

SECTION 23 05 01

BASIC MECHANICAL AND PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. General provision:
1. Mechanical General Provisions supplement the requirements of Division 1.
 2. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
 3. Applies to all Work and requirements of Divisions 21, 22 and 23.
- B. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these specifications.
- C. Related work specified elsewhere:
1. Concrete work, except as otherwise specified: Division 3.
 2. Motor starters and disconnect switches, wiring and conduit, except as otherwise specified: Division 25, 26, 27 and 28.
 3. Painting, except as otherwise specified: Division 9.
 4. Outside air intake, exhaust louvers and screens: Division 8 and 9.
 5. Installation of access doors and plaster frames for registers and grilles: Division 8.
 6. Temperature control wiring, except as otherwise specified herein: Division 25, 26, 27 and 28.
- D. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1.
1. Submittals
 2. Record Documents
 3. Maintenance manuals
 4. Rough-ins
 5. Mechanical installations
 6. Cutting and Patching

1.02 DEFINITIONS (AS USED ON DIVISION 21, 22 and 23 AND HEREIN)

- A. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- B. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- C. "Ductwork" means ducts, plenums, compartments, or casings including the building structure, which are used to convey or contain air.
- D. "Extend", "Submit", "Repair" and similar words mean that the Developer Design/Builder (or his designated sub-contractor) shall accomplish the action described.
- E. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.

- F. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- G. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces that are not included in the utility areas definition.
- H. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- I. "Below Grade" means buried in the ground.
- J. "Substantial Mechanical Completion" means all components of all systems are functioning but lacking in final adjustment.
- K. "Pressure Rating Specified" (such as for valves and the like) mean design working pressure for and with references to the fluid which the device will serve.

1.03 QUALITY ASSURANCE

A. Regulations and standards: (Current Edition unless otherwise noted)

AABC	Associated Air Balance Council
ADC	Air Diffuser Council, Test Code
AGA	American Gas Association
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CCR	California Code of Regulation
CBC	California Building Code
CEC	California Electric Code
CMC	California Mechanical Code
CPC	California Plumbing Code
CTI	Cooling Tower Institute
CS	Commercial Standards - U.S. Department of Commerce
CISPI	Cast Iron Soil Pipe Institute
FMS	Factory Mutual System
FIA	Factory Insurance Association
HI	Hydraulic Institute Standards
IAPMO	International Association of Plumbing and Mechanical Officials
IRI	Industrial Risk Insurance Companies
ISA	Instrument Society of America
MSS	Manufacturers Standardization Society
NCWB	National Certified Pipe Welding Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NEBB	National Environmental Balancing Bureau
OSHA	Occupation Safety and Health Act
PDI	Plumbing and Drainage Institute
SAMA	Scientific Apparatus Makers Association
SHEMA	Steam Heating, Equipment Manufacturers Association

SMACNA	Sheet Metal and Air Conditioning Contractor National Association, Inc. 1995 1st Edition.
SCAQMD	Southern California Air Quality Management Division
UL	Underwriters Laboratories, Inc.

- B. Requirements of regulatory agencies: Nothing in the Specifications shall be construed to permit work not conforming to applicable laws, ordinances, rules and regulations. In the event of a conflict with local ordinances and statutes, the local requirements shall take precedence over the specified standards and codes. When specifications exceed requirements of applicable laws, ordinances, rules and regulations, the Specifications take precedence. It shall be the Developer Design/Builder responsibility to correct, at no cost to the County, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Developer Design/Builder in locating applicable information or to deny him permission to use options that are permitted by codes.
- C. Permits and inspections charges:
1. Refer to the General Conditions of the Contract.
 2. Obtain schedule and pay for permits, licenses, approvals, tests, inspection and certificate of final inspection required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
 3. Afford the County's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during the periodic visits.
- D. Service connections:
1. Sanitary and storm sewer: Make all arrangements with the proper authorities, pay all required charges and connect building sewers to existing street sewers where indicated.
 2. Domestic "plumbing" water: Make all arrangements with the proper authorities and pay all required charges for water meter installation and connect to main where indicated.
 3. Fuel gas: Make all arrangements with the proper authorities and pay all required charges for gas meter and regulator installation including any excess line cost by the local gas company. Vent regulator to outside of building at approved location, subject to approval by the County's Representative.
 4. Fire main: Make all arrangements with the proper authorities; pay all required charges for the fire and domestic water service mains. Extend the mains through the building to the fire pump and to the domestic service as indicated. Provide outside indicating valve in concrete manhole. Connections to street water mains shall be included in the work of this section.

1.04 PROJECT CONDITIONS

- A. Verifying Job Conditions: Examine all specifications in a manner to be fully cognizant to all work required under this Division. Adjoining work of other trades shall be examined for interferences and conditions affecting the work of this Division.
- B. Visit site prior to bidding and investigate the existing conditions that affects and will be affected by the work of this Division. Become familiar with the working conditions and take into account any special or unusual features peculiar to these jobs. By the act of submitting the bid, the Developer Design/Builder will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his bid.
- C. The locations of existing utility lines are shown in accordance with reference data received by the County's Representative. The points of connection are therefore approximate and the Bidder shall include in his bid adequate funds to cover cost of connection regardless of their exact location.
- D. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the County.

1.05 INSTALLATION OF THE WORK

- A. Installation of mechanical work shall be coordinated with the Project Construction Schedule. The Developer Design/Builder shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Developer Design/Builder.
1. Work installed which interferes with the work of other trades shall be removed and reinstalled at the Developer Design/Builder's expense when so directed by the County's Representative.
 2. Notify the County's Representative of points of conflict between the work and that of other trades so that the conflict may be properly adjusted.
 3. Coordinate mechanical systems, equipment, and materials installation with other building components.
 4. Verify all dimensions by field measurements.
 5. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 6. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 7. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 8. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 9. Coordinate connection of mechanical system with exterior underground and overhead utilities and services.
 10. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 11. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components, where installed exposed in finished spaces.
 12. Install access panel or doors where units are concealed behind finished surfaces.
 13. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specific slope.
- B. Coordinate field details with other trades to avoid construction delays and maintain required clearances.
1. Equipment bases and supports: Furnish certified details and details for approval before fabrication. Furnish all parts necessary for each base, sub-base and support.
 2. Pipe sleeves and inserts: Furnish and install all pipe sleeves and pipe support inserts before concrete is poured.
 3. Roof, wall and floor openings: Furnish shop drawings showing exact locations and sizes of openings through roofs, walls and floors.
- C. Prepare coordination in accordance with Division 1 to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination for the installations are of importance to the efficient flow of the work, including but not necessarily limited to the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Clearances for installing and maintaining insulation.
 - b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - c. Equipment for connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Sizes and location of required concrete pads and bases.

2. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 3. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling mounted items.
- D. Examine other Divisions for work related to the work of this Division, especially Division 25, 26, 27 and 28.
- E. Rough-In
1. Verify final locations of rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 2. Refer to equipment specifications in Divisions 2 through 44 for rough-in requirements.
- F. Delivery and Storage:
1. All material shall be delivered to the site with all labels intact and identified to permit check against approved material lists and for shop drawings. Lost or damaged materials and equipment will be replaced by new at no increase in contract cost. Damaged factory applied finishes supplied with final finish under this Division shall be refinished as approved by the County's Representative, employing workmen skilled in the work involved. Finishing materials shall be obtained from the equipment or materials manufacturer.
 2. Protect materials against dirt, water, chemical and mechanical damage both while storage and during construction.

1.06 OPENINGS, CUTTING AND PATCHING

- A. Openings are to be indicated by the Developer/Design/Builder's structural consultant, additional openings or holes required for the work of this Division and cost of such work is under Division 1.
1. Openings, cutting and patching to be in accordance with that specified under Division 1, 7 and 8.
 2. If the work of this Division requires such, furnish new instructions as to requirements for these openings, subject to approval by the County's Representative.
- B. Additional cutting and patching and reinforcement of construction of building, required under the work of this Division, subject to approval by the County's Representative, to be performed under the Division of the Specification covering the particular materials, and the cost of same shall be an obligation to this Division.
- C. Core drilling of floor slabs and concrete walls for passage of pipes, where authorized by the County's Representative, shall be provided under the work of this Division.

1.07 EXCAVATION AND BACKFILL

- A. Do all excavation, trenching and backfill required to install the work of this Division both inside and outside, as indicated. Excavation and backfill to be in accordance with that specified under Division 2, 31 and 33.
- B. Excavations are to be of the proper depth and width to install the required piping and/or equipment. Piping shall be installed promptly after excavation in order to keep trenches open as short a time as possible.
- C. Excavation:
1. Jetting or flooding of backfill will not be permitted.
 2. Any existing underground piping or conduit that is encountered shall be properly shored and protected from damage. Active piping shall be left intact and undamaged or relocated and reconnected to the existing system, as directed by the County's Representative. Any damage resulting from the Developer Design/Builder's operations shall be repaired by the Developer Design/Builder at his own expense.

3. All excavation, backfilling and repaving in connection with work in public streets, under public sidewalks or elsewhere in public property, shall be done as required by, or under the supervision of, the proper authorities.

D. Trenching:

1. Pipe trench dimensions: The following requirements are considered minimal unless otherwise indicated, in order to provide adequate pipe clearances and bedding. Provide trenches wider than the specified minimum where required to properly install the particular type of piping. In the event utility company regulations, code requirements, or the pipe manufacturer's recommendations differ from these provisions, the more restrictive requirements shall take precedence:

a. Pipe Burial Depths:

Sewer & Drainage	34" (a) + pipe O.D. (b) + 3" bed
Gas	30" + pipe O.D. + 4" bed
Water (Domestic)	30" + pipe O.D. + 4" bed
PVC	24" (30" at planters) + pipe

- Notes: (a): Finish grade to top of pipe, typical
 (b): OD outside dimension

b. Trench Widths:

Sewer & Drainage	12" + pipe O.D. for 4" to 18"
Gas	8" + pipe O.D.
Water (Domestic)	8" + pipe O.D.

2. Where rock is encountered, carry excavation below required elevation and backfill with a layer of selected bedding sand prior to installation of pipe. Provide a minimum of 6 inch of stone or gravel cushion between rock bearing surface and pipe.
3. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
4. Do not install copper piping or metal gas piping in a common trench with other dissimilar metal piping or conduit; separate a minimum of 4 feet when running parallel to such piping or conduit.
5. Separate multiple parallel lines of piping in a common trench a minimum of 12 inch, both horizontally and vertically, between individual pipes.
6. Install domestic water piping, running parallel in a common trench a minimum of 12 inches, both horizontally and vertically, between individual pipes.
7. Do not run electrical power and communications conduit in a common trench with sewer, drainage, water or gas piping.
8. Provide and install 14-gauge copper "Tracer" wire, continuous for entire length, for all underground non-metallic piping. Secure piping at alternate joints, at each fitting and at each valve. Locate "Tracer" wire along side of pipe, but not under pipe.
9. Install thrust blocks in all pressurized lines. Install thrust blocks in accordance with pipe manufacturer's recommendations.

E. Backfilling and Filling:

1. Backfilling and Filling: Place soil materials in layers to required sub grade elevations for each area classification listed below, using materials specified in appropriate Division of this specification.
2. Bedding: Lay and bed pipe in compacted select bedding sand, thickness as specified herein and backfill with the same material to a height of one foot above the top of pipe.
 - a. Sewer drain lines, except as hereinafter specified may be bedded in the native soil provided it is rock free and sandy. Dig out under bell portions of the piping for uniform bearing.

