spanish, Swedish, Thai and Turkish.
- I. The Configuration UI and Surveillance UI shall support many of the latest UI concepts to enhance usability and operator efficiency such as
  - 1. A customizable Home Page including favorite and recently used tasks.
  - 2. Task-oriented approach for administrator/operator activities where each type of activity (surveillance, visitor management, individual reports, and more) is an operator task.
  - 3. Consolidated and consistent workflows for video, and access control.
  - 4. Single click functionality for reporting and tracking. The Surveillance UI shall support single-click reporting for access control, and video, as well as single-click tracking of areas, cameras, doors, zones, cardholders, elevators, and more. Single-click reporting or tracking shall create a new task with the selected entities to report on or to track.
- J. Configuration UI and Surveillance UI Home Page and Tasks
  - 1. The Configuration UI and Surveillance UI shall be task-oriented.
  - 2. A task shall be user interface design patterns whose goal is to simplify the user interface by grouping related features from different systems such as video and access in the same display window. Features are grouped together in a task based on their common relevance to help the user perform a specific task.
  - 3. Tasks shall be accessible via the Configuration or the Surveillance CSA's Home Page.

4. Newly created tasks shall be accessible via the Configuration UI or the Surveillance UI taskbar.
5. Similar tasks shall be grouped into the following categories:
  - a. Operation: Access control management, LRP management, and more.
  - b. Investigation: Video bookmark/motion/archive reports, access control activity reports, visitor activity reports, alarm reports activity reports, and more.
  - c. Maintenance: Access control and video configuration reports, troubleshooters, audit trails, health-related reports, and more.
6. An operator shall be able to launch a specific task only if he has the appropriate privileges.
7. The Home Page content shall be customizable through the use of privileges to hide tasks an operator should not have access to and through a list a favorite and recently used tasks. Further to that, editing a CSP XML file to add new tasks on the fly shall be possible.

## 2.8 CONFIGURATION USER INTERFACE (UI)

- A. The Configuration UI application shall allow the administrator or users with appropriate privileges to change the system configuration. The Configuration UI shall provide decentralized configuration and administration of the CSP system from anywhere on the IP network.
- B. The configuration of all embedded ACS, and VMS, systems shall be accessible via the Configuration UI.
- C. The Configuration UI shall have a home page with single-click access to various tasks.
- D. The Configuration UI shall include a variety of tools such as troubleshooting utilities, import tools, and a unit discover tool, amongst many more.
- E. The Configuration UI shall include a static reporting interface to:
  1. View historical events based on entity activity. The user shall be able to perform actions such as printing a report and troubleshooting a specific access event from the reporting view.
  2. View audit trails that show a history of user/administrator changes to an entity.
- F. Common entities such as users, schedules, alarms and many more, can be reused by all embedded systems (ACS, VMS, and LPR).

## 2.9 SURVEILLANCE USER INTERFACE (UI)

- A. The Surveillance UI shall fulfill the role of a Consolidated Security Interface able to monitor video, LPR, and access control events and alarms, as well as video live and recorded video.
- B. The Surveillance UI shall provide a graphical user interface to control and monitor the CSP over any IP network. It shall allow administrators and operators with appropriate privileges to monitor their consolidated security platform, run reports, and manage alarms.

- C. The Surveillance UI shall support the following UI concepts to enhance usability and operator efficiency such as:
1. Dynamically adaptive interface that adjusts in real-time to what the operator is doing.
  2. A dynamic dashboard loaded with entity-specific widgets, e.g. door and camera widget.
  3. Use of transparent overlays that can display multiple data in a seamless fashion.
  4. Display tile menus and quick commands.
  5. Consolidated and consistent workflows.
  6. Tile menus and quick commands easily accessible within every display tile of the user workspace.
  7. Single click functionality for reporting and tracking. The Surveillance UI shall support single-click reporting for access control, LPR, and video, as well as single-click tracking of areas, cameras, doors, zones, cardholders, elevators, LPR entities, and more. Single-click reporting or tracking shall create a new task with the selected entities to report on or to track.
- D. Surveillance UI Home Page and Tasks
1. Similar tasks shall be grouped into the following categories:
    - a. Operation: Access control/LRP/video surveillance, visitor management, mustering, access control and video alarm monitoring, and more.
    - b. Investigation: Video bookmark/motion/archive reports, access control activity reports, visitor activity reports, alarm reports, LPR activity reports, and more.
    - c. Maintenance: Access control and video configuration reports, troubleshooters, audit trails, and more.
- E. Dynamically Adaptive UI, Dashboard, and Widgets
1. The Surveillance UI shall dynamically adapt to what the operator is doing. This shall be accomplished through the concept of widgets that are grouped in the Surveillance UI dashboard.
  2. Widgets are mini-applications or mini-groupings in the Surveillance UI dashboard that let you perform common tasks and provide you with fast access to information and actions.
  3. With a single click on an entity (e.g. door or camera) the specific widgets associated to that entity appear and other non-relevant widgets disappear dynamically (instantly). Widgets shall bring the operator information such as door status and camera stream information, as well as user actions such, door unlock, PTZ controls, and more.
  4. Specific widgets include those for a door, camera, alarm, zone, display tile, video stream (statistics), PTZ camera, and more.
- F. Operator Workflows
1. A workflow shall be a sequence of operations an operator or administrator shall execute to complete an activity. The "flow" relates to a clearly defined timeline or sequence for executing the activity.
  2. The Surveillance UI shall be equipped with consistent workflows for the LPR, video, and access control systems it unifies.
  3. Generating or printing a report, setting up or acknowledging an alarm, or creating an incident report shall follow the same process (workflow) whether the operator is working with video, LPR, or access control, or both video and access control.
- G. Each task within the surveillance UI shall consist of one or more of the following items:

1. Event list.
  2. Logical tree. Doors, cameras, zones, LPR units, and elevators shall be grouped under Areas in a hierarchical fashion.
  3. Entities list of all entities being tracked.
  4. Display tiles with various patterns (1 x 1, 2 x 2, and more).
  5. Display tile menu with various commands related to cameras, doors, PTZ, and tile controls.
  6. Dashboard with widgets.
- H. The Surveillance UI shall support multiple event lists and display tile patterns, including:
1. Event/alarm list layout only
  2. Display tile layout only
  3. Display tile and alarm/event list combination
  4. LPR map and alarm/event list combination
- I. User workspace customization
1. The user shall have full control over the user workspace through a variety of user-selectable customization options. Administrators shall also be able to limit what users and operators can modify in their workspace through privileges.
  2. Once customized, the user shall be able to save his workspace.
  3. The user workspace shall be accessible by a specific user from any client application on the network.
  4. Display tile patterns shall be customizable.
  5. Event or alarm lists shall span anywhere from a portion of the screen up to the entire screen, and shall be resizable by the user. The length of event or alarm lists shall be user-defined. Scroll bars shall enable the user to navigate through lengthy lists of events and alarms.
  6. The Surveillance UI shall support multiple display tile patterns, e.g. 1 display tile (1x1 matrix), 16 tiles (8x8 matrix), and multiple additional variations.
  7. The Surveillance UI shall support as many monitors as the PC video adapters and Windows Operating System are capable of accepting.
  8. Additional customization options include: show/hide window panes, show/hide menus/toolbars, show/hide overlaid information on video, resize different window panes, choice of tile display pattern on a per task basis.
- J. The Surveillance UI shall provide an interface to support the following tasks and activities common to access control, LPR, and video:
1. Monitoring the events from a live security system (ACS and/or VMS and/or LPR).
  2. Generating reports, including custom reports.
  3. Monitoring and acknowledging alarms.
  4. Creating and editing incidents and generating incident reports.
  5. Displaying dynamic graphical maps and floor plans. Executing actions from a dynamic graphical map and floor plan.
  6. Management and execution of hot actions and macros.
- K. The Surveillance UI shall be able to monitor the activity of the following entities in real-time through the surveillance task, among others: areas, LPR entities, doors, elevators, cameras, cardholders, cardholder groups, zones (input points), and more. The Surveillance UI shall provide an interface to support the following access control tasks and capabilities:

1. Monitoring and management of access events and alarms.
  2. Viewing of cardholder picture or badge IDs.
  3. Verification of cardholder picture IDs against live video.
  4. Visitor management.
  5. People counting or mustering, including resetting the people count in an area
  6. Door control (remotely unlocking doors, overriding a door's unlocking schedules, enabling door maintenance mode).
  7. Forgiving antipassback.
  8. Generation of ACS configuration and activity reports.
  9. Viewing of HTML files including alarm instructions.
- L. The Surveillance UI shall include advanced video capabilities:
1. Advanced live video viewing functionality.
  2. Advanced archive playing and video playback functionality.
  3. Monitoring and management of video system events and alarms.
  4. Intercom or duplex audio.
  5. Generation of video reports.
  6. Control of PTZ cameras.
  7. Creating and Monitoring archive transfer requests
  8. Display overlay metadata over the video live or playback
- M. The Surveillance UI shall leverage Graphical Processing Unit (GPU) for video decoding.
1. The following GPU technologies shall be supported:
    - a. NVidia CUDA
    - b. Intel Quick Sync
  2. The Surveillance UI shall have the ability to decode the video with an optimal usage of simultaneously Graphical Processing Unit (GPU) and Computer Processing Unit (CPU)
- N. The Surveillance UI's video live viewing capabilities shall include:
1. Display of all cameras attached to the CSP and all cameras attached to federated systems.
  2. Shall support live video monitoring on each and every display tile within a task in the user's workspace.
  3. The CSP shall support uninterrupted video streaming. The CSA shall keep existing video connections active in the eventuality that a SSM (except Archiver) become unavailable.
  4. The operator shall be able to drag and drop a camera into a display tile for live viewing.
  5. The operator shall be able to drag and drop a camera into a display tile for live viewing on an analog monitor connected to a IP hardware decoder (converting IP encoded stream into analog video signal).
  6. The operator shall be able to drag and drop a camera from a map into a display tile for live viewing.
  7. Shall support digital zoom on live camera video streams.
  8. Shall allow for audio communication with video units with audio input and output.
  9. The operator shall be able to control pan-tilt-zoom, iris, focus, and presets.
  10. Shall allow operators to bookmark important events for later retrieval on any archiving camera. Operators can uniquely name each bookmark in order to facilitate future searches.

11. The operator shall be able to start/stop recording on any camera in the system, which is configured to allow manual recording, by clicking on a single button.
  12. The operator shall have the capability to activate or de-activate viewing of all system events as they occur.
  13. Shall allow operators to switch to instant replay of the video for any archiving camera with the simple click of button.
  14. Users shall be able to take snapshots of live video and be able to save or print the snapshots.
  15. The user shall be able to view the same camera multiple times in different tiles.
- O. The Surveillance UI's video playback (archive playing) capabilities shall include:
1. Shall support audio and video playback of any time span.
  2. Shall support video playback on each and every display tile.
  3. Shall allow operators to switch to instant replay of the video for any archiving camera with the simple click of button.
  4. Shall allow the operator to select between instant synch of all video streams in playback mode allowing operators to view events from multiple angles or across several camera fields, or non-synchronous playback.
  5. Shall allow the operator to simultaneously view the same camera in multiple tiles at different time intervals.
  6. Shall allow the operator to control the playback with:
    - a. Pause
    - b. Lock Speed
    - c. Forward and Reverse Playback at: 1x, 2x, 4x, 6x, 8x, 10x, 20x, 40x, 100x.
    - d. Forward and Reverse Playback frame by frame
    - e. Slow Forward and Reverse Playback at: 1/8x, 1/4x, 1/3x, 1/2x.
    - f. Loop playback between two time markers
  7. Shall display a single timeline, or optionally one timeline for each selected video stream, with which the operator can navigate through the video sequence by simply clicking on any point in the timeline.
  8. Shall display the level of motion at any point on a timeline.
  9. Shall clearly display bookmarks events on the timeline(s).
  10. Shall be able to query archived video using various search criteria, including but not limited to, time, date, camera, and area, among others.
  11. Shall provide the tool to search video and associated audio on user-defined events or motion parameters.
  12. Shall allow operators to define an area of the video field in which to search for motion as well as define the amount of motion that will trigger search results. The Surveillance UI then retrieves all archived video streams which contain motion which meets the search parameters. There shall be a graphical timeline where the time of each search hit shall be indicated.
  13. Shall allow operators to browse through a list of all bookmarks created on the system and select any bookmarked event for viewing.
  14. Shall allow the user to add bookmarks to previously archived video for easier searching and retrieval.
  15. Shall support digital zoom on playback video streams.
  16. Shall provide still image export to PNG, JPEG, GIF, and BMP format with Date and Time stamp, and Camera Name on the image (snapshot).

17. Shall provide tools to export video and a self-contained video player on various media such as a USB keys, CD/DVD-ROM. This video player shall be easy to use without training and shall still support to review video metadata such as bookmark or navigate the video with function like panoramic camera view dewrapping.
  18. Shall provide tools to export video sequences in standard video formats, such as ASF.
  19. Shall provide the ability to encrypt exported video files
  20. Shall allow operators to load previously exported video files from their computer or network.
  21. Shall allow queries to be saved upon closing the CSA and reappear when the application is reopened.
  22. Shall allow operators to block, on demand, video stream dynamically to lower level users to prevent access, for a specific time, to live and recorded video.
  23. Shall provide a tool to build and export a set of video into a single container. This tools shall allow to build sequences of video to create a storyboard and allow the export of synchronous cameras.
  24. Shall enforce the video export and still image export to be stored on a pre-defined storage location.
  25. Shall provide an interface to list, search and manipulate the video exports previously generated.
- P. The Surveillance UI shall provide an interface to support the following LPR tasks and capabilities:
1. Monitoring and management of LPR events and alarms.
  2. Viewing of license plate picture(s) and context images.
  3. Viewing of license plate data (e.g. license plate reads)
  4. Verification of LPR data against live and recorded video.
- Q. Tracking
1. The CSP shall permit the user to select multiple entities to monitor from the Surveillance UI by adding the entities one by one to the tracking list.
  2. The Surveillance UI shall provide the option to filter which events shall be displayed in the display tile layout and/or event list layout.
  3. It shall be possible to lock a Surveillance UI display tile so that it only tracks the activity of a specific entity, e.g. specific door or camera.
  4. The user shall be able to drag and drop an event from an event list (or an alarm from an alarm list) onto a display tile to view a license plate read, cardholder picture ID, badge ID, or live/archived video, among other options.
  5. Event, alarm, monitoring/tracking, and report lists shall contain cardholder pictures, where applicable.
  6. The user shall be permitted to start or pause the viewing of events within each display tile.
- R. Display Tile Packing and Unpacking
1. Packing and unpacking of entities shall allow operators to quickly obtain additional information and camera views of a specific entity.
  2. Unpacking of an entity shall display associated entities. For example, unpacking a door with multiple associated cameras shall display all cameras associated to the door. Unpacking shall reconfigure the display tiles to be able to display all associated entities. For example, unpacking a door (or zone , or alarm) that is currently in a 1 x 1 tile configuration and that has 3 cameras tied to it will create a 1 x 3 display tile arrangement to view all associated entities.

3. Packing will return the display to the original tile pattern.

S. Visual Tracking

1. The Surveillance UI shall support the ability to manually track a moving target with the single click of a button.
  2. The ability to switch from one camera view to an adjacent camera shall be done within a single display tile.
  3. Switching between camera streams shall be accomplished by simply clicking on a semi-transparent shape or overlay.
  4. Visual tracking shall be available with both live and recorded video.
- T. The following additional tools or utilities shall be available from the Surveillance UI: create credentials, create cardholders, and access control troubleshooter.

2.10 SERVER ADMINISTRATOR

- A. The Server Administrator shall be used to configure the SSM, as well as the Directory Role (main configuration) and its database(s), apply the license, and more.
- B. The Server Administrator shall be a web-based application. Through the Server Administrator, it shall be possible to access the SSM across the network or locally on the server.
- C. Access to the Server Administrator shall be protected via login name and password, as well as encrypted communications.
- D. The Server Administrator shall allow the administrator (user) to perform the following functions:
  1. Manage the system license.
  2. Configure the database(s) and database server for the Directory Role,
  3. Activate/Deactivate the Directory Role.
  4. Manually back up the Directory Role database(s) and/or restore the server database(s), as well as configure scheduled backups of the databases.
  5. Define the client-to-server communications security settings.
  6. Configure the network communications hardware, including connection addresses and ports.
  7. Configure system SMTP settings (mail server and port).
  8. Configure event and alarm history storage options.

2.11 CONSOLIDATED WEB CLIENT (CWC)

- A. The UPS shall support a consolidated web client (CWC) for access control, and video.
- B. The CWC shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.
- C. The CWC shall be platform independent and run within Microsoft Internet Explorer, Firefox, Safari, and Google Chrome.

D. Web pages for the web client shall be managed and pushed by the Mobile Server. Microsoft IIS or any other web hosting service shall not be required given that all the web pages shall be hosted by the Mobile Server.

E. Functionalities:

1. Login using name and password or Active Directory support shall be available.
2. Encrypted communications for all transactions.
3. Print reports, export to CSV file
4. Customer logo customization shall be available for multi-tenant and hosted services applications.
5. Video
  - a. Live and playback video 320 x 240, 640 x 480 or 1280 x 1024 @ 15 fps
  - b. Video export
  - c. 1, 4, 6 or 9 tiles
  - d. Basic PTZ Controls (Pan/Tilt, Zoom, go to presets, start pattern)
  - e. Start / Stop recording
  - f. Sample web page for customers to see how to view video for own development
6. Access Control
  - a. Cardholder and group (add/modify/delete)
  - b. Credential management (modify/delete)
  - c. Unlock door
  - d. Door Activities report

## 2.12 SMARTPHONE AND TABLET APPS

- A. The CSP shall support mobile apps for various off-the-shelf smartphones and tablets. The mobile apps shall communicate with the CSP's Mobile Server over any WiFi or wireless IP connection.
- B. Mobile apps shall communicate with the UPS via a Mobile Server (same as the Consolidated Web Client or CWC). Communication between the mobile device and the Mobile Server shall support optional encryption.
- C. Supported devices shall include (refer to Mobile App specifications for latest compatibility list):
1. Apple iPod Touch, iPhone, and iPad.
  2. RIM Blackberry smartphones
  3. Android-compatible smartphones and tablets.
  4. Windows 8
- D. It shall be possible to download the mobile apps from the Central application store (Apple iTunes App Store, Google Play, Windows Store).
- E. Functionalities
1. Live monitoring, command and control of the CSP.
  2. Receive alarm push notifications from Apple Push Notification Server or Google Android push server.

3. Alarm management (view and acknowledge alarms, video tied to alarms)
4. View CSP hierarchy and search for entities
5. Stream video from the mobile device using the built-in camera
  - a. Video streams from mobile devices shall be available in the CSP to be viewed in live and recorded on the Archiver.
6. Video
  - a. View live and playback video at 320 x 240, 640 x 480 or 1280 x 1024 @ 15 fps
  - b. Monitor camera status.
  - c. View up to 6 video feeds.
  - d. Control PTZ functionality of a camera, including access to PTZ presets.
  - e. Save snapshots locally on the device.
  - f. View video tied to access control events, and alarms.
7. Access Control
  - a. View cardholder picture with access-related events.
  - b. Monitor door status.
  - c. Unlock door
  - d. Override unlocking or locking schedule.
  - e. Set door in maintenance mode.

## 2.13 UNIFICATION OF VIDEO AND ACCESS CONTROL

- A. The Surveillance UI shall present a true Consolidated Security Interface for live monitoring and reporting of the ACS and VMS. Advanced live video viewing and playback of archived video shall be available through the Surveillance UI.
- B. The Configuration UI shall present a true Consolidated Security Interface for configuration and management of the ACS and VMS.
- C. User shall be able to associate one or more video cameras to the following entity types, among others: areas, doors, elevators, zones, alarms, and intrusion panels.
- D. It shall be possible to view video associated to access control events when viewing a report.
- E. It shall be possible to view video associated to intrusion panel events when viewing a report.

## 2.14 FAILOVER AND STANDBY FUNCTIONALITY

- A. The CSP shall support native and off-the-shelf failover options.
- B. Failover Directory
  1. The Standby Directory shall act as a replacement SSM on hot standby, ready to take over as the acting Directory in case the primary Directory fails. The failover will occur in less than 1 minute. No action from the user will be required.
  2. The CSP shall support up to five (5) Directories on standby, lined up to take over as the acting Directory in a cascading fashion.

3. The Standby Directory shall keep its configuration database synchronized with the primary Directory.
  4. The Standby Directory shall support synchronization of the configuration databases using a backup and restore mechanism. The synchronization period shall be configurable from 15 minutes to 1 week.
  5. The Standby Directory shall support real-time synchronization of the configuration databases using SQL Mirroring mechanism.
- C. Standby Archiver. Refer to section **Error! Reference source not found. Error! Reference source not found.** for more information.
- D. Off-the-shelf standby/failover options (excluding the VMS Archiver) shall include
1. Windows Clustering
  2. NEC ExpressCluster X LAN

## 2.15 ALARM MANAGEMENT

- A. The CSP shall support the following Alarm Management functionality:
1. Create and modify user-defined alarms. An unrestricted number of user-defined alarms shall be supported.
  2. Assign a time schedule or a coverage period to an alarm. An alarm shall be triggered only if it is a valid alarm for the current time period.
  3. Set the priority level of an alarm and its reactivation threshold.
  4. Define whether to display live or recorded video, still frames or a mix once the alarm is triggered.
  5. Define the time period after which the alarm is automatically acknowledged.
  6. Define the recipients of an alarm. Alarm notifications shall be routed to one or more recipients. Recipients shall be assigned a priority level which prioritizes the order of reception of an alarm.
  7. Define the alarm broadcast mode. Alarm notifications shall be sent using either a sequential or an all-at-once broadcast mode.
  8. Define whether to display the source of the alarm, one or more entities, or an HTML page.
  9. Specify whether an incident report is mandatory during acknowledgment.
- B. The workflows to create, modify, add instructions and procedures, and acknowledge an alarm shall be consistent for access control, LPR, and video alarms.
- C. Alarms shall be federated allowing global alarm management across multiple independent CSP, ACS, and VMS systems.
- D. The CSP shall also support alarm notification to an email address or any device using the SMTP protocol.
- E. The ability to create alarm-related instructions shall be supported through the display of one or more HTML pages following an alarm event. The HTML pages shall be user-defined and can be interlinked.
- F. Alarm unpacking and packing shall be supported where all the entities associated to an alarm can be display in the Surveillance UI with the single click of button.

- G. User shall have the ability to acknowledge alarms, create an incident upon alarm acknowledgement, and put an alarm to snooze.
- H. The user shall be able to spontaneously trigger alarms based on something he or she sees in the system.
- I. An alarm must be configured in such a way that it remains visible until the source condition has been acknowledged
- J. A user must be able to investigate an alarm without acknowledging it

## 2.16 THREAT LEVELS

- A. The CSP shall support Threat Levels to dynamically change the system behavior to respond to critical events.
- B. Threat Levels are activated and deactivated by the CSA operator with the right privilege.
- C. Threat Levels can be set on an area or on the entire system.
- D. Threat Levels can affect the system behavior by executing any action available in the CSP such as: trigger output, start recording, block camera, override recording quality, arm zone, set a door in maintenance mode, etc.
- E. The following specific actions shall be available with Threat Level:
  - 1. Set minimum security clearance to restrict or permit access to cardholders on specific areas on top of the restrictions imposed by the access rules.
  - 2. Set minimum user level to automatically log out user from the CSP.
  - 3. Set reader mode to change how the doors are accessed (e.g. card and PIN, or card or PIN).
- F. A visible notification shall be displayed in all operator CSA when a Threat Level is activated

## 2.17 REMOTE TASK

- A. The CSP shall provide, through a Remote Task, capabilities to remotely monitor and control the content of other workstations running the CSA (Surveillance UI) that are part of the same system.
- B. The CSP shall support video wall applications by connecting and controlling multiple workstations and monitors simultaneously.
- C. The Remote Task shall be a graphical interface showing a replication of the remote workstation running the CSA (Surveillance UI).
- D. The Remote Task shall allow to connect to other workstations with a low bandwidth mode to receive only snapshots of the video viewed remotely.
- E. The Remote Task shall allow to connect to other workstations with a spy mode to remain invisible to the remotely connected workstation.

F. The functionality provided by the remote monitoring and control capability shall include:

1. Remote monitoring and control of the monitoring and alarm monitoring tasks.
2. Ability to remotely switch cameras, doors and zones into display tiles.
3. Ability to remotely control live and playback video.
4. Ability to remotely change the tile pattern
5. Ability to remotely create and delete tasks
6. Ability to remotely start/stop task cycling
7. Ability to remotely go into full screen mode
8. Ability to remotely save and reload the workspace

## 2.18 HEALTH MONITORING

- A. The CSP shall monitor health of the system, log health-related events, and calculate statistics.
- B. CSP services, roles, agents, units, and client apps will trigger health events.
- C. It shall populate the Windows Event Log with health events related to CSP roles, services, and client apps.
- D. A dedicated role, the Health Monitoring Role, shall perform the following actions:
1. Monitor health of the entire system and logs events
  2. Calculate statistics within specified time frame (hours, days, months)
  3. Calculates availability for clients, server, video/access/LPR units
- E. A Health Monitoring task and Health History reporting task shall be available for live and historical reporting.
- F. Health events shall be accessible via the SDK (can be used to create SNMP traps)

## 2.19 ADVANCED TASK MANAGEMENT

- A. The CSP shall support an infrastructure for managing Surveillance UI tasks used for live monitoring, day to day activities, and reporting.
- B. Administrators shall be able to assign tasks and lock the operator's workspace. User management of their workspace shall be limited by their assigned privileges.
- C. Operators shall be able save their tasks as either Public Tasks or Private Tasks and in a specific partition. Public tasks shall be available to all users. Private tasks shall only be available to the owner of the task.
- D. Operators shall be able to share their tasks by sending them to one or more online users. Recipients shall have the option to accept the sent task.

## 2.20 REPORTING

- A. The CSP shall support report generation (database reporting) for access control, LPR, video, and intrusion.

- B. Each and every report in the system shall be a CSP task, each associate with its own privilege. A user shall have access to a specific report task if he or she has the appropriate privilege.
- C. The workflows to create, modify, and run a report shall be consistent for access control, LPR, and video reports.
- D. Reports shall be federated allowing global consolidated reporting across multiple independent CSP, ACS, and VMS systems.
- E. Access control and LPR reports shall support cardholder pictures and license plate pictures, respectively.
- F. The CSP shall support the following types of reports:
  - 1. Alarm report
  - 2. Video-specific reports (archive, bookmark, motion, and more)
  - 3. Configuration reports (cardholders, credentials, units, access rules, readers/inputs/outputs, and more)
  - 4. Activity reports (Cardholder, cardholder group, visitor, credential, door, unit, area, zone, elevator, and more)
  - 5. LPR-specific reports (mobile LPR playback, hits, plate reads, reads/hits per day, reads/hits per LPR zone, and more)
  - 6. Health activity and health statistics reports
  - 7. Other types of reports include visitor reports, audit trail reports, incident reports, and time and attendance reports.
- G. Generic Reports, Custom Reports and Reports Templates
  - 1. A user has the option of generating generic reports from an existing list, generating reports from a list of user-defined templates, or creating a new report or report template.
  - 2. The user shall be able to customize the predefined reports and save them as new report templates. There shall be no need for an external reporting tool to create custom reports and report templates. Customization options shall include setting filters, report lengths, and timeout period. The user shall also set which columns shall be visible in a report. The sorting of reported data shall be available by clicking on the appropriate column and selecting a sort order (ascending or descending).
  - 3. All report templates shall be created within the Surveillance UI.
  - 4. These templates can be used to generate reports on a schedule in PDF or Excel formats.
  - 5. An unrestricted number of custom reports and templates shall be supported.
- H. A reporting task layout shall consist of panes with settings (report length, filters, go and reset commands, etc.), the actual report data in column format, and a pane with display tiles. The user shall be able to drag and drop individual records in a report onto one or more display tiles to view a cardholder's picture ID, playback a video sequence, or both.
- I. The CSP shall support comprehensive data filtering for most reports based on entity type, event type, event timestamp, custom fields, and more.
- J. The user shall be able to click on an entity within an existing report to generate additional reports from the Surveillance UI.

- K. The CSP shall support the following actions on a report: Print report, export report to a PDF/Microsoft Excel/CSV file, automatically email a report based on a schedule and a list of one or more recipients.

## 2.21 MICROSOFT ACTIVE DIRECTORY INTEGRATION

- A. The CSP shall support a direct connection to one or multiple Microsoft Active Directory server via the Active Directory Role(s). Active Directory integration shall enable the synchronization of information from the Active Directory server to the CSP.
- B. Active Directory integration shall permit the central management of the CSP users, user groups, cardholders, and cardholder groups.
- C. The CSP shall be able to connect to and synchronize data from multiple Active Directory servers (up to 10).
- D. The CSP shall support Microsoft Active Directory encryption using LDAP SSL.
- E. When enabled, Active Directory shall manage user logon to the CSP client applications through the user's Windows credentials. Logon to the CSP shall utilize native Active Directory password management and authentication features.
- F. It shall be possible to synchronize the following CSP entities and their information from Active Directory to the CSP:
  - 1. Users (username, first and last names, email address, and more)
  - 2. User groups (user group name, description, and group email address)
  - 3. Cardholders (first and last names, description, email, picture and more)
  - 4. Cardholder groups (cardholder group name, description, and group email address)
  - 5. Active Directory attributes to CSP custom fields.
- G. When enabled, the addition, removal, or suspension of a user's Windows account in Active Directory shall result in the creation, deletion, or disabling of the equivalent user account in the CSP.
- H. When enabled, the addition, removal, or suspension of a user's Windows account in Active Directory shall result in the creation, deletion, or disabling of the equivalent cardholder account in the CSP.
- I. Supported synchronization methods for additions, modification, and deletions of synchronized entities shall include: on first logon (users only), manual synchronization, scheduled synchronization.

## 2.22 ZONE MANAGEMENT

- A. The CSP shall support the configuration and management of zones for input point monitoring via the Zone Manager Role. A user shall be able to add, delete, or modify a zone if he has the appropriate privileges.

- B. A zone shall monitor the status of one or more inputs points. Zone monitoring or input point monitoring shall be possible through the use of a controller and one or more input modules. Inputs from video cameras or video encoders shall also be accessible via a zone.
- C. Supervised inputs shall be supported depending on the hardware installed. Depending on the input module used, both 3-state and 4-state supervision shall be available.
- D. A schedule shall be defined for a zone, indicating when the zone will be monitored.
- E. Custom Events shall provide full flexibility in creating custom events tailored to a zone. Users shall be able to associate custom events to state changes in monitored inputs.
- F. The ACS shall support one or more cameras per zone. Video shall then be associated to zone state changes.
- G. Input/Output (IO) Linking
  - 1. Zone management shall support Input/Output (IO) Linking. IO linking shall allow one or more inputs to trigger one or more outputs.
  - 2. IO linking shall be available in offline mode when communication between the server and hardware is not available.
  - 3. Custom Output Behaviors shall provide full flexibility in creating a variety of complex output signal patterns: Simple pulses, periodic pulses, variable duty-cycle pulses, state changes.
  - 4. Through the "trigger an output" action, the ACS shall support the triggering of outputs with custom output behaviors.

