

ATTACHMENT 65001.01
INSPECTION OF ITAAC-RELATED FOUNDATIONS & BUILDINGS

PROGRAM APPLICABILITY: 2503

65001.01-01 INSPECTION OBJECTIVES

01.01 To determine whether foundation work and related quality control activities are being performed in accordance with design specifications, approved procedures and by qualified personnel.

01.02 To verify that as-built site parameters, characteristics, and key building critical dimensions, volumes, materials, and separation satisfy design specifications, requirements, and relevant ITAAC.

01.03 To assess the adequacy of licensee controls for ensuring that critical dimensions, volumes, materials, and separation of key buildings satisfy design specifications, requirements, and relevant ITAAC.

01.04 To verify that the as-built condition of steel structures and **concrete structures** meets the specified design requirements, specifications and drawings. **For installation of concrete structures also refer to IP 65001.02.**

01.05 To determine whether records reflect that completed work meets design specifications and acceptance criteria.

01.06 To determine that the implementation of the quality assurance program related to work activities was effective and to verify that deviations from requirements were effectively resolved.

65001.01-02 INSPECTION REQUIREMENTS AND GUIDANCE

02.01 Procedures. This inspection procedure is intended to verify that approved and effective oversight ensures that the construction and quality control of foundations and buildings is in accordance with design specifications and program requirements.

- a. Verify that contractors performing safety-related work have approved implementing procedures that describe administrative and procedural controls, approved work processes, and inspection requirements.
- b. Verify that procedures clearly prescribe acceptable methods of quality control inspection to ensure that the as-built condition meets specified design requirements, drawings and material specifications.
- c. **Verify that procedures on the reconciliation of construction deviations in critical dimensions and tolerances prescribed are reasonable and acceptable based on the guidance provided in Appendix C to SRP Section 3.8.4 "Design Report – Seismic Category I Structures".**

- d. Verify that procedures include appropriate quantitative and/or qualitative acceptance criteria for determining that the prescribed activities have been accomplished satisