PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The 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. Section Includes: Inspection and testing laboratory services for materials, products, and construction methods as specified hereafter for the work.

B. All special testing and inspections for the Seismic Load Resisting System as described herein.

C. Costs: The costs of the initial services for testing and inspection personnel will be paid by the Owner. If initial tests indicate non-compliance with contract document requirements, any subsequent testing shall be performed by the same personnel and paid for by the contractor. Schedule portions of the work requiring testing and inspections services so as to be continuous and as brief as possible.

D. Code Compliance Inspection and Tests: Inspections and tests not specified herein and required by codes and ordinances, or by plan approval authorities, and made by a legally constituted authority, shall be the responsibility of the contractor, unless otherwise specified.

1.3 REFERENCE STANDARDS

A. General: Comply with the provisions of the latest versions of the publications listed below except as otherwise shown or specified.

B. The Building Code as defined in the Structural Drawings.

C. American Concrete Institute (ACI):
1. ACI 301 Specifications for Structural Concrete

D. American Institute of Steel Construction (AISC):
1. AISC 341 Seismic Provisions for Structural Steel Buildings, dated March 2005, including Supplement No. 1, dated November 2005.

E. American National Standards Institute (ANSI)/American Society for Nondestructive Testing (ASNT):
1. ANSI/ASNT CP-189-1995
2. ANSI/ASNT SNT-TC-1A

F. American Society for Testing and Materials (ASTM). The following are specifically referenced for structural steel testing:
1. ASTM A435 Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates
2. ASTM A898 Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes
3. ASTM E114 Standard Practice for Ultrasonic Pulse-Echo Straight Beam Examination by the Contact Method
4. ASTM E164 Standard Practice for Contact Examination of Weldments
5. ASTM E329 Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction
6. ASTM E543 Standard Practice for Agencies Performing Non-destructive Testing
7. ASTM E587 Standard Practice for Ultrasonic Angle-Beam Examination by the Contact Method
8. ASTM E709 Standard Guide for Magnetic Particle Examination
9. ASTM E1212 Standard Practice for Establishment and Maintenance of Quality Control Systems for Non-destructive Testing Agencies
10. ASTM E1444 Standard Practice for Magnetic Particle Examination

G. American Society for Testing and Materials (ASTM). The following are specifically referenced for concrete testing:
1. ASTM C31 Practice for Making and Curing Concrete Test Specimens in Field
2. ASTM C33 Specification of Concrete Aggregates
3. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

4. ASTM C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5. ASTM C94 Specification for Ready-Mixed Concrete
6. ASTM C143 Test Method for Slump of Hydraulic Cement Concrete
7. ASTM C172 Practice for Sampling Freshly Mixed Concrete
8. ASTM C173 Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method
9. ASTM C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
10. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
11. ASTM C597 Test Method for Pulse Velocity Through Concrete
12. ASTM C803 Test Method for Penetration Resistance of Hardened Concrete
13. ASTM C805 Test Method for Rebound Number of Hardened Concrete

H. American Welding Society (AWS):
1. AWS D1.1 Structural Welding Code – Steel
2. AWS D1.8 Structural Welding Code - Seismic Supplement

1.4 DEFINITIONS

A. Testing Agency refers to the organization or group of organizations responsible for representing the Owner and performing all inspection, testing, and laboratory services as described herein.

B. Seismic Load Resisting System (SLRS) is defined as the assembly of structural elements in the building that resists seismic forces as described in the general structural notes.

C. Demand Critical (DC) welds for the SLRS are identified in the drawings at welded connections as required for quality assurance measures (at welded connections) as specified in AWS D1.8 and AISC 341.

1.5 SUBMITTALS

A. Testing agency shall submit the following:
1. The qualifications of the testing agency management and personnel designated to the project.
2. The testing agency "Written Practice for Quality Assurance."
3. Qualification records for Inspector and NDT technicians designated for the project.
4. The testing agency NDT procedures, equipment calibration records, and personnel training records.
5. The testing agency Quality Control Plan for the monitoring and control of the testing operations.
6. Welding Inspection Procedures.
7. Bolting Inspection Procedures.
8. Shear Connector Stud Inspection Procedures.

B. Test and Inspection Reports: The independent testing and inspection agency or agencies will prepare logs, test reports, and certificates applicable to specific tests and inspections and deliver copies distributed as follows:
1. 1 copy to the Owner
2. 1 copy to the Architect
3. 1 copy to the Structural Engineer
4. 1 copy to the General Contractor
5. Copy or copies, as required, to the building department (or as required by the authority having jurisdiction)

C. Other tests, certificates, and similar documents shall be obtained by the Contractor and delivered to the Owner and/or Architect in such time as not to delay progress of the work or final payment therefore.

D. Laboratory Reports: Furnish reports of materials and construction as required, including:
1. Description of method of test.
2. Identification of sample and portion of the work tested.
   a. Description of location in the work of the sample.
   b. Time and date when sample was obtained.
   c. Weather and climatic conditions at time when sample was obtained.
3. Evaluation of results of tests including recommendations for action.

E. Inspection Reports: Furnish "Inspection at Site" reports for each site visit documenting activities, observations, and inspections, including notation of weather and climatic conditions, time and date, conditions and status of the work, actions taken, and recommendations or evaluation of the work.

1.6 QUALITY ASSURANCE

A. Qualifications: All inspection and testing required to establish compliance with the contract document requirements, except as may be otherwise specified, shall be made by a prequalified, independent professional testing agency provided, and paid for by the Owner.

B. Certification: Product producers and associations, which have instituted approved systems of quality control and which have been approved by document approval agencies, are not required to have further testing. Concrete mixing plants, plants producing fabricated concrete and wood or plywood products certified by the agency, lumber, plywood grade marked by approved associates, and materials or equipment bearing underwriters' laboratory labels require no further testing and inspection.

C. Written Practice for Quality Assurance: The testing agency shall maintain a written practice for the selection and administration of inspection personnel, describing the training, experience, and examination requirements for qualification and certification of inspection personnel. The written practice shall describe the testing agency procedures for determining the acceptability of the structure in accordance with the applicable codes, standards, and specifications. The written practice shall describe the testing agency inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.

D. Special Inspector Qualifications: All special inspectors shall be trained and competent in accordance with the quality assurance plan.

E. Welding Inspector Qualifications:
1. All welding inspectors shall meet the qualification as set forth in AWS D1.1.
2. For DC welds as noted in the drawings, welding inspectors shall be qualified in accordance with AWS D1.8.

F. Nondestructive Testing (NDT) Personnel Qualifications: NDT personnel shall be qualified in accordance with AWS D1.8.

G. Bolting Inspector Qualifications: Each bolting inspector shall be trained and qualified to inspect bolting operations and high strength bolted connection for compliance with the Research Council on Structural Connections (RCSC) Specification and the Quality Assurance Plan. Competency shall be demonstrated through the administration of a written examination and through the hands-on demonstration by the Inspector of the methods to be used for bolt installation and inspection.

1.7 CONTRACTOR'S RESPONSIBILITY

A. General: Coordinate quality control activities to avoid delay and to eliminate any need to uncover work for testing or inspection.

B. Access: Furnish free access to the various parts of the work and assist testing and inspection personnel in the performance of their duties at no additional cost to the Owner.

C. Data: Furnish records, drawings, certificates, and similar data as may be required by the testing and inspection personnel to assure compliance with the contract documents.

D. Notice: Furnish notice to Owner and/or Architect and testing and inspection agency not less than 48 hours prior to any time required for such services.

E. Defective Work: Remove and replace any work found defective or not complying with contract document requirements at no additional cost to the Owner. Where testing personnel take cores or cut-outs to verify compliance, repair prior to acceptance.

F. Concrete: If test cylinders for concrete fail to meet design requirements, provide additional tests as may be directed by the Owner and/or Architect. Make core tests in accordance with ASTM C42 and load tests in accordance with ACI 318. Correct all deficiencies found in forms, reinforcing steel, and embedded objects.

G. Structural Steel: Should any weld or structural connection fail to meet design requirements, provide additional testing for structural connections as directed by the Owner and/or Architect or Structural Engineer. Replace or repair all defective connections as directed.

H. Seismic Load Resisting System: The Contractor shall accommodate sufficient time needed by the designated inspector to complete their inspection work as required by AWS D1.1, AWS D1.8, and AISC 341. The Contractor/welder shall only proceed with the work after the completion of the inspection.

1.8 TESTING AGENCY SERVICES

A. General: Testing agency shall test or obtain certificates of tests of materials and methods of construction, as described herein or elsewhere in the technical specification. The testing agency shall provide the management, personnel, equipment, and services necessary to perform the testing functions as outlined in this section.

B. Inspection Services: The testing agency will have full authority to see that the work is performed in strict accordance with requirements of the contract documents and the directions of the Owner and/or Architect.

C. Welding Procedure Review: The testing agency shall provide a review and approval or rejection of all welding procedures to be used and shall verify compliance with all reference standard requirements.

1.9 TESTS AND INSPECTION REPORTS

A. Laboratory Reports: Furnish reports of materials and construction as required, includes description of method of test; identification of samples and portion of the work tested; description of location in the work of the sample, time and date when sample was obtained, weather and climatic conditions at time when sample was obtained, and an evaluation of results of tests including recommendations for action.

B. Inspection Reports: Furnish "Inspection at Site" reports for each site visit documenting activities, observations, and inspections. Include notation of weather and climatic conditions, time and date, conditions and status of the work, actions taken, and recommendations or evaluation of the work.
   1. Include the following in all structural steel test and inspection reports (include all that apply):
      a. Welder's certification
      b. Weld qualification tests
      c. Visual inspections
      d. Review of materials testing procedures, including electrodes used, item inspected
      e. Magnetic particle tests (MP)
      f. Radiographic tests (RT)
      g. Ultrasonic tests (UT)
      h. Liquid Penetrant tests (LP)
      i. High-strength bolted connection tests
   2. Include the following in all concrete test and inspection reports:
      a. Exact mix used and maximum size aggregate
      b. Location in building for which samples were taken
      c. Cylinder identification
      d. Date cylinder received in laboratory
      e. Slump data
      f. Concrete supplier's name
      g. Brand and type of cement used

1.10 REPORTING TEST FAILURES

A. Immediately upon inspector's determination of a test failure, the inspector shall telephone results to the Contractor, Owner, and Architect. On the same day, the inspector shall distribute written test results.

1.11 TESTING AND INSPECTION

A. Concrete Formwork: Inspect forms for location, configuration, camber, shoring, sealing of form joints, correct forming material, concrete accessories, and form tie locations. Contractor shall provide the inspector with a copy of the approved formwork/shoring shop drawings.

B. Reinforcing Steel: All steel bars must be positively identified as to heat number and mill analysis.
   1. All steel bars that cannot be identified by heat number and mill analysis shall have one tensile and one bend test made for each 2 metric tons or fraction thereof, of each size and kind of reinforcing steel.
   2. Testing procedure shall conform to ASTM A615.

C. Concrete Sampling and Testing:
   1. Perform the following services as required to assure compliance with requirements of Section 03 30 00, "Cast-In-Place Concrete," of this specification. The contractor shall notify the engineer and inspection-testing agency of the brand and type of cement and sources of aggregates in time for approval, sampling, and testing (if required).
   2. Batch Plant Inspection: Batch plant inspection by the inspector shall be as specified in the Building Code. Batch plant(s) shall continuously monitor and control fines content of arriving aggregate at plant prior to batching.
   3. Continuous Field Inspection: The inspector shall be present at all times during the placing of structural, reinforced concrete. Prior to placing concrete, he shall inspect and approve, if satisfactory, accuracy of all formwork and quantity and placement of all reinforcing steel.
   4. Water: Test in accordance with ASTM C94 and CRC-C 400 as appropriate.
   5. Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C33.
   6. Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C172. Concrete test specimen shall be produced from concrete directly exiting the chute of the truck delivering the concrete.
      a. Air Content: Test for air content shall be performed in accordance with ASTM C173 or ASTM C231. A minimum of one test per day shall be conducted.
      b. Slump Tests: Slump tests shall be taken every 150 cubic yards delivered for each set of compression strength test cylinders, but not less than one test per hour during continuous pours. Slump shall be tested in accordance with ASTM C143.
      c. Strength Tests: Strength tests per ASTM C39 shall be performed on test specimen prepared in accordance with either ASTM C192 for Laboratory Cured Specimen or ASTM C31 for Field Cured Specimen. Strength tests shall conform with the following:
         1) Test specimen (cylinders) shall be taken so as to represent as nearly as possible the batch of concrete from which they are taken.
         2) Tests shall be performed for each 150 cubic yards of each separate mix design of concrete or fraction thereof being placed each day.
         3) The quantity of test specimens shall be produced in order to achieve the following: At least one test at 7 days, at least one test at 28 days, and at least two tests for 6- by 12-inch cylinders or three tests for 4- by 8-inch cylinders at the specified test age as indicated on the structural drawings.
         4) An additional test specimen shall be produced should it be necessary to perform further testing. This specimen is to be discarded should the additional testing not be necessary.
         5) The strength level of an individual class of concrete for the cured specimen shall be satisfactory if both of the following requirements are met: (1) Average of all sets of three consecutive strength tests equal or exceed the specified compressive strength, (2) No individual class of concrete strength test (average of two cylinders) falls below the specified compressive strength by more than 500 psi.
         6) Report exact mix tested, minimum size aggregate, location of pour in the work, cylinder identification, date of receipt of cylinder in laboratory, cement brand and type, and admixtures used.
   7. Investigation of Low-Strength Test Results: When any strength test of laboratory-cured or field-cured test cylinder falls below the specified strength requirement by more than 500 psi, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized.
      a. Nondestructive testing in accordance with ASTM C597, ASTM C803, or ASTM C805 may be permitted by the Owner and/or Architect to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection.
      b. When strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the Owner's representative to least impair the strength of the structure.
      c. If the concrete in the structure will be dry under service conditions, the cores shall be air-dried (temperature 60 to 80 degrees F), relative humidity less than 60 percent for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.
      d. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement.

e. Repair core holes in the concrete found acceptable with an approved dry-pack or non-shrinking mortar.
f. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Owner and/or Architect in accordance with the requirements of ACI 318.
g. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to the Owner and/or Architect.
h. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by the Owner and/or Architect, at the expense of the Contractor.

D. Precast Concrete:
1. The inspection-testing agency shall review all precast plant test reports.
2. The inspection-testing agency shall provide inspection of all precast during construction, transportation, and erection, verifying precast is undamaged, and installed in accordance with the requirements of the contract documents.
3. The inspection-testing agency shall provide inspection of precast concrete anchorages to other components of the structure.

E. Masonry:
1. General: The testing agency shall check reinforcing steel placement prior to grouting; quality of block placement and appearance; mortar work; and shall monitor all grouting operations in accordance with the Building Code.
2. The inspection-testing agency shall make field tests of mortar and grout in accordance with the Building Code. Grout shall be tested for each 20 cubic yards of grout placed each day. For mortar one test shall be conducted for every 750 square feet of construction.
3. Provide prism tests in accordance with the Building Code.

F. Structural Steel – General:
1. Mill Certificates: Mill certificates or affidavits and manufacturer's certification shall be supplied to the inspector for verification of steel materials. Testing laboratory shall be notified at least three weeks in advance of fabrication and supplied with the reports so that shop inspection may be performed.
2. General Inspection:
a. Testing agency shall be at the fabricator's plant to verify that materials used match the mill tests or affidavits of test reports; that fabrication, welding procedures, surface preparation, and shop painting meet specifications; and that the work in progress conforms with project requirements.
b. Testing agency shall visually check fabricated steel delivered to the job to confirm that the work is in compliance with approved shop drawings and shall make any physical tests, measurements, etc., believed to be necessary.
c. Testing agency shall witness and report all corrections performed by the steel fabricator occurring on the fabricators own initiative.
d. Testing agency shall be present during steel erection at all times.
3. Welding Requirements: Special inspection shall be provided by the testing agency for all welding in accordance with the Building Code.
a. Nondestructive testing shall be performed as required by the Building Code and AWS D1.1 as specified herein for all shop and field welds.
b. All welds shall be visually inspected. Welds considered suspect shall be further checked by other means deemed necessary by the welding inspector.
c. Ultrasonically test 100 percent of all complete joint penetration welds and 100 percent of all partial joint penetration column splice welds with effective throats of 1/2 inch or larger. For partial joint penetration welds, rejection shall not be on the basis of the indication rating from the root area of the weld.
d. Ultrasonically test all joints where the base metal is thicker than 1-1/2 inches, when subjected to through-thickness weld shrinkage strains. The joint shall be ultrasonically inspected for discontinuities directly behind such welds after joint completion.
e. When ultrasonic indications arising from the weld root cannot be interpreted as either a weld defect or the backing strip itself, the backing strip shall be removed at the expense of the Contractor, and if no root defect is visible, the weld shall be re-tested. If no defect is indicated on this re-test, and no significant amount of weld metal has been removed, no further repair of welding is necessary. If a defect is indicated, it shall be repaired at no expense to the Owner.
f. Perform Magnetic Particle (MP) tests of fillet welds larger than 3/8 inch.
g. The inspector shall perform magnetic particle testing in accordance with ASTM E709 for any questionable welds.

h. See Specification Section 05 12 00, "Structural Steel Framing," for additional test/quality control requirements.
i. Exceptions:
1) When approved by the Building Official, Architect, and Structural Engineer, the rate of testing for ultrasonic testing of complete joint penetration welds may be reduced in accordance with the following:
a) The nondestructive testing rate for an individual welder or welding operator may be reduced to 25 percent, provided the reject rate is demonstrated to be 5 percent or less of the welds tested for the welder or welding operator. A sampling of at least 40 completed welds for a job shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed.
b) For complete joint penetration groove welds on materials less than 5/16 inch thick, nondestructive testing is not required provided continuous inspection is provided.
c) When approved by the Building Official, nondestructive ultrasonic testing may be performed in the shop of an AISC approved fabricator utilizing qualified welding inspections in the employment of the fabricator.
2) Other ultrasonic or magnetic particle testing may be reduced by approval of the Owner and/or Architect and Structural Engineer upon presentation of satisfactory documentation submitted by the contractor.

4. Bolting Requirements: All inspection shall conform to the requirements of the current edition of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
a. For connections using high–strength bolts installed using Load Indicating Washers, the Owner's testing agency need not be present during the entire installation and tightening operation, provided the Owner's testing agency provides the following:
1) Inspection of the surface and bolt type for conformance to plans and specifications prior to the start of bolting.
2) Verification of the minimum specified bolt tensions visually and by using the feeler gauge as "no go" inspection on a few bolts in each connection (10 percent or two bolts, whichever is greater).
b. For connection using high–strength tension control bolts, the Owners Testing Agency need not be present during the entire installation and tightening operation, provided the Testing Agency provides the following:
1) Inspection of the surface and bolt type for conformance to plans and specifications prior to the start of bolting.
2) Visual inspection of 100 percent of the high-strength bolts for properly installed tension.
5. Miscellaneous Metal: Where miscellaneous angles, channels, studs, and similar shapes are detailed for support of major components of the work, the welds, bolts, and material are subject to the same testing requirement as other structural supporting members.

G. Structural Steel – Seismic Load Resisting System:
1. Welding Inspections at the Seismic Load Resisting System (SLRS): The welder, contractor's quality control personnel, and testing agency's welding inspector shall perform the inspections of all welded connections within the SLRS in accordance with Appendix Q of AISC 341.
2. Nondestructive Testing (NDT) of Welded Joints: For DC welds, Magnetic Particle Testing (MP) and Ultrasonic Testing (UT) shall be conducted by the testing agency at the frequency designated in Appendix Q of AISC 341. MP and UT shall be performed in accordance with the requirements of AWS D1.1, AWS D1.8, and the referenced ASTM standards of this Section.
a. NDT Delay Periods: Final visual inspection may take place immediately upon cooling to ambient temperature. Final NDT, either MP or UT, may not begin until 24 hours after the completion of welding. If delayed cooling such as insulating blankets or post weld heat treatment has been used, the 24-hour delay period shall begin after the steel has reached ambient temperature.
b. At the Contractor's option, Contractor quality control NDT may be performed before the delay period has expired, but shall not be used for final acceptance. In-process MP, such as for verifying the removal of cracks and other discontinuities when backgouging or repairing thermal cut surfaces, may be performed immediately upon completion of the welding or backgouging. No cooling period is necessary. Final MP and UT of the joint or repair shall not be performed until the 24-hour delay period is met. Final MP of weld tabs may be performed immediately upon completion.
c. The NDT technician shall perform all NDT, other than visual, required by this Section. NDT shall be performed in a timely manner, so as not to hinder production, and to detect welding problems soon after occurrence so that the Contractor may take corrective measures.

d. The NDT technician shall mark the welds, parts, or joints that have been inspected and accepted with a distinguishing mark or die stamp, and maintain records indicating the specific welds inspected.

3. Additional NDT Testing: In addition to providing NDT of welded joints in the special moment resisting frame, the following additional testing shall be performed:
   a. For the SLRS and for complete joint penetration welds on ASTM A6 rolled shapes or built-up shapes with a thickness exceeding 1-1/2 inch, the joints shall be ultrasonic tested prior to welding to check for evidence of lamination, inclusions, or other discontinuities in accordance with ASTM A435. The area to be tested is a zone 3 inches above and below each beam flange connection.
   b. Column splices with complete joint penetration (CJP) or partial joint penetration (PJP) welds shall be UT tested.
   c. Gusset plate to column and base plate connections utilizing CJP welds shall be UT tested.
   d. Continuity plates at column webs shall have the column webs examined for cracking using MP testing over a zone 3 inches above and below the continuity plates.
   e. Doubler plates that are welded to the column at the "k" area shall have the weld termination areas and adjacent column web inspected using MP testing over a zone 3 inches above and below the doubler plate.
   f. Weld access holes shall be inspected using LP or MP testing for base metal cracks and cracks from thermal cutting in accordance with Appendix Q of AISC 341.

H. Steel Decking:
   1. General: Periodic inspection shall be provided for field attachment of all steel roof and floor decking; check and verify attachment and location of all closures and accessories.
   2. Welding Inspection: In addition to the specified operator qualifications, prior to each welder starting work on the job and periodically as the testing agency determines, each welder shall perform a weld test to demonstrate to the inspector his ability to produce a satisfactory weld. The weld test shall be as follows:
      a. Weld at least two samples of deck material to a base steel section simulating the framing with one weld each sample. Twist the deck sample with respect to the base until failure occurs. If the decking tears or if the welds shearing in torsion show the proper fusion area, the welds are satisfactory.
      b. Questionable welding of the permanent decking shall be checked by the inspector by suitable means, including ultrasonic methods, if applicable.

I. Shear Stud Connectors: Special inspection shall be provided for the shop and field installation of all shear stud connectors in accordance with AWS D1.1. In addition, where the rejection rate for any welder exceeds 5 percent, each stud welded by that welder shall be struck twice by a hammer with a force sufficient to indicate whether or not a quality weld has been obtained. This hammer test is in addition to the two 30 degree bend tests required by AWS D1.1.
   1. Visual inspection shall be done after ferrule removal.
   2. The inspector shall also check for plumbness, dimensions, and other requirement, including required stud layout patterns, and when welding is through steel deck, that fusion is complete between studs and underlying beams.
   3. Certification of the stud base qualification by manufacturer per AWS D1.1 shall be supplied to the inspector.

J. Drill-In/Power-Driven Anchors: The testing agency shall verify procedures used for installation of all concrete anchors and monitor their installation for compliance with manufacturer's requirements.

K. Nonshrink Grout Sampling and Testing:
   1. Perform the following services as required to assure compliance with this specification. The Contractor shall notify the Engineer and inspection-testing agency of the brand and type of nonshrink grout in time for approval, sampling, and testing (if required).
   2. The Owner's testing agency shall test the grout for strength, height change, and fluidity daily in accordance with ASTM C1107.
      a. Test specimen (cubes) shall be taken so as to represent as nearly as possible the batch of nonshrink grout from which they are taken.
      b. Make three test specimens from a batch of nonshrink grout for each period of test or test age.
      c. An additional test specimen shall be produced should it be necessary to perform further testing. This specimen is to be discarded should the additional testing not be necessary.
      d. Report exact mix tested, location of nonshrink grout in the work, cube identification, date of receipt of cube in laboratory, and nonshrink grout brand and type.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION - NOT APPLICABLE

END OF SECTION