- b. Under walks and pavements, use a combination of sub base materials and excavated or borrowed materials.
 - c. Under building slabs, set piping on a 6 inch bed of damp sand and backfilled to 12 inches of finish grade with damp sand. Remainder of backfilled to be of approved backfill material.
 - d. Under piping and equipment, use sub base materials where required over rock bearing surface and for correction of unauthorized excavation.
 - e. For piping less than 30 inches below surface of roadways, provide 4 inch thick concrete base slab support. After installation and testing of piping, provide a 4 inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway sub base.
 - f. Other areas use excavated or borrowed materials.
3. Backfill excavations as promptly as work permits, but not until completion of the following:
- a. Do not backfill until installation has been approved and as-built details are up to date.
 - b. Inspection, testing, approval, and location of underground utilities have been recorded.
 - c. Removal of concrete formwork.
 - d. Removal of shoring and bracing, and backfilling of voids.
 - e. Removal of trash and debris.
4. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and more than 4 inches in loose depth for material compacted by hand operated tampers.
5. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage as specified in Division 2. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
6. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
7. Unauthorized excavation:
- a. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to The County's Representative.
 - b. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by The County's Representative.
8. Materials:
- a. Select Bedding Sand: Class A screened fill sand with a maximum particle size of 1/2 inch, not exceeding 18 percent and free of expansive materials, debris and organic matter.
 - b. Select Backfill Material: Non-expansive soil excavated from the utility trench or site cut areas, or from off-site borrows material, which in the opinion of the County's Representative is suitable for backfilling. The material shall contain no rocks or clods over 3 inches in diameter, free of debris and organic matter, and a minimum of 40 percent of the material shall pass a No. 4 screen. Rock and clod size shall be limited to 3 inches maximum diameter for backfilling trenches 12 inches or less in width.
 - c. Mastic Coatings: "Henry's" oil base roof mastic.
 - d. Polyethylene sheeting not less than 8 mils thick.

1.08 CORROSION PROTECTION

- A. All below ground metallic fittings, valves, flanges, bolts, shall be protected against corrosion as follows:
 - 1. All metallic components as described above shall receive a heavy coating of "Henry's" or "Marvin" oil base roof mastic.

2. After mastic coating is completed and inspected, wrap entire metallic component with a minimum of 8 mil polyethylene wrap overlapped 50% of the circumference and extended beyond ends of component as required for polyethylene to be secured to piping. The overlap seam shall be located to avoid backfill material from entering the encapsulated area. The ends of the seam of the polyethylene material shall be secured to the piping and sealed with 3M Scotch or Calpico/Wrap No. 50, 10 mil, 2 inch wide, printed, pipe wrap and sealing tape.
3. The mastic coating shall be inspected and approved prior to finish application of the polyethylene material, which shall also be inspected.

1.09 PROJECT RECORD DOCUMENTS

- A. Drawings of Record: The Developer Design/Builder shall provide and keep up-to-date a complete record set. Prints for this purpose may be obtained from the County's Representative at cost. This set of prints shall be kept on the job site, and shall be used only as a record set.
- B. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
- C. Changes: Clearly and correctly mark Record Drawings to show all changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by a Modification or by a specific approval of deviations or revisions in submittals.
- D. Upon completion of the work, a set of reproducible drawings marked as "As-Builts" and a compact disk containing electronic files of the drawings in current version of AutoCAD shall be submitted to the County's Representative for approval. After approval, asp-built drawings and the electronic file shall be turned over to the County's Representative.

1.10 STANDARDS

- A. Compliance shall be in conformance with the requirements of Division 1. Submit proof of material and equipment conformance to the requirements of Regulations and Standards. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, the Developer Design/Builder may submit a written certificate from an approved, nationally recognized testing organization, adequately equipped and competent to perform such services, verifying that the items have been tested and that the work conforms to the Regulations and Standards, including the methods of testing utilized by the testing agency.

1.11 MATERIALS AND EQUIPMENT

- A. Compliance shall be in conformance with the requirements of Division 1.
 1. Provide products by manufacturers regularly engaged in the manufacture of similar items with an acceptable history of successful production and ability to render competent and thorough technical services and spare parts through local organizations.
 - a. Provide the names and addresses of the nearest service and maintenance organization and spare parts supplier.
 - b. Discontinued models will not be accepted by the County even if that model was specified. The County's Representative must be immediately notified if there is a conflict in this matter.
 2. Materials and equipment shall be new, current models of manufacturers and bear complete identification by the manufacturers.
 3. Materials and equipment shall be guaranteed by the manufacturer to equal or exceed specified, submitted and published ratings. Equipment specified by manufacturer's number shall include all accessories, controls and devices listed in manufacturers catalog as standard with the equipment.
 4. Provide a complete working installation with all equipment called for in proper operating conditions. Specifications do not undertake to list every item or device of equipment to be installed. When an item or device is necessary for the operation of the equipment shown or specified, the items or devices shall be provided with the equipment that will allow the system to function properly.