## 2.23 INTRUSION DEVICE INTEGRATION

- A. The CSP shall integrate with third party intrusion panels and devices via an Intrusion DDK. The Intrusion Manager Role shall manage communications with the intrusion panels. Communications with intrusion devices shall be over serial communications and/or an IP network.
- B. Integration with intrusion panels shall be possible outside the release cycle of the CSP. It shall be possible to add new integrations at any point in time.
- C. Functionality available via the CSPs integration of intrusion devices shall include the following (where supported by the intrusion panel):
  - 1. Arm and disarm intrusion devices (manually, on schedule, following a CSP event).
  - 2. Activate or trigger intrusion device outputs.
  - 3. View intrusion events and alarms.
  - 4. Monitor the status, including arming status, of the intrusion devices.
  - 5. Video verification of intrusion events and alarms with video panels.
  - 6. Create CSP zones using intrusion device inputs.
- D. Currently supported intrusion panels include:
  - 1. Bosch G Series panels
  - 2. DSC Powerseries panels
  - 3. DMP XR Series panels

4. Honeywell Galaxy Dimension panels

2.24 USER AND USER GROUP SECURITY, PARTITIONS, AND PRIVILEGES MANAGEMENT

- A. The CSP shall support the configuration and management of users and user groups. A user shall be able to add, delete, or modify a user or user group if he has the appropriate privileges.
- B. Common access rights and privileges shared by multiple users shall be defined as User Groups. Individual group members shall inherit the rights and privileges from their parent user groups. User group nesting shall be allowed.
- C. User privileges shall be extensive in the CSP. All configurable entities for the CSP, including access control/video/video, shall have associated privileges.
- D. Specific entities such as cardholders, cardholder groups, and credentials shall include a more granular set of privileges such as the right to access custom fields and change the activation or profile status of an entity.
- E. Partitions
  - 1. The CSP shall limit what users can view in the configuration database via security partitions (database segments). The administrator, who has all rights and privileges, shall be allowed to segment a system into multiple security partitions.
  - 2. All entities that are part of the CSP can be assigned to one or more partitions.
  - 3. A user who is given access to a specific partition shall only be able to view entities (components) within the partition he has been assigned. Access to a user is given by assigning the user as an accepted user to view the entities that are members of a particular partition.
  - 4. A user or user group can be assigned administrator rights over the partition.
- F. It shall be possible to specify user and user group privileges on a per partition basis.
- G. Advanced logon options shall be available such as dual logon and more.
- H. It shall be possible to specified an inactivity period for the Surveillance User Interface after which the application automatically lock, but preserves access to currently displayed camera feeds.

2.25 EVENT/ACTION MANAGEMENT

- A. The CSP shall support the configuration and management of events for access control, LPR, and video. A user shall be able to add, delete, or modify an action tied to an event if he has the appropriate privileges.
- B. The CSP shall receive all incoming events from one or more ACS and/or VMS. The CSP shall take the appropriate actions based on user-define event/action relationships.
- C. The CSP shall receive and log the following events:
  - 1. System-wide events
  - 2. Application events (clients and servers)

3. Area, camera, door, elevator, and LPR events (reads, hits)
4. Cardholder, credential events
5. Unit events
6. Zone events
7. Alarm events
8. First Person In and Last Person Out events, antipassback events.
9. Intrusion events.
10. Asset management events.

- D. The CSP shall allow the creation of custom events.
- E. The CSP shall have the capability to execute an action in response to an access control, video, and LPT event.
- F. The CSP shall allow a schedule to be associated with an action. The action shall be executed only if it is an appropriate action for the current time period.

## 2.26 SCHEDULES AND SCHEDULED TASKS

### A. Schedules

1. The CSP shall support the configuration and management of complex schedules. A user shall be able to add, delete, or modify a schedule if he has the appropriate privileges.
2. The CSP shall provide full flexibility and granularity in creating a schedule. The user shall be able to define a schedule in 1-minute or 15-minute increments.
3. Daily, weekly, ordinal, and specific schedules shall be supported.

### B. Schedules Tasks

1. The CSP shall support scheduled tasks for access control, LPR, and video.
2. Scheduled tasks shall be executed on a user-defined schedule at a specific day and time. Recurring or periodic scheduled tasks shall also be supported.
3. Scheduled tasks shall support all standard actions available within the CSP such as sending an email or emailing a report.

## 2.27 MACROS AND CUSTOM SCRIPTS

- A. The CSP shall enable users to automate and extend the functionalities of the system through the use of macros or custom scripts for access control, LPR, and video.
- B. Custom macros shall be created with the CSP Software Development Kit (SDK).
- C. A macro shall be executed either automatically or manually.
- D. In the Surveillance UI, a macro shall be launched through hot actions.

## 2.28 DYNAMIC GRAPHICAL MAPS (DGM)

- A. The CSP shall support mapping functionality for access control, video surveillance, intrusion detection, LPR and external applications.

- B. The DGM shall provide the ability to display any type of third party entities integrated through an SDK.
- C. The DGM shall offer central management and storage of the maps.
- D. The DGM shall offer built-in map data backup and restore.
- E. The DGM shall offer failover capabilities.
- F. The DGM shall provide a mean to update a map background without affecting the map object configuration.
- G. The DGM shall provide a user friendly and intuitive navigation including:
  - 1. The ability to create maps with hierarchies to facilitate navigation within and between various sites and buildings.
  - 2. The ability to define favorites for recurrent position recall. Favorites shall be public or restricted per user.
  - 3. The possibility to create links between maps.
  - 4. A common user experience regarding navigation into the map for both GIS or private maps.
  - 5. The possibility to zoom in by scrolling the mouse or simply by drawing a region on the map.
- H. It shall be possible to represent the physical location of areas, cameras, doors, alarms, zones (monitored inputs), intrusion area, digital inputs and outputs.
- I. It shall be possible to monitor the state of entities on the map. The display of the state on the map shall be customizable and represented by:
  - 1. An icon
  - 2. A colorization of the icon
  - 3. A transparency level of the icon
  - 4. A blinking rate
- J. The DGM shall display in overlay within the map the video feed of a selected camera
- K. For PTZ cameras position feedback capabilities, the DGM shall:
  - 1. Dynamically represent the accurate field of view of the camera
  - 2. Allow to act on the PTZ by moving its field of view
- L. The DGM shall support the use of GIS maps or private maps or a combination of both for map background.
- M. The DGM shall be compatible with any GIS compliant maps with the OGC and supporting WMS. This includes, but not limited, to ESRI maps. The DGM will allow to select the appropriate GIS layers.
- N. The DGM shall provide an intuitive built-in map designer for entity positioning on the map using drag and drop. Any configuration shall be graphic.
- O. It shall be possible to edit and configure multiple map object at once.

- P. Various actions shall be available within maps for execution through simple and intuitive double-click, right-click, or drag-and-drop functionality. Examples of actions available through maps shall include unlocking a door and acknowledging an alarm.
- Q. The DGM shall allow the management of the CSP alarms from the map:
  - 1. Locate on the map entities related to the alarm
  - 2. Display entities on alarm with a specific icon, color, transparency level, and blinking rate.
  - 3. List, select and locate alarms.
  - 4. Auto center the map on the highest priority alarm
  - 5. Handle the alarm from the map, including acknowledgement, forwarding, investigation.
  - 6. All map containers, such as hotspot or maplink shall reflect the alarm status of the contained entities
- R. It shall be possible to add advanced functionality to maps object using the SDK. Any functionality available through the CSP SDK shall be available within maps.
- S. The DGM shall offer lasso tools for:
  - 1. Displaying entities of a location in one single action.
  - 2. Selecting and pointing dynamically PTZ to a selected points of interest in the map
  - 3. Triggering an action on all entities of a location in a single click.
  - 4. Editing multiple entities of a location at once.
- T. The DGM shall allow to display CSP entities selected from the map to a remote monitor (video wall)
- U. DGM shall provide search capabilities:
  - 1. Search within the map by entity name, street name or point of interest.
  - 2. Drag and drop entities from the CSP to the map to center on its location.
- V. The DGM shall allow the use of KML overlay map information for both GIS and private maps. Movable object shall be supported through the use of KML.
- W. Update of the map content by an administrator shall be immediately and dynamically pushed to all operator displaying the map.

## 2.29 AUDIT AND USER ACTIVITY TRAILS (LOGS)

- A. The CSP shall support the generation of audit trails. Audit trails shall consist of logs of operator/administrator additions, deletions, and modifications.
- B. Audit trails shall be generated as reports. They shall be able to track changes made within specific time periods. Querying on specific users, changes, affected entities, and time periods shall also be possible.
- C. The CSP shall support the generation of user activity trails. User activity trails shall consist of logs of operator activity on the CSP such as login, camera viewed, badge printing, video export, etc.

- D. The ACS shall support the following actions on an audit and activity trail report: print report, export report to a PDF/ Microsoft Excel/CSV file.

## 2.30 INCIDENT REPORTS

- A. Incident reports shall allow the security operator to create reports of incidents that occurred during a shift. Both video-related and access control-related incident reports shall be supported.
- B. The operator shall be able to create standalone incident reports or incident reports tied to alarms.
- C. The operator shall be able to link multiple video sequences to an incident, access them in an incident report and being able to change date on time of the sequences later.
- D. It shall be possible to create a list of Incident categories, tag a category to an incident and filter the search with the category as a parameter.
- E. Incident report shall allow to create a custom form to intake information on an incident.
- F. Incident reports shall allow entities, events, and alarms to be added to support the report's conclusions.

## 2.31 VIDEO SURVEILLANCE SYSTEM FUNCTIONALITY

## 2.32 GENERAL

- A. The VMS shall be based on a true open architecture that shall allow for use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.
- B. The VMS shall offer a complete and scalable video surveillance solution which allows cameras to be added on a unit-by-unit basis.
- C. The VMS shall interface with analog-to-digital video encoders and IP cameras and with and digital-to-analog video decoders, hereafter referred to as digital video servers (DVS). The VMS shall support DVS from various manufacturers.
- D. The VMS shall integrate DVS using the DVS native SDK or using the following industry standards to interface to the DVS.
  - 1. ONVIF
- E. All video streams supplied from analog cameras or IP cameras shall be digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, Wavelet or JPEG2000 compression formats and recorded simultaneously in real time.
- F. All audio streams supplied from IP video servers shall be digitally encoded in g711 (u-law), g721, g723 or AAC compression formats and recorded simultaneously in real time.

- G. Each camera's bit rate, frame rate and resolution will be set independently from other cameras in the system, and altering these settings will not affect the recording and display settings of other cameras.
- H. The VMS shall be able to use multiple CCTV keyboards to operate the entire set of cameras throughout the system, including cameras of various manufacturer's brands, including their PTZ functionalities (i.e.: Pelco keyboard controls Panasonic dome or vice-versa).
- I. The VMS shall be able to retrieve and set the current position of PTZ cameras using XYZ coordinates.
- J. The VMS shall support PTZ camera protocols from multiple manufacturers including analog and IP protocols.
- K. The VMS shall arbitrate the user conflict on PTZ usage based on user levels per camera
- L. The VMS shall support the following list of CCTV keyboard protocols:
  - 1. American Dynamics 2078 ASCII, American Dynamics 2088 ASCII
  - 2. Bosch Autodome, Bosch Intuikey
  - 3. DVTel
  - 4. GE ImpactNet
  - 5. Panasonic, Pelco ASCII, Pelco KBD-300, Pelco P
  - 6. Radionics
  - 7. Samsung SSC-1000
  - 8. Videoalarm
- M. The VMS shall support the following list of joysticks and control keyboards:
  - 1. Axis 295
  - 2. Axis T8310 Video Surveillance Control Board
  - 3. Panasonic WV-CU950 Ethernet keyboard
  - 4. Any USB joystick detected as a Windows Game Controller
- N. The VMS shall allow for the configuration of a time zone for each camera connected to a DVS. For playback review, users shall have the ability to search for video based on the following options:
  - 1. local time of camera
  - 2. local time of the SSM
  - 3. local time of user's workstation
  - 4. GMT Time
  - 5. other time zone
- O. Audio and Video storage configuration for the SSM shall either be:
  - 1. Internal or external IDE/SATA/SAS organized or not in a RAID configuration;
  - 2. Internal or external SCSI/iSCSI/Fiber Channel organized or not in a RAID configuration;
  - 3. It shall be possible to include within the overall storage system disks located on external PCs on a LAN or WAN as well as;
  - 4. Network Attached Servers (NAS) on a LAN or WAN as well as;
  - 5. Storage Area Networks (SAN);

- P. The SSM shall not limit the actual storage capacity configured per server

## 2.33 CONFIGURATION UI

- A. The Configuration UI shall allow the administrator or users with appropriate privileges to change video configuration.
- B. The Configuration UI shall provide the ability to change video quality, bandwidth and frame rate parameters on a per camera (stream) basis for both live and recorded video.
- C. The Configuration UI shall provide the ability to configure brightness, contrast and hue settings for each camera on the same DVS.
- D. The Configuration UI shall provide the capability to enable audio recording on DVS units that support audio
- E. The Configuration UI shall provide the ability to change audio parameters, serial port and I/O configuration of individual DVS units
- F. The Configuration UI shall provide the capability to rename all DVS units based on system topology and add descriptive information to each DVS
- G. The Configuration UI shall provide the ability to set recording schedules and modes for each individual camera. The recording mode can be:
  - 1. Continuous
  - 2. On motion and Manual
  - 3. Manual only
  - 4. Disabled
- H. The Configuration UI shall support the creation of schedules to which any of the following functional aspects can be attached:
  - 1. Video quality (for each video stream per camera)
  - 2. Recording (for each camera)
  - 3. Motion detection (for each detection zone per camera)
  - 4. Brightness, Contrast, Hue (for each camera)
  - 5. Camera sequence execution
- I. The Configuration UI shall support creation of unlimited recording schedules and assign any camera to any schedules.
- J. The Configuration UI shall detect and warn user of any conflict within assigned schedules
- K. The Configuration UI shall provide the capability to set a pan-tilt-zoom protocol to a specific DVS serial port and allow mixing domes of various manufacturers within a system.
- L. User shall have the ability to configure a return to home function after a predefined time of inactivity for PTZ cameras. The inactivity time is configurable from 1 to 7200 seconds.

## 2.34 ARCHIVING

- A. The Archiver (role) shall use an event and timestamp database for advanced search of audio/video archives. This database shall be a Microsoft SQL 2008 or Microsoft SQL 2012.
- B. The Archiver shall protect archived audio/video files and the system database against network access and non-administrative user access.
- C. The Archiver shall digitally sign recorded video using 248-bit RSA public/private key cryptography.
- D. The Archiver shall offer a plug and play type hardware discovery service with the following functionalities:
  - 1. Automatically discover DVS units as they are attached to the network.
  - 2. Discover DVS units on different network segments including the Internet and across routers with or without network address translation (NAT) capabilities.
- E. The Archiver shall have the capacity to configure the key frame interval (I-frame) in seconds or number of frames.
- F. The Archiver shall provide a pre-alarm and post-alarm recording option that can be set between one second and 5 minutes on a per camera basis.
- G. Shall provide the functionality of storing of video and audio streams based on triggering events such as:
  - 1. Digital motion detection
  - 2. Digital input activation
  - 3. Macros
  - 4. Through SDK application recording
- H. The Archiver shall perform video motion detection on each individual camera based on a grid of 1320 motion detection blocks. All of the video motion detection settings are configurable on schedule. A global sensitivity threshold is available to reduce motion detection sensitivity where video signal is noisy or a lot of false hits are incurred. Video motion detection itself can be set into four different modes:
  - 1. Full Screen: All 1320 blocks on screen are activated, a general threshold for the overall motion in the entire image can be set and when reached it can trigger recording and a motion event or a custom event.
  - 2. Full Screen Unit: This is the same as the Full Screen but the motion detection takes place in the DVS.
  - 3. Detection Zone: Six overlapping zones can be defined in the 1320 blocks on screen, each of these zones has its own threshold and when reached each one of them can trigger recording and a motion event or a custom event. Each zone triggering its own event allows for the configuration of directional motion detection events and other complex motion detection logic.
  - 4. Detection Zone Unit: This is the same as the Detection Zone but the motion detection takes place in the DVS and only one zone is supported.
  - 5. Disabled: No motion detection is made on this camera.

- I. The Archiver shall be able to detect motion in video within 200 milliseconds and not only on key frames.
- J. The Archiver shall allow for multiple recording schedules to be assigned to a single camera, each schedule shall be created with the following parameters:
  - 1. Recording mode:
    - a. Continuous
    - b. On Motion/Manual
    - c. Manual
    - d. Disabled
  - 2. Recurrence pattern
    - a. Once on specific days
    - b. Specific days on a yearly basis
    - c. Specific days on a monthly basis
    - d. Specific days on a weekly basis
    - e. Daily
- K. Time coverage
  - 1. All day
  - 2. Specific time range(s)
  - 3. Daytime or nighttime based on the times of sunrise and sunset, automatically calculated from the time of year and a geographical location. Provision shall be given to offset the calculated sunrise or sunset time by plus or minus 3 hours.
- L. The Archiver shall allow each camera (video source) to be encoded multiple times in the same or different video formats (MPEG-4, MPEG-2, MJPEG, H.264, Wavelet or JPEG2000), limited only by the capabilities of each DVS.
- M. Whenever multiple video streams are available from the same camera, users shall be free to use any one of them based on their assigned usage. The standard video stream usages are:
  - 1. Live
  - 2. Recording
  - 3. Remote
  - 4. Low resolution
  - 5. High resolution
- N. The Archiver shall allow the video quality to vary according to predefined schedules. Such schedules shall have the same configuration flexibility as the recording schedules mentioned earlier. The video quality shall be based on, but not limited to, the following parameters:
  - 1. Maximum bit rate
  - 2. Maximum frame rate
  - 3. Image quality
  - 4. Key frame interval
  - 5. etc.

- O. The Archiver shall have the ability to dynamically boost the quality of the "recording stream" (see previous bullet) based on specific events:
  - 1. When recording is started manually by a user
  - 2. When recording is triggered by a macro, an alarm or detected motion
- P. The Archiver shall have the capacity to communicate with DVS using 128 bits SSL encryption.
- Q. The Archiver shall have the capacity to communicate with DVS using HTTPS secure protocol.
- R. The Archiver shall have the capacity to receive multicast UDP streams directly from the DVS.
- S. For network topologies that restrict the DVS from sending multicast UDP streams, the Archiver shall redirect audio/video streams to active viewing clients on the network using multicast UDP.
- T. The Archiver shall have the capacity to redirect audio/video stream to active viewing clients on the network using unicast UDP or TCP.
- U. The Archiver shall empower the administrator with a full range of disk management options:
- V. The Archiver shall allow the administrator to choose the disks to use for archiving and to set a maximum quota for each.
- W. The Archiver shall allow the administrator to spread the archiving of different cameras on different disk groups (groups of disks controlled by the same controller) so that archiving could be carried out in parallel on multiple disks.
- X. The Archiver shall have the capacity to move video archives to the Azure Cloud. The archives will be moved after a preset number of days.
- Y. The Archiver shall offer the following options to clean up old archives, on a camera by camera basis:
  - 1. After a preset number of days
  - 2. Deleting oldest archives first when disks run out of space
  - 3. Stop archiving when disks are full
- Z. The Archiver shall allow important video sequences to be protected against normal disk cleanup routines.
- AA. Users shall have the following options when protecting a video sequence:
  - 1. Until a specified date
  - 2. For a specified number of days
  - 3. Indefinitely (until the protection is explicitly removed)
- BB. The Archiver shall allow the administrator to put a cap on the percentage of storage space occupied by protected video.
- CC. The Archiver shall keep a log and compile statistics on disk space usage.
- DD. The statistics shall be available by disk group or for the whole Archiver.

- EE. The statistics shall show the percentage of protected video over the total used disk space.
- FF. The Archiver shall have the capacity to down-sample video streams for storage saving purposes. The down-sampling options available are the following:
1. For H.264 streams the down-sampling options are: all key frames, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame
  2. For MPEG-4 streams the down-sampling options are: all key frames, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame
  3. For MJPEG streams the down-sampling options are: 15 fps, 10 fps, 5 fps, 2 fps, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame
- GG. The Archiver shall support DVS with edge recording capabilities and offer the following capacity:
1. The ability to playback at different speeds the video recorded on the DVS
  2. The ability to offload (video trickling) on schedule, on event or manually the video recorded on the DVS to store it on the Archiver.
  3. It shall be possible to filter the video that is being offloaded using one or multiple of the following filters:
    - a. Time interval
    - b. Playback request
    - c. Video analytic events
    - d. Motion events
    - e. Bookmarks
    - f. Alarms
    - g. Input pin events
    - h. Unit offline events

## 2.35 MEDIA STREAMING

- A. The Media Router Role shall be responsible for routing video and audio streams across local and wide area networks from the source (e.g. DVS) to the destination (e.g. CSA).
- B. The Media Router Role shall support multiple transport protocols such as unicast TCP, unicast UDP, and multicast UDP.
- C. The Media Router shall support IGMP (Internet Group Management Protocol) to establish multicast group memberships.
1. IGMP v3 including SSM (Source-Specific Multicast) shall be supported.
- D. The Media Router Role using Redirector Agents shall be responsible to redirect a stream from a source IP endpoint to a destination IP endpoint.
- E. The Redirector Agents shall be capable of converting a stream from and to any supported transport protocols, i.e.:
1. Multicast UDP to Unicast TCP
  2. Multicast UDP to Unicast UDP
  3. Unicast TCP to Multicast UDP

4. Unicast UDP to Multicast UDP

- F. It shall be possible to limit the number of concurrent live and playback video redirections for each Redirector Agent in order to better control the bandwidth across multiple sites.
- G. It shall be possible to protect the Media Router Role against hardware or software unavailability by configuring another Media Router Role acting as a hot standby server.
- H. Multiple Redirector Agents shall be used on large VMS installation to increase the service availability and to provide automatic load balancing.

2.36 VIDEO ARCHIVES TRANSFER CAPABILITIES

- A. Archive transfer shall provide the ability to :
  - 1. Transfer video from a server to another server in the same system
  - 2. Transfer video from a federated server to another server
  - 3. Transfer the video from a camera storage to a server
- B. It shall be possible to program the video transfers on recurrent schedule, trigger it manually or upon connection
- C. It shall be possible to filter the video of interest for a transfer. The video of interest shall be defined with the following filters:
  - 1. All archives when the camera was offline
  - 2. Alarms
  - 3. Playback request from the edge
  - 4. Video analytics events
  - 5. Motion events
  - 6. Bookmarks
  - 7. Input triggers
  - 8. Time range
- D. It shall be possible to define the length of video before and after the event used as a filter to define the video of interest.
- E. The CSP shall offer an interface to display all the video archive transfer requests. This interface shall display all the current, requested and scheduled video transfer request. It shall be possible to edit, trigger and cancel Video archive transfer from this interface

2.37 ACCESS CONTROL SYSTEM FUNCTIONALITY

2.38 GENERAL

- A. The ACS shall be an enterprise class IP access control software solution. It shall be fully embedded within a Consolidated Security Platform (CSP). The CSP shall allow the seamless unification of the ACS with an IP video management system (VMS).

- B. The ACS shall be highly scalable to support configurations consisting of thousands of doors with facilities spanning multiple geographic areas.
- C. The ACS shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
- D. The ACS shall support a variety of access control functionality, including but not limited to:
  - 1. Controller (Unit) management, door management, elevator management, and area management
  - 2. Cardholder and cardholder group management, credential management, and access rule management
  - 3. Badge printing and template creation.
  - 4. Visitor Management.
  - 5. People counting, area presence tracking, and mustering.
  - 6. Offer a framework for third party hardware integration such as card and signature scanner

#### 2.39 ACCESS MANAGEMENT

- A. The ACS shall be based on an open architecture able to support multiple access control hardware manufacturers. The ACS shall be able to integrate with multiple non-proprietary interface modules and controllers, access readers, and other third party applications.
- B. The ACS shall be an IP enabled solution. All communication between the ACS and hardware controllers shall be based on standard TCP/IP protocol.
- C. Access Manager Role
  - 1. The Access Manager Role shall be the server that synchronizes all access control hardware units under its control, such as door controllers and IO modules. It shall also be able to validate and log all access activities and events when the door controllers and IO modules are online.
  - 2. The Access Manager Role shall maintain the communication link with the hardware controllers under its control. It shall also continuously monitor whether the controllers are online or offline.
  - 3. Synchronization of hardware units shall be automated and transparent to users and shall occur in the background. It shall also be possible to manually synchronize units or on a schedule.
  - 4. The Access Manager Role shall support doors and controllers located within one or more facilities. The Access Server shall support a minimum of 200 readers per computer.
- D. The Access Server shall store all access events associated with the doors, areas, hardware zones (hardware input points), elevators, and controllers under its direct control.

#### 2.40 GLOBAL CARDHOLDER MANAGEMENT

- A. The ACS shall support global cardholder management and synchronization between a central independent site and remote independent site, all of which can have their own Directory and databases.

- B. It shall be possible to synchronize the following entities and their configuration data:
  - 1. Cardholders (incl. custom fields)
  - 2. Cardholder groups
  - 3. Credentials
  - 4. Badge templates.
- C. Cardholders and other synchronized entities can be added centrally and synchronized to remote sites for central cardholder management.
- D. Cardholders and other synchronized entities can be added at remote sites and synchronized to the central site and other remote sites.
- E. Shall support a single card per cardholder across all of an organizations sites.
- F. Manual and scheduled synchronization shall be supported.

#### 2.41 HARDWARE COMPATIBILITY LIST

- A. The ACS shall have an open architecture that supports the integration of third party IP-based door controllers and IO modules. The ACS shall simultaneously support mixed configurations of access control hardware from multiple vendors.
- B. The ACS shall support multiple types of hardware devices: Single-reader controllers, 2-reader controllers, 1- to 64-reader controllers, integrated readers and door controllers, Power-over-Ethernet (PoE) enabled door controllers.
- C. The ACS shall support most industry standard card readers that output card data using the Wiegand protocol and Clock-and-Data.
- D. The ACS shall support the following IP-enabled controllers. For a description of the capabilities of the controller, refer to the specific controller's A&E specification.
  - 1. Intelligent Field Controller, which shall support the following downstream interface modules:
    - a. Mercury MR52 SIO reader interface module
    - b. Mercury MR16OUT SIO output module
    - c. Mercury MR16IN SIO input module
- E. The following USB enrollment readers shall be supported:
  - 1. RF Ideas pcProx HID USB reader for enrolling proximity cards
  - 2. RF Ideas AIR ID Enroll iCLASS ID# USB reader for enrolling HID iCLASS cards
  - 3. RF Ideas AIR ID Enroll 14443/15693 CSN USB reader for enrolling a MIFARE card using the CSN (card serial number)
  - 4. RF Idea AIR ID Enroll pcProx Plus w/iCLASS reader for enrolling proximity and iCLASS cards
  - 5. STid STR-W35-E/PH5-5AA
  - 6. HID Omnikey 5x21 USB readers

## 2.42 SOFTWARE FUNCTIONALITY

### A. Seamless Unification with IP Video Management System (VMS)

1. Through the CSP (Consolidated Security Platform), the ACS shall support integration with an IP Video Surveillance System or MVS. Integration with an IP video surveillance system shall permit the user to view live and recorded video.
2. User shall be able to associate one or more video cameras to the following entity types, among others: doors, elevator, and hardware zone (input points).
3. The Surveillance UI shall present a true Consolidated Security Interface for access control and video surveillance. Advanced live video viewing and playback of archived video shall be available through the Surveillance UI.
4. It shall be possible to view video associated to access control events when viewing a report.

### B. Controller (Unit) Management

1. The ACS shall support the discovery, configuration, and management of IP enabled controllers and IO modules (hardware units). A user shall be permitted to add, delete, or modify a controller if he has the appropriate privileges.
2. The ACS shall support automatic unit discovery. The user shall set the settings for discovery ports and types of unit discovery and the ACS shall automatically detect all connected devices.
3. Unit Swap Utility. The ACS shall support a unit swap utility to swap out an existing controller with a new controller. The unit swap utility shall avoid the reprogramming of the system whenever a unit is replaced. All logs and events from the old unit are maintained.
4. The ACS shall support preconfiguration of the system prior to the physical hardware installation

### C. Cardholder And Cardholder Group Management

1. The ACS shall support the configuration and management of cardholders and cardholder groups. A user shall be able to add, delete, or modify a cardholder or cardholder group if he has the appropriate privileges.
2. Custom fields shall be supported for both cardholders and cardholder groups.
3. The ACS shall permit the following activation/expiration options for a cardholder's profile: delayed activation of a cardholder's profile, expiration based on the date of first use of credential, or expiration on a user-defined date
4. It shall be possible to associate a picture to the cardholder's profile. The picture shall be imported from a file, captured with a digital camera, or captured from a video surveillance camera. When a cardholder event occurs, the picture of the cardholder shall be displayed in the Surveillance UI. The ACS shall support multiple standard picture formats.
5. Cardholder groups shall enable the grouping of cardholders to facilitate mass changes to system settings. It shall be possible to assign cardholder groups to access rules, thus avoiding the assignment of one cardholder at a time.
6. It shall be possible to search by picture association, custom fields, names and credential code
7. It shall be possible to select multiple cardholder for immediate deactivation or reactivation
8. The ACS shall support synchronization of cardholders and cardholders group through Active Directory including credential and picture of the cardholders

### D. Credential Management

1. The ACS shall support the configuration and management of credentials, e.g. access cards and keypad PIN numbers. A user shall be able to add, delete, or modify a credential if he has the appropriate privileges.
2. User shall be able to add Custom Fields (user-defined fields) to credentials. Creating a new credential shall be accomplished either manually or automatically.
3. Automatic creation shall allow the user to create a credential entity by presenting a credential to a selected reader. The ACS shall read the card data and associate it to the credential entity. It shall be possible to automatically enroll any card format (128 bits or less).
4. The ACS shall support multiple credentials per cardholder, without necessitating duplicate cardholder information. The ACS shall automatically detect and prevent attempts to register an already-registered credential.
5. Batch enrollment of credentials shall be supported.
6. The ACS shall provide a workflow for badge issuance and card requests

E. Custom Card Formats

1. A custom card format feature shall allow the administrator to add additional custom card formats using an intuitive tool within the Configuration UI. The custom card format tool shall be flexible in the following ways:
  - a. Once enrolled, new custom card formats shall appear in the card format lists for manual card enrollment.
  - b. An unrestricted number of additional custom card formats can be added.
  - c. Supports credential with up to 256 bits
2. The administrator shall be able to set the following options when defining a new format:
  - a. The order in which card fields appear in the user interface or CSA.
  - b. Whether a field is hidden from, or visible to an operator.
  - c. Whether a field is read only or modifiable by an operator.
  - d. Complex parity checking schemes.
  - e. The order and location of a field's data. Location can be defined on a bit-by-bit basis

F. Badge Designer

1. The badge designer shall allow the creation of badge templates that define the content and presentation format of a cardholder badge to be printed.
2. Badge production shall consist of selecting the credential, the badge template, and clicking print.
3. Batch printing of cards shall be available.
4. The contents of a badge template can include: cardholder's first name, last name, picture, custom fields, bitmap graphics, lines, ovals, rectangles, dynamic text labels linked to custom fields and static text labels, barcodes (Interleaved 2 of 5, Extended Code 39).
5. Copy and paste of badge template objects shall be available.
6. It shall be possible to set the border thickness, border color, fill color of badge objects (content), and the color of text labels.
7. Settings such as object transparency, text orientation, and auto-sizing of text shall be available or transparent to the user.
8. Supported badge formats shall be (portrait and landscape): CR70 (2.875" x 2.125"), CR80 (3.37" x 2.125"), CR90 (3.63" x 2.37"), CR100 (3.88" x 2.63"), and custom card sizes.

9. Dual-sided badges shall be supported.
10. A badge template import and export function shall be available to allow the sharing of badge templates between distinct or independent ACS.
11. Chromakey shall be supported

#### G. Door Management

1. The ACS shall support the configuration and management of doors. A user shall be able to add, delete, or modify a door if he has the appropriate privileges.
2. The ACS shall permit multiple access rules to be associated to a door.
3. The ACS shall support the following forms of authentication: Card Only, Card or Keypad (PIN), or Card and Keypad (PIN). It shall be possible to define a schedule for when Card Only or Card and Keypad authentication modes shall be required.
4. Extended Grant Time. It shall be possible to set an extended grant time on a per-door basis (in addition to the standard grant time). Cardholder properties shall include the option of using the extended grant time. When flagged cardholders are granted access, the door shall be unlocked for the duration of the extended grant time instead of the standard grant time.
5. The ACS shall allow the configuration of relocking mode on doors such as on door open, after a definite time or on door close
6. The ACS shall support the ability to enforce the use of two valid reads from different cardholders to grant access to an area
7. The ACS shall support the ability to enable access rule to other cardholders once a supervisor access an area.
8. The ACS shall support the ability to enable unlocking schedule on a door once an employee entered the facility.
9. Readerless door.
  - a. The ACS shall support doors configured solely with a lock, a REX, and a door contact but without readers.
  - b. Implementation of a readerless door shall be possible with the use of standard access hardware IO modules. External hardware such as timers shall not be required.
  - c. Unlocking schedules shall be programmable for readerless doors.
  - d. Standard door activity reports shall also be possible with readerless doors.
10. Unlocking schedules and exceptions to unlocking schedules shall be associated to a door. An unlocking schedule shall determine when a door should be automatically unlocked. The ACS shall also support the use of a specific offline unlocking schedule. Exceptions to unlocking schedules shall be used to define time periods during which unlocking schedules shall not be applied, e.g. during statutory holidays.
11. The ACS shall support one or more cameras per door. Video shall then be associated to door access events, e.g. access grant or access denied.

#### H. Elevator Management

1. The ACS shall support the configuration and management of elevators. A user shall be able to add, delete, or modify an elevator if he has the appropriate privileges.
2. The ACS shall be able to control access to specific floors using a reader within the elevator cab. Control shall be available through the use of a controller with an interface to a reader and to multiple output modules with relays.
3. Elevator floor selections shall be tracked using a controller with an interface to multiple input modules. Floor tracking shall be available within an elevator activity report.

4. The elevator control module shall continue to function in offline mode should communication between the ACS and the controller fail.
5. The ACS shall support one or more cameras per elevator cab. Video shall then be associated to elevator access events, e.g. access grant or access denied.

I. Visitor Management

1. The ACS shall support the configuration and management of visitors. A user shall be able to enroll or remove a visitor if he has the appropriate privileges. The ACS shall support check-in and check-out of visitors from the Surveillance UI.
2. A visitor check-in wizard shall facilitate the enrollment process, allowing a user to specify the visitor's specific information.
3. The ACS shall permit the following credential options during visitor check-in:
  - a. Use an existing credential
  - b. Automatically create a new credential
  - c. Manually create a new credential
4. The ACS shall support the creation of a pool of visitor credentials in advance. Existing visitor credentials shall be assigned to visitors during the check-in process.
5. The ACS shall permit cardholder groups to be designated as "available for visitors". Users shall be able to define the access privileges for the cardholder groups (visitor cardholder groups) in advance. During visitor check-in, the user shall select the visitor cardholder group to associate with a visitor. All of the visitor cardholder group access privileges shall be automatically transferred to the visitor. This feature shall permit the creation of multiple types of visitor groups and associated privileges (for contractors, VIPs, day visitors, etc.). Visitors added to visitor cardholder group in the Surveillance UI shall be automatically updated in the Configuration UI cardholder group screen.
6. A visitor's profile shall support the real-time modification of visitor information after a visitor has checked-in.
7. The ACS shall also provide comprehensive visitor tracking and visitor reporting. Through the real-time tracking feature, the ACS shall generate a real-time and historical visitor activity listing in the Surveillance UI. The ACS shall also generate visitor-specific reports that provide comprehensive listings of visitors as well as full details on their movement.
8. It shall be possible to exempt a visitor from any antipassback rules in effect.
9. The operator shall be able to print visitor badges during the check-in process. The printing of both paper badges (visitor without an assigned credential) and actual credentials shall be supported.
10. Visitor management and reporting shall be available through the Web Client as well.
11. It shall be possible to locate a visitor's information or profile by swiping the visitor's credential (card) at a USB reader.
12. It shall be possible to tag the person visited to the visitor profile.
13. It shall be possible to require that the visitor requires an escort to enter an area and that escort needs to badge to confirm the access of the visitor.

J. People Counting & Area Presence Tracking (Mustering)

1. The ACS shall support people counting (or area presence tracking). The ACS shall be able to monitor and report the number of cardholders in an area in real-time and for all areas. Monitoring shall be based on the entire access control infrastructure, for both local areas and those in remote geographic locations. People Counting can also be used to perform mustering.

2. The ACS shall report area presence counts in the Surveillance UI. Area presence tracks shall dynamically track the total number of cardholders in an area. Displayed data shall be updated dynamically.
3. The ACS shall be able to generate an area presence report listing the cardholders located in one or more areas, accessible through the Surveillance UI. It shall be possible to filter the report by area and time period. The report shall also include activity from sub-areas (nested areas).
4. Through people counting, the ACS shall be able to generate First Person In and Last Person Out events. The First Person In event shall detect when the first cardholder enters an empty area. The Last Person Out event shall detect when the last cardholder leaves an area. It shall be possible to trigger actions from both events such as sending a message or triggering an alarm. Refer to the section Event/Action Management (§5.16) for more information on the event/action mechanism.
5. The ACS shall be able to determine the entry of cardholder based on a dedicated sensor

K. Custom Fields (User-Defined Fields)

1. The ACS shall permit the creation of custom fields. Up to 1,000 custom fields shall be supported.
2. Custom fields shall be supported for the following entities: Cardholders, Cardholder groups, Credentials, and Visitors.
3. Supported custom fields include: Text, Integers, Decimal Numbers, Dates, Boolean, and Images (graphics).
4. User shall be able to define a default value for a custom field.
5. The creation of new custom field types shall be possible. New custom field types shall be based on the standard custom fields supported. They shall support user-defined values from which an operator must make a selection.
6. Administrators have the ability to define which users can view and modify specific custom fields. This shall limit the access to custom field data to users with pre-defined privileges. The ACS shall support querying and report generation using custom fields.
7. Custom fields can be grouped and ordered within these groups as defined by the user.
8. Values for custom fields can be imported using the Import Tool.

L. Import Tool

1. The ACS shall support an integrated Import Tool to facilitate the import of existing cardholder and credential data. The import of data shall be through the use the CSV file format. The tool shall be available from the Configuration UI.
2. The Import Tool shall also support the ability to manually import data that has been exported from a third party database if it is in CSV format.
3. The import tool shall permit the import of the following data:
  - a. Cardholder name, descriptions, picture, email, and status
  - b. Cardholder group information
  - c. Credential name, status, format, and card number (including credentials with custom formats)
  - d. Partition information
  - e. Custom fields
4. Full flexibility in selecting the fields import during an import session shall be available.

5. The option to use a custom and unique cardholder key shall be specified during the import process to ensure that cardholders with duplicate names will not have their data overwritten. Cardholder key generation shall be automated. The end user shall have the option to select which fields will be used to create this unique key, e.g. credential number, custom fields, cardholder name.
6. The ACS shall also support re-importing a CSV file containing new information to update existing information in the ACS database. Re-importing shall enable bulk amendments to existing access control data.

M. Web Client

1. The Web Client shall allow users to perform configuration, management, and reporting activities of the ACS.
2. The Web Client shall be accessible through Microsoft Internet Explorer. It shall be a truly thin client. It shall not require the download of any ACS-specific files or executable on the client workstation.
3. Functionality available through the web client includes:
  - a. Configuration and management of cardholders and cardholder groups
  - b. Configuration and management of credentials
  - c. Configuration and management of access rules
  - d. Badge printing over the network
  - e. Assignment of access rules to doors and areas
  - f. Visitor management including visitor check-in and check-out and reporting
  - g. Advanced reporting

N. IP cameras

1. All IP cameras shall meet the following minimum requirements:
  - a. The IP camera shall capture live video, compress the video and stream the video over an Ethernet network connection to a remote location, where it may be viewed and / or recorded.
  - b. The IP camera shall incorporate Power over Ethernet (PoE) technology natively in accordance with IEEE 802.3af or 802.3at. External power splitters or other devices shall not be necessary at the camera.
  - c. Except as noted below, the IP camera shall have the ability to generate video that complies with both of the following compression standards:
    - 1) MJPEG
    - 2) H.264 (MPEG-4 Part 10)
  - d. The IP camera shall have the ability to adjust the compression ratio setting for variable bit rate at a given video resolution. The IP camera shall also have the ability to provide for a constant bit rate by adjusting the compression ratio as motion or other factors increase.
  - e. The IP camera shall provide for multi-streaming, with the capability to simultaneously generate no less than two streams of video. Each stream shall have, at a minimum, the following individually configurable settings:
    - 1) Compression technology
    - 2) Resolution
    - 3) Frame rate

4) Compression ratio

- f. The IP camera shall provide for selectable image aspect ratio of either 4:3 or 16:9.
- g. The IP camera shall provide a setup utility that is accessible via a standard web browser such as Microsoft Internet Explorer® or Mozilla Firefox®.
- h. The IP camera manufacturer shall publish a software developer's kit (SDK) and shall keep the SDK updated as camera software / firmware upgrades are made available.
- i. The IP camera shall comply with Open Network Video Interface Forum (ONVIF) standards for video compression and streaming.
- j. The IP camera shall allow for local storage of video on SD card or other removable local media. Local media shall comply with electronics industry standards and shall not be proprietary to the IP camera manufacturer. The camera shall be configurable to store video on the removable local media in the event of a network or recording server outage and shall have the ability to automatically upload the video to the recording server upon restoration.
- k. All IP cameras shall incorporate a true progressive scan imaging device. Interlaced video signals with "deinterlacing" technology shall not be acceptable.
- l. All IP cameras shall support both IPv4 and IPv6 protocols as defined by the IETF.
- m. IP cameras intended for outdoor use shall be designed for the environmental conditions in which they are installed, or shall be installed in compatible housings that provide the appropriate environmental protection.
- n. IP cameras installed in areas that experience low light conditions, such as poorly-lit outdoor areas, shall incorporate a day / night feature. The day / night feature shall detect when illumination levels drop below a certain threshold, and automatically switch the camera from color to black and white mode to provide for better video during low light conditions.
- o. Provide with built in IR illuminator.

2. 2.0 MP resolution fixed IP camera

- a. Resolution: 1920x1080 pixels
- b. Image sensor: 1/2.7" CMOS
- c. Frame rate: Selectable up to 30 IPS
- d. Minimum required illumination:
  - 1) Color: 0.2 lux F/1.2
  - 2) BW: 0.02 lux F/1.2
- e. Wide dynamic range: 69 dB
- f. Varifocal 3 to 9 mm
- g. Acceptable Product
  - 1) Avigilon
    - a) On-Ceiling 2.0-H3-DO1-IR (Type 1 C)
    - b) Surface 2.0-H3-DO1-IR (Type 1 S)
    - c) Pendant 2.0-H3-DP1 (Type 1 P)

3. 3.0 MP resolution fixed IP camera

- a. Resolution: 2048x1536 pixels
- b. Image sensor: 1/3" CMOS

- c. Frame rate: Selectable up to no less than 20 IPS
  - d. Minimum required illumination:
    - 1) Color: 0.2 lux F/1.2
    - 2) BW: 0.02 lux F/1.2
  - e. Wide dynamic range: 100 dB
  - f. Varifocal 3 to 9 mm
  - g. Acceptable Product
    - 1) Avigilon
      - a) On-Ceiling 3.0W-H3-DO1-IR (Type 2 C)
      - b) Surface 3.0W-H3-DO1-IR (Type 2 S)
      - c) Pendent 3.0W-H3-DP1 (Type 2 P)
4. 5.0 MP resolution fixed IP camera
- a. Resolution: 2592x1944 pixels minimum
  - b. Image sensor: 1/3.2" CMOS
  - c. Frame rate: 13 IPS minimum
  - d. Minimum required illumination:
    - 1) Color :0.3 lux at F/1.2
    - 2) BW: 0.03 lux at F/1.2
  - e. Wide dynamic range: 69 dB
  - f. Varifocal 3 to 9 mm
  - g. Compression technology: H.264
  - h. Acceptable Product
    - 1) Avigilon
      - a) On-Ceiling 5.0-H3-DO1-IR (Type 3 C)
      - b) Surface 5.0-H3-DO1-IR (Type 3 S)
      - c) Pendent 5.0-H3-DP1 (Type 3 P)
5. 9 MP 180 Degree Fixed IP Camera
- a. Resolution: 6144 x 1536 pixels minimum
  - b. Image sensors: 3 - 1/3" CMOS
  - c. Frame rate: 20 IPS minimum
  - d. Minimum required illumination:
    - 1) Color: 0.23 lux at F/1.3
    - 2) BW: 0.023lux at F/1.3
  - e. Dynamic range: 100 dB
  - f. Compression technology: H.264
  - g. Acceptable Product
    - 1) Avigilon

a) Surface 9W-H3-3MH-DO1 (Type 5 S)

6. 12 MP 360 Degree Fixed IP camera

- a. Resolution: 8192 x 1536 pixels minimum
- b. Image sensors: 4 - 1/3" CMOS
- c. Frame rate: 15 IPS minimum
- d. Minimum required illumination:

- 1) Color: 0.23 lux at F/1.3
- 2) BW: 0.023lux at F/1.3

- e. Dynamic range: 100 dB
- f. Compression technology: H.264
- g. Acceptable Product

- 1) Avigilon

- a) In-Ceiling 12W-H3-4MH-DC1 (Type 9 R)
- b) Pendent 12W-H3-4MH-DP1 (Type 9 P)

7. Elevator Cab Camera

- a. Exterior 1080p fisheye sensor unit
- b. The sensor unit shall meet or exceed the following design specifications:
  - 1) The sensor unit shall operate on an open source; Linux-based platform, and including a built-in web server.
  - 2) The sensor unit shall be equipped with a progressive scan sensor.
  - 3) The sensor unit shall be equipped with a fisheye lens with fixed iris.
    - a) 1080p
    - b) Horizontal angle of view: 194°
    - c) Vertical angle of view: 113°
    - d) Diagonal angle of view: 190°
- c. The sensor unit shall be manufactured with an IP66- and NEMA 4X-rated aluminum casing.
- d. The unit shall consist of a lens and an image sensor with a pre-installed RJ12 cable. Cable length options are 3 m (10 ft) or 12 m (39 ft).
- e. The sensor unit shall meet or exceed the following performance specifications:
  - 1) Illumination
    - a) The sensor unit shall meet or exceed the following illumination specifications:
      - i. 0.3 lux in color
  - 2) Resolution

- a) The sensor unit shall be able to deliver two individually configured 1080p resolution video streams over IP networks with 25/30 fps in H.264 or MJPEG. One 1080p video stream with 50/60 fps in H.264 or MJPEG.
  - i. The sensor unit shall support video resolutions including:
  - ii. 1920x1080 (HDTV 1080p)
- 3) Encoding
  - a) The sensor unit shall support the following video encoding algorithms:
    - i. Support Baseline Profile H.264 encoding with motion estimation in up to 60 fps (60Hz), 50 fps (50Hz).
    - ii. Support Main Profile H.264 encoding with motion estimation and context-adaptive binary arithmetic coding (CABAC) in up to 60 fps (60Hz), 50 fps (50Hz).
    - iii. Support High Profile H.264 encoding with motion estimation up to 60 fps (60Hz), 50 fps (50Hz).
  - b) The sensor unit shall provide independently configured simultaneous H.264 and Motion JPEG streams.
  - c) The sensor unit shall support both Maximum Bit Rate (MBR) and Variable Bit Rate (VBR) in H.264.
  - d) The sensor unit shall provide configurable compression levels.
  - e) The sensor unit shall support motion estimation in H.264/MPEG-4 Part 10/AVC.
- 4) Image
  - a) The sensor unit shall incorporate Automatic and Manual White Balance.
  - b) The sensor unit shall incorporate Wide Dynamic Range - Forensic Capture functionality providing up to 120dB dynamic range.
  - c) The sensor unit shall provide backlight compensation.
  - d) The sensor unit shall support manually defined values for:
    - i. Color level
    - ii. Brightness
    - iii. Sharpness
    - iv. Contrast
- 5) Enclosure
  - a) The sensor unit shall be manufactured with an IP66 and NEMA 250 Type 4X aluminum casing.

- b) The sensor unit shall be manufactured with a pre-installed cable equipped with a RJ12 connector. Two options of cable lengths are available:
  - i. 3 m (10 ft)
  - ii. 12 m (39 ft)
- 6) Environmental
- 7) Operate in a temperature range of -30 °C to +55 °C (-22 °F to 131 °F).
- 8) Operate in a humidity range of 10–100% RH (condensing).
  - a) Acceptable Product:
    - i. Axis Communications
    - ii. Exterior 1080p fisheye sensor unit shall be AXIS F1035-E
    - ii. Mount using WREN Solutions FM I in Control panel of Elevator.
    - iv. Encoder: Axis Communication encoder F41 mounted behind Control panel of elevator.
- 8. Fiber Optic Transceiver:
  - a. Provide fiber optic transceivers for cameras that are over 90 meters from the IDF rooms.
  - b. Provide NEMA 4 housing for transceiver to be mounted in near camera.
  - c. Provide NEMA 12 housing for mounting transceivers in IDF rooms within building.
  - d. Provide 24 VDC @ 500 ma per transceiver power supply in the IDF room. Power transceiver near camera over composite fiber cooper cable from IDF
  - e. Acceptable Product:
    - 1) Comnet CNMCSFPPOE with Comnet SFP3

O. Intelligent Field Controller

1. Controller Board

- a. The intelligent controller will be an Ethernet ready, fault-tolerant host communication capable for the efficient management of a large network of access panels in any system design. The intelligent controller will use an RS-232, 2-wire RS-485 or Ethernet link to connect to a Windows or Linux host. The intelligent controller will be capable of elaborate processes and procedures without host intervention. Once configured, the intelligent controller will function independently of the host, and will be capable of controlling access, managing alarms, interfacing with an array of hardware devices, all while providing the decision-making oversight that each system configuration requires. The intelligent controller will provide centralized biometric template management and support a wide range of reader technologies, including Wiegand, magnetic stripe and biometric 2-wire RS-485 connectivity and capable of supporting up to 64 doors in paired and or alternate reader configurations with peripheral interface device

- b. Primary Power: twelve to twenty-four volts of direct current (12-24VDC) +/- 10%, three hundred milliamperes (300mA) maximum.
- c. Communication Ports:
  - 1) Host Port 0: 10/100 Ethernet
  - 2) Host Port 1: RS-232, 2-wire RS485 or Ethernet adapter
  - 3) Peripheral interface Port 2: 2-wire RS-485
  - 4) Peripheral interface Port 3: 2-wire RS-485
- d. Inputs: Two dedicated: tamper and power monitor.
- e. Temperature: zero to seventy degrees Centigrade (0 to 70° C) operational, minus fifty-five to eighty-five degrees Centigrade (-55 to 85° C) storage
- f. Humidity: ten to ninety-five percent (10 to 95%) relative humidity, non-condensing (RHNC)
- g. Standards:
  - 1) UL294 Recognized, CE Compliant, ROHS,
  - 2) FCC Part 15 Class A, NIST Certified Encryption
- h. Connectivity:
  - 1) Primary Port: 10/100 Ethernet
  - 2) IP Server, IP Client, DHCP Client
  - 3) HTTP, TLS, X.509
  - 4) Back up channel: RS-232, RS-485, Dial-up
- i. Access Control:
  - 1) 600,000 Cardholder capacity
  - 2) 50,000 Transaction buffer
  - 3) If/Then Macro capability
- j. Card Formats:
  - 1) Eight active card formats per intelligent controller
  - 2) Entire card number reported on invalid read
  - 3) 19 digit (64-bit) User ID and 15 digit PIN numbers maximum
  - 4) PIV-II, CAC, TWIC card compatible
  - 5) 32 Access Levels per cardholder
  - 6) Activation/Deactivation Dates
- k. Card Reader Functions
  - 1) Multiple card format support by reader
  - 2) Paired reader support
  - 3) Alternate reader support
  - 4) Elevator support
  - 5) Turnstile support
  - 6) Biometric device support
  - 7) Open Supervised Device Protocol (OSDP) compliant
  - 8) Occupancy count
  - 9) Support of multi-occupancy rules
  - 10) Anti-passback support

- a) Area-based, reader-based, or time based
  - b) Nested area, hard, soft, or timed forgiveness
- 11) Supports host-based approval rules
  - 12) Keypad support with programmable user commands, card input

I. Database Functions

- 1) Configurable card database
- 2) Supports up to nineteen (19) digital card numbers
- 3) Supports pin codes up to fifteen (15) digits
- 4) Programmable card activation and deactivation times and dates
- 5) Card issue code, ADA and VIP flags (up to 32 bits); PIV (75 bits); Smart Card (200 bits)
- 6) Up to 128 access levels per user
- 7) Ability to track people and objects

m. Intrusion Alarm Functions

- 1) Supports entry delays and exit delays
- 2) Area monitoring
- 3) Standard alarm masking
- 4) Provides control and alarm processing from the keypad

n. Acceptable Product:

- 1) Mercury EP2500 Controller

P. Card Reader Board

- 1. The peripheral interface device will provide a solution for interfacing to TTL/Wiegand/RS-485 type readers and door hardware. The intelligent controller will accept data from a reader with clock/data, Wiegand or RS-485 signaling, provide a tri-stated LED control and buzzer control. It will also provide six
- 2. Form-C relay outputs and eight supervised inputs for monitoring. The controller will communicate via a 2-wire RS-485 interface
- 3. Primary Power:
  - a. 12-24VDC 10%, 550mA maximum, plus reader current
  - b. 12VDC at 450mA nominal, plus reader current
  - c. 24VDC at 270mA nominal, plus reader current
- 4. Communication: 2-wire RS-485, 4,000 feet using Belden 9841
  - a. Reader Interface: two reader ports, data card/keypad, clock/data, data-1/data-0, or 2-wire RS-485
  - b. LED: one-wire bi-color LED support or two-wire
  - c. Buzzer: one-wire LED mode
- 5. Keypad: 8-bit Mercury, 8-bit Dorado, or 4-bit HID
- 6. Reader Power:
  - a. Pass through or 12Vdc regulated power, 125mA each reader

7. Inputs: eight general purpose programmable type and two dedicated for tamper and power monitor
8. Outputs: six relays – Form-C, 5 Amps at 28Vdc
9. Environmental:
  - a. Temperature: 0 to 70 degrees Centigrade operational, -55 to 85 degrees Centigrade storage
  - b. Humidity: 10-95 percent RHNC
10. Standards: UL 294 recognized, CE compliant, RoHS
11. Acceptable Product:
  - a. Mercury MR52 Card Reader Board

Q. Card Reader:

1. Provide support for multiple card formats and card reader types.
2. Provide support the following features for directly connected readers:
  - a. User defined card formats up to 256 bits.
  - b. Unlimited number of card formats.
  - c. The ability to assign up to 10 card formats per reader.
  - d. The ability to show reader status on card reader LCD. (If available)
  - e. Support Wiegand and 3x4 matrix keypads.
  - f. The enrollment of biometric templates to smartcards.
  - g. Custom CHUID FIPS201-compliant supporting full 256-bit data
3. Acceptable product:
  - a. HID SE series readers.

R. Input Board

1. The peripheral interface device will be used to monitor sixteen (16) inputs
2. Primary Power:
  - a. 12-24Vdc 10%, 350mA maximum
  - b. 12Vdc at 300mA nominal
  - c. 24Vdc at 220mA nominal
3. Communication: 2-wire RS-485, 4,000 feet using Belden 9841
4. Inputs: sixteen (16) general purpose programmable type and two dedicated for tamper and power monitor
5. Outputs: two (2) relays – Form-C, 5 Amp, 28Vdc
6. Temperature: 0 to 70 degrees Centigrade operational, -55 to 85 degrees Centigrade storage
7. Humidity: 10 to 95 percent RHNC
8. Standards: UL 294 recognized, CE compliant, RoHS
9. Acceptable Product:
  - a. Mercury MR16IN 16 Input Board

S. Door Hardware Power Supply:

1. Provide output voltage, power conversion modules, and UPS & power controllers as required based on field conditions.
  2. Acceptable product:
    - a. Altronix Maxim 33.
- T. Door Position Switch:
1. Provide door position switches from GE Security Products
  2. Acceptable product:
    - a. 1076D / 1" diameter.
- U. Request to exit motion detector.
1. Provide Detection System request to exit motion detector.
  2. Acceptable product:
    - a. DS160
- V. Above Door Junction Boxes
1. Provide above door junction boxes for the access control system to house access control hardware.
  2. Acceptable product:
    - a. Hoffman 8 X 8.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify final camera locations, desired views, and camera housing and mount requirements prior to installation
- B. Ensure that relevant doors and door frames are properly prepared for electric locking hardware and door position switches.
- C. Verify acceptance of each type of specified request-to-exit hardware for each application with the LAHJ.
- D. Verify fail-safe and fail-secure lock requirements with the Owner's Representative.

#### 3.2 INSTALLATION

- A. Where analog cameras are used with coaxial cable, only crimp style connectors shall be used.
- B. Adjust all vari-focal lenses to provide the best field of vision. Anticipate returning to adjust each camera at least once to verify requirements for focus and field of view with the Owner's Representative.

- C. Adjust AGC to provide the best image resolution at each camera location.
- D. Adjust vertical phase calibration on analog cameras to ensure stabilization of video image.
- E. Back focus to optimize the focal range of each camera's viewing area.
- F. Provide programming of VSS/ACAMS interface for camera call-up on alarm in coordination with the Owner.
- G. Provide programming of camera tours as required in coordination with the Owner.
- H. Field-verify the exact location and positioning of all cameras with the Owner's Representative prior to installation.
- I. Provide ground isolation transformers as required to eliminate humbars and ground loops in analog video.
- J. Power all fixed analog cameras from centrally located power supplies.
- K. Power all analog PTZ cameras from the local power supply adjacent to the PTZ camera location.
- L. Power all IP cameras via power over Ethernet (PoE) in accordance with IEEE 802.3af or IEEE 802.3at.
- M. Adjust digital displays to provide optimum viewing angle in coordination with the Owner.
- N. Program and configure VSS client workstations to provide multiplexed views as coordinated with the Owner
- O. End of line supervision
  - 1. Selected field wiring shall be supervised. Cutting, shorting or altering connections of any wire listed as supervised below, shall be detected, and activate an alarm condition at system workstations. Provide wiring supervision for the following functions:
    - a. Door position switches
    - b. Request to exit devices
    - c. Motion sensors
    - d. Glass break sensors
    - e. Perimeter intrusion detection devices
    - f. Any other device which reports a digital (on/off) condition back to the system IFC.
  - 2. End of line supervision shall detect and annunciate four (4) states. Electrical open and short conditions shall not annunciate as any other condition than trouble or fault within the ACS software.
- P. All access control system enclosures shall be provided with tamper switches.
- Q. Provide signs or labels for all tamper monitored enclosures warning that an alarm will sound if access is attempted, and giving the telephone number of the security workstation operator.

- R. Multiple Contractor user privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor user privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner. Prior to removal of contractor access privileges, Contractor shall ensure that the Owner has been set up with a master password.
- S. Configure the ACS such that devices can be connected to spare input points, output points and card reader inputs on the IFC without requiring reconfiguration of the ACS.
- T. Card Readers: Wire card reader LEDs to indicate valid and invalid card reads, and door locked and unlocked conditions. All card reader LED indicators shall operate identically throughout the Project. The LED shall be red in the normal, secured state, and shall be green on valid card read and while the door is unlocked.
- U. Electric Locking Mechanisms
  - 1. Interface with electric locking mechanisms provided under a separate Section.
  - 2. Wire fail-safe electric locking mechanisms in accordance with requirements of the LAHJ.
- V. Fire alarm interface
  - 1. Connect (hard wire) fail-safe electric and time delay locking mechanisms to the building fire alarm system for fail-safe release upon any fire alarm.
  - 2. Interface with a single low voltage / low current normally closed dry contact from the fire alarm system provided by the fire alarm contractor (verify exact locations). The contact shall open on any fire alarm condition.
  - 3. Provide all additional UL listed fail-safe relays and power supplies necessary to interface to this contact and unlock all fail-safe doors.
  - 4. Connect fail-safe relays and power supplies to standard building power. Connection of fail-safe devices to emergency or UPS power shall not be acceptable.
  - 5. Reference the Drawings for fire alarm interface requirements.
- W. The ACS shall be interfaced with the intercommunications system as defined in a separate Security Subsystem Interface to provide for remote unlocking of controlled doors via an output from an associated intercom station.
- X. Provide interface to uninterruptible power system (UPS) for all security head-end components, including those specified in other Security Subsystem Specifications.

### 3.3 PROGRAMMING

- A. Provide all initial system programming and setup of the VSS system including, but not limited to the following:
  - 1. Enrollment of all cameras, encoders, and other devices into the VSS software. Provide all necessary configuration of each device, including IP address, name, description, frame rate, compression ratio, resolution, and other required settings.
  - 2. Configuration of all rules-based actions within the system including setup of initiating events, and all resulting actions.

3. Initial setup for the interface with the ACAMS. The interface shall provide for automatic VSS camera selection upon alarms within the ACAMS as specified herein and as indicated in the Contract Documents. Coordinate automatic VSS camera selection, real-time record initialization, and VSS record status alarm annunciation requirements with the Owner prior to programming.
  4. VSS software graphical maps and icons. Coordinate with the Owner's Representative to obtain AutoCAD architectural backgrounds for implementation as graphical maps. Import all AutoCAD background information provided by the Owner's Representative and produce a complete set of graphical maps depicting all VSS points.
  5. Automatic selection of a VSS camera adjacent to applicable card readers upon an invalid card use. Coordinate automatic camera selection requirements with the Owner prior to system programming
- B. Enter all data needed to make the Security System operational. Deliver the data to the Owner on data entry forms, utilizing data from the Contract Documents, Contractor's field surveys and all other pertinent information in the Contractor's possession required for complete installation of the database. Identify and request from the Owner any additional data needed to make the Security System fully operational and integrated. The completed forms shall be delivered to the Owner for review and approval at least 30 days prior to the Contractor's scheduled need date.
- C. Programming and setup data shall include, at a minimum, the following:
1. Graphical maps and icons
    - a. Coordinate with the Owner's Representative to obtain AutoCAD architectural backgrounds for implementation as graphical maps. Import all AutoCAD background information provided by the Owner's Representative and produce a complete set of graphical maps depicting all ACS points.
    - b. Partition and segregate graphical map displays between "Base Building" and "Tenant" as specified herein.
  2. ACS card reader information
    - a. Coordinate all card reader values and text, including descriptors, alarm messages, VSS camera call up, map call up and identification with the Owner's Representative.
    - b. Certain card readers shall be designated for handicap access only. Coordinate special access privileges with the Owner's Representative and program the ACS accordingly.
  3. Input and output points for the ACS. Coordinate all input and output priorities and text, including descriptors, alarm messages, VSS Camera call up, and map call up and identification with the Owner's Representative.
  4. Initial system users, including levels of access. This shall include the designation of an Owner's representative at the "Super User" level immediately upon ACS initialization.
  5. Initial VSS camera call-up and alarm information for interface with VSS system.
  6. Alarm monitoring and automatic shutdown information for the UPS interface.
- D. Delivery, Storage, And Handling
1. SMS components shall be shipped to the job-site in original manufacturer's shipping containers.

2. All shipping and handling costs shall be paid for by the Contractor at no additional cost to the Owner.
3. All equipment stored on the job site shall be secured in a locked storage area as designated by the General Contractor or Owner.
4. The contractor may receive a progress payment for the value of the equipment stored on site if adequate storage space is available.

E. Testing And Commissioning

1. The Contractor shall be responsible for testing and commissioning the installation in accordance with all applicable documents in the Contract set.
2. Testing shall be comprehensive and sufficient to demonstrate compliance with each requirement.
3. A proposed test plan shall be submitted to the Contracting Officer or Owner's representative for approval before commencement of final test.
4. Final tests shall be conducted in the presence of the Contracting Officer or Owner's representative.

F. Training And Instruction

1. Operator training shall consist of a two-day course conducted on-site by a factory trained professional instructor. Training conducted by unqualified personnel is unacceptable.
2. Training materials shall consist of the following:
3. Formal course outline and agenda.
4. Operator training student guide for each student.
5. Hands-on practice with online equipment.
6. Written examinations.
7. The training course shall be for at least two continuous business days.
8. Additional video imaging training sessions shall be made available to the Owner if necessary, at additional cost.

G. Warranty

1. All equipment furnished under this contract shall be warranted for a period of twelve (12) months from the date of final Owner acceptance of the system.
2. Respond to service requests on-site, if required.
3. Replace or repair defective components as required.

H. Service Contract Proposal

1. The bidder shall include an optional service contract proposal at the time of bid. The proposal shall include:
2. Response to emergency service requests on-site, if required.
3. Replace or repair defective components, as required.
4. Manufacturer's recommended preventive maintenance.
5. Two-year and five-year maintenance contract, with price, terms, and conditions shown for each year.
6. The service contract shall be optional and the Owner shall have the right to accept or reject the contract, and accept only the warranty service as described above, at no additional cost.

### 3.4 COORDINATION

- A. Field-verify and confirm views with the Owner's Representative prior to final installation and adjust camera positions and lens sizes as required.
- B. Coordinate with the Owner's IT department for connection to the network, including IP addresses, VLAN setup, and other required network setup
- C. Coordinate cylinder and master key requirements for LAAs and bypass keyswitches.
- D. Coordinate custom ACS report requirements. Submit report templates to the Owner's Representative for review and acceptance.
- E. Coordinate initial database partitioning and setup with the Owner prior to initial programming and cardholder data entry.

END OF SECTION 281310

Back-Check No. 2 - ASI 009  
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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 282310 VIDEO SURVEILLANCE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.
- B. The General Security Requirements specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the General Security Requirements Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the General Security Requirements specification Section.

#### 1.2 DEFINITIONS

- A. CCD: Charged coupled device
- B. HD: High definition
- C. IETF: Internet Engineering Task Force
- D. IP: Internet Protocol
- E. IPS: Images per second
- F. ITU: International Telecommunications Union
- G. MP: Megapixel
- H. MPEG: Moving Picture Experts Group
- I. NTSC: National Television System Committee
- J. ONVIF: Open Network Video Interface Forum
- K. PAL: Phase alternating line
- L. PTZ: Pan, tilt and zoom
- M. RWC: Regional Watch Center
- N. SCC: Security Control Center
- O. SD: Standard definition

P. VSS: Video surveillance system

Q. WAN: Wide Area Network

### 1.3 REFERENCES

- A. Electronics Industry Association (EIA) RS-170a standard for analog video
- B. NTSC broadcast video standard
- C. ITU PAL-B broadcast video standard (Referred to herein as simply PAL)
- D. ONVIF standards for IP video interoperability
- E. MPEG standards for video encoding / decoding
- F. ITU-T standards for video encoding / decoding

### 1.4 SUMMARY OF WORK

- A. Work specified in this Section includes systems used for visual monitoring and recording of activities within the scene of view of attached cameras and associated features and functions, and equipment as necessary to support this capability.
- B. Systems shall consist of:
  - 1. Software
  - 2. Recording servers
  - 3. Management server
  - 4. Recording storage
  - 5. Client Workstations
  - 6. Cameras
  - 7. Network video encoders
  - 8. Camera housings and mounts
  - 9. Video analytics software / firmware
- C. The VSS shall provide the following functions:
  - 1. Video display as necessary for live monitoring and assessment of security incidents
  - 2. Recording of, and retrieval from, video to digital storage media for historical record
  - 3. Graphical map creation
  - 4. System administration
  - 5. Reports generation
- D. The VSS shall consist of a collection of devices by different manufacturers that are seamlessly managed by a single software package over an IP-based communications network. Video generated natively in digital IP format, as well as analog video digitized by an IP encoder shall both be supported by the VSS.

- E. The VSS shall have the capability to integrate with intelligent video analysis products for monitoring of specific activities or behaviors that occur within the scene of view of the associated camera.
- F. Multiple disparate video surveillance systems shall have the ability to be linked together in a centralized architecture, allowing cameras from any system to be viewed on any other system. The centralized architecture shall be configured and managed in a hierarchical manner.
- G. The VSS shall incorporate security measures, including advanced authentication measures and encryption of data.
- H. The VSS shall provide for redundancy of video storage using local storage at camera locations where critical or essential as indicated in the Construction Documents. Upon loss of recording server or network connectivity, the camera shall automatically buffer video to local storage, then automatically upload that video to the recording server upon restoral.
- I. Components of the VSS that use proprietary digital technologies shall have an associated software developer's kit (SDK) that is published, regularly updated, and available for other manufacturers / software vendors to write to.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Unless otherwise noted, all materials and equipment shall be new, of the type, capacity, and quality specified and free from defects. Material shall bear the label of, or be listed by the appropriate local listing agency unless of a type for which label or listing service is not provided.
- B. Where multiple items of a similar kind are provided, all shall be identical and of the same manufacturer.
- C. The Contract Documents indicate major system components and may not show every component, connector, module or other accessory that may be required for a complete and operational system. It is the Contractor's responsibility to identify and provide each component necessary for a complete and operational system in accordance with the Contract Documents.

### 2.2 MANUFACTURE

- A. This project is to provide a new IP video surveillance system for the Los Angeles Lakers Headquarters project. Provide the licenses for all cameras connected to the system.
- B. Acceptable Product:
  - 1. Avigilon

## 2.3 FUNCTIONAL REQUIREMENTS

- A. The video surveillance system shall consist of an open architecture whereby multiple edge devices such as cameras and encoders from different manufacturers stream video in real-time to a software-based video surveillance system. The video surveillance system shall reside on non-proprietary computer hardware and shall provide for live viewing of the video, in addition to recording and storage of historical video information as well as other functions as defined herein.
- B. The video surveillance software shall incorporate a client / server architecture, whereby management and / or monitoring of the system shall be done through client software. The client software shall access a centralized system database stored on a management server to control authentication into the system and to provide management for the various devices that constitute the system, including recording servers. The management server shall also provide for logging of system events. Recording servers shall be configured to receive video feeds from the various edge devices, and recording the video streamed from these devices to a database for future retrieval.
- C. Centralized architecture
  - 1. The system shall allow multiple independent video surveillance systems to be linked together for centralized access to system devices across multiple systems in a hierarchical, tiered configuration. The individual video surveillance systems shall be fully independent systems with their own management server, recording server(s), edge video devices, etc.
  - 2. Each of the individual video surveillance systems shall be individually manageable, even though they appear to be one large system to administrators and users.
  - 3. The centralized architecture shall have the capability to scale to an unlimited number of sites.
  - 4. The centralized architecture shall not require extra servers or other hardware at each of the connected sites in order to provide the centralized architecture described herein.
  - 5. Each of the individual systems / sites connected via the centralized architecture shall continue to operate when the network connection to the centralized hierarchy is disconnected. All users in the hierarchy shall be able to login and access edge devices from all other sites in the hierarchy that are still online in the event that communications is lost to one site in the hierarchy.
  - 6. The centralized architecture shall allow for access to all configured remote systems / sites from a single login.
  - 7. The centralized architecture shall provide for automated synchronization between all associated sites. Every time a site is added or removed, the systems shall automatically synchronize.
- D. Live viewing
  - 1. Through client workstations, the system shall allow a user to view live video, trigger manual events, control outputs, control PTZ cameras, and perform other system monitoring tasks.
  - 2. The live monitoring interface shall allow a specific camera to be sent to a position in the main viewing window, a new floating window or to a preconfigured video wall.
  - 3. The system shall allow an operator to tag live video for later use, and shall provide the capability for the operator to add details about the specific tag.
  - 4. The system shall support multicasting of one video stream to multiple video clients simultaneously. The system shall incorporate a feature whereby network stability is automatically detected and the system automatically switches over to unicast operation.

5. The system shall have a privacy masking feature whereby specific areas within the scene of view of the camera shall be masked off to prevent viewing by an unauthorized operator.
6. The system shall incorporate a rule processing engine for execution of start and stop actions triggered by events or time profiles. This feature shall provide for automated event handling of events initiated by external devices or conditions detected internally to the video surveillance software.
7. Matrix simulation
  - a. The system shall include an integrated matrix solution for distributing video to any computer on which the client software is installed.
  - b. The matrix functionality and video wall functionality defined herein shall allow operators at one client monitoring workstation to send video manually to another client workstation or video wall.
  - c. The system shall allow for automated transmission of video to a designated matrix recipient on a rules basis upon activation of internal or external events or alternatively upon the command of a user.
  - d. The matrix setup and information shall be fully configurable from the system management software.
  - e. The system shall allow for client workstation monitors to be set up in a video wall configuration, with any number of monitors in the video wall and any number of video walls in the system.
  - f. For each video wall setup, the system shall allow for multiple presets to be defined such as grid view layouts and specific cameras / content to display within the layouts.
8. PTZ camera control
  - a. The system shall support the following PTZ functions:
    - 1) Point and click PTZ control via a mouse.
    - 2) Optical zoom using a mouse wheel.
    - 3) Software-defined navigation buttons available both in the PTZ control pane within the application and as an overlay on the video.
    - 4) Preset positioning of the camera. The presets shall be available from a drop-down list.
  - b. The system shall provide for a digital zoom feature whereby an operator may enlarge a portion of a given image for a closer look without affecting recording functions.
  - c. The system shall provide for operator priority levels assignable by a system administrator to control which operators are able to take control of the camera in the event of a conflict. The system shall allow for override of a lower-priority user's manual PTZ control when setting up a camera manual tour.
  - d. The system shall allow an administrator to define a high number of priority levels. It must be possible to set a number to define the PTZ priority.
  - e. The system shall allow an administrator to set/define the following:
    - 1) A PTZ priority when creating a rule that moves a camera to a PTZ position.
    - 2) A PTZ priority when creating a rule that starts a tour on a camera.
    - 3) A PTZ priority when creating a rule that sends one or more cameras to their default PTZ position.
9. Maps / graphics

- a. The system shall provide for a built-in map function that shall allow for display of information on client workstations in a graphical format. The map function shall provide an intuitive overview of the system and shall offer access to any system component.
- b. The map function shall be able to use standard graphical file formats including: .jpg, .gif, .png, .tif, etc.
- c. It shall be possible to use any number of layered maps, and it shall be possible to easily drag-and-drop and point-and-click definition of cameras, servers, PTZ camera presets and other system devices.
- d. The system shall allow for hot zones for intuitive navigation between different map levels. Hot zones shall provide for the following features:
  - 1) When used in a centralized architecture, the map function shall allow a system user to link the maps from different sites together through use of hot zones.
  - 2) Hierarchical propagation of status indication to higher tier maps.
- e. The map function shall support instant camera preview when moving the mouse pointer over a specific camera.
- f. The map function shall support real-time status monitoring indication from all system components. Status monitoring shall support color coding of system device status.
- g. The map function shall provide a central overview of the surveillance system via an alarm list containing alarm indicators of high, medium or low prioritized alarms. Furthermore, the alarms shall be categorized by the following states; new, in progress, on hold, or closed. Alarms must be possible to acknowledge by right-clicking elements on maps.

#### 10. Alarms

- a. The system shall allow for generation of alarms based on system-related events such as video motion, archiving problems, lack of disk space, etc. Alarms shall be configurable by event message used to trigger alarm as well as by servers, cameras, or other devices the event message originates from in order to trigger the alarm.
- b. Alarms shall be configurable on a time schedule, such as always, defined by time profile, or by event.
- c. The system shall support alarm priorities for sorting purposes and workflow control within the system workstation software. Alarms shall have the ability to be assigned to a specific operator or shared by all operators.
- d. It shall be possible to select defined events to trigger alarms on the centralized system server.

#### E. Recording

- 1. The system shall provide for recording and archiving of video generated by cameras attached to the system. All video collected by the system shall be stored in a database for future retrieval and to enable advanced search and archiving features.
- 2. Provide ability to configure the system to throttle the maximum bit rate for video transmitted over the Owner's WAN to 500 kbps.
- 3. The system shall allow for hot failover to a standby server for one or multiple recording servers in the event of a network or hardware failure.

4. In order to increase access speed on the disk system, the system shall incorporate a storage optimization feature whereby video files are stored on the associated disk system in as few fragments as possible. Video data block files shall be stored in a single disk system fragment no less than 90% of the time.
5. Bookmarking
  - a. A bookmarking feature shall be included in the system, allowing the client viewer users to mark incidents on live and/or playback video streams.
  - b. Bookmarks shall be set from the client viewer, and stored in the recording server.
  - c. Bookmarks and comments shall be removed automatically once the associated recording is deleted.
  - d. The following actions shall make entries to the audit log; add, edit, delete, view details, search for, and list bookmark search results in the client viewer.
6. The system shall provide for encryption of video data recorded by the system. The encryption feature shall allow for encryption of all video data written to the system database, or simply encryption of record headers for improved system performance.
7. The system shall allow for video export in multiple formats, including video from multiple cameras in the native encrypted database format. Export using the native encrypted format shall include a viewer within the video data so that viewing software is not required on the playback computer.
8. Edge device storage
  - a. In the event of a network or server failure, the system shall allow for video to be recorded locally in storage on the camera and shall automatically synchronize video with the database upon network or server restoration.
  - b. When the recording server is restored and back online, it shall poll the connected hardware for recorded data and retrieve it. The recording server shall specify the period of time from which data shall be retrieved from the camera.
  - c. The edge storage feature shall ensure that the system logs when data is retrieved from edge storage.
  - d. The edge storage feature shall ensure that the timestamps in the retrieved data are used when inserted into the media database.
  - e. The edge storage feature shall be able to work in a failover server scenario. When the failover server takes over, it shall retrieve the recorded data on the edge storage.
  - f. The edge storage feature shall have the ability to throttle the data transfer rate between the edge storage and the recording server.
9. Multi-stage archiving
  - a. The system shall allow for multiple stages of video storage with varying levels of reliability, access speed, and frame rate. It shall be possible to define time thresholds after which video stored in a particular stage (location) shall be moved to another stage (location.)
  - b. When video is moved from one stage to another, it shall be possible to store the video data at a reduced frame rate in order to reduce storage requirements.
  - c. The 'live' database shall automatically be divided in 1 hour segments keeping the size of the open 'live' databases as small as possible ensuring that a potential database repair after a failure is as short as possible.

- d. System administrators shall be able to enable an encryption function that shall encrypt video and audio data recorded in the 'live' database from the cameras using the storage container. The encryption shall be kept and transferred with the recording when archived. The encryption shall also be kept, even if the recordings are groomed during the archiving process.

F. Web-based client

1. The system shall allow for client access to the system through a web-based interface. The web-based interface shall not require any sort of rich-client software to be installed on the viewing machine, with the exception of readily-downloadable standard browser plug-ins.
2. The web-based remote client viewer shall offer live view of up to 16 cameras, including PTZ control with joystick, fisheye (360 degrees) cameras and event/output activation. The playback function shall give the user concurrent playback of up to 16 recorded videos with date, alert sequence, or time searching.
3. The web-based remote client viewer shall offer quick overviews of sequences with detected motion.
4. The web-based remote client viewer shall be able to generate and export video evidence in AVI (movie clip) and JPG (still image) formats. A video clip containing privacy mask shall when being exported as JPEG or AVI keep the applied privacy mask as a black part on the image.
5. The web-based remote client viewer shall be able to print images.
6. The web-based remote client viewer shall have the ability to adjust the display parameters of the video images; meaning reduce the frames per second, or reduce the resolution from the recording server to optimize bandwidth utilization.
7. The remote client viewer shall support shared and private server-based views with a layout of up to 4 4. Any of these views shall have the ability to contain a combination of cameras, images, and HTML page view items.
8. The remote client viewer shall support login using Microsoft Domain Controllers

G. Multiple language support

1. The system shall support localization on both the monitoring client and at the administration client.
2. Upon installation of either client software package, the installer shall have the capability to select the appropriate language for that specific client.

H. User authentication

1. The system shall provide for unique user logins to the system monitoring client and management client software applications. Login to the system shall be either through the Microsoft Windows® user account on the system or through an associated Microsoft Active Directory® server.
2. It shall be possible to select the correct Windows® profile to associate with a system user when multiple exist on the PC on which the system software is installed.
3. The system shall provide for a high granularity for control of user rights and shall at a minimum allow the user to specify the rights for the following:
  - a. Info
  - b. Users and groups
  - c. Device
  - d. PTZ – it shall be possible to define a PTZ priority by setting a number between 1 and 32.000.

- e. Speech
- f. Application
- g. User-defined events
- h. View group
- i. Servers
- j. Matrix
- k. Alarms

I. System audit logs

1. System shall record a log of all operator actions taken in system, including both monitoring client operators and management client operators.
2. Each audit log entry shall at a minimum include a description of the event, the time and date stamp of the event, and the login name of the logged-in operator.
3. Operator audit logs shall not be editable.

J. Video playback

1. The system shall provide for an intuitive interface for playback of recorded video. The interface shall provide for a quick overview of recorded sequences, events, and alerts. The interface shall also provide a graphical timeline that displays a scrollable view of recorded sequences by variable time spans for a graphical overview of recorded images.
2. The playback controls shall incorporate a slider knob to quickly scrub video both forward and backward.
3. The system shall incorporate an independent playback capability for playback of recorded video for one or more cameras.
4. Within the playback mode it shall be possible to press a 'back to live' mode button that easily shall bring the camera back to 'live' mode.
5. Recorded playback of video shall incorporate a smart search feature whereby a user-selected area in the video scene is searched for motion in a specific time interval and all relevant video clips are displayed to the operator.
6. The system shall allow for digital zoom of the recorded video upon playback.
7. Playback controls shall conspicuously display the time date of the video being viewed.

K. Third-party integration

1. The system manufacturer will provide publish and make available SDK for integration with 3rd-party devices and systems, including IP cameras, camera encoders, digital video recorders, video analytics packages, and other system components.
2. The SDK will have all features of the client software available for integration with 3rd party devices and systems.
3. Video analytics
  - a. The system shall support integration of multiple video content analytics (VCA) systems from different manufactures. Video content analysis shall be available as a software module and shall provide a single, easy to manage interface. The video analytics software module shall handle video analytics from different types of video content analytics systems, including server-based systems, edge-based systems and library-based systems.
  - b. The video analytics software module shall support a common alert XML format to convert other third party analytics components.
  - c. The video analytics software module shall utilize a central database for all alerts.

- d. The video analytics software module shall allow the correlation of alerts from multiple analytics to verify these alerts with multiple behaviors in a single user interface.
  - e. The video analytics software module shall be able to view multiple alerts simultaneously.
  - f. The video analytics software module shall utilize a client and shall allow an operator to create views with pre-defined filters and search criteria.
- 4. Using the SDK, system developers shall be able to perform simple actions such as straightforward exchanges of events, or complex actions, and by these create solutions that meet the diverse needs of customers. The SDK shall allow developers to:
  - a. Integrate the video surveillance system via protocols executing on a non-Microsoft operating system, or developed using some other non .NET supported languages accessing the video surveillance system's configuration, get live or recorded video.
  - b. Integrate the video surveillance system to end user applications via components. The component integration contains ActiveX's and .NET library that, for example, enables an application to display live and recorded video and send events to the system.
  - c. Use plug-ins to integrate the system's administration tools, event handling services and a client viewer for hosting an application. This environment shall allow to: store third party developed configurations, share third party developed configurations between applications, make customized graphics overlay on top of live or recorded video, e.g. for analytics applications.
- L. The system shall support no less than two different streams of video from each supported camera to the recording server with different resolutions, encoding schemes, and frame rates
- M. System utilities
  - 1. The system shall incorporate utilities to provide for improved uptime and simplified configuration and maintenance of the various system components.
  - 2. Background database repair
    - a. System shall detect and provide for automated repair of corrupted database files with no action required on the part of the system operator.
    - b. Upon startup, if the system detects that database files have been corrupted; the system shall go ahead and start up, allowing the user access to those parts of the system not affected by the corruption. Database repair shall occur in the background and the system shall notify the operator when repair is complete.
  - 3. Automatic device discovery
    - a. The system shall have a software wizard for automated detection and enrollment of devices that exist on the network. The wizard shall detect both the manufacturer and model number of the device in question, along with various configuration settings within the device.
    - b. The wizard shall allow the system administrator to specify network IP ranges between which to search devices. Detected devices shall be auto-populated in the video surveillance system software.
    - c. The wizard shall allow for replacement of devices and shall automatically configure all appropriate settings within the device to match the one that it has replaced.

## 2.4 TECHNICAL REQUIREMENTS

### A. Video management software

1. Shall support all features defined within the section above entitled "Functional Requirements."
2. Video management software shall be scalable up to an unlimited number of connected IP cameras, encoders, and other system devices.
  - a. Video management software shall be hardware-agnostic, and shall support industry-standard hardware devices such as servers, workstation PCs, storage and other devices from standard industry sources.

### B. Server hardware

1. Provide operating system for the system server as per VSS manufacturer requirements. Where multiple system server operating systems are supported by the VSS manufacturer, MS Windows® products shall be used.
2. System server shall comply with all relevant Owner IT requirements.
3. Where the Owner IT Requirements do not provide specific direction, system server and its individual components shall not be proprietary to a specific manufacturer.
4. Minimum specifications for the system server shall be as per the published minimum specifications of the VSS manufacturer. Confirm specific requirements with the VSS manufacturer based on Project capacity requirements.

### C. Video management server

1. The video management server shall provide for central management of all video recording servers, client workstations, cameras and other system devices.

### D. Video recording server

1. The video recording server shall receive video streams from associated cameras, record the video data from these streams to the system database and attached storage, and serve live video to monitoring client workstations.
2. The system server shall incorporate RAID level 1 redundant storage technology or approved equivalent. Redundant disks shall be hot-swappable, shall be accessible from the front of the server unit and shall provide a visual indication of disk status on the front of each disk.

### E. Client workstation hardware

1. The client workstation shall provide for operator interface to the system, including all management, monitoring and control activities.
2. Client workstation shall comply with all relevant Owner IT requirements.
3. Provide operating system for the client workstation as per VSS manufacturer requirements. Where multiple client workstation operating systems are supported by the VSS manufacturer, MS Windows® products shall be used.
4. Where Owner IT Requirements do not provide specific direction, client workstation and its individual components shall not be proprietary to a specific manufacturer.
5. Minimum specifications for the client workstation shall be as per the published minimum specifications of the VSS manufacturer. Confirm specific requirements with the VSS manufacturer based on Project capacity requirements.

- F. Network transmission hardware: Coordinate with the Owner's IT / Telecom group for equipment requirements, including switches, power over Ethernet injectors, and any other network equipment specified within the Construction Documents.
- G. Video Storage device:
1. Provide a video storage device that has a minimum of 200 TB of usable storage.
  2. Provide a device with an active storage controller that will do the following formats:
    - a. Raid 6 8+2, 4+2
    - b. Raid 5 8+1, 4+1
    - c. Raid 1 1+1
    - d. 12.4GB/s sustained large block sequential read performance.
    - e. 10.75GB/s sustained large block sequential write performance.
  3. Provide an active controller
  4. Provide power fail cache
  5. Support Windows, Linux and MacOSX
  6. Support Enterprise Class 2.5" SSD up to 1.6TB Performance SAS 2.5" up to 900GB, and Capacity SAS/SATA 3.5" drives up to 4TB\* 60 in base unit, up to 396 total with expansion enclosures
  7. Environment:
    - a. nOperating temperature 5°C to 35°C (41°F to 95°F)
    - b. Relative Humidity 20% to 80% non-condensing
    - c. Altitude -200 ft to 10,000 ft (-61m to 3048m)
  8. Acceptable Product:
    - a. Data Direct Networks SFA7700
- H. IP cameras
1. All IP cameras shall meet the following minimum requirements:
    - a. The IP camera shall capture live video, compress the video and stream the video over an Ethernet network connection to a remote location, where it may be viewed and / or recorded.
    - b. The IP camera shall incorporate Power over Ethernet (PoE) technology natively in accordance with IEEE 802.3af or 802.3at. External power splitters or other devices shall not be necessary at the camera.
    - c. Except as noted below, the IP camera shall have the ability to generate video that complies with both of the following compression standards:
      - 1) MJPEG
      - 2) H.264 (MPEG-4 Part 10)
    - d. The IP camera shall have the ability to adjust the compression ratio setting for variable bit rate at a given video resolution. The IP camera shall also have the ability to provide for a constant bit rate by adjusting the compression ratio as motion or other factors increase.

- e. The IP camera shall provide for multi-streaming, with the capability to simultaneously generate no less than two streams of video. Each stream shall have, at a minimum, the following individually configurable settings:
    - 1) Compression technology
    - 2) Resolution
    - 3) Frame rate
    - 4) Compression ratio
  - f. The IP camera shall provide for selectable image aspect ratio of either 4:3 or 16:9.
  - g. The IP camera shall provide a setup utility that is accessible via a standard web browser such as Microsoft Internet Explorer® or Mozilla Firefox®.
  - h. The IP camera manufacturer shall publish a software developer's kit (SDK) and shall keep the SDK updated as camera software / firmware upgrades are made available.
  - i. The IP camera shall comply with Open Network Video Interface Forum (ONVIF) standards for video compression and streaming.
  - j. The IP camera shall allow for local storage of video on SD card or other removable local media. Local media shall comply with electronics industry standards and shall not be proprietary to the IP camera manufacturer. The camera shall be configurable to store video on the removable local media in the event of a network or recording server outage and shall have the ability to automatically upload the video to the recording server upon restoration.
  - k. All IP cameras shall incorporate a true progressive scan imaging device. Interlaced video signals with "deinterlacing" technology shall not be acceptable.
  - l. All IP cameras shall support both IPv4 and IPv6 protocols as defined by the IETF.
  - m. IP cameras intended for outdoor use shall be designed for the environmental conditions in which they are installed, or shall be installed in compatible housings that provide the appropriate environmental protection.
  - n. IP cameras installed in areas that experience low light conditions, such as poorly-lit outdoor areas, shall incorporate a day / night feature. The day / night feature shall detect when illumination levels drop below a certain threshold, and automatically switch the camera from color to black and white mode to provide for better video during low light conditions.
  - o. Provide with built in IR illuminator.
2. 2.1 MP resolution fixed IP camera
- a. Resolution: 1920x1080 pixels
  - b. Image sensor: 1/3" CMOS
  - c. Frame rate: Selectable up to no less than 30 IPS
  - d. Minimum required illumination: 0.3 lux
  - e. Wide dynamic range: >60 dB
  - f. Varifocal 3 to 9 mm
  - g. Acceptable Product
    - 1) Pelco
      - a) In-Ceiling IMPS219-1ERI (Type 1 C)
      - b) Surface IMPS219-1ERS (Type 1 S)
      - c) Pendent IMPS219-1ERP (Type 1 P)
3. 3.1 MP resolution fixed IP camera

- a. Resolution: 2048x1536 pixels
- b. Image sensor: 1/3" CMOS
- c. Frame rate: Selectable up to no less than 30 IPS
- d. Minimum required illumination: 0.3 lux
- e. Wide dynamic range: >60 dB
- f. Varifocal 3 to 9 mm
- g. Acceptable Product

1) Pelco

- a) In-Ceiling IMPS319-1ERI (Type 2 C)
- b) Surface IMPS319-1ERS (Type 2 S)
- c) Pendent IMPS319-1ERP (Type 2 P)

4. 5.0 MP resolution fixed IP camera

- a. Resolution: 2592x1944 pixels minimum
- b. Image sensor: 1/2.5" CMOS
- c. Frame rate: 10 IPS minimum
- d. Minimum required illumination: 0.3 lux
- e. Wide dynamic range: >60 dB
- f. Varifocal 3 to 9 mm
- g. Compression technology: H.264
- h. Acceptable Product

1) Pelco

- a) In-Ceiling IMPS519-1ERI (Type 3 C)
- b) Surface IMPS519-1ERS (Type 3 S)
- c) Pendent IMPS519-1ERP (Type 3 P)

5. 8.0 MP 180 Degree Fixed IP Camera

- a. Resolution: 2560x1800 pixels minimum
- b. IR Illumination
- c. Image sensor: CMOS
- d. Frame rate: 15 IPS minimum
- e. Minimum required illumination: 0.04 lux (Color) at F/1.8
- f. Dynamic range: 95 dB
- g. Compression technology: H.264
- h. Acceptable Product

1) Sentry360

- a) Surface DAVID 8180+ (Type 5 S)

6. 16 MP Fixed IP Camera

- a. Resolution: 3840 X 2160 pixels minimum
- b. Image sensor: 1/2 inch format.
- c. Frame rate: 12 fps
- d. Minimum required illumination:

- 1) Color (non-binned): 0.005 Lux: F1.4
  - e. Wide Dynamic range
    - 1) 70 db
    - 2) Dynamic Range shall not change based on configured encoding resolution
  - f. Lenses: 75mm-300mm
  - g. Compression technology: H.264
  - h. Acceptable Product:
    - 1) Avigilon (Type 6)
    - 2) Avigilon Enclosure ES-HD-CWS-LG
    - 3) Lens Cannon EF-70-300-HD-CA
7. 8.0 MP 360 Degree Fixed IP camera
  - a. Resolution: 2592x1944 pixels minimum
  - b. IR Illumination
  - c. Image sensor: CMOS
  - d. Frame rate: 12 IPS minimum
  - e. Minimum required illumination: 0.04 lux (Color) at F/1.8
  - f. Dynamic range: 95 dB
  - g. Compression technology: H.264
  - h. Acceptable Product
    - 1) Sentry360
      - a) On-Ceiling DAVID 3604-K+(Type 9 R)
      - b) Pendant DAVID 3604-K+(Type 9 P)
8. Elevator Cab Camera
9. PTZ IP camera
  - a. The PTZ IP camera shall provide for operable pan, tilt and zoom control manually by an operator, automatically through preset positioning, and via automated tours.
  - b. The PTZ IP camera shall meet all of the requirements defined in 1.a-n above.
  - c. The PTZ IP camera manufacturer shall at a minimum provide for the following mounting options:
    - 1) Wall-mount
    - 2) Parapet-mount
    - 3) Pendant ceiling-mount
    - 4) In ceiling-mount
    - 5) Corner-mount
  - d. HD 1080P resolution PTZ IP camera
    - 1) Resolution: 1920x1080 to 320x180 pixels
    - 2) Image sensor 1/2.8 Exmor CMOS
    - 3) Minimum illumination:
      - a) Color: 0.65 lux at 30 IRE F1.6

b) B/W: 0.20 lux at 30 IRE F1.6

- 4) Wide dynamic range: 80 dB
- 5) Preset pan speed: 280° / second
- 6) Preset tilt speed: 280° / second
- 7) Manual pan speed: 160° / second
- 8) Presets: 256 minimum
- 9) H.264 Video Stream
- 10) Acceptable Product:

- a) Pelco
- b) In Ceiling S5230-FW1 (Type 10-C)
- c) Pendant S5230-PG1 (Type 10-P)

10. Video analytics-enabled IP camera

- a. In addition to the above requirements, video analytics-enabled IP cameras shall analyze patterns within the video produced by the IP camera image sensor to detect specific pre-defined patterns or behaviors of subjects within the view of the camera.
- b. The video analytics-enabled IP camera shall have the capability to set rules for which behaviors are considered acceptable and those for which alarm conditions are generated.
- c. The video analytics-enabled IP camera shall be seamlessly integrated into the VSS software and detected analytics events shall be treated similarly to other system alarm or detection events.
- d. Video analytics-enabled IP camera shall contain sufficient processing power to perform analysis for all behaviors running on the camera.

I. Camera lens

- 1. Lens focal length shall be as necessary to provide the appropriate horizontal angular field of view.
- 2. The camera lens shall incorporate all glass optics and shall be of the correct format as necessary to match the associated camera.

J. Video encoder

- 1. The video encoder shall accept NTSC or PAL standard analog video from attached cameras, digitize the video, and compress the video to be streamed out over an attached network connection.
- 2. Video encoders shall be available in either single-channel or four-channel units.
- 3. Video encoders shall be available in both box enclosure and in rack card blade configurations. Box enclosures shall be listed by a testing agency for shelf- or rack-mounting. Rack card blades shall insert into an associated rack card cage. The rack card cage shall be equipped with a power backplane to provide power to each rack card blade. The rack card cage shall accommodate no less than three rack card blades.
- 4. Video encoders shall support MPEG-4 and MJPEG compression technologies. The video encoder shall have the capability to stream no less than two streams of video simultaneously. Each stream shall be individually configurable for compression technology, frame rate, and resolution.

5. Video encoders shall incorporate the ability to control attached analog PTZ cameras. The video encoder shall allow for PTZ control via either up-the-coax protocols or via separate standard serial communications.
6. Single-channel encoders shall be compatible with power over Ethernet (PoE) technology.
7. All encoders shall have the capability to stream video from all attached cameras at full 4CIF resolution (704x480 NTSC) at 30 IPS simultaneously.
8. Encoders shall support streaming of video at multiple resolution settings from 160x120 pixels to 704x480 pixels.

K. Camera power supplies

1. Power supplies shall be sized such that the connected load shall not exceed 80% of the rated current output of the power supply.
2. Interior camera rack-mount power supply
  - a. Camera power supplies shall take a 120/240VAC 50/60 Hz input and provide individually selectable 24VAC or 28VAC individually fused power outputs for analog cameras.
  - b. Power supply enclosure shall be a rack-mountable 1U chassis.
  - c. Power supply shall incorporate surge suppression to provide for protection of attached equipment.
  - d. Distribute connection to each power supply between fixed cameras and PTZ cameras so as not to exceed the overall power rating of the power supply.
3. Interior camera wall-mount power supply
  - a. Interior camera wall-mount power supplies shall take a 120/240VAC 50/60 Hz nominal input and shall output individually fused 24VAC power to analog cameras.
  - b. Power supply shall be housed in a wall-mount steel enclosure equipped with a key lock.
  - c. Distribute connection to each power supply between fixed cameras and PTZ cameras so as not to exceed the overall power rating of the power supply.
4. Exterior PTZ camera power supply:
  - a. PTZ camera power supplies shall accept 120/240VAC 50/60 Hz input and shall provide a single 24VAC output.
  - b. PTZ camera power supplies shall be housed within a NEMA-rated electrical enclosure rated for the conditions in which it is installed.
  - c. Provide PTZ camera power supplies as per the PTZ camera manufacturer's recommendations and / or requirements.