1.12 SHOP DRAWINGS, MATERIAL LISTS AND SUBMITTAL DATA

A. Comply with requirements of Division 1 - "Submittals" and the following:

1. Material list: 6 copies of a complete list of material and equipment. It shall be tabbed and according to main areas of work and shall be submitted to the County's Representative within 30 days after award of Contract. Submission shall include manufacturers' names, catalog numbers and other data necessary for identification. 3 copies will be returned to the Developer Design/Builder. If corrections are required, 6 additional copies shall be resubmitted within 15 days. No material or equipment is to be delivered to the job site until the County's Representative has reviewed material lists. Developer Design/Builder shall note all items that replaced discontinued models or items.
2. Submittal data: Printed catalog material and brochures covering equipment and material shall be submitted as follows: 2 copies shall be submitted for preliminary review; 1 copy shall be returned to the Developer Design/Builder, who shall review the corrections, if so noted, and resubmit 6 copies for final review. Assemble each brochure with tabbed separators for each specification section where products are noted to be submitted, with separate tabs for each product label.
3. Three copies of final submittal data will be returned to the Developer Design/Builder. The Developer Design/Builder may submit additional copies deemed necessary to correlate the work of other trades.
 - a. Submittal data to include complete brochures containing only items specified, indicating names of manufacturers, catalog figure numbers, technical data and requested information on each item.
 - b. Submittal data to be referenced to section number and paragraph numbers of the specifications, and to fixture and equipment indicated. Brochure not to contain extraneous material not specified.

B. Shop Drawings:

1. Submission of shop drawings shall consist of 6 complete sets, one of blue line prints and the other of sepia transparency, indicating the required technical information. One complete set of the sepia transparency will be returned to the Developer Design/Builder.
2. Shop drawings shall use the same nomenclature indicated on the Scoping Documents and must indicate locations where material or equipment is to be installed.
3. Shop drawings shall be submitted covering equipment, piping and ductwork in each equipment room.
4. Shop drawings shall be coordinated with all other trades before submission to the County's Representative.
5. Submit following material with all equipment room shop drawings:
 - a. Manufacturer's specifications, including materials, type, performance characteristics and capacity ratings.
 - b. Certified dimension drawings, indicating size, component parts and installation details.
 - c. Electrical wiring diagram and controls where applicable.
 - d. Complete automatic control and wiring diagrams.
 - e. Equipment supports.
 - f. For items such as valves, hangers and accessories, indicate specific items and where they are to be used.
 - g. Supplementary framing including calculations.
6. Equipment and/or materials installed without the Developer Design/Builder receiving written approval from the County's Representative are subject to removal and replacement by the Developer Design/Builder with approved materials, at no additional cost to the County, or delay of job progress.

- C. Submittals: Unless otherwise specified, specific items for which the following requirements apply and for which submittals are required shall be as specified in each section of Division 21, 22, and 23.
1. **Manufacturer's Data:** Submittals for manufactured items shall comprise manufacturer's descriptive literature, drawings, diagrams, performance and characteristic curves, and catalog cuts. These shall be identified by manufacturer's name, trade name, model or catalog number, name-plate data, size, layout dimensions, capacity, project specification reference, applicable Federal, Military, industry, and technical society publication references, and any other additional information necessary to establish contract compliance. Photographs of existing installation and similar data submitted in lieu of manufacturer's catalog data are not acceptable and will be returned without approval.
 2. **Shop Drawings:** Submit required shop drawings in one complete package. Drawings shall be drawn to a minimum scale of 1/8 inch; shall be a minimum of 14 x 20 in size; and shall include wiring diagrams, plans, elevations, and sections of equipment and control spaces identifying and indicating proposed and existing locations, layouts, and arrangement of items of equipment, control panels, accessories, piping, ductwork, and any other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate adequate clearances for operation, maintenance, and replacement of operating equipment and devices. If any equipment is disapproved, revise drawings to show acceptable equipment resubmitted.
 3. **Standard Compliance:** Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as National Electrical Manufacturers Association, American Society for Mechanical Engineers (ASME), Underwriters' Laboratories (UL), American Gas Association (AGA), or American Refrigeration Institute (ARI), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence. In lieu of the label or listing, submit a certificate from an independent testing organization of suitable competence, stating that the item has been tested and found to conform to the specified standard.
 4. **Certificates of Conformance of Compliance:** Certifications shall be in the original and not preprinted. The certification shall not contain statements that could be interpreted to imply that the project does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material". The certification shall simply state that the product conforms to the requirements specified.
 5. **Certified Test Reports:** Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment proposed for use, results of the tests shall be submitted in accordance with the requirements for laboratory test results of this Contract.
 6. **Factory Tests:** Factory tests are tests that are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
 7. **Permits and Certificates of Inspection:** Furnish the originals.
 8. Testing procedures and test results required in this and other sections.
 9. Other data required by other sections of this Division.
- D. Submit for review only the specific items required in this section or other sections of Division 21, 22, and 23.
- E. Submittal materials will be reviewed for substantial conformity with the intent of the Scoping Documents only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the Developer Design/Builder, which are indicated thereon.
- F. Additional copies may be required by individual sections of these specifications.

1.13 CLOSING-IN OF UN-INSPECTED WORK

- A. Developer Design/Builder shall not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested and approved by the County's Representative and proper inspector. Should any of his work be covered up or enclosed before such inspection and test, he shall, at his own expense, uncover the work and after it has been inspected, tested and approved, make all repairs with such materials as may be necessary to restore all his work and that of other trades to its original and proper condition.

1.14 EQUIPMENT/PIPE/DUCT SUPPORTS

- A. Furnish and install steel supports and seismic restraints for fans, coils, receivers, tanks, piping, ductwork and other equipment for a complete installation as indicated.
- B. Exposed to weather supports shall be galvanized per Division 5.
- C. Exposed to view interior supports shall be painted with rust preventative paint per Division 9.

1.15 BUILDING FOOTING CLEARANCES

- A. Under no circumstances shall pipes, ducts or conduits be run through footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearances from the cone of influence indicated as required by Code.

1.16 DAMAGE BY LEAKS

- A. Developer Design/Builder shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished and/or installed by him for a period of 1 year from the date of acceptance of the work by the County.

1.17 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

- A. All motors, power driven equipment and automatic control equipment, except motor starters as hereinafter set forth required and connected with the work of this section of the specifications are to be furnished and installed under Division 21, 22, and 23.
- B. Control low (24V) and control line (120V) voltage wiring, conduit and related switches and relays required for the automatic control and/or interlock of motors and equipment including final connection, are to be furnished and installed under Division 21, 22 and 23. Materials and installation to conform to Class 1 or 2, CCR Title 24, Article E725, and as restricted under the Division 25, 26, 27 and 28 of these specifications.
- C. Power wiring, conduit, outlets, disconnect switches motor starter and motor-rated contactors, and making of final connections, except as hereinafter specified, are to be furnished and installed under the Division 25, 26, 27 and 28 of the specification.
- D. Identify circuits and equipment as outlined in the Electrical section of these specifications.
- E. Coordinate requirements for underground conduit only between buildings for control interlocks. This conduit is to be furnished and installed under Division 25, 26, 27 and 28 of these specifications.

1.18 SUPPLEMENTARY FRAMING

- A. Provide supplementary framing required for attachment of hanger, supports and anchors. Fasten supplementary framing to structure in an approved manner. Supplementary framing of structural angle iron, channels and "I" beams properly designed to carry the weight of piping and its contents and to withstand any thrust exerted by the expansion or contraction of the piping. Design of supplementary framing shall be by structural engineer.

- B. Submit details of hangers, anchors, supplementary framing including the proposed method of fastening of supplementary framing to the base building structure and calculations used in determining the proposed fastening method.
- C. Structural work shall conform to applicable building codes.
- D. Paint supplementary framing with one coat of rust preventive paint after installation of work under this Division.