L. Digital displays

1. Digital displays shall provide for viewing of cameras attached to the system through the system software, either through client workstation computers, via analog video connected directly to the display, or through video decoders connected to the system.
2. Digital displays shall incorporate active matrix thin-film transistor (TFT) liquid crystal display (LCD) technology.
3. Digital displays shall be equipped with VESA compatible mounting hole patterns for compatibility with industry-standard mounting brackets.
4. 24" digital display

- a. Max resolution: 1920x1200 pixels
  - b. Brightness: 400 cd/m<sup>2</sup>
  - c. Contrast ratio: 1000:1
  - d. Aspect ratio: 16:9
  - e. Inputs: 2 – composite video, 1 – S-Video, 1 – DVI/HDMI
5. 60" digital display
- a. Max resolution: 1920x1080 pixels
  - b. Brightness: 500 cd/m<sup>2</sup>
  - c. Contrast ratio: 1300:1
  - d. Aspect ratio: 16:9
  - e. Inputs: 2 – composite video, 1 – S-Video, 1 – DVI/HDMI

M. Camera housing

- 1. Camera housings shall be used with box-style cameras to provide mechanical and environmental protection against tampering and the elements.
- 2. Camera housings shall be constructed of die-cast aluminum, extruded aluminum, high-impact ABS plastic, or a combination of the three.
- 3. Camera housings shall be equipped with an adjustable mounting facility to accommodate multiple different camera and lens sizes and weights.
- 4. Camera housings shall be equipped with a heater and blower motor for cameras installed outdoors in climates where temperatures are regularly lower than 0° C or higher than 35° C.
- 5. In outdoor areas where fine particulate dust is prevalent, camera enclosures shall be sealed and filled with pressurized inert gas to prevent dust entry.
- 6. Viewing window shall be constructed of clear Lexan® or equivalent.
- 7. Camera housings shall be securable with a key lock.
- 8. Camera housings shall be equipped with conduit knockouts for simple conduit connection using standard conduit fittings.
- 9. Camera housings shall be provided with the appropriate mount per the camera housing manufacturer's recommendations.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify final camera locations, desired views, and camera housing and mount requirements prior to installation.

#### 3.2 INSTALLATION

- A. Adjust all vari-focal lenses to provide the best field of vision. Anticipate returning to adjust each camera at least once to verify requirements for focus and field of view with the Owner's Representative.
- B. Adjust AGC to provide the best image resolution at each camera location.
- C. Adjust vertical phase calibration on analog cameras to ensure stabilization of video image.

- D. Back focus to optimize the focal range of each camera's viewing area.
- E. Provide programming of VSS/ACAMS interface for camera call-up on alarm in coordination with the Owner.
- F. Provide programming of camera tours as required in coordination with the Owner.
- G. Field-verify the exact location and positioning of all cameras with the Owner's Representative prior to installation.
- H. Provide ground isolation transformers as required to eliminate humbars and ground loops in analog video.
- I. Where POE power cannot be used for IP PTZ cameras provide a centrally located power supply. Exception is in locations where the PTZ is located over 300 ft from the central power supply. Provide a power supply adjacent to the PTZ camera location.
- J. Power all IP cameras via power over Ethernet (PoE) in accordance with IEEE 802.3af or IEEE 802.3at.
- K. Adjust digital displays to provide optimum viewing angle in coordination with the Owner.
- L. Program and configure VSS client workstations to provide multiplexed views as coordinated with the Owner.

### 3.3 PROGRAMMING

- A. Provide all initial system programming and setup of the VSS system including, but not limited to the following:
  - 1. Enrollment of all cameras, encoders, and other devices into the VSS software. Provide all necessary configuration of each device, including IP address, name, description, frame rate, compression ratio, resolution, and other required settings.
  - 2. Configuration of all rules-based actions within the system including setup of initiating events, and all resulting actions.
  - 3. Initial setup for the interface with the ACAMS. The interface shall provide for automatic VSS camera selection upon alarms within the ACAMS as specified herein and as indicated in the Contract Documents. Coordinate automatic VSS camera selection, real-time record initialization, and VSS record status alarm annunciation requirements with the Owner prior to programming.
  - 4. VSS software graphical maps and icons. Coordinate with the Owner's Representative to obtain AutoCAD architectural backgrounds for implementation as graphical maps. Import all AutoCAD background information provided by the Owner's Representative and produce a complete set of graphical maps depicting all VSS points.
  - 5. Automatic selection of a VSS camera adjacent to applicable card readers upon an invalid card use. Coordinate automatic camera selection requirements with the Owner prior to system programming.

### 3.4 COORDINATION

- A. Field-verify and confirm views with the Owner's Representative prior to final installation and adjust camera positions and lens sizes as required.
- B. Coordinate with the Owner's IT department for connection to the network, including IP addresses, VLAN setup, and other required network setup.

END OF SECTION 282310

## SECTION 283000 - FIRE DETECTION AND ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with provisions of Section 280500.
- B. Provide labor, materials, equipment and items of service required for completion of a functionally operative fire alarm system as described in subsequent parts of this section.
- C. Provide labor, materials, equipment and items of service required for completion of a functionally operative addition to the existing building fire alarm system as described in subsequent parts of this section. Provide new equipment to match existing equipment and operation of the existing system.
- D. Include in the bid the cost to furnish and install additional devices required by the Authority Having Jurisdiction during the final inspection. Provide this cost as a separate line item with the unit cost for each device. Turn over to Owner devices not installed at the end of the project with a credit for the installation. Include the following device quantities in the cost:
  - 1. 5 Manual pull stations.
  - 2. 10 Smoke detectors.
  - 3. 5 Heat detectors.
  - 4. 5 Duct smoke detectors with remote switches.
  - 5. 15 A/V devices or visual devices and speakers.
  - 6. 5 Monitor modules.
  - 7. 5 Control modules.

#### 1.2 RELATED WORK

- A. Section 213113: Electric Drive Centrifugal Fire Pump.
- B. Section 211313: Fire Suppression Sprinkler Systems.
- C. Section 233300: Air Duct Accessories.
- D. Section 230923: Building Automation and Direct Digital Controls.
- E. Division 11: Audio Visual Systems.
- F. Division 21: Fire Protection System Drawings.
- G. Division 22: Plumbing System Drawings.
- H. Division 23: Mechanical System Drawings.

### 1.3 SUBMITTALS

- A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:
  - 1. Product data sheets for system components highlighted to indicate the specific products, features or functions required to meet the specification.
  - 2. Complete conduit and wiring layout, point-to-point wiring diagram and riser diagram. Include location of all devices and FACP.
  - 3. System power and battery charts with performance graphs and voltage drop calculations to assure the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards and providing for a minimum of 10% spare capacity in each.
  - 4. Provide voltage drop calculations for signaling circuits.
  - 5. Select strobe candela rating to provide coverage per NFPA 72 Guidelines, ADA Accessibility Guidelines, and Manufacturer's recommendation.

### 1.4 TEMPORARY SYSTEM REQUIREMENTS

- A. Provide temporary fire alarm system coverage for the project area, new and demolition areas, as described herein. Install equipment before construction commences in any area and leave in service until construction is complete or until permanent fire alarm system is in place and operational.
- B. Coordinate with Owner the extension of existing fire alarm system for temporary coverage in renovated areas. In new construction, provide complete system with connection into existing building fire alarm system for reporting purposes.
- C. Provide manual stations, heat detectors or other fire alarm devices for temporary system as follows:
  - 1. One 135 degree heat detector for every 900 square feet (30 feet on center).
  - 2. Locate manual stations, at least one per area, such that the distance from any point within a construction area does not exceed 100 feet. Locate stations in readily accessible areas with preference given to the means of egress from the construction area. Relocate stations during the duration of construction as required to maintain ready access.
- D. Remove all fire alarm devices, wiring and raceways at the completion of construction. Heat detectors and other fire alarm devices shall be turned over to the Owner in good condition.

### 1.5 SYSTEM DESCRIPTION

- A. Provide a complete, non-coded, addressable, intelligent, microprocessor-based, reporting fire alarm system as indicated on the drawings and as specified herein, including but not limited to the following:
  - 1. Fire Alarm Control Panel (FACP).
  - 2. Initiation devices.
  - 3. Notification appliances.
  - 4. Emergency voice/alarm communications equipment.
  - 5. Monitoring and control devices.

6. Annunciators.
- B. Provide control panel with a resident, non-volatile, programmable operating system with the following:
1. Program with logic and supervision for closed loop initiating device circuits, individual alarm appliance circuits and operating power, both A.C. and standby power.
  2. Capability of storing and downloading a second set of operating software resident in the control panel as backup in case the primary operating software is corrupted while the system is operating.
  3. Capability of on-site programming to accommodate system expansion and facilitate changes in operation.
  4. Instructions stored in memory that will not be erased upon loss of primary and secondary power.
- C. Provide Fire Alarm Control Panel (FACP) with the following functions:
1. Alarms and trouble conditions that display immediately on the alphanumeric, liquid crystal display indicating the floor level, smoke compartment and device.
  2. A system alarm, red LED that flashes until alarm is acknowledged, after which it remains illuminated steadily until system is reset, unless another alarm is received. The alarm LED will flash again and a new description will appear on the liquid crystal display upon receipt of another alarm.
  3. A pulsing tone that sounds upon arrival of each alarm, until acknowledged.
  4. The ability to scroll through the alarms and troubles existing in the system on the LCD display.
  5. An "alarm list" key that displays, in sequence, all possible alarm, trouble and supervisory service control functions.
  6. A priority sequence for signals with fire alarm events having the highest priority. Subsequent alarm events will be queued in order received and will not affect existing alarm conditions. Second, third and fourth level priorities will be given to supervisory and trouble events respectively. Signals of higher priority take precedence over signals of lower priority even though the lower priority condition occurred first. Regardless of priority or order received, all events will be annunciated.
  7. A means to recall alarms and trouble conditions in chronological order for the purpose of creating an event history. Provide a separate alarm and trouble log with the capacity to store a minimum 300 alarms and 300 trouble events.
  8. A system printer that records all alarm, supervisory, and trouble events including type of signal, the device identification, date and time of occurrence.
  9. An alarm silence button that, upon acknowledgement of an alarm, silences the audible alarm signals while the visual alarm signals remains operating until the alarm is cleared. Upon receipt of a new alarm event, the system initiates the audible alarm signal again.
  10. A system reset button that returns the system to its normal state after the system verifies all circuits or devices are restored to avoid the potential for re-alarming the system. Display message "Alarm Present, System Reset Aborted." if system device is not restored.
- D. Provide FACP and system with smoke detector sensor self-checking, compensating and trouble indicating capabilities as follows:
1. Individually monitor smoke detector sensors for calibration, sensitivity, and alarm condition, and to individually adjust for sensitivity.
  2. Determine the condition of each sensor by comparing the sensor value to the stored values.

3. Maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
  4. Photoelectric smoke sensors with seven selectable sensitivity levels ranging from 0.2% to 3.7% programmed and monitored from the FACP.
  5. Printable sensor reports that meet NFPA 72 calibrated test method requirements that can be utilized for annual recording and logging of the calibration maintenance schedule.
  6. Continuous automatic self-test on each sensor that checks sensor electronics and ensures the accuracy of the values being transmitted. Upon test failure of any sensor, indicate a "Self Test Abnormal" trouble condition.
  7. Automatic indication when an individual sensor needs cleaning with three progressive levels of reporting as the sensor's average value reaches predetermined values. The progressive levels that will be reached if sensors are left unattended and corresponding system reactions are:
    - a. First level: indicates an "Almost Dirty" state without creating a trouble on the system.
    - b. Second level: indicates a "Dirty Sensor" condition that requires attention but that does not affect the sensitivity level required to alarm the sensor, creating a trouble on the system.
    - c. Third level: indicate an "Excessively Dirty Sensor" and a trouble condition shall be indicated on the control unit.
- E. Provide supervisory service initiation device circuits for control of sprinkler valve tamper switches as follows:
1. Label circuits for supervisory service and visually and audibly differentiate between tamper switch activation and wiring faults.
  2. Upon activation illuminate supervisory service LED and sound audible signal.
  3. Upon depressing acknowledge switch, silence the audible and maintain the LED until valve has been returned to normal position.
- F. Provide Emergency Voice/Alarm Communication capabilities integral to the FACP or within a separate cabinet as indicated. System capabilities to include:
1. Alarm/evacuation signal generation with multiple built-in tones, digitally pre-recorded voice messages, and/or manual voice communications.
  2. Automatic or manual control of voice messaging.
- G. Wiring for the system shall conform to the following criteria:
1. Provide Class B, Style 4 signaling line circuits (SLC) for initiating devices with minimum one isolation module per floor. Design the system with the appropriate number of SLC's so that on any floor, the quantity of initiating devices can be increased by 25% without adding a circuit.
  2. Provide Class B, Style Y notification appliance circuits (NAC) for speakers and visual strobe units as follows:
    - a. Wire speakers and strobes on separate circuits.
    - b. Dedicate each NAC to the floor it serves (except in stairwells).
    - c. Design the system so that the number of notification appliances can be increased by 25% on each floor without adding a circuit.

- d. Provide "survivability" of circuits per NFPA 72 by protecting circuits that serve multiple evacuation signaling zones. The evacuation signaling zones match the building smoke compartment zones. Methods considered acceptable as meeting the survivability requirements include using a 2-hour rated cable or cable system or by installing circuits in a 2-hour rated chase. Circuits or portions of circuits that serve a single evacuation signaling zone do not have to meet this requirement.
- H. Provide secondary power supply with battery backup in accordance with NFPA 72:
1. Provide sufficient capacity to operate the fire alarm system under quiescent load (system operating in non-alarm condition) for a minimum 24 hours and at the end of that period be capable of operating all alarm notification appliances for 5 minutes.
  2. Provide sufficient capacity to operate the emergency voice/alarm system under quiescent load (system operating in non-alarm condition) for a minimum 24 hours and at the end of that period be capable of operating the system under an emergency condition for a period of 15 minutes at maximum connected load.

## 1.6 SYSTEM OPERATION

- A. Initiate an alarm condition on the fire alarm system when one or more of the following devices or inputs are activated:
1. Manual pull station.
  2. Ceiling mounted smoke and heat detectors.
  3. Duct mounted smoke detectors in the supply and return ducts of air handling units.
  4. Projection beam detectors.
  5. Duct mounted smoke detectors in the supply and return ducts of air handling units and at each damper.
  6. Sprinkler system water flow switch.
  7. Preaction sprinkler system.
- B. Immediately perform the following alarm sequence when an alarm condition is activated on the system:
1. Annunciate on the fire alarm system identifying the floor level, smoke compartment, room number and specific device(s) in alarm. (The room number used for identification shall be the room number assigned by the Owner and not necessarily the room number indicated on the floor plans. Coordinate the device description with the Owner.)
  2. Initiate a general fire alarm activating all audio/visual appliances.
  3. Signal central monitor station (without time delay).
  4. Initiate a pre-signal timing function for occupant notification.
  5. Close doors throughout the facility held open by electric door holders and deactivate all smoke barrier power operated doors.
  6. Unlock all egress doors that are electrically locked via a security or other system.
- C. Interface fire alarm system with the HVAC system such that when any device except a manual pull station activates an alarm condition, the following occurs in addition to the actions listed above:
1. Shut down supply and return fans serving the affected smoke compartment.
  2. Close smoke dampers in the affected air handling systems.
  3. Initiate smoke control sequence in accordance with Division 23.

4. Shutdown systems 2000 cfm and less that serve egress corridors upon alarm in the respective smoke compartment.
- D. Provide a monitor module for each disconnect switch associated with smoke control system fans. Interlock modules with auxiliary contacts of disconnect switches such that a trouble indication is received when disconnect switch is placed in the open position.
- E. Provide an addressable initiating circuit for one manual station to be located in the fire command room. Perform the following functions upon activation of this manual station:
  1. Initiate a general fire alarm occupant notification (without time delay).
  2. Signal central monitor station (without time delay).
  3. Annunciate on the fire alarm system identifying that manual station operation.
- F. Provide an elevator lobby smoke detector zone. When one or more detectors sense smoke, send a signal to the FACP to perform the following functions:
  1. Initiate a general fire alarm and perform all other functions outlined above for ceiling mounted smoke detectors.
  2. Flash a lighted sign in the associated elevator lobby that reads "DO NOT USE ELEVATOR". (Provide this sign under Division 26). (OPTION)
  3. Flash a lighted sign in the associated elevator lobby that reads "DO NOT USE ELEVATOR". (This illuminated sign furnished by other divisions and connected under Division 26). (OPTION)
  4. Initiate elevator recall sequence to automatically return elevators to a designated floor, where doors open and remain open until a fireman captures the elevator with a key in the elevator cab. Refer to Division 14 for designated return levels.
  5. Upon activation of lobby detectors on the designated floor, initiate the elevator recall to automatically return the elevators to an alternate floor (specified in Division 14) other than the designated floor, where the doors open and remain open until the fireman captures the elevator with a key in the elevator cab. Verify the location of the alternate floor prior to programming.
  6. Start elevator shaft pressurization fans (if installed).
- G. Provide a separate elevator equipment room smoke detector zone. Upon activation of one of these smoke detectors, send a signal to the FACP to perform the following functions:
  1. Initiate all other functions described above for elevator lobby smoke detectors.
  2. Open the smoke damper(s) at elevator hoist way.
- H. Provide a separate elevator equipment room heat detector zone with a 180 degree heat detector placed adjacent to and within 12 inches of each sprinkler head in the machine room. (Refer to Sprinkler shop drawings for exact number.) Upon activation of a heat detector, send a signal to the FACP to perform the following functions:
  1. Initiate all other functions described above for ceiling mounted heat detectors.
  2. Interrupt power to all elevator equipment within the elevator equipment room.
- I. Where a motor operated damper is installed to vent the hoist way, provide a separate elevator hoist way smoke detector zone.
  1. Locate smoke detector at the top of each common shaft hoist way.

2. Upon activation of a smoke detector in this zone, initiate the same functions as described above for the elevator equipment room smoke detectors.
- J. If hoist way is sprinklered, provide a separate elevator hoist way heat detector zone.
1. Install a 180 degree heat detector placed adjacent to and within 12 inches of each sprinkler head in the elevator shaft. Where sprinkler heads are installed in the bottom of the hoist way, install heat detectors 26 inches or more above the elevator pit floor.
  2. Upon activation of a heat detector in this zone, initiate the same functions as described above for the elevator equipment room heat detectors.
- K. Provide smoke detectors located within 5 feet of both sides of fire rated roll-up windows and doors. Automatically close the window or door upon activation of the adjacent detectors only, using one set of "dry" contacts in the door holding circuit and initiate a general alarm through a second set of "dry" contacts. No other alarm source will cause the roll-up window or door to close.
- L. Initiate a trouble tone and illuminate an LED light on the FACP to indicate a trouble condition under the following conditions:
1. System wiring short circuit, open circuit or short to ground condition.
  2. Failure of audio amplifier.
  3. Failure of tone-generating equipment.
  4. Failure of primary or secondary power supply.
  5. Missing or failed initiating device.
- M. Initiate a supervisory tone and illuminate an LED light on the FACP to provide supervision of each distinct device under the following conditions:
1. Activation of a sprinkler valve status switch.
  2. Activation of a sprinkler post indicator valve.
- N. Provide supervision and indication for certain non-system equipment on the FACP. Provide necessary relays with dry contacts at the equipment and monitor modules for the following points:
1. Fire pump running.
  2. Fire pump loss of phase (loss of power on any phase at the line terminals of the motor contactor).
  3. Fire pump phase reversal.
  4. Fire pump controller connected to Alternate Power Source.
  5. Elevator shunt-trip power "ON".
  6. Smoke control system fan is running (i.e.: smoke removal, stair pressurization, etc.).
  7. Smoke control system fan disconnect is in the "open" position.
- O. Provide a Digital Alarm Communicator Transmitter (DACT) for signaling the central monitoring service that an alarm, trouble or supervisory alert condition exists at the facility. Provide equipment with the following:
1. UL listing for fire reporting to a Central Station and meet performance requirements of NFPA 72.
  2. Battery backup.
  3. Supervise wiring from the FACP to the DACT.

- P. Coordinate the connection of the fire alarm panel with the Audio System Installer. Provide one set of "dry" contacts in FACP and circuiting to the Audio System so that the Fire Alarm system is capable of "capturing" audio system speakers for pre-recorded or live message transmission. Provide audio feed from FACP to Audio System. Upon any fire alarm, send a "power up" signal to the audio system sequencer to activate system if it is powered down when not in use.
- Q. Automatic Occupant Notification Sequence:
  - 1. Upon initiation of pre-signal timing sequence, allow 90 seconds to acknowledge and 3 minutes to clear. These time settings are subject to approval of AHJ, adjust accordingly.
  - 2. Transmit visual signal and pre-recorded voice evacuation message or override with live voice evacuation message to affected zone if first alarm is not cleared, or
  - 3. Upon activation of fire alarm occupant notification, signal emergency low voltage relay cabinets to bring all emergency circuits to "on" position. OPTION (If seating bowl dimming system alternate is selected, dimming cabinets shall bring all circuits to "full on" setting).
- R. Upon initiation of alarms in zone(s) with power operated doors in rated walls, send these doors a signal to disable automatic operation and to release any specific locking function. Coordinate with door hardware schedule and specifications.

## 1.7 QUALITY ASSURANCE

- A. Comply with applicable sections of NFPA 72; locally enforced code requirements and NEC article 760 for equipment and installation.
- B. Provide all materials for the fire alarm system s listed as a product of a SINGLE fire alarm system manufacturer, bearing the UL label. Provide all control equipment listed under UL Category UOJZ as a single control unit. Partial listing is NOT acceptable.
- C. Provide transient voltage protection for all control equipment to comply with UL 864.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Following are approved manufacturers:
  - 1. Simplex.
  - 2. EST.
  - 3. Cerberus/Pyrotronics.
  - 4. Notifier.
  - 5. Honeywell.
  - 6. Johnson Controls.

### 2.2 EQUIPMENT

- A. Fire Alarm Control Panel: Provide FACP with the following functions, components and characteristics:

1. UL 864 compliance.
2. Microprocessor based Central Processing Unit (CPU) and power supply in a single cabinet.
3. Lockable steel enclosure with a transparent door panel that prevents tampering while giving full view of controls and alarm lights. Provide door that is site configurable for right or left hand hinging. Where multiple cabinets are required to form a complete control unit, provide matching modular unit enclosures.
4. Power supplies: 24VDC output, sufficient to supply 24VDC to all the fire alarm system equipment connected to the system.
5. Support for five RS-232-C ports and one service port with each RS-232-C port capable of supporting multiple, remote TFT plasma displays or printers.
6. Include operator controls that are accessible behind the "see through" access door as follows:
  - a. 80 character alphanumeric, LCD display.
  - b. Red system alarm LED, separate yellow supervisory service and trouble LEDs, and a green power on LED.
  - c. Acknowledge Switch that silences the local panel audible alarm when alarm is acknowledged.
  - d. Alarm Silence Switch that silences the general audible alarms throughout the building while keeping the visual alarms active until the system status returns to normal.
  - e. Alarm Activate (Drill) Switch that manually activates all notification appliance circuits.
  - f. System Reset Switch that causes all initiating devices, appliances or software zones, as well as all associated output devices and circuits to return to their normal condition.
  - g. Lamp Test Switch that activates all local system LEDs and light all segments of the liquid crystal display.
  - h. Local City Loop Disconnect Switch that allows testing of the system without sending alarms to the central alarm station.
  - i. An alpha numeric keypad with easy touch rubber keys for field programming.
7. Provide FACP with capacity sufficient to accommodate the system defined by the contract drawings and these specifications. Include necessary provisions in the power supplies, batteries and system capacities for 25% spare capacity of monitor/control points and annunciation points without requiring the addition of expansion cards, power supplies, batteries, etc.
8. Emergency Voice/Alarm system: Provide emergency voice/alarm system integral to the FACP with the following:
  - a. Alarm/evacuation signal generation with multiple built in tones.
  - b. Standard or customized digital message storage and message generation.
  - c. Multiple digitally recorded human voice messages.
  - d. Automatic or manual operations of pre-recorded messages as well as a microphone for live messaging from operator.
  - e. Fully supervised NAC speaker circuits that can be manually turned on, off or disabled. Each circuit shall include a custom label to identify its location.
  - f. Local panel speaker for message broadcast verification.

B. Smoke Detectors

1. Photoelectric smoke detectors: intelligent (analog) and addressable, utilizing the photoelectric light-scattering principle to measure smoke density. Furnish with the following:
  - a. LED's that provide dual alarm and power indication. LED's flash green under normal conditions, indicating that the detector is operational and in regular communication with the FACP. LED's produce a steady red light when an alarm condition has been detected.
  - b. Ability to operate a remote alarm LED, an auxiliary relay or an audible base.
  - c. Magnetically actuated test switch to provide for easy alarm testing at the detector location.
  - d. Where called for on drawings, provide detector with an integral, resettable, thermistor-based, 135 degree Fahrenheit fixed-temperature heat detector.
2. Ionization smoke detectors: intelligent (analog) and addressable, utilizing the dual-chamber ionization principle to measure products of combustion, sending data to the panel representing the analog level of products of combustion on command from the FACP. Furnish with the following:
  - a. LED's that provide dual alarm and power indication. LED's flash green under normal conditions, indicating that the detector is operational and in regular communication with the FACP. LED's produce a steady red light when an alarm condition has been detected.
  - b. Ability to operate a remote alarm LED, an auxiliary relay or an audible base.
  - c. Magnetically actuated test switch to provide for easy alarm testing at the detector location.
3. Duct mounted smoke detectors: intelligent (analog) and addressable, utilizing the photoelectric light-scattering principle to measure smoke density. Furnish with the following:
  - a. Sampling tubes of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.
  - b. Air duct housing designed for detection of smoke in HVAC ducts in accordance with NFPA 90. Provide with two test ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test activation of the duct smoke detector.
  - c. A supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A @ 28VDC or 1/2 A @ 120VAC. This auxiliary relay operates when the detector reaches its alarm threshold. Mount relay within 3 feet of the HVAC control circuit.
  - d. LED's that provide dual alarm and power indication. LED's flash green under normal conditions, indicating that the detector is operational and in regular communication with the FACP. LED's produce a steady red light when an alarm condition has been detected.
  - e. A remote test station with an alarm LED and test switch.
  - f. UV stabilized plastic weatherproof duct housing with a NEMA 4X rating for use where detectors are installed on ducts located outside on the roof or otherwise. Housing shall circulate conditioned air from duct to maintain detector housing at rated temperature range. Install duct housing per manufacturer's instructions, providing additional ventilated, sheet metal canopy where the housing is mounted in direct sunlight.

4. Beam smoke detectors: intelligent (analog) and addressable, utilizing a transmitter and receiver to project an infrared beam that is monitored by the receiver to determine smoke obscuration. Furnish with the following:
  - a. LED's that provide dual alarm and power indication. LED's flash green under normal conditions, indicating that the detector is operational and in regular communication with the FACP. LED's produce a steady red light when an alarm condition has been detected.
  - b. Coverage of distances up to 300 feet.
  - c. Remote LED status indicator panel with remote test switch for each detector.
- C. Heat detectors: intelligent (analog) and addressable, rated for 135 degrees Fahrenheit or 200 degrees Fahrenheit with a rate-of-rise element rated at 15 degrees Fahrenheit per minute. Furnish with the following:
  1. Automatic reset.
  2. Ability to operating a remote alarm LED, an auxiliary relay or an audible base.
  3. Utilize 200 degree heat detectors in spaces with high ambient temperatures such as boiler rooms. Provide a remote module located where ambient temperature is lower and within recommended operating range of the addressable module.
- D. Manual Pull Stations: Provide with the following:
  1. Double action operation.
  2. Red LEXAN or metal finished in red with molded, raised-letter operating instructions of contrasting color. Use metal pull stations where subject to damage.
  3. Station to mechanically latch upon operation and remain so until manually reset with a key common with the control units.
  4. Provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations where called for on drawings. Include a battery powered piercing warning horn to activate when shield is lifted to gain access to the station. Lowering and realigning the shield will silence the horn. Provide horn with 85dB at 10 feet and 9V battery operation.
- E. Addressable Circuit Interface Modules: individually addressable, utilized to monitor and/or control system components that are not otherwise equipped for addressable communication.
  1. Monitor modules shall supervise and monitor the status of non-addressable devices with normally open dry contacts. Module shall communicate device status (normal, alarm, trouble) to the FACP.
  2. Control modules shall supervise and control the operation of auxiliary devices. Module shall provide double pole, double throw relay switching for 2 amp @30 VDC resistive power limited and at 1/2 amp @120 VAC resistive, non-power limited. It shall contain easily replaceable 2 amp fuses, one on each common leg of the relay.
  3. Modules to be capable of mounting in a standard electric outlet box with cover plates to allow surface or flush mounting.
  4. Modules shall receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
  5. All circuit interface modules shall be supervised and uniquely identified by the control panel. Modules shall have an on board LED to provide indication that the module is powered and communicating with the FACP.
- F. Alarm Notification Appliances

1. Combination Audible/Visual Devices. Provide UL 1480 listed device with the following:
    - a. Red, impact resistant and flame retardant thermoplastic covers.
    - b. High quality voice and tone reproduction, 4" speaker with matching transformer having taps for 1/4, 1/2, 1 or 2 watts at 25 or 70.7 VRMS input.
    - c. Xenon flash tube and associated lens/reflector system with different flash intensities of 15, 15/75, 30, 75 and 110 candela. Furnish with a visible label inside the lens to indicate the listed candela rating.
  2. Ceiling Speaker (Voice capable). Provide UL 480 listed device with the following:
    - a. Eight inch diameter single voice coil loudspeaker with dual (whizzer) cone and 10 oz. ceramic magnet.
    - b. Fire-retardant and moisture-proof cone with factory mounted multi-tap transformer and DC blocking capacitor for line supervision.
    - c. Frequency response of 85 HZ - 8 kHz, +5 dB, power rating of 10 watts, 8 ohm impedance, and a sensitivity of 97 dB peak at 1 watt and 10 feet.
    - d. Standard round, white grille and a companion enclosure of welded CRS construction, finished in textured black epoxy, and be undercoated to guard against acoustical and mechanical resonance.
    - e. Mounting brackets capable of transferring the combined weight of the loudspeaker assembly to the ceiling support members via adjustable rails. Enclosure shall be
  3. Visual Only Strobes. Provide UL 1971 listed device with the following:
    - a. Xenon flash tube and associated lens/reflector system.
    - b. Provide with different flash intensities of 15, 15/75, 30, 75 and 110 candela.
    - c. Provide a visible label inside the lens to indicate the listed candela rating.
    - d. Mount with red, impact resistant and flame retardant thermoplastic cover.
    - e. Wall or ceiling mounted as show on drawings with the "FIRE" lettering oriented for easy reading.
  4. Combination Horn/Visual Devices. Provide UL 1480 listed device with the following:
    - a. Red, impact resistant and flame retardant thermoplastic covers.
    - b. Electronic horn with loud, penetrating output. Sound output @ 24 VDC equal to 85 dBA @ 10 ft. for reverberant room test and 93 dBA @ 10 ft. for anechoic chamber test.
    - c. Xenon flash tube and associated lens/reflector system with different flash intensities of 15, 15/75, 30, 75 and 110 candela. Furnish with a visible label inside the lens to indicate the listed candela rating.
- G. Magnetic Door Hold Devices. Provide UL 228 listed device with the following:
1. Wall or floor mounting as indicated on drawings, complete with matching doorplate.
  2. 24VDC operation (unless otherwise required by the system) developing a minimum of 25 lbs. holding force.
- H. Isolator Module
1. Provide modules to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch, limiting the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch.

2. Provide at least one isolator module for each floor or protected zone of the building.
3. Provide automatic disconnection of the SLC when a wire-to-wire short occurs with automatic reconnection of the isolated section and when the short circuit condition is corrected.

I. Remote Monitors and Printers

1. Monitors
  - a. Provide a minimum 17", full color, TFT plasma display units with 1024 x 1024 resolution and a keyboard.
  - b. System status, system history or analog sensor status, service or history logs to be viewable on the display.
  - c. Provide password-protected status command line mode to allow user to perform disable/enable functions from the keyboard.
2. Remote printer: High-resolution 24-pin dot matrix type that is listed and labeled as an integral part of the fire alarm system.

J. Remote LCD Annunciator:

1. Primary Acknowledge, Silence, Reset Keys, Status LEDs and LCD display similar to the FACP.
2. Minimum two lines of 40 characters each and four programmable control switches and associated LEDs.
3. Operator keys shall be keyed switch enabled to prevent unauthorized use.
4. Furnish and install a remote annunciator at each location indicated on drawings to annunciate smoke detectors located in rooms by device type, device number and room number. Include an 80 Character LCD readout, an audible alarm device with audible silence switch. Reset smoke detectors at the FACP.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system. Manufacturer's representatives to be available on a 24-hour basis within 150 miles of this project.
- B. Provide system complete, in accordance with drawings, specifications and with manufacturer's instructions, including conduit, boxes, wiring and accessories.
- C. Device labeling:
  1. Coordinate all system programming, including device descriptors, with Owner in advance. Submit final programming for approval prior to implementation.
  2. Label all initiating devices and associated remote indicating devices with the specific descriptor of that device. Coordinate with Owner for proper descriptors of each device. Provide a minimum 3/8-inch high lettering, located on device so it is visible from the ground.

D. Wiring Installation

1. Install wiring in conduit and tag wires at junction points.
2. Obtain from Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. Make no deviation from the written instructions without prior written approval from the Fire Alarm System manufacturer and engineer of record.
3. Color-code fire alarm conductors differently from normal building power wiring. Use one color code for alarm initiating circuit wiring and a different color code for supervisory circuits. Color code notification appliance circuits differently from alarm initiating circuits.
4. Install wiring to central station transmitter in a 1 inch conduit from FACP to the central station transmitter connection. Install the quantity of conductors and electrical supervision for connecting wiring as required to suit the central station monitoring function.
5. For each exterior circuit, in addition to the number of panel wires required, provide a green grounding conductor for operation of transient protection cube. Obtain ground at panel nearest to the point of cube application, but in no case exceed 28 feet of wire length.
6. Provide a dedicated emergency power, 120 volt circuit to power the FACP and DACT. Provide a red marking on the circuit breakers for these circuits and identify them as "Fire Alarm Circuit".

E. Provide on-premise warranty service during normal working hours at no cost for a period of twelve months from date of completion and acceptance.

F. Smoke detectors:

1. For addressable smoke detectors, permanently write the address in the base so that it is visible with the smoke head removed, where the address is contained in the smoke head.
2. Mount ceiling smoke detectors no less than 3 feet from a supply, return or exhaust air diffusers, and 3 feet from electronic ballasts. Coordinate with division 15 for diffuser locations.

G. Duct mounted smoke detectors:

1. Provide duct smoke detectors as specified on Division 23 drawings for HVAC supply, return and exhaust fans and ducts. Refer to Division 23 drawings for location and quantities.
2. Install duct smoke detectors in the supply air stream of an air handling unit downstream of filters and at least 6 feet from humidifier, preferably upstream.
3. Install duct smoke detectors within 5 feet of smoke dampers where required.
4. Install duct smoke detectors in the return air stream of an air handling unit on upstream side of outside air inlet.
5. Furnish and connect duct detectors under this Division but install them under Division 23.
6. Support sampling tube within the duct and extend at least 3/4 of the distance across the duct.
7. Mount detectors the appropriate distance from ells, turns, etc. as required by the detector manufacturer.
8. Where duct detectors are mounted above ceilings or above 6 feet in mechanical rooms, provide remote LED alarm light and test switch in ceiling close to detector or surface mounted on an adjacent wall of mechanical room.

H. Alarm Devices:

1. Wire flashing lights separately from audible alarms. When alarm signal is silenced, lights shall continue to flash until the condition responsible for the system alarm has been cleared and reset.
2. Provide synchronized visual devices throughout project.
3. Comply with ADA regulations for mounting of strobe units. Depending upon the configuration of the strobe unit, utilize mounting requirements as follows:
  - a. Mount strobe unit 80 inches to bottom of the device faceplate, measured from the highest floor level of area served, and
  - b. Entire lens shall not be less than 80 inches or greater than 96 inches above the finished floor.
4. Locate visual alarm devices in sleeping rooms no more than 16 feet from the head of the bed, a minimum of 24" below the ceiling with a rating of 110cd.
5. Locate visual alarm devices in corridors per the plans but no more than 15 feet from the end of a corridor or an interruption of the viewing path such as a corridor door or an elevation change. Locate devices in corridors no more than 100 feet apart.

I. Water Flow and Tamper Switches:

1. Assign a separately addressable, supervised point and annunciate separately each water flow switch and each valve tamper switch.
2. Connect sprinkler water flow switches, provided under Division 21, to the fire alarm system. Refer to Division 21 drawings for location and quantity of flow switches.
3. Install a valve status switch, furnished under Division 21, on each sprinkler system valve and PIV (Post Indicator Valve). Refer to plumbing drawings and sprinkler system shop drawings for exact location and quantity of valve status switches and PIV switches.

J. System is to automatically actuate certain control functions and monitor or supervise points. Electrically supervise wiring to auxiliary fire alarm relays used to activate such functions or monitor/supervise points. Locate relays within 3 feet of the device controlled, such as a motor starter. Functions for which circuits are to be supervised include, but are not limited to, the following:

1. Release of door hold-open devices.
2. Shutdown of selected HVAC systems or activation of smoke control systems.
3. Elevator shunt trip power.
4. Audio system "power up" and control.
5. Elevator hoist way pressurization.
6. Sprinkler valve status switches.
7. Air pressure status on dry-pipe systems.
8. Disconnect switch position on smoke control equipment.

### 3.2 TEST AND CERTIFICATION

- A. Provide a 10 day minimum notice in writing when the system is ready for final acceptance testing. Send notice after pre-testing has been completed to confirm that the system conforms to the drawings and specifications and malfunctioning or damaged devices have been replaced.
- B. Test completed fire alarm system in the presence of Owner's representative and the AHJ. After test, certify test was completed, deficiencies were corrected and system performs as specified.

- C. Upon completion of smoke detector installations, test each detector's sensitivity and compare the installed sensitivity with that recorded at the factory when the detector was manufactured and shipped. Replace detectors that test out of limits. Prepare a typewritten tabulation of these tests along with name and signature of tester. Include the following information:
  - 1. Smoke detector descriptor.
  - 2. Smoke detector location in the project.
  - 3. Sensitivity value - field test.
  - 4. Sensitivity value - factory test.
  - 5. Within limits - "yes" or "no".
- D. Provide the services of a factory authorized service representative to demonstrate the system and train the Owner's maintenance personnel. Include procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintenance of the system in the training. Provide a minimum of 16 hours of training. Schedule training with the Owner at least 14 days in advance.
- E. Test system in accordance with the procedures outlined in NFPA 72.
- F. Completion Documents
  - 1. Furnish a written record of inspections, tests, and detailed test results in the form of a test log.
  - 2. Prepare the "Fire Alarm System Record of Completion" document per NFPA 72.
  - 3. Upon final acceptance furnish the following to the Owner's representative:
    - a. "Record of Completion" document.
    - b. Owner's manual and installation instructions covering all system equipment.
    - c. Record drawings.

END OF SECTION 283000

## SECTION 311000 – SITE CLEARING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing groundcovers, plants, and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion and sedimentation control measures.

#### 1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site-clearing operations until temporary erosion and sedimentation control measures are in place.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.

- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

### 3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.

### 3.5 CLEARING AND GRUBBING

- A. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of eight inches and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

### 3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

### 3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 312000 – EARTH MOVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

#### 1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC), latest edition and supplements for rock materials. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

#### 1.3 REFERENCES

A. This specification section has been prepared using the project soils report "Preliminary Geotechnical Investigation Report, Proposed Gymnasium Training Center and Office Complex, Northwest Corner of Douglass Street and Mariposa Avenue, City of El Segundo, California" by Albus-Keefe & Associates, Inc. dated June 9, 2014 as a reference.

#### 1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Classified Excavation: Removal and disposal of materials not defined as rock

- F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- H. Fill: Soil materials used to raise existing grades.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- K. Unclassified Excavation: Removal and disposal of materials encountered regardless of nature of materials, including rock.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.5 PROJECT CONDITIONS

- A. Examine site, Drawings, records of existing utilities and construction, record of test borings, and subsurface exploration report available from Owner. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

#### 1.6 PROTECTION

- A. Soils Consultant: A geotechnical consultant shall advise on Construction techniques involved in work, including design, checking and approving of temporary bracing, sheeting, shoring, underpinning and other items pertinent to work, and encountered during prosecution of work. Consultant shall be primarily concerned with construction methods, which will prevent settlement or damage to surrounding structures, sidewalks, embankments, utilities and roads on Owner's property and adjoining properties.
- B. Existing Utilities:
  - 1. Maintain existing utilities that are to remain in service. Before excavating over or adjacent to existing utilities, notify utility Owner to ensure protective work will be coordinated and performed in accordance with utility Owner's requirements. If existing service lines, utilities and utility structures, which are to remain in service, are uncovered or encountered during these operations, safeguard and protect from damage.

2. Within limits of excavation, remove existing piping, subsoil drainage systems, conduit, manholes and relocated items, which are to be abandoned. Plug open ends of utilities to remain with concrete.
  3. Re-route existing subsoil drains which obstruct work around new constructions, or incorporate them into new drainage systems.
  4. Consult Architect immediately for directions, should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with Owner and public and private utility companies in keeping their respective services, utilities and facilities in operation. If damaged, repair utilities to satisfaction of Architect and utility Owner.
- C. Existing Facilities: Protect and maintain in satisfactory manner, existing pavements, curbs, gutters, structures, conduits, fences, walls and other facilities to remain above and below grade. Restore facilities damaged by construction operations.
- D. Pumping and Draining: Excavate areas in such manner as to afford adequate drainage. Control grading in vicinity of excavated areas so ground surface will slope to prevent water running into excavated areas. Until work is completed, remove water from areas of construction that may interfere with proper performance of work or that may result in damage to the soil sub-grade and provide sumps, pumps, well points, electric power and attendance required for this purpose on a 24 hour basis if necessary. Protect construction from water during construction, including prevention of erosion of completed work during construction and until permanent drainage and erosion controls are operational. Repair adjoining properties, facilities and streets damaged due to improper protection.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Sand, gravel, friable earth, or non-expansive clays, subject to Testing Laboratory's approval. Fill and backfill material shall be free of organic material, slag, cinders, expansive soils, trash or rubble and stones having maximum dimension greater than four inches.
- C. Unsatisfactory Soils: Expansive and other soils as defined in the project's geotechnical investigation report.
1. Unsatisfactory soils also include satisfactory soils not maintained within two percent of optimum moisture content at time of compaction.
- D. Base Course: Material conforming to SSPWC section 200-2.2, Crushed Aggregate Base or SSPWC section 200-2.4 Crushed Miscellaneous Base.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a one and one-half-inch sieve and not more than 12 percent passing a No. 200 sieve.

- F. Bedding Course: Crushed rock conforming to SSPWC Section 200.1-2 and Table 306-1.2.1.3 (B) for non-flexible pipes. Clean coarse sand conforming to SSPWC Section 200-1.5.5 for flexible pipes.
- G. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a one and one-half-inch sieve and zero to five percent passing a No. 8 sieve.

## 2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six inches wide and four mils thick, continuously inscribed with a description of the utility. Color coding shall be according to the American Public Works Association (APWA) standards:
  - 1. Blue – Potable water and fire suppression lines.
  - 2. Green – Sanitary sewer and storm drain lines
  - 3. Orange – Communication, alarm or signal lines
  - 4. Purple – Reclaimed water, irrigation, and slurry lines
  - 5. Red – Electrical power lines, cables, conduit and lighting lines
  - 6. Yellow – Gas, oil, steam, petroleum, or gaseous material lines.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing".
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing" during earthwork operations.

### 3.2 EXCAVATION

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

### 3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus one inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

### 3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide six-inch clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. Excavate trenches six inches deeper than elevation required in rock or other unyielding bearing material, four inches deeper elsewhere, to allow for bedding course.

### 3.6 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 pounds per square inch (psi), may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

### 3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section Cast-in-Place Concrete.
- D. Provide four-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of four inches of concrete before backfilling or placing roadway base.
- E. Place and compact initial backfill of satisfactory soil, free of particles larger than one inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Install warning tape directly above utilities, minimum six inches above top of pipe, minimum 12 inches below finished grade, except six inches below subgrade under pavements and slabs.

### 3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than one vertical to four horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use engineered fill.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.

### 3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within two percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by two percent and is too wet to compact to specified dry unit weight.

### 3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material to 95 percent.
  - 2. Under walkways, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill soil material to 90 percent.
  - 3. Under lawn or unpaved areas, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill soil material to 90 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material to 90 percent.

### 3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus one inch.
  - 2. Walks: Plus or minus one inch.
  - 3. Pavements: Plus or minus one-half inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of one-half inch when tested with a 10-foot straightedge.

### 3.14 BASE COURSES

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
  - 1. Shape base course to required crown elevations and cross-slope grades.
  - 2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.15 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Place drainage course that exceeds six inches in compacted thickness in layers of equal thickness, with no compacted layer more than six inches thick or less than three inches thick.
  - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### 3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

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## SECTION 320190 - LANDSCAPE MAINTENANCE

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Work Specified in this Section: Furnish all labor, material, equipment, and services required to maintain the landscape in an attractive condition as specified herein for a period of 90 calendar days.
- B. Related Work Specified in Other Sections:
  - 1. Section 328400: Landscape Irrigation
  - 2. Section 329000: Landscape Planting
- C. Definition: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

#### 1.2 QUALITY ASSURANCE

- A. The Contractor's representatives and employees shall be experienced in landscape maintenance.

#### 1.3 90 CALENDAR DAY MAINTENANCE PERIOD

- A. The Contractor shall continuously maintain all areas involved in this Contract during the progress of work. Maintenance period shall not start until all elements of construction, planting, and irrigation for the entire project are in accordance with Plans and specifications.
  - 1. A prime requirement is that all groundcover areas shall have been planted. Maintenance period will not be shortened when this criteria is met, but may be lengthened if not met.
  - 2. The Contractor's maintenance period will be extended if the provisions required within the Plans and specifications are not fulfilled. Project may not be segmented into maintenance phases.
  - 3. The Contractor shall request a Pre-Maintenance inspection by the Owner and Architect at the completion of the installation process.
  - 4. The Maintenance Period shall begin upon successful completion of the Pre-Maintenance walk-through punch list and acceptance of the landscape installation by the Owner.
  - 5. If such criteria are met to the satisfaction of the Owner, a field notification will be issued to the Contractor to establish the effective beginning date of the maintenance period.
- B. The Maintenance Period continues for 90 calendar days until final acceptance of the work by the Owner. Improper maintenance or poor condition of planting at the termination of the scheduled maintenance period may cause postponement of the final completion date of the Contract.

- C. Any day when the Contractor fails to adequately maintain planting, replace unsuitable plants or do weed control or other work, as determined necessary by the Owner, will not be credited as one of the maintenance period working days.

#### 1.4 GUARANTEE AND REPLACEMENT

- A. Guarantee: All plant material installed under the contract shall be guaranteed for a period of one year. Plants found to be dead or in poor condition due to faulty materials or workmanship, as determined solely by the Architect, shall be replaced by the Contractor at his expense.
  - 1. Replacement: Materials found to be dead, missing, or in poor condition during the Maintenance period shall be replaced immediately.
  - 2. The Architect shall be the sole judge as to the condition of material.
  - 3. The Contractor shall replace material rejected during the Guarantee period within fifteen (15) days of written notification by the Owner.

#### 1.5 OBSERVATION VISITS

- A. The Contractor shall request progress visits from the Architect at least 48 hours in advance of anticipated visits. Normal observation visits are as follows:
  - 1. Immediately prior to the commencement of the work in this section.
  - 2. Completion of first 90 days of maintenance.
  - 3. Final acceptance.

#### 1.6 FINAL ACCEPTANCE OF THE PROJECT

- A. Prior to the date of the final observation visit, the Contractor shall acquire from the Architect-approved reproducible Plans and record (from the job record set) all changes made during construction, label these Plans "Record Drawings", and deliver to the Architect for review and approval.
- B. Prior to the date of final inspection, the Contractor shall deliver to the Architect a written "Landscape and Irrigation Guarantee" as required herein.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. All materials used shall either conform to landscape specifications in other sections or shall otherwise be acceptable to the Owner.
- B. The Owner shall be given a monthly record of all herbicides, insecticides, and disease control chemicals used. Failure to provide such a record will continue maintenance period until compliance occurs.

## PART 3 - EXECUTION

### 3.1 MAINTENANCE

- A. Maintenance shall be performed according to the following standards:
1. All areas shall be weeded and cultivated at intervals of not more than ten (10) days.
  2. Watering, edging, trimming, fertilization, spraying, and pest and rodent control, as may be required, shall be included in the maintenance period.
  3. Street gutters shall be cleaned as part of the maintenance program.
  4. The Contractor shall be responsible for maintaining adequate protection of the area.
    - a. Damaged areas shall be repaired at the Contractor's expense.
- B. The Contractor shall be responsible for reporting to the Owner conditions beyond his control that prevent or have negative impact on the work required herein.

### 3.2 TREE AND SHRUB CARE

- A. Watering
1. Apply enough irrigation water so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
    - a. Do not maintain soils in a constantly wet condition.
    - b. Contractor shall be responsible for familiarizing himself with the particular water requirements for the various plantings and shall be responsible for setting and maintaining the automatic controller to optimum minimum levels.
    - c. Damage to the plantings caused by over-watering or under-watering shall be the responsibility of the Contractor to replace at no cost to Owner.
  2. Maintain a water basin around newly planted plants so that water can be applied to moisturize throughout the root zone. At the end of the maintenance period these basins shall be flattened out to match surrounding grades.
  3. If hand-watering, use a fan spray nozzle to break the water force.
- B. Tree Pruning
1. Nursery grown trees will not normally require pruning for the first year. Prune trees only if directed by Architect or Owner, and only for these purposes:
    - a. selection and development of permanent scaffold branches that have a vertical spacing of from 18" to 48" and radial orientation so as not to cross each other,
    - b. elimination of diseased or damaged growth,
    - c. elimination of narrow V-shaped branch forks that lack strength,
    - d. reduction of toppling and wind damage by thinning out crowns,
    - e. maintenance of growth within space limitations,
    - f. maintenance of natural appearance,
    - g. Balancing of crown-to-root ratio.

2. Under no circumstances will stripping of lower branches ("rising up") of young trees be permitted.
    - a. Lower branches shall be retained in a "tipped-back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk).
    - b. Lower branches can be cut flush with trunk only after the tree is able to stand erect without staking or other support.
  3. Evergreen trees shall be thinned out and shaped when necessary to prevent wind and storm damage. The primary pruning of deciduous trees shall be done during the dormant season. Damaged trees or those that constitute health or safety hazards shall be pruned at any time of the year as required.
- C. Shrub Pruning
1. The objectives of shrub pruning are the same as for trees. Shrubs shall not be clipped into balled or boxed forms unless such is required by the design.
  2. All pruning cuts shall be made to lateral branches or buds or flush with the trunk. "Stubbing" will not be permitted.
- D. Staking and Guying: Stakes and guys shall remain in place until final acceptance and are to be continuously inspected and adjusted to prevent girdling of trunks or branches and to prevent rubbing that causes bark wounds and to allow trees to sway freely. Stakes and guys are to be removed when trees become sufficiently well rooted or after one year. When stakes or guys are removed, tree heads may be thinned to reduce wind load.
- E. Weed Control: Keep all areas, including basins and areas between plants, free of weeds.
1. Use recommended legally approved herbicides only when mechanical removal methods are not feasible.
  2. Avoid frequent soil cultivation next to trees or shrubs that destroys shallow roots.
  3. Use mulches to help prevent weed seed germination.
- F. Pest and Disease Control: Maintain control of insect and rodent infestations. The preferred method of control shall be biological control, or with non-toxic, biodegradable, organic materials. If stronger materials are needed, only materials that are recommended by a licensed Pest Control Advisor and are EPA approved and regulated shall be used. Only registered and licensed Pest Control Operators shall apply insecticide or chemical applications. Notify Owner a minimum of five (5) working days before chemical applications.
- G. Fertilization
- 3.3 Fertilize all planting areas at 30-day intervals, with fertilizer and at rate as recommended by Soils Report.
1. Avoid applying fertilizer to root balls and bases of main stems
  2. Spread fertilizer evenly around plants to drip line.
  3. Distribute fertilizer evenly over turf or groundcover areas to avoid patchy coloration.
- B. Replacement of Plants: Replace dead, dying, and missing plants with plants of a size, condition, and variety acceptable to Architect or Owner at Contractor's expense.

### 3.4 GROUND COVER CARE

- A. Weed Control: Control weeds preferably with mechanical methods, and also with preemergent herbicides and selective systemic herbicides. Hoe weeds as little as possible since this may result in plant damage. Foot traffic in planted areas shall be minimized, and soil compaction shall be loosened immediately.
- B. Watering: Water enough so that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
  - 1. Do not maintain soils in a constantly wet condition.
  - 2. Contractor shall familiarize himself with the particular water requirements for the planting and shall be responsible for setting and maintaining the automatic controller to optimum minimum levels.
  - 3. Damage to the planting caused by over-watering or under-watering shall be the responsibility of the Contractor to replace.
- C. Trash: Remove trash weekly. Remove debris, clippings or branches produced by maintenance activities within 8 hours.
- D. Edging and Trimming: Edge ground cover to keep in bounds and trim top growth as necessary to achieve an overall even appearance.
- E. Replacement: Replace dead and missing plants at Contractor's expense.

### 3.5 IRRIGATION SYSTEM

- A. System Inspection: Contractor shall continuously check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each of the lateral. All heads are to be continuously adjusted as necessary for proper coverage and to eliminate over-spray on buildings or paving. Contractors regular maintenance personnel shall test, observe, and adjust each sprinkler system no less than once per month.
- B. Controllers: Set and program automatic controllers for seasonal water requirements and minimum optimum water use. Give Owner's representative a key to controllers and instructions on how to turn off system in case of emergency.
- C. Repairs: Repair all damage to irrigation system at Contractor's expense. Repairs shall be made within one watering period.

END OF SECTION 320190

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## SECTION 320800 - COMMISSIONING OF EXTERIOR IMPROVEMENTS (IRRIGATION)

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Commissioning is a systematic process of ensuring that the building systems perform according to the design intent.
- B. Refer to Section 019100 Commissioning Requirements.

#### 1.2 RELATED DOCUMENTATION

- A. Contract drawings, Division 00, Conditions of the Contract, and Division 01, General Requirements, apply to the Work of this Section.

#### 1.3 RELATED SECTIONS

- A. Form - Product Substitution.
- B. Section 013300 Submittal Procedures.
- C. Section 019100 Commissioning Requirements.

#### 1.4 SYSTEM TO BE COMMISSIONED

- A. Landscape Irrigation Systems.

### PART 2 - PRODUCTS

- A. Refer to Section 019100 Commissioning Requirements.

### PART 3 - EXECUTION

- A. Refer to Section 019100 Commissioning Requirements.

END OF SECTION 320800

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## SECTION 321216 – HOT-MIX ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes hot-mix asphalt paving and patching.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Material certificates.
- D. Log of placement of asphalt, including dates, times, temperature readings and other pertinent information.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work. These Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.
- C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

#### 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
  - 1. Tack Coat: Minimum surface temperature of 60 degrees Fahrenheit.
  - 2. Asphalt Base Course: Minimum surface temperature of 40 degrees Fahrenheit and rising at time of placement.
  - 3. Asphalt Surface Course: Minimum surface temperature of 60 degrees Fahrenheit at time of placement.

- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees Fahrenheit for oil-based materials, 50 degrees Fahrenheit for water-based materials, and not exceeding 95 degrees Fahrenheit.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. Coarse and fine aggregate shall conform to SSPWC section 203-6.2.2. Mineral filler, if required, shall conform to SSPWC section 203-6.2.4.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: Paving asphalt, viscosity grade PG 64-10 conforming to Section 92 of the Caltrans Standard Specifications.
- B. Tack Coat: PG 64-10 conforming to Section 92 of the Caltrans Standard Specifications.
- C. Mixes: Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mix III-C3 PG 64-10 designed in conformance with SSPWC Section 203-6.5.

### 2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.
  - 1. Color: White or As Indicated
- C. Wheel Stops: Precast, air-entrained concrete
  - 1. Dowels: Galvanized steel, three-fourth-inch diameter, 24-inch minimum length.

## PART 3 - EXECUTION

### 3.1 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gallons/square yard.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

### 3.2 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gallons/square yard.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.3 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Spread mix at minimum temperature of 250 degrees Fahrenheit.
  - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.4 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 degrees Fahrenheit.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.5 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  1. Base Course: Plus or minus one-half inch.
  2. Surface Course: Plus one-fourth inch (no minus).
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  1. Base Course: One-fourth inch.
  2. Surface Course: One-eighth inch.
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is one-fourth inch.

### 3.6 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

### 3.7 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.9 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 321216

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## SECTION 321313 - CONCRETE PAVING & FORMWORK

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Furnish all materials, labor, and equipment required to provide complete concrete paving and curbs as shown on Drawings and as specified herein. See Drawings, schedules and details for types and locations of concrete work required. Furnish all labor, materials, equipment and supervision in accordance with these specifications and applicable Drawings.
- B. Work Specified in This Section:
  - 1. Concrete pavements, sidewalks and mow strips.
- C. Related Work in Other Sections
  - 1. Earthwork.
  - 2. Compacted base courses under paving.
- D. d herein shall refer to the Landscape Architect or the Owner's authorized representative.

#### 1.2 COORDINATION

- A. Fully coordinate work with all other trades involved. Coordinate with General Contractor items of other trades to be furnished and set in place. They shall execute portions of their work that is embedded, built in, attached to, or supported by the work of this section in ample time so that progress of the work is not delayed. Any cutting or patching made necessary to comply with this injunction shall be done at the General Contractor's expense. General Contractor shall be responsible for the proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of other trades.

#### 1.3 GENERAL REQUIREMENTS

- A. All concrete work shall be true to line and grade as indicated on the Drawings. The Contractor shall be responsible for proper drainage, without birdbaths, on all concrete paving surfaces. Any discrepancies or omissions on Drawings or conditions on the site that prevent the Contractor from providing proper drainage shall be brought to the attention of the Owner's Representative in writing for correction or relief before work proceeds. All construction shall conform to current applicable codes and ordinances.
- B. Piping: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures to maximum. Verify size, length and location of electrical conduit. Sleeve any other piping.
- C. Embedments: Anchor plates, inserts, and other items embedded in concrete shall be accurately secured so that they will not be displaced during placing of concrete.

1. Reactive metal embedments shall be sleeved or have a bituminous coating applied to the portions in contact with concrete. Applies to zinc, aluminum, steel (not stainless) and iron.
- D. Samples: Furnish one 4'x4'x4" sample of each concrete finish with all specified joints in places at job site for approval from Owner's Representative. Approved samples shall be standards for finishes and joints in concrete work.
- E. Surface Tolerances: Finished paving surfaces shall not vary more than 1/4 inch when measured with a 10-ft. metal straightedge, except at grade changes. No "birdbaths" or other surface irregularities will be permitted. Correct irregularities to the satisfaction of Owner's Representative.
- F. Surface Friction Coefficient: All concrete shall have a slip-resistant surface with a minimum friction coefficient of 0.6. Pool areas shall have a coefficient of 0.8.
- G. Testing
  1. The Owner's Representative will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary. The Owner's Representative will pay for costs of such tests. Contractor shall cooperate in making tests and shall be responsible for notifying the designated laboratory in sufficient time to allow taking of sample at time of pour.
  2. Refer to Division 1 for specific requirements of testing.
  3. Should tests show that concrete is below specified strength; Contractor shall remove all such concrete as directed by Owner's Representative. Full cost of removal of low-strength concrete, its replacement with concrete of proper specified strength, and testing shall be borne by Contractor.
  4. The specifications and recommended practices of the American Concrete Institute (ACI), American Society for Testing and Materials (ASTM), The Uniform Building Code, and the Shaw US Patent #4,748,788, referred to in this specification with their individual designations are to be considered part of this specification. The latest revision of each recommended practice or specification shall apply.

## PART 2 - PRODUCTS

### 2.1 PORTLAND CEMENT

- A. Shall conform to current requirements of ASTM Designation C150, Type II cement with low alkaline.
- B. Use same brand of cement from single source throughout entire project.

### 2.2 AGGREGATES

- A. Coarse aggregate for concrete paving:
  1. Shall be non-reactive aggregate. No Sun Valley aggregate shall be used. Contractor will submit a certificate stating that the aggregate has no history of reactivity and meets the ASTM standards

2. Coarse aggregate for regular-weight concrete shall be hard, curable, uncoated, washed, graded, cleaned, and screened crushed rock or gravel conforming to current requirements of ASTM Designation C33.
  3. Coarse aggregate for paving shall not exceed 3/4 inch.
  4. Use same aggregate from single source throughout entire project.
- B. Aggregate for exposed aggregate finish shall be 1/4" to 5/8" water-washed #4 pea rock with smooth edges.
- C. Fine aggregate:
1. Sand shall be clean, hard, and durable with uncoated grains
  2. Free from injurious amounts of silt, loam, clay or other deleterious matter,
  3. Conforming to ASTM Designation C33,
  4. Graded in size from coarse to fine with 95-100% by weight passing a No. 4 sieve, 45-70% passing a No. 16 sieve, 15-30% passing a No. 50 sieve, and 3-8% passing a No. 100 sieve.
  5. Use same sand from single source throughout entire project.

## 2.3 RETARDER: WR Grace TopCast

## 2.4 WATER

- A. Provide clean, potable concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials, or other deleterious matter.

## 2.5 COLORING AGENTS

- A. Only commercially pure mineral pigments shall be used to produce the desired color and in no case shall they exceed 10% of the cement content by weight. Color shall be as specified on drawings. Coloring agent shall be used in strict conformity with manufacturer's specification.
1. Integral color admixtures for color-conditioned concrete: Davis Colors, Chromix by Scofield, Bomanite Integral Color, QC Integral Color, or equal.

## 2.6 EXPANSION JOINT MATERIALS

- A. Pre-molded expansion joint filler shall conform to ASTM D1751-6B size per Drawings. "Ethafoam Polyfelt" by White Cap, Inc., "Denver" foam backer rod by DFC, "Sonofoam" backer rod by Sonneborn, or approved equivalent.
- B. Joint sealant compound shall be polyurethane two-part as manufactured by Sonneborn or approved equivalent. Color shall be per Drawings, or as approved by Owner's Representative.

## 2.7 METAL DOWELS

- A. Shall conform to current requirements of ASTM Designation A36.

- B. Dowels at expansion joints shall be ½" diameter rebar free of dirt, grease and oils.
- C. 50% of each dowel shall be encased in a "Speed Dowel" plastic sleeve, available from Greenstreak (888) 225-2193 or "Diamond Dowel System", available from Hub Construction Specialties (800) 889-4482, to allow parallel lateral movement of each dowel.

## 2.8 REINFORCING

- A. Reinforcing bars shall conform to current requirements of ASTM Designation A615 deformed Grade 40 or Grade 60 billet-steel, clean and free from rust, scale, or coating that will reduce bonding.
- B. Welded wire fabric shall conform to current requirements of ASTM Designation A185. Tags designating wire size and spacing shall be left on each roll until ready to use. Lap 6" on all edges.
- C. Provide certified mill test reports regarding chemical and physical properties of all reinforcing bars and welded wire fabric furnished.

## PART 3 - EXECUTION

### 3.1 DESIGN OF MIXES AND PROPORTIONING

- A. Ensure that batch plant guarantees single source supply for cement, fine aggregate, and coarse aggregate for entire length of project
- B. Proportioning and mixing of cement, aggregate, admixture, and water to attain required plasticity and strength shall be in accordance with the current edition of the ACI Manual of Concrete Practice and the PCA "Design and Control of Concrete Mixtures."
- C. Concrete mixtures shall be designed by an approved commercial testing laboratory, using approved materials furnished by the Contractor, to obtain the specified minimum compressive strengths.
- D. Any use of accelerants shall be limited to non-chloride accelerators.
- E. Maximum slump shall be 5", with ½ slump differential for successive batches.