1.19 STARTERS, DISCONNECTS AND WIRING

- A. Starters and disconnects will be provided under Division 25, 26, 27, 28, except for special equipment which is specified with the equipment.
- B. All line voltage control wiring and all conduits for both line voltage and low voltage control wiring shall be provided under Division 25, 26, 27 and 28, except as specified under Division 21, 22 and 23 and/or specified herein.

1.20 ADDITIONAL BALANCING DEVICES

- A. Provide any additional apparatus, devices or equipment that may be required to completely balance all the air and hydronic systems. Such apparatus, devices or equipment shall be included in the work at no additional cost to the County.

1.21 DELIVERY, HANDLING, STORAGE OF MATERIALS, PROTECTION OF WORK

- A. Properly store, adequately protect, and carefully handle equipment and materials to prevent damage before and during installation as recommended by the manufacturer and as approved by the County's Representative. Items determined to be damaged or defective shall be replaced at no cost to the County. Determinations of the County's Representative shall be final.
- B. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- C. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- D. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop-fabricated ductwork.
- E. Keep cabinets and other openings closed to prevent entry of foreign matter.
- F. Refer to other sections of this Division for additional requirements.

1.22 STANDARD PRODUCTS

- A. Materials and equipment shall be essentially the standard catalogued products of manufacturers regularly engaged in production of such materials or equipment, and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

1.23 SAFETY REQUIREMENTS

- A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type specified herein. Provide items such as catwalks, ladders, and guard rails where required for safe operation and maintenance of equipment.

1.24 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish printed copies of these recommendations to the County's Representative prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.25 OPERATION AND MAINTENANCE MANUAL:

- A. Furnish an operation and maintenance manual covering the stipulated mechanical systems and equipment. Seven copies of the manual, bound in the hardback binders or an approved equivalent, shall be provided to the County and one copy to the County's Representative. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:
 - 1. Operations and Maintenance Manual
 - 2. Building Number
 - 3. Developer Design/Builder
 - 4. Contract Number
- B. Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:
 - 1. System layout showing piping, valves and controls.
 - 2. Wiring and control diagrams with data to explain detailed operation and control of each component.
 - 3. A control sequence describing start-up, operation and shutdown.
 - 4. Detailed description of the function of each principal component of the system.
 - 5. Procedure for starting.
 - 6. Procedure for operating.
 - 7. Shutdown instructions.
 - 8. Installation instructions.
 - 9. Adjustments, maintenance and overhaul instructions.
 - 10. Lubrication schedule including type grade, temperature range and frequency.
 - 11. Safety precautions, diagrams and illustration.
 - 12. Test procedures.
 - 13. Performance data.
 - 14. Parts lists, with manufacturer's names and catalog numbers.
 - 15. Preventive maintenance schedule.
 - 16. Service organization with name, address and telephone number.
 - 17. Valve identification chart and schedule.
 - 18. ASME certificates.
 - 19. Air balance report.
 - 20. Hydronic balance report.

- C. Provide operation and maintenance manuals for all mechanical and electrical equipment. Product videotaped instructions during the training period for operating personnel at the time of final inspection using factory startup engineers to show adjusting, calibrating, testing, operating and servicing procedures for all systems.
 - 1. Furnish four (4) complete sets of videotaped cassettes for each system and the equipment requiring the instructions.
 - 2. Developer Design/Builder shall use the videotaped instructions during the training period for the building operating personnel.

1.26 INSTRUCTIONS TO COUNTY PERSONNEL

- A. When specified in other sections or herein, the Developer Design/Builder shall furnish, without additional expense to the County, the services of competent instructors who will give full instruction to the designated personnel in the adjustments, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation, and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the County for regular operation. The number of man-days of instruction is specified; approximately half of the time shall be for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.
- B. The following systems and equipment shall be required to be furnished with operating instructions videocassette:
 - 1. Chilled water system, man-day (16 hours).
 - 2. Hot water system, man-day (16 hours).
 - 3. Air handling system, man-day (8 hours).
 - 4. Miscellaneous exhaust equipment and systems, man-day (3 hours per system).
 - 5. Building Automation System (BAS) refer to Division 21, 22, 23.

1.27 BUILDING OCCUPANCY VENTILATION

- A. Prior to move in by the occupants, the building shall have a minimum period of two weeks with their systems running on full exhaust and 100% outside air 24 hours a day to completely off-gas the furnishings.
- B. The total ventilation of the buildings shall be scheduled with the County's Representative.

1.28 SPARE PARTS AND TOOLS

- A. Developer Design/Builder shall furnish difficult-to-obtain manufacturer unique spare parts upon contract completion.
- B. Developer Design/Builder shall furnish any special tools required to service equipment with the equipment. Provide a lockable metal toolbox to secure tools.

1.29 WARRANTY

- A. In addition to requirements of the Conditions of the Contract, warrant all equipment, ratings, capacities, motor HP, etc., to produce the specified and indicated performance.
 - 1. Refer to Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

2. Developer Design/Builder shall guarantee all workmanship, equipment and materials installed under his contract for a period of not less than one year from the date of acceptance of the installation. Should any defects occur during this period, the Developer Design/Builder shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the County, including cost of labor and materials.
 3. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components which are inactive because of said failure shall be suspended. The warranty period for such components shall resume to run for the remaining portion of this warranty period when failed components are completely repaired and in operation.
 4. Neither payment for work, nor total or partial occupancy of work by the County, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Developer Design/Builder in doing the work.
 5. Compile and assemble the warranties specified in Division 21, 22, and 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
 6. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.
 7. The Developer Design/Builder shall require that the manufacturer of the chiller shall furnish the parts and the labor to replace any item found to be defective in the refrigeration equipment, within the guarantee period.
 8. In addition to other guarantees, the Developer Design/Builder shall furnish free maintenance for the refrigeration equipment, including replacement of refrigerant and oil, for a period of one year. This shall include regular monthly maintenance and "On Call" service if required.
- B. Warranty start on date of acceptance by the County.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

- A. Workmanship shall be in the best standard practice of the trade.
- B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.
- C. Sequence, coordinate and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots and openings in other building components during progress of construction to allow for mechanical installation.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of mechanical system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the County's Representative.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance and repair or replacement of equipment components, where installed exposed in finished spaces.
11. Install access panel or doors where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specific slope.

3.02 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Division 2 through 44 for rough-in requirements.

3.03 CUTTING AND PATCHING

- A. Perform cutting and patching in accordance with Division 1.
- B. In addition to the requirements specified in Division 1, the following requirements apply: Protection of Installed Work: During cutting and patching of operations, protect adjacent installations.
- C. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 1. Remove and replace defective work.
 2. Remove and replace work not conforming to requirements of the contract documents
 3. Remove samples of installed work as specified for testing.
 4. Install equipment and materials in existing structures.
 5. Upon written instructions from the County's Representative, uncover and restore work to provide for The County's Representative observation of concealed work.
- D. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new work.
- E. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
- F. Coordinate with general Developer Design/Builder for temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- G. Patch of existing finished surfaces and building components shall be under Division 01.

3.04 SYSTEM OPERATIONAL TESTS

- A. The Developer Design/Builder shall inform the County one week prior to starting this testing in order that the County's Representative may be present.
- B. After balancing and prior to final inspection, the Developer Design/Builder shall operate all systems continuously trouble free and stable for a minimum period of fourteen consecutive days including Saturday and Sunday. Each day shall be a 24 hour day for buildings with 24 hour operation and an 8 hour day for buildings with 8 hour and less operating schedules. Should a problem arise, the 14 day period shall be restarted and repeated until successfully operated for a full 14 days. A written report certified by the County's Representative shall indicate the successful completion of a stable and trouble free 14 day period.

3.05 CLEANING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Refer to Division 1 for general requirements for final cleaning.
- C. Leave exposed parts of the mechanical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.
- D. Thoroughly clean all materials, equipment and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the County's Representative.
- E. Remove, thoroughly clean and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after 10 days and again after the system has been in operation 30 days. Submit certification that this operation has been completed.

END OF SECTION