### 3.2 FORM WORK

- A. Forms shall be constructed accurately to dimensions and plumb and true to line and grade. Forms shall be substantial, mortar tight, braced, and tied so as to maintain position and shape during placing of reinforcing and concrete. Way surfaces and bulged walls or slab surfaces resulting from settlement or springing of formwork will not be acceptable.
- B. The Contractor shall carefully examine Drawings and provide all recesses and all openings of proper sizes or shapes required or as may be directed by Owner's Representative for installation of all work requiring opening.

- C. Forms shall be constructed and assembled in such a manner that construction joints shall occur at approved locations. Forms shall be thoroughly cleaned out before concrete is placed and forms shall be removed without damage to concrete.
- D. Care shall be taken in all details of forming, setting, reinforcing, mixing, and placing all concrete exposed in finish work to obtain smooth, even surfaces of dense concrete, and clean sharp inside and outside corners, except where tooled corners are indicated. Concrete will be free of voids and irregularities.
- E. Earth forms may be used for footings only where soil is firm and stable and concrete will not be exposed. Excavations shall be cut neat and accurate to size, and all exposed concrete shall be formed with the form extending at least six inches below finish grade.
- F. Forms shall be carefully observed and checked for alignment and level as the work proceeds. All needed adjustment or additional bracing shall be done promptly.
- G. After forms have been placed and approved, the Contractor shall see that all other trades have been properly notified and are given sufficient time to complete installation of their work. Placing of reinforcing steel shall proceed progressively with work of other trades and each shall arrange their working schedules so as to avoid disturbing or moving of work already installed by one trade to admit the work of another. Each trade shall be entirely responsible for proper installation and securing of the work and each shall keep his work under observation during placing of concrete.
- H. Before pouring footings for foundations, see that bottoms of excavations are undisturbed earth free from water or frost, properly cleaned and leveled off, and compacted as required by the ACI building code. Do not place concrete on frozen earth or uncompacted fill.
- I. Forms shall remain in place long enough to allow concrete to set properly and the Contractor shall assume all responsibility for removing forms. In no case shall supporting forms or shoring be removed until concrete has sufficient strength to safely carry its own weight and the load upon it. Supporting vertical surfaces shall stay in place for 2 days minimum.

### 3.3 BASE PREPARATION

- A. Subgrades shall consist of a minimum 4" layer of graded washed concrete sand compacted to 95% relative compaction. Sand shall be kept damp prior to concrete placement. All subgrades shall be graded to plus or minus 0.05"
- B. Conform to all recommendations as noted in the soils engineer's report.

### 3.4 PLACING REINFORCEMENT

- A. Place all reinforcement as shown on Drawings. Accurately place and securely fasten and support reinforcement to prevent displacement before or during pouring. Hang footing bars from forms. Support wire mesh with suitable metal cradles.
- B. Clean, bend, and place reinforcement in accordance with current requirements of ACI Manual of Concrete Practice.
- C. Reinforcement Splices:

1. Welded wire fabric - One-mesh minimum
2. Reinforcing bars:
  - a. #3 through #7 = 30-bar diameter
  - b. #8 through #9 = 40-bar diameter
  - c. #10 through #11 = 54-bar diameter

### 3.5 FINISHES

- A. Broom Finish: After surface water disappears and floated surface is sufficiently hardened, steel trowel and re-trowel to smooth surface. When ready, apply approved coarse texture finish by sliding a wire or stiff bristle broom in one direction along a straightedge guide set at right angles to the direction of traffic. On walkways, smooth finish 2" wide at edges, expansion joints, and score joints.
- B. Retarded Finish
  1. Before initial set takes place, apply retarder to finished surface as directed by retardant manufacturer by spray, roller, or brush, depending on retardant consistency. Cover with wet curing burlap and cure for not less than ten (10) and no more than eighteen (18) hours. Test surface with a knife blade to determine when to commence work of revealing aggregate.
  2. Edge with a small radius edger before and immediately after the surface aggregate has been embedded.
  3. Reveal aggregate by using water jet and coarse fiber brushes to remove retarded paste from surface, washing thoroughly until surface is clean and exposure is complete. Then replace curing burlap and maintain moist for at least 7 days.
  4. Slab surfaces shall exhibit an aggregate exposure of coarse aggregate particles of a 3/8-in. size, constituting not less than 60% and not more than 80% of the surface. Exposure shall be to sufficient depth to provide a surface profile of 1/8 in. + 1/16 in.
  5. Control joints shall be scored straight even lines.
- C. Score joints shall be formed in the fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. All joints shall be struck before and after brooming.
- D. Expansion Joints and Edging: Expansion joints shall be formed provided at the location and intervals as shown on the Drawings and at all locations where concrete paving abuts buildings or other permanent vertical structures. Approved joint material shall be placed with top edge 1/4 in. below the paved surface, and shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression. All edges shall be struck before and after brooming. After the curing period, expansion joints shall be carefully cleaned and filled with approved backer rod and joint compound flush with the paved surface in such a manner as to avoid spilling on paved surfaces or overflow from joint.
- E. Sawcut joints: Sawcut all joints as shown on Drawings. Sawing shall be done as soon as the surface is firm enough not to be torn or damaged by the blade. Sawcut joints before sandblasting.

### 3.6 CURING AND PROTECTION

- A. General: Protect concrete against frost, rapid drying, and rain damage, and keep moist for at least seven (7) days after placing. Protect concrete during this period by wet burlap, canvas covering, or liquid curing compound. Secure Owner's Representative's approval of proposed methods. During this period maintain concrete above 70 F for at least three days or above 50 F for at least five days. Concrete from which forms are removed within seven (7) days after pouring shall be sprayed during the curing period as frequently as drying conditions may require. Concrete covering shall be a type that will not stain or discolor finished concrete surfaces. Cure concrete in accordance with requirements of the current ACI Manual of Concrete Practice.
- B. Metal Form Ties: Metal form ties extending from the face of permanently exposed concrete shall be cut off at least one inch deep in the concrete immediately after removal of forms. Fill holes with a 1:3 cement and sand mortar as dry as possible and finish flush with the adjacent surface.
- C. Defects: All defects in concrete work shall be corrected. Voids shall be chipped to sound concrete and to a depth of at least one-inch with the edges perpendicular to the surface and parallel to form markings. Repairing voids and rubbing shall be done as directed by the Owner's Representative, and shall be done at the Contractor's expense. Concrete surfaces so repaired shall duplicate the appearance of the unpatched work.

END OF SECTION 321313

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 321530 - DECOMPOSED GRANITE

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Section includes decomposed granite, and the following:
  - 1. Sub-grade Preparation
  - 2. Base Preparation
  - 3. Stabilizer Application
  - 4. Compaction
  - 5. Cleanup
- B. Related work:
  - 1. Section 329119: Finish Grading
  - 2. Section 329000: Landscape Planting
- C. Definitions: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

#### 1.2 SUBMITTALS:

- A. Procedure: In accordance with Division One, or two weeks prior to start of installation.
- B. Submit one pint sample of the specified decomposed granite, with named source.

### PART 2 - PRODUCTS

#### 2.1 DECOMPOSED GRANITE:

- A. Decomposed granite is referred to by the abbreviation (D.G.), or referred to as disintegrated granite. All decomposed granite for vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
3/8 inch	100
No. 4	95-100
No. 8	75-80
No. 16	55-65

Sieve Designation	% Passing
No. 30	40-50
No. 50	25-35
No. 100	20-25
No. 200	5-15

- B. The portion of D.G retained on the no. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96.
- C. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and maximum plasticity index of 7 as determined by AASHTO T89 and AASHTO T90, respectively.
- D. D.G. to be used for pathways and non-vehicular areas may be 1/4" minus sieve size.
- E. Crushed aggregate screenings shall be free from clay lumps, vegetative matter and deleterious material.
- F. See Drawings for D.G. color specification.

## 2.2 SOIL STABILIZER:

- A. Stabilizer shall be a non-toxic, colorless, odorless, organic powder that binds D.G. screenings. The stabilizer shall be as manufactured by Stabilizer Inc., (800) 336-2468, FAX: (602) 852-0718.

## 2.3 EDGING

- A. Aluminum edging: 3/16" x 5-1/2", manufactured from 6063 extruded aluminum alloy of T-6 hardness with interlock system and 5 stake punch outs fabricated in each strip. Stakes 12" long, lock 1/2" below top of edging.
  - 1. Finish: Black anodized

## PART 3 - EXECUTION

### 3.1 SUBGRADE AND DECOMPOSED GRANITE PREPARATION AND COMPACTION

- A. Subgrade and base under all D.G. shall be prepared and compacted to 90% relative compaction.
- B. Minimum compaction for D.G. surfaces shall be 90% relative compaction.
- C. The finish grade shall be even between the headers with no humps or depressions after the compaction. The Contractor shall provide compaction tests as required by the Architect.
- D. Treat compacted subgrade with pre-emergent herbicide, as recommended by certified pest control advisor.

### 3.2 SOIL STABILIZER AND DECOMPOSED GRANITE INSTALLATION

- A. Soil stabilizer shall be thoroughly blended with the D.G. screenings prior to installation.
  - 1. The stabilizer shall be mixed at a rate of 12 Lbs. of Stabilizer product per ton of D.G. screenings.

2. Mixed stabilizer product in accordance with its manufacturer's instruction.
  3. Premixed Stabilizer and D.G. material can be obtained locally by contacting the stabilizer manufacturer and obtaining the location of a local vendor.
  4. Not acceptable: drop spreading of the Stabilizer product over raked D.G. screenings and mixing stabilizer by rototilling.
- B. Place the premixed stabilizer product on the desired subgrade in maximum 2" lifts. Rake smooth to the desired grade and cross slope.
- C. After placement and raking, water the Stabilized D.G. to achieve full depth moisture penetration of the placed product. A one-hour rate of 20 gpm per 1,000 sq. ft. should achieve the proper full depth moisture penetration.
- D. While the Stabilized D.G. is still thoroughly moist roll the material with a heavy lawn roller, approximately 1000 to 3000 pounds, and maximum 30" wide, to achieve finish grade and initial compaction. Utilize a hand tamp at edges, around benches, and sign posts. Do not use a wacker or vibratory roller to compact the Stabilized D.G.
1. Compacted finish surface of DG is to be level with adjacent paving, unless otherwise indicated.
  2. Compacted finish surface of DG is to be one-inch above finish grade in adjacent planting areas, unless otherwise indicated.
- E. Allow the finished surface sufficient time to dry prior to use.

### 3.3 CLEANUP

- A. After all stabilization operations are completed, remove trash, excess materials, empty containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

END OF SECTION 321530

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 323119 - DECORATIVE METAL FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Decorative aluminum fences.
  - 2. Swing gates.
  - 3. Motorized vehicular gates.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each fence material and for each color specified.
- D. Field quality-control reports.
- E. Product Test Reports: For decorative fences, including finish, indicating compliance with referenced standard.
- F. Maintenance Data: For gate operators to include in maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 DECORATIVE ALUMINUM FENCES

- A. Decorative Aluminum Fences:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Omega II Fence Systems (Basis-of-Design).
    - b. Ameristar Fence Products.

- c. Jerith Manufacturing Company, Inc.
- d. Master Halco.

- B. Posts: Square extruded tubes, 2 by 2 inches (51 by 51 mm) with 0.100-inch (2.54-mm) wall thickness.
- C. Post Caps: Manufacturer's standard.
- D. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers.
- E. Fabrication: Assemble fences into sections by mounting panels on square posts.
  - 1. Panel Dimensions: As indicated on Drawings.
- F. Finish: Baked enamel or powder coating.

## 2.2 SWING DOOR GATES (DG)

- A. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum 2 by 2 inches (51 by 51 mm) with 0.140-inch (3.56-mm) wall thickness.
- B. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
  - 1. Refer to A-390 for Door Gate (DG) designations and hardware types.
- C. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- D. Aluminum Finish: Baked enamel or powder coating.

## 2.3 MOTORIZED VEHICULAR GATES

- A. Swing Gates:
  - 1. Basis-of-Design Product: Omega Double Swing Gate GPM20 (To match selected perimeter fence. Refer to L-151).
  - 2. Size: Refer to Details on A-390 and A-393 and coordinate dimensions in-field.
  - 3. Gate Operator: Lift Master Elite Series CSW24VDC or approved equal.
    - a. In coordination with selected security and card reader system.
- B. Sliding Gates:
  - 1. Basis-of-Design Product: Omega Architectural Cantilever Sliding Gate (To match selected perimeter fence. Refer to L-151).

2. Size: Refer to Details on A-390 and A-393 and coordinate dimensions in-field.
3. Gate Operator: Lift Master AC Heavy Duty Industrial slide gate operator SL585 or approved equal.

a. In coordination with selected security and card reader system.

C. Custom 'Player Entry Gate':

1. (Swing) Wood/Steel Security Gate: Refer to Details on A-392 and A-392.1
2. Gate Operator: Lift Master Elite Series CSW24VDC or approved equal.

a. In coordination with selected security and card reader system.

## 2.4 ALUMINUM

- A. Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
- B. Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
- C. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

## 2.5 MISCELLANEOUS MATERIALS

- A. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

## 2.6 GROUNDING MATERIALS

- A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
  1. Material above Finished Grade: Aluminum.
  2. Material on or below Finished Grade: Copper.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.

## 2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 DECORATIVE FENCE INSTALLATION

- A. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.
- B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
  - 3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
  - 4. Space posts uniformly as indicated on Drawings.

### 3.2 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### 3.3 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 750 feet.
  - 1. Gates and Other Fence Openings: Ground fence on each side of opening. Bond metal gates to gate posts.
- B. Grounding Method: Refer to Electrical Drawings and Fence Grounding Details: E,001, E-100 and E-501.
- C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- D. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
- E. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

### 3.4 FIELD QUALITY CONTROL

A. Testing Agency: Electrical Contractor to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

END OF SECTION 323119

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Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 328400 - LANDSCAPE IRRIGATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.
- B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

#### 1.2 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.
- C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

#### 1.3 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

- C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.
- E. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

#### 1.4 SUBMITTALS

##### A. Water Pressure Test

- 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a written verification of the existing water pressure on the project at each of the points of connection shown.
- 2. The water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings, water is not flowing, are not acceptable.
- 3. Written dynamic water pressure test confirmation shall be made on the contractor's letterhead and include the flow rate during the test, the recorded water pressure, the date of the test and the time of the test.

##### B. Material List:

- 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
- 2. The submittals materials list shall include the following information:
  - a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
  - b. An index sheet showing the item number (i.e. 1,2,3, etc.); an item description (i.e. sprinkler head); the manufacturer's name (i.e. Hunter Industries); the item model number (i.e. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
  - c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
  - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.

- e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
  - 3. Submittal materials list format requirements:
    - a. Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.
    - b. Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittals shall not have tabs, tab sheets, spiral binding, or any other type of binding that will interfere with automated copying of submittals.
    - c. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
    - d. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.
  - C. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.
    - 1. Provide a written statement indicating the reason for making the substitution.
    - 2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
    - 3. Provide in writing the difference in installed price if the item is accepted.
  - D. The Landscape Architect or Owner's authorized representative will allow no substitutions without prior written acceptance
  - E. No substitutions of pump manufacturers, distributors or assemblies will be accepted.
  - F. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
  - G. The Landscape Architect or Owner's authorized representative will not review the submittal package unless provided in the format described above.
- 1.5 EXISTING CONDITIONS
- A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, and electrical supply connection to the irrigation system.
  - B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.

- C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.
- D. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost; all damage resulting from his operations or negligence.
- E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.
- F. The Contractor shall verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.
- G. The Contractor shall protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.
- H. Contractor shall notify Owner's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
- I. The Contractor shall repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Owner's Representative.
- J. The contractor shall provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at [www.bulletmole.com](http://www.bulletmole.com)). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

## 1.6 INSPECTIONS

- A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.
- C. Inspections will be required for the following at a minimum:

1. Pre-construction meeting.
  2. System layout.
  3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
  4. Coverage test of irrigation system. Test shall be performed prior to any planting.
  5. Final inspection prior to start of maintenance period.
  6. Final acceptance prior to turnover.
- D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.
- E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, Owner's authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to Owner.

#### 1.7 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner and at no additional cost to the Owner.
- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

#### 1.8 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the Owner's authorized representative.
- B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

#### 1.9 TURNOVER ITEMS

- A. Record Drawings:
1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
  2. The record drawings shall be prepared to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Landscape Architect or Owner's authorized representative.

3. All record drawings shall be prepared using AutoCAD 2016 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or Owner's authorized representative.
4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or Owner's authorized representative. After acceptance by the Landscape Architect, City Inspector or Owner's authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2016 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.
  - a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
  - b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
6. Show locations and depths of the following items:
  - a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
  - b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
  - c. Isolation valves
  - d. Automatic remote control valves (indicate station number and size)
  - e. Quick coupling valves
  - f. Drip air relief and flush valves
  - g. Routing of control wires where separate from irrigation mainline
  - h. Irrigation controllers (indicate controller number and station count)
  - i. Related equipment (as may be directed)

B. Controller Charts:

1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
2. Landscape Architect or Owner's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
  - a. Operating and maintenance instructions for all equipment.
  - b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:

1. Supply as a part of this contract the following items:
  - a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
  - b. Three 30-inch sprinkler keys for manual operation of control valves.
  - c. Two keys for each automatic controller.
  - d. Two quick coupler keys with a 3/4" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
  - e. One valve box cover key or wrench.
  - f. Six extra sprinkler heads of each size and type.
  - g. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to Owner's authorized representative at the final inspection.

1.10 COMPLETION

- A. At the time of the pre-maintenance period inspection, the Landscape Architect, Owner's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or Owner's authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, Owner's authorized representative, and governing agencies.
- B. The Owner's authorized representative shall have final authority on all portions of the work.
- C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.

- D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the Owner's satisfaction by the Contractor without any additional expense to the Owner. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

#### 1.11 GUARANTEE

- A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
- B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to Owner within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitute an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owner by the Contractor, all at no additional cost to the Owner.
- C. Guarantee shall be submitted on Contractors own letterhead as follows:

##### GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 calendar days following written notification by the Owner. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:

PROJECT LOCATION:

CONTRACTOR NAME:

ADDRESS:

TELEPHONE:

SIGNED:

DATE:

## PART 2 - MATERIALS

### 2.1 SUMMARY

- A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, Owner's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.

### 2.2 PIPE

- A. Pressure supply line between the water meter and the basket strainer device shall be type K copper, one size larger than backflow device.
- B. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.
- C. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.
- D. Recycled water PVC pipe to be color-coded purple in color marked on two sides with recycled water warning statements "Caution-Recycled Water". Recycled water piping must be accepted by the local recycled water governing agencies.

### 2.3 METAL PIPE AND FITTINGS

- A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.
- B. Fittings shall be medium brass, screwed 125-pound class.
- C. Copper pipe and fittings shall be Type "K" sweat soldered, or brazed as indicated on the drawings.

### 2.4 PLASTIC PIPE AND FITTINGS

- A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.
- B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.
- C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

- D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.
- E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
- F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.
- G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

## 2.5 BASKET STRAINER UNITS

- A. The basket strainer unit shall be of the manufacturer, size, and type indicated on the drawings.
- B. The basket strainer unit shall be installed in accordance with the requirements set forth by local codes.

## 2.6 VALVES

- A. Gate Valves:
  - 1. Gate valves shall be of the manufacturer, size, and type indicated on the drawings.
  - 2. Gate valves shall be constructed of a bronze body, gate and stem. Gate valves shall have threaded connections.
  - 3. All gate valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
- B. Ball Valves:
  - 1. Ball valves shall be of the manufacturer, size, and type indicated on the drawings.
  - 2. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
- C. Quick Coupler Valves:
  - 1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
  - 2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1" female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.
  - 3. Vinyl quick coupler cover to be purple in color with the words "Warning-Recycled Water-Do Not Drink" permanently marked on lid.
- D. Automatic Control Valves:

1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Provide Christy's valve ID tags for each remote control valve with valve number.

## 2.7 VALVE BOXES

- A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.
- B. The valve box cover shall be purple in color and secured with a hidden latch mechanism or bolts.
- C. The cover and box shall be capable of sustaining a load of 1,500 pounds.
- D. Valve box extensions shall be by the same manufacturer as the valve box.
- E. The plastic irrigation valve box cover shall be an overlapping type.
- F. Automatic control valve, master valve, and flow sensor boxes shall be 17"x11"x12" 'nominal' rectangular size. Valve box covers shall be marked "RCV" with the valve identification number, or "MV", "FS" "heat branded" onto the cover in 1-1/4 inch high letters / numbers.
- G. Drip air relief valve boxes shall be 6" circular size. Valve box covers shall be marked with "ARV" "heat branded" onto the cover in 1-1/4 inch high letters.
- H. Quick coupler and ball valve boxes shall be 10" circular size. Valve box covers shall be marked with "QCV" or "BV" "heat branded" onto the cover in 1-1/4 inch high letters.
- I. Valve box cover shall be green in color and permanently marked (attached tags are not acceptable) on valve box cover plate with the words "Warning-Recycled Water-Do Not Drink".

## 2.8 AUTOMATIC CONTROLLER

- A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.
- B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.
- C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

## 2.9 ELECTRICAL

- A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
- B. All electrical work shall conform to local codes and ordinances.

## 2.10 LOW VOLTAGE CONTROL WIRING

- A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.
- B. Remote control wire shall be 14 AWG solid core twisted pair, type as indicated on the irrigation drawings.
- C. Connections shall of the manufacturer, size, and type indicated on the drawings.
- D. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).
- E. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

## 2.11 IRRIGATION HEADS AND DRIP EMITTERS AND INLINE DRIP TUBING

- A. Irrigation heads, drip emitters and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.
- B. Irrigation heads, drip emitters and inline drip tubing shall be used as indicated on the drawings.
- C. Irrigation heads shall have purple recycled water warning cover.

## 2.12 DRIP IRRIGATION EQUIPMENT

- A. Drip tubing equipment such as flush valves, air relief valves, wye strainers and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

## 2.13 MISCELLANEOUS EQUIPMENT

- A. Landscape Fabric:
  - 1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
  - 2. Type: DeWitt Pro 5 Weed Barrier or approved equal.
- B. Equipment such as flow sensors, rain sensors, flush valves, air relief valves, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 SITE CONDITIONS

- A. Inspections:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Landscape Architect or Owner's authorized representative.
2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:

1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:

1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:

1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to Owner.

F. Layout:

1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:

1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.

H. Electrical Service:

1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
3. Contractor shall make electrical connections to the irrigation controller. 230-volt single-phase electrical power source to pump assembly location shall be provided by others per NEC codes.

### 3.2 TRENCHING

- A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
- B. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.
- C. Provide minimum cover of 18 inches for control wires within planters.
- D. Provide minimum cover of 24 inches for control wires within sleeves below paving.
- E. Provide minimum cover of 36 inches on pressure supply lines under vehicular travel ways.
- F. Provide minimum cover of 12 inches for non-pressure lines.
- G. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

### 3.3 THRUST BLOCKS

- A. Thrust blocks must be constructed of Class "B" concrete.
- B. Thrust blocks shall be poured against undisturbed site soil.
- C. PVC fitting joints shall be kept free of concrete. Do not encase fitting in concrete.
- D. Thrust blocking shall be sized to provide the minimum bearing areas as shown below. Bearing areas indicated have been calculated for Class 200 PVC pipe at a test pressure of 150 PSI in soil with 2,000 PSI bearing capacity. Increase thrust block sizing as necessary for varying soil conditions.
  1. Provide a minimum thrust block bearing area of 2.0 square feet on all bends (all degrees) and tees installed on pressure supply lines 4 inches and smaller.

### 3.4 BACKFILLING

- A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.

- B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.
- C. Flooding in lieu of tamping is not allowed.
- D. Under no circumstances shall truck wheels be used to compact backfill.
- E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

### 3.5 PIPING

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
- B. Cutting or breaking of existing pavement is not permitted.
- C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.
- D. Remove all dented and damaged pipe sections.
- E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.
- F. Parallel lines shall not be installed directly over each other.
- G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
- H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.
- I. Center load all plastic pipe prior to pressure testing.
- J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.
- K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic male adapters.

### 3.6 CONTROLLER

- A. The exact location of the controller shall be approved by the Landscape Architect or Owner's authorized representative before installation. The electrical service shall be coordinated with this location.

- B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.
- C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

### 3.7 CONTROL WIRING

- A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.
- B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.
- C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
- D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.
- E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

### 3.8 VALVES

- A. Automatic control valves, quick coupler, and ball valves are to be installed in the approximate locations indicated on the drawings.
- B. Valve shall be installed in shrub areas whenever possible.
- C. Install all valves as indicated in the detail drawings.
- D. Valves to be installed in valve boxes shall be installed one valve per box.
- E. Provide valve ID tags for each remote control valve with valve number.

### 3.9 VALVE BOXES

- A. Valve boxes shall be installed in shrub areas whenever possible.
- B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

### 3.10 IRRIGATION HEADS DRIP EMITTERS AND INLINE DRIP TUBING

- A. Irrigation heads, drip emitters and inline drip tubing shall be installed as indicated on the drawings.

- B. Spacing of heads and inline drip tubing shall not exceed maximum indicated on the drawings.
- C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

### 3.11 BASKET STRAINER UNITS

- A. Basket strainer Units shall be installed as indicated on the drawings. The basket strainer unit shall be installed in accordance with the requirements set forth by local codes.
- B. The exact location of the basket strainer shall be approved by the Landscape Architect or owner's authorized representative before installation.

### 3.12 MISCELLANEOUS EQUIPMENT

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
- B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.
- C. Install devices such as rain sensors, flush valves, and air relief valves, master valves and flow sensors as indicated on the drawings and as recommended by the manufacturer.

### 3.13 FLUSHING THE SYSTEM

- A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.
- B. Irrigation heads shall be installed after flushing the system has been completed.

### 3.14 ADJUSTING THE SYSTEM

- A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.
- B. If it is determined by the Landscape Architect or Owner's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.
- C. The entire system shall be operating properly before any planting operations commence.
- D. Automatic control valves are to be adjusted so that the irrigation heads, drip emitters and inline drip tubing operate at the pressure recommended by the manufacturer.

### 3.15 TESTING AND OBSERVATION

- A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, Owner, and governing agencies.
- B. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.
- C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.
- D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.
- E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, Owner, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.
- F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect's hourly rate and will be paid for by the contractor at no additional cost to the owner.
- G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

### 3.16 MAINTENANCE

- A. During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

### 3.17 COMPLETION CLEANING

- A. Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

## SECTION 329000 - LANDSCAPE PLANTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes materials, soil and installation in over-structure planters, soil preparation, planting, palm planting, seeding, sodding, staking and guying, and cleanup.
  - 1. Planting occurs at street level and on upper building levels.
- B. Related work:
  - 1. Section 320190: Landscape Maintenance.
  - 2. Section 328400: Irrigation System.
  - 3. Section 329119: Finish Grading.
- C. Definitions:
  - 1. Architect: the Architect or the Owner's authorized representative.
  - 2. Soil Test: Required testing performed by Contractor after site is rough graded. A current soil report is also required for import soil prior to transport to the site.
  - 3. Punch List: List of work within the Contract, generated by Architect that needs to be completed, repaired, replaced, or rectified by Contractor.
  - 4. Pre-maintenance review: Observation by Architect to verify substantial completion of the Work. The Architect will generate a Punch List during this review. Maintenance Period will commence when Contractor has completed items on this Punch List and Architect has verified that the Punch List is complete.
  - 5. Maintenance Period: See Specification section 320190.
  - 6. Final Acceptance: Observation review by Architect at end of the specified Maintenance Period to verify completion and acceptance of the Work.

#### 1.2 QUALITY ASSURANCE

- A. Standards:
  - 1. Provide plants and planting materials that meet or exceed specifications of Federal, State, and County laws requiring inspection for plant disease or insect control.
  - 2. Provide quality and size conforming to current edition of "Horticultural Standards" for number one nursery stock as adopted by the American Association of Nurserymen.
  - 3. Provide plants that are true to name. Tag one of each bundle or lot with the name and size of plants in accordance with the standards of practice of the American Association of Nurserymen.
  - 4. Botanical names shall take precedence over common names.
- B. Workmanship: Perform work in accordance with the best standards of practice for landscape work and under the continual supervision of a competent foreman capable of interpreting the Drawings and Specifications.

- C. Quantities and Types: Plant materials shall be furnished in the quantities and/or spacings as shown or noted for each location, and shall be of the species, kinds, sizes, etc., as symbolized and/or described in the Plant List, and as indicated on the Drawings.
- D. Verification of dimensions and quantities: scaled dimensions are approximate. Before proceeding with work, carefully check and verify dimensions and quantities and immediately inform the Architect of discrepancies between the Drawings and/or specifications and actual conditions. Do not start work in areas where there are discrepancies until approval for same has been given by the Architect.

### 1.3 SUBMITTALS

- A. Submit documentation to Architect 60 days before start of planting that plant material is available. Include:
  - 1. A list of plants stating quantity, size, and supplier.
    - a. Requests for substitutions due to unavailability must be made in writing.
    - b. Substitutions may not be made without approval of the Architect.
    - c. Contractor shall notify Architect 24 hours in advance of delivery of plant materials, and shall submit an itemized list of plants in each delivery.
  - 2. Photographs of trees 24" box and larger.
    - a. Label each photo with plant name, plant height, spread and trunk caliper.
    - b. Label each photo with nursery name, nursery contact and phone number.
    - c. Photograph shall include a person in picture for scale purposes.
- B. Soil Test: Contractor shall have import soil and the soil of the site tested for fertility, agricultural suitability, and appraisal by Soil and Plant Laboratory Inc. (714) 282-8777, or Wallace Labs (310) 615-0116.
  - 1. Submit a copy of the Planting Plan and Plant Legend to the laboratory with the samples.
  - 2. Soil report shall include:
    - a. pH measurement.
    - b. Nutrients and elements:
      - 1) Measurement (low, medium, high) of: Boron, calcium, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, sodium, sulfur, and zinc.
      - 2) Analyze saturation extract for: calcium, magnesium, sodium, boron, chloride, phosphorus, nitrate and sulfate.
      - 3) Trace metals: Aluminum, arsenic, cadmium, chromium, cobalt, lead, lithium, nickel, selenium, silver, strontium, tin and vanadium.
      - 4) The presence of calcium carbonate and/or magnesium carbonate.
    - c. Soil Texture (gravel, sand, silt and clay). Determine organic matter content by the measurement of organic carbon. The quality of the organic matter shall be determined by measuring organic carbon and total nitrogen.

- 1) Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods, Soil Science Society of America, Inc., 1986, chapter 36, pgs 901-926 and Methods of Soil Analysis, Part 3 Chemical Methods, Soil Science Society of America, Inc, 1996, chapter 34, pgs 965-977 & pgs 1001-2 and chapter 37, pg 1088
- d. Interpretation and recommendations for correction of nutritional deficiencies/excesses and potential toxicities.
3. Soil shall be tested from a minimum of four (4) locations per acre of planted area. Contractor shall record locations where samples were taken.
4. A copy of the soil test results shall be submitted to the Owner and Architect before work begins.
5. Contractor shall pay cost of soil tests.
- C. Cut sheets of materials to be used: tree stakes, tree guys, root barriers, amendments, mycorrhizal fungi, etc.
- D. Legible copies of delivery slips for soil amendments, including mycorrhizal fungi.
- E. The Contractor shall submit samples or specifications of items being used upon the request of the Architect, and as required by this Part 2 of this Specification.

#### 1.4 OBSERVATION SCHEDULE

- A. Contractor shall be responsible for notifying the Architect, in advance, for the following observations, according to the time indicated:
  1. Pre-construction conference - seven (7) days
  2. Tree tagging at nursery (trees 24" box size and larger) - 48 hours
  3. Final grade, soil preparation and planting area layout review - 72 hours
  4. Plant materials review - 48 hours
  5. Plant layout review - 48 hours
  6. Planting operations - 48 hours
  7. Completed planting (Pre-maintenance) walk through - seven (7) days
- B. Contractor shall be responsible for scheduling site Observation visits with Architect as work progresses. Failure to schedule required Observations shall not relieve Contractor of responsibility for obtaining approvals. Contractor shall redo, at no cost to the Owner, work that does not satisfy the Owner.
- C. Observations may be waived or combined at the discretion of the Architect.
- D. When someone other than the Architect conducts Observations, the Contractor shall show evidence in writing of when and by whom these observations were made.
- E. No site visits shall commence without adequate preparation or items noted in previous Observation Reports, either completed or remedied, unless the Owner has waived such compliance. Failure to adequately prepare or accomplish previous punch list items shall make the Contractor responsible for reimbursing the Architect for the site visit at his current billing rates per hour plus transportation costs. No further inspections will be scheduled until this charge has been paid and received.

## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer or soil amendments to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and conformance to state law. Protect material from damage or breakage. Immediately remove empty containers from site.
- B. Deliver plants with legible identification labels. Store plant material in shade and protect from weather or injury. Maintain in a healthy, vigorous condition. Architect may at time reject plant material not maintained in this condition.
- C. Handling: Do not drop plants or pick up container plants by their stems or trunks.

## 1.6 SAMPLES AND TESTS

- A. Contractor shall submit soil samples for testing, per this Specification.
- B. Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Architect.
- C. Rejected materials shall be immediately removed from the site at the Contractor's expense.
- D. Contractor shall pay cost of testing or replacement of materials not meeting specifications.

## 1.7 WARRANTY AND REPLACEMENT

- A. Contractor shall fully warrant and agree to replace poor, inadequate, or defective materials and workmanship for one year from date of acceptance of completed planting work.
- B. Replacement: Materials found to be dead, missing, or in poor condition during the establishment period shall be replaced immediately. The Architect shall be the sole judge as to the condition of material. Material to be replaced during the warranty period shall be replaced by the Contractor within fifteen days of written notification by Owner.

## PART 2 - PRODUCTS

### 2.1 SOIL

- A. Site Soil:
  - 1. Site soil used to form landscape planting areas or backfill planters shall be clean, fertile, loamy soil, free of stones, sticks, stumps, or other deleterious matter one inch in diameter or larger. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance.
  - 2. The Architect shall approve suitability of soil of the site after reviewing results of the soil test.

- B. Import Top Soil: Clean, fertile, sandy loam soil, free of stones or other deleterious matter one inch in diameter or larger. It shall also be free of pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens. Import top soil must conform to the following:

1. Particle size

Class	Particle Size Range	Maximum %	Minimum %
Coarse sand	0.5 - 2.0mm	15	0
Silt plus clay	<0.05mm	50	15
Other classes:			
Gravel	2-13mm	15	0
Rock	1/2 - 1"	5% by volume with none > 1"	

2. Chemistry

- Salinity: Saturation Extract Conductivity (ECe) - less than 3.0 sD/m @ 25° C
  - Sodium: Sodium Absorption Ratio (SAR) - less than 6.0
  - Boron: Saturation Extract Concentration - Less than 1.0 ppm
  - Reaction: pH of Saturated Paste - 5.5-7.8 without high lime content
- Soil shall contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant grown. In the event of nutrient inadequacies, provisions shall be made to add required material prior to planting.
  - In order to insure conformance, samples of the import soil shall be submitted to an approved laboratory for analysis prior to and following backfilling.
  - Obtain imported topsoil from approved local sources.

- C. Backfill for at grade trees and shrubs shall be per Soils Report.

## 2.2 SOIL AMENDMENTS

- Soil amendments shall be as required by Soils Test.
- Contractor shall provide amendments recommended by Soils Report at no additional cost to Owner, including recommendations for the quality of organic amendment.
- Mycorrhizal fungi shall be added in all planting areas, regardless of Soils Report. Mycorrhizal inoculum consists of a combination of :
  - Innoculum shall contain a blend of eight top types of Endospores: Glomus aggregatum, G. clarum, G. deserticola, G. intraradices, G. monosporus, G. mosseae, Gigaspora margarita, and Paraglomus brasilianum, and seven top types of Ecto fungi spores: Lacarria laccata, Pisolithus tinctorius, Rhizopogon amylpogon, R. fulvigleba, R. rubescens, R. villosuli, and Scleroderma spp. The guaranteed Endo spore count shall be a minimum 50 spores/cc, and the Ecto spore count shall be a minimum 50,000 spores/cc
  - Manufacturers:
    - BioOrganics Mycorrhizae Inoculants, (888) 332-7676
    - Mycorrhizal Applications, Inc, (866) 476-7800

c. Or equal.

## 2.3 PLANT TABLETS

- A. 7 gram planting tablet designed for 12 month slow release. 12-8-8 NPK, 20% humus, 4% humic acids, 3.5% sulfur, 2% iron, micronutrients.

## 2.4 PLANT MATERIAL:

- A. Plants shall be in conformance with the California State Department of Agriculture's regulation for nursery inspections, rules, and ratings. Plants shall be healthy, vigorous, and free of insect infestations, plant diseases, sunscalds, frostdamage, abrasions, or other disfigurement. Plants shall be grown in climatic conditions similar to that of the planting site, and well hardened off. Plants shall have vigorous fibrous root systems which are not rootbound or potbound. The Architect is the sole judge as to acceptability of plant material.
- B. The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock or as specified on Drawings.
- C. The Architect shall approve plant material prior to planting. Plants shall be subject to review and approval of Architect at place of growth or upon delivery for conformity to specifications, and for injury, insect infestation, and trees and shrubs for improper pruning. Such approval shall not impair the right of review and rejection during progress of the work. Architect reserves the right to refuse review if, in his/her judgment, a sufficient quantity of plants is not available for review.
- D. Plants not conforming to the requirements herein specified shall be considered defective, and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site and replaced with new plants at the Contractor's expense.
- E. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book."
- F. Substitute plant material will not be permitted unless specifically approved in writing by the Architect.

## 2.5 GUYING AND STAKING MATERIALS:

- A. Wood tree stakes: Lodgepole pine, fully treated with CuNap, ACQ or other non-arsenic wood preservative. Do not use split stakes.
  - 1. 24" box trees and smaller: 2" (nom.) diameter by 10' long.
  - 2. 36" box trees: 3" (nom.) diameter by 12' long.
- B. Tree Ties:
  - 1. Flexible vinyl tree ties meeting ASTM-D-412 standards for tensile and elongation strength. Material shall be black.
  - 2. Each tie shall be a single piece, not multiple ties joined together.
  - 3. Manufacturers: VIT Cinch Tie, VIT Cinch Belt (larger trees), Villa Root Barrier E-Z Band, or equal.

C. Guying Hardware:

1. Wire: Pliable 1/8" galvanized steel cable.
2. Hose: 1/2" new black rubber hose.
3. Turnbuckles: galvanized or dip-painted, size as required.
4. Cable clamps: galvanized, size as required.
5. Safety Sleeve: 1/2" white PVC full length of wire.
6. Steel Guy Anchor: Duckbill Anchor by Foresight Products (800) 325-5360; Platypus Tree Anchoring Systems (866) 752-8478, or equal. Size as needed.

2.6 WATER

- A. Furnished by Owner.
- B. Transport by Contractor as required.

2.7 MULCH

A. Decorative Bark:

1. Walk-On-Bark as supplied by Sequoia Forest Products, telephone: (559) 591-1177.
2. Small Bark product #083 by Kellogg Supply, Inc., telephone: (310) 830-2200.
3. Small Deco Bark by Aguinaga Fertilizer Company, (949) 786-9558.

B. Composted, shredded tree trimmings:

1. Forest Floor 0-4" by Aguinaga Fertilizer Company, (949) 786-9558.

C. Submit mulch samples for approval by Architect. No shredded lumber products will be accepted.

D. Rock mulches: per Plans.

2.8 DRAINAGE MATERIAL - 3/8" CRUSHED ROCK:

- A. 95% -100% passing through a 3/8" screen.
- B. 0-5% passing through No. 8 mesh.
- C. 80-100# per cubic yard.

2.9 SAND:

- A. Top dress /bunker sand from Gail Materials 951-667-6107.

2.10 EROSION CONTROL FABRICS

- A. Jute mesh.

Specification	Test Method	Typical Values
Yarn Fiber		Woven jute, undyed and unbleached
Yarn Count, Warp		78 per width, minimum
Yarn Count, Weft		42 per linear yard, minimum
Color		Natural (Brown, Earth Tone)
Fabric Width (in)		48
Fabric Weight (lb/yd <sup>2</sup> )		92
Strands/ft, Warp		19.5
Strands/ft, Weft		14.0
Mass/Unit Area (oz/yd <sup>2</sup> )		14.7
Wide Width Tensile, Dry (lb/ft)		
Warp x Fill	ASTM D 4595	300 x 175
Wide Width Tensile, Wet (lb/ft)		
Warp x Fill	ASTM D 4595	125 x 65
Elongation at Break (%)		10 x 10
Open Area (%)		60 - 65
Durability(yr)		1 - 2
Water Velocity (ft/sec)		8
Unit Shear Test (lb/ft <sup>2</sup> )		0.45
"C" Factor, 1.5:1 slope		0.005

## 2.11 ROOT BARRIER

- A. Polyethylene (0.08 inch thick) or polypropylene (2.032 - 2.16 mm thick), with self-locking joiners, ½" raised 90 degree molded root deflecting ribs, ground lock tabs, double top edge, UV inhibitors. Use 24" barrier unless otherwise stated.
- B. Bamboo root barrier: 0.76mm thick, minimum, polyethylene. Use 36" wide barrier unless otherwise stated.

## PART 3 - EXECUTION

### 3.1 INSPECTION AND PREPARATION:

- A. Site acceptance:
  1. The Contractor shall be responsible for coordinating his work with the General Contractor and other Sub-Contractors so no damage occurs to plantings after installation.
  2. The Contractor shall be responsible for verifying grades and site conditions before beginning work. No change in Contract price will be owed for actual or claimed discrepancy between existing grade and those shown on the plan after Contractor has accepted existing grades and moved on the site.
- B. Scheduling: Perform planting only when weather and soil conditions are suitable, as approved by Architect.
- C. The irrigation system shall be complete, operational and approved prior to planting.

- D. Utilities: Prior to excavation for planting or installation of stakes or guys, Contractor shall locate utility lines and cables, so that proper precautions will be taken not to damage them. In the event of a conflict between utility lines and plant locations, promptly notify the Architect, who shall arrange for the relocation of one or the other. Failure to follow this procedure shall make the Contractor responsible for repairing damages at his own expense.

### 3.2 SOIL PREPARATION:

A. Planting Areas:

1. Uniformly spread amendments and thoroughly cultivate by means of mechanical tiller per Soils Report.
2. Use nutrients recommended in the Soil Report.
3. Add the appropriate Mycorrhizal inoculum and incorporate at manufacturer's recommended rate.
4. Perform soil preparation after irrigation is installed and tested, and prior to planting.

B. Final Grades and Planting Area Layout:

1. At time of planting, the top two (2) inches of areas to be planted or seeded shall be free of stones, sticks, stumps, or other deleterious matter one inch in diameter or larger. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance.
2. Contractor shall be responsible for shaping planting areas as indicated on Plans or as directed by Architect.
3. Minor modifications to grade may be required to establish the final grade. Remove soil generated by excavations to an approved off-site location unless said soil can be utilized to obtain desired grade.
4. Finish grading shall insure proper drainage of the site as determined by the Architect.
5. Areas shall be graded so that the final grades will be 1-1/2" below adjacent paved areas, sidewalks, valve boxes, headers, cleanouts, drains, manholes, etc. or as indicated on Plans.
6. Surface drainage shall be away from building foundations.
7. Eliminate erosion scars prior to commencing maintenance period. Depressions due to settling shall be eliminated before and after planting.
8. Slopes of two to one (2:1) or steeper shall be protected with erosion control fabric. Contractor shall request clarification from Architect for fabric and methods.

C. Compacted Soil / Percolation Testing: Soil may be heavily compacted which can hinder root development, drainage and aeration.

1. Severely compacted areas shall be ripped or tilled to a depth of at least 9" prior to planting.
2. Percolation tests of water through the soil shall be performed where trees 24" box size and larger are proposed. If trees are to be planted over a large area, several percolation tests will be required.
  - a. Excavate two planting pits 24" deep by 2 times rootball diameter. Install sand filled drainage sump as specified in 3.3.D.4, below, in one of the pits.
  - b. Fill the pits with water and allow to drain completely.
  - c. Fill the pits with water a second time.
  - d. Results:

- 1) If the pit with no sump drains completely within 24 hours, no drain sump is necessary for trees planted within the vicinity of the test pit.
- 2) If the pit with no sump does not drain completely within 24 hours, but the pit with the sump does, sumps are required for trees planted in the vicinity of the test pit.
- 3) If the pit with the sump does not drain completely within 24 hours, advise the Owner prior to planting.

D. Pre-Plant weed Control:

1. "Grow & Kill": If weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, recommended by an approved licensed landscape Pest Control Advisor and applied by a licensed Pest Control Operator. Leave sprayed plants intact to allow systemic kill as directed by Advisor. After recommended kill period, water thoroughly to encourage new weed growth, and re-apply systemic herbicide.
2. Treat planting areas, except for those to be seeded, with pre-emergent herbicide, recommended by an approved licensed landscape Pest Control Advisor and applied by a licensed Pest Control Operator
3. Maintain site weed free until final acceptance by Owner by utilizing mechanical, manual, or chemical treatment.

E. Slope Stabilization

1. Slopes greater than 3:1 are to be stabilized with jute mesh.
2. Prepare soil as noted above.
3. Unroll jute from top of slope to bottom. Secure at top of slope by toeing jute in 6" deep. Reinforce with a row of at least five staples, spacing each about a foot apart, and covering with soil.
4. Place staples 18" to 24" apart throughout to secure matting to ground. Staples must be driven flush with soil surface.
5. Overlap edges of rolls 6", minimum. Securely staple the two layers to the ground.
6. Install jute mesh loosely - do not stretch.
7. Check slots may be needed on steep slopes to prevent subsurface erosion.
  - a. Dig 6" deep trench perpendicular to water flow.
  - b. Drop two or three folds of fabric in the slot.
  - c. Staple fabric securely in bottom of trench, and continue rolling downhill.
8. Use approximately 200 staples per 100 square yards of fabric.

3.3 PLANTING

- A. Planting Layout: Plant layout is to be approved by Architect before planting begins. Layout of trees and major plantings shall be approved first. One tree with each type of specified staking shall be approved prior to planting of trees. Bring conflicts regarding the exact locations of plant pits to the attention of Owner's representative and Architect. If underground utility lines or other unknowns are encountered in excavation for planting, alternate locations for planting may be selected by the Architect. It is the Contractor's responsibility to verify with the Owner's superintendent and governing agencies the location and depth of underground utilities.
- B. Planting of Trees and Shrubs (at grade):

1. Do not plant rootbound, dried out, undersized, or damaged plants.
2. Install trees, shrubs, and groundcovers before planting seed or sod.
3. Excavated holes shall have vertical sides with roughened surfaces and shall be twice the diameter and the depth of the root b.
4. Drainage: Drainage sumps are to be provided in each tree pit. Drain sumps (12-inch diameter by 6 feet deep) may be augured. Sump is to be filled with coarse sand. Planting may proceed after sump installation.
5. Fill excavations with water and allow to percolate out, before positioning trees and shrubs.
6. Install root control barriers where indicated on Plans and where site conditions (trees within three feet of pavement) dictate. Install per manufacturer's instructions.
7. Center plant in pit or trench. Remove boxes and cans without damage to rootball. Add the appropriate Mycorrhizal inoculum next to rootball at manufacturer's recommended rate. Set plant plumb and hold rigidly in position until soil has been dampened firmly around b or roots. An earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least two inches (2") of water. Remove basin in turf areas after initial watering. Plants that settle deeper than the surrounding grade shall be raised to surrounding grade level.

- C. Planting Tablets: Place the following numbers of 7-gram planting tablets within the backfill of each plant:

Container size / Number of tablets

1 gallon	3
5 gallon	8
15 gallon	12
24" box	16
36" box	24
48" box	32

- D. Staking and Guying: Staking and Guying of trees shall be completed immediately upon planting. Stakes shall be installed plumb and as indicated in details. Guy locations and methods shall be reviewed prior to planting of boxed trees. Bring conflicts of locating guys or stakes to the attention of Architect. Remove nursery stakes when site stakes have been installed.
- E. Ground covers: Ground covers or seedlings shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawing. Triangular spacing shall be used unless otherwise noted on the drawing. Fill in bare areas with plants at the required spacing. Damage to plants by trampling or other work in this contract shall be repaired immediately.
- F. Mulch covers:
1. Complete planting and finish grades before placing mulch.
  2. Place mulch material in a continuous layer 3" deep adjacent to plant crown in shrub and groundcover areas, and in areas between shrubs.
  3. Place mulch in a 2" deep layer in areas with flatted groundcover and annual color.
  4. Install special mulches (glass, rock) over weed control fabric.
    - a. Overlap fabric a minimum of 8".
- G. Install Arbor-gard tree trunk protector on trees planted in turf areas. Install per manufacturer's instructions.

#### 3.4 CLEANUP

- A. After planting operations have been completed, remove trash, excess soil, empty plant containers, and rubbish from the property, and dispose of legally.
- B. Cleanup shall be performed at the end of each working day, with a maximum cleanup effort (in a manner satisfactory to the Owner) for each weekend or Holiday.
- C. The Contractor shall sweep the site and shall wash down pavement within the Contract area, leaving the premises in a clean condition.
- D. Walks shall be left in a clean and safe condition.
- E. Scars, ruts, or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

END OF SECTION 329000

## SECTION 329119 - FINISH GRADING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Work includes: weeding and finish grading of lawn and planting areas.
- B. Related work:
  - 1. Section 321531: Decomposed Granite
  - 2. Section 321313: Concrete Paving
  - 3. Section 328400: Landscape Irrigation
  - 4. Section 329000: Landscape Planting

#### 1.2 DEFINITIONS

- A. Finish grading: finish grading shall consist of adjusting and finishing soil surfaces with site or imported topsoil, raking grades to a smooth, even, uniform plane. Remove and legally dispose of all extraneous matter off site. Facilitate natural run-off water and establish grades and drainage indicated as part of the contract work.
- B. The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Import Top Soil: Import top soil shall be classified as sandy loam, and must conform to the following:

- 1. Particle size

Class	Particle Size Range	Maximum %	Minimum %
Coarse sand	0.5 - 2.0mm	15	0
Silt plus clay	<0.05mm	50	15

Other classes:

Gravel	2-13mm	15	0
Rock	1/2 - 1"	5% by volume with none > 1"	

- 2. Chemistry

- a. Salinity: Saturation Extract Conductivity (ECe) - less than 3.0 sD/m @ 25° C
- b. Sodium: Sodium Absorption Ratio (SAR) - less than 6.0

- c. Boron: Saturation Extract Concentration - Less than 1.0 ppm
  - d. Reaction: pH of Saturated Paste - 5.5-7.8 without high lime content
- 3. Soil shall contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required material prior to planting.
- B. In order to insure conformance, samples of the import soil shall be submitted to an approved laboratory for analysis prior to and following backfilling.
- C. Obtain imported topsoil from approved local sources.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of conditions: Prior to commencing the finish grading, review the installed work of other trades and verify that their work is complete.
  - 1. Rough Grading: Grading in planting areas (except raised planter areas) shall be established to within plus or minus 0.10 foot prior to beginning of finish grading.
  - 2. Moving onto the site and/or commencing work shall be construed as acceptance of rough grade conditions by the Contractor.
- B. Import topsoil only when necessary to supplement site soil to achieve grades shown on Drawings, or if site soil is unsuitable for planting.

#### 3.2 PREPARATION

- A. Weeding: Before finish grading, weeds and grasses shall be dug out by the root or sprayed with an herbicide and disposed of off-site. This procedure is outlined under the Landscape Planting Section.
- B. Debris: Remove stones and debris 1 inch in diameter and greater and clumps of earth that do not break up. Dispose of off-site.

#### 3.3 INSTALLATION

- A. General: When rough grading and weeding have been completed, and the soil has dried sufficiently to be readily worked, lawn and planting areas shall be graded to the elevations indicated on the Drawings.
  - 1. Grades indicated on Drawing are grades that will result after thorough settlement and compaction of the soil.
  - 2. Grades not otherwise indicated shall be uniform finish grades and, if required, shall be made at the direction of the Architect.
  - 3. Finish grades shall be smooth, even, and a uniform plane with no abrupt change of surfaces.

4. Soil areas adjacent to buildings shall slope away from the building to allow a natural run-off of water, and surface drainage shall be directed as indicated on the drawings by remodeling surfaces to facilitate the run off water at 2% minimum grade.
5. Low spots and pockets shall be graded to drain properly.

B. Drainage: Finish grade with proper slope to drains.

1. Flow lines, designated or not, shall be graded and maintained to allow free flow of surface water.
2. If any drainage problems arise during construction period due to Contractor's work (such as, but not limited to, low spots, slides, gullies and general erosion), the Contractor shall be responsible for repairing these areas to a condition equal to their original condition, and in so doing shall prevent further drainage problems from occurring.

C. Toe of slope: To prevent soil creep or erosion across pavement, where pavement (walk, curb, etc.) is at the toe of a slope, finish grade is to level out or swale slightly at least 6" before reaching pavement

D. Moisture Content: The soil shall not be worked when the moisture content is so great that excessive compaction occurs, nor when it is so dry that dust may form in the air or that clods do not break readily. Water may be applied, if necessary, to provide moisture content for tilling and planting operations. It is the Contractor's responsibility to control dust that is spread as a result of grading operations.

E. Grades: The finish grade shall be 1-1/2 inch below grade of adjacent pavement, walks, curbs, or headers except when drainage conditions require flush grades, as directed by the Owner's Representative, or if otherwise indicated on Drawings.

F. Compaction: Soils in planted areas shall be loose and friable, yet firm enough that no settling occurs from normal foot traffic or irrigation.

### 3.4 FIELD OBSERVATION

- A. Contact the Architect 48 hours or two working days in advance of each agreed observation or conference.
- B. Schedule for On-Site Reviews: At completion of finish grading and prior to any planting operations.

END OF SECTION 329119

Back-Check No. 2 - ASI 009  
January 15, 2016

Lakers Practice Facility  
Los Angeles, CA  
RA Project No. 2014-015

## SECTION 331100 - WATER UTILITY DISTRIBUTION PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Requirements: Provide water distribution system, complete, as indicated on the Drawings or inferable therefrom and/or as specified in accordance with the Contract Documents.

#### 1.2 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's specifications and installation instructions for each material. Include certification or other data verifying compliance with required characteristics. Indicate by transmittal form that copy of each has been distributed to the Installer.
- B. Shop Drawings: Submit layout and shop drawings as required under Section Submittals. Include details of reinforced concrete structures.
- C. Test Reports: Submit certified Test Reports showing compliance of the following items in accordance with Section General Conditions.
  - 1. Laboratory test for bedding and trench stabilization materials.
  - 2. Concrete design mix.
  - 3. Compression tests.
  - 4. Water Test Reports: Submit results of water sample tests by State or local health authorities

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
  - 2. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
  - 3. The Contractor shall have one copy of the Standard Specifications at the job site.
  - 4. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to materials during loading, transportation, and unloading. Store equipment with moving parts off ground on platforms or skids.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE AND FITTINGS

A. PVC, AWWA Pipe (NPS 4 to NPS 12): AWWA C900, Class 200 DR 14, with bell-and-spigot or double-bell ends.

1. PVC to PVC Fittings: Push-on-Joint, PVC Fittings, ASTM 3139, with elastomeric gasket bell ends, conforming to ASTM D2122 for bell measurements.
2. PVC to Metal Fittings, Valves, and Accessories: Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

- a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts. Use corrosion resistant, high strength, low alloy steel, bolts and nuts where in contact with corrosive soil ASTM A 325.

## 2.3 VALVES

### A. AWWA, UL/FM Cast-Iron, Gate Valves:

- 1. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509 and UL/F.M. approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
  - a. Minimum Working Pressure: 200 pounds per square inch gauge (psig).
  - b. End Connections: Flanged, push-on rubber gasketed, or mechanical joint, as required.
  - c. Interior Coating: Complying with AWWA C550.

## 2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately five-inch diameter barrel. Fabricate valve box cover to fit snugly to prevent displacement by traffic.
  - 1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- B. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve with tamperproof electrical supervisory switch for connection to the fire alarm control panel system.

## 2.5 VALVE APPLICATION

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
  - 1. Where specific valve types are not indicated, the following requirements apply:
    - a. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated, gate valves with valve box.
    - b. Underground Valves, NPS 4 and Larger, for Vertical-Type Indicator Posts: UL/FM, Cast-iron, nonrising-stem gate valves with indicator post.

## 2.6 CORROSION-PROTECTION ENCASUREMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

## 2.7 WATER METERS

- A. Water meter(s) indicated on drawings shall be installed by the local water purveyor for the area, unless noted otherwise.

## 2.8 BACKFLOW-PREVENTION DEVICES

- A. General: FM Approved, AWWA, UL Classified, Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California.
  - 1. Working Pressure: 175 pounds per square inch (psi) minimum, unless otherwise indicated.
  - 2. Interior Components: Corrosion-resistant materials.
  - 3. Exterior Components: Assembly shall be provided with flanged connections, galvanized cast-iron or epoxy coated construction.
- B. Reduced-Pressure-Principle Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.
- C. Reduced-Pressure-Detector Assembly Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.
- D. Double-Check-Valve Backflow Prevention Assemblies: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.
- E. Double-Check-Detector Assembly Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

## 2.9 FIRE HYDRANTS

- A. Before procurement, verify approval has been issued by the Fire Department having jurisdiction.
- B. Wet-Barrel Fire Hydrants: AWWA C503 or UL 312, one NPS 4 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have 150 pounds per square inch gauge (psig) minimum working-pressure design.
  - 1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

2. Operating and Cap Nuts: Pentagon, one-and-one-half inches point to flat.
  3. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
- C. Combined length of bury and extension shall be as indicated. Where not indicated, install top of hydrant flange three inches above finished surface.
- D. Exterior Finish: "O.S.H.A. safety yellow" Ameritone 719 or approved equal after receiving a prime coat.

## 2.10 FIRE DEPARTMENT CONNECTIONS

- A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate, and all appropriate check valves per NFPA 24.
1. Escutcheon Plate Marking: "[AUTO SPKR]."

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examination: Examine substrates, adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected

### 3.2 PREPARATION

- A. Field Measurements: Verify dimensions before proceeding with Work. Obtain field measurements for work required to be accurately fitted to other construction. Be responsible for accuracy of such measurements and precise fitting and assembly of finished work.

### 3.3 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
  2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
  3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
  4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
  5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

### 3.4 PIPING INSTALLATION

- A. Project site water lines shall terminate approximately five feet from buildings, unless otherwise indicated on Drawings. Install temporary cap or plug terminals for future connection to building.
- B. Bury piping with depth of cover over top at least 36 inches, unless otherwise indicated.
- C. Comply with NFPA 24 for fire-service-main piping materials and installation.
- D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- F. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports for all lines NPS 3 or greater.
- H. Water Main Connection: Arrange and pay for tap in the water main, water meter, and all associated fees from the water purveyor.

### 3.5 CLEARANCE OF WATER LINE

- A. Building or Structure: Two feet minimum horizontal separation.
- B. Sewer crossing:
  - 1. Typical Conditions: Lay water mains over sanitary sewers to provide vertical separation minimum three feet.
  - 2. Unusual Conditions: If above separation cannot be met, for sewers less than three feet below the water pipe, use the following:
    - a. Install water line with all joints located at least four feet from each side of the sewer pipe.
    - b. Sewer pipe encased in six inches concrete around pipe, and extend four feet either side of water main.
- C. Parallel to Sewer Line: Water line shall not be installed in a common trench with the building sanitary sewer unless both of the following requirements are met:
  - 1. The bottom of the water pipe, at all points, shall be at least 12 inches above the top of the sewer.
  - 2. The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a minimum clear horizontal distance of at least 12 inches from the sewer.

### 3.6 ANCHORAGE INSTALLATION

- A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches for all lines NPS 3 or greater. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.
4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.7 VALVE INSTALLATION

- A. Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. Vertical-Type Indicator Post Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

### 3.8 BACKFLOW-PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support three-inch and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.
- E. Access and clearance shall be provided for the required testing, maintenance and repair. Access and clearance shall require a minimum of one foot between the lowest portion of the assembly and grade or platform.
- F. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

### 3.9 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

### 3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install fire department connections of types and features indicated.
- B. Install ball drip valves at each check valve for fire department connection to mains.

### 3.11 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. Refer to Division 31 Section "Earth Moving" for tape specifications.

### 3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: The piping shall be subjected for a minimum of two hours to a pressure of one and one-half times the working pressure, but in no case less than 150 pounds per square inch (psi). Examine all exposed pipe, joints, fittings and accessories during the test period. Replace or repair defective portions of the system, and repeat tests until results are satisfactory.
  - 1. Allowable leakage shall be as specified in AWWA C-600, Table 3.
- C. Prepare reports of testing activities.

### 3.13 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
  - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:
    - a. Fill system or part of system with water/chlorine solution containing at least 50 parts per million (ppm) of chlorine; isolate and allow to stand for 24 hours, or
    - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 parts per million (ppm) of chlorine; isolate and allow to stand for three hours.
    - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331100

## SECTION 333100 – SANITARY UTILITY SEWERAGE PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
  - 1. Cleanouts.
  - 2. Precast concrete manholes.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

#### 1.3 SUBMITTALS

- A. Manufacturer's product data for pipe and fittings.
- B. Field quality-control test reports.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.3 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

## 2.4 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.5 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 1. Diameter: Forty-eight inches, unless otherwise indicated.
  - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  - 3. Base Section: Six-inch minimum thickness for floor slab and four-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  - 4. Riser Sections: Four-inch minimum thickness, and of length to provide depth indicated.
  - 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  - 6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  - 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  - 8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, one-half-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
  - 9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced concrete rings, six- to nine-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by seven- to nine-inch riser with four-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording "SANITARY SEWER."
  - a. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48/A 48M, Class 35 gray iron, unless otherwise indicated.

## 2.6 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  1. Top-Loading Classification: Light, Medium, Heavy, and Extra Heavy duty.
  2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
  1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Portland Cement Design Mix: 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.
  1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
  1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: Two percent through manhole unless otherwise noted.
  2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: Four percent.

- D. Ballast and Pipe Supports: Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
    - a. Shielded flexible couplings for same or minor difference OD pipes.
    - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
  2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

### 3.2 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
5. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

### 3.3 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops three inches above finished surface elsewhere, unless otherwise indicated.

### 3.4 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
  1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

### 3.5 FIELD QUALITY CONTROL

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.

- d. Disconnect water supply.
  - e. Test and inspect joints for leaks.
  - f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).
- 6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
  - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- B. Leaks and loss in test pressure constitute defects that must be repaired.
- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 333100

## SECTION 334100 - STORM UTILITY DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage pipe and drainage structures outside the building.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product installed.
- B. Field quality-control test reports.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

#### 2.3 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

- B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

## 2.4 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.5 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.6 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 1. Diameter: Forty-eight inches minimum, unless otherwise indicated.
  - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  - 3. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  - 4. Riser Sections: Four-inch minimum thickness, and of length to provide depth indicated.
  - 5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  - 6. Joint Sealant: ASTM C 990 bitumen or butyl rubber.
  - 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  - 8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, one-half-inch steel reinforcing rods encased in ASTM D 4101, PP wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, six- to nine-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by seven- to nine-inch riser with four-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording "STORM DRAIN."
  - a. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48, Class 35 gray iron, unless otherwise indicated.

## 2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
  1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
  5. Ballast and Pipe Supports: Portland cement design mix, 3,000 pounds per square inch (psi) minimum, with 0.58 maximum water-cementitious materials ratio.
    - a. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
    - b. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

## 2.8 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  1. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
  3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (heavy traffic) structural loading unless otherwise indicated. Include 24-inch ID by seven- to nine-inch riser with four-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.
  1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
  - a. Shielded flexible couplings for same or minor difference OD pipes.
  - b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

### 3.2 PIPING INSTALLATION

- A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- B. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections unless direct tap into existing storm drain is indicated.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
  1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
  2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
- E. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
  1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
  3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
  4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

### 3.4 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops three inches above finished surface elsewhere, unless otherwise indicated.

### 3.5 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.

### 3.6 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

### 3.7 FIELD QUALITY CONTROL

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Hydrostatic Tests: Test sewers according to requirements of authorities having jurisdiction and the following:
    - a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  - 6. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).
  - 7. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- B. Leaks and loss in test pressure constitute defects that must be repaired.
- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334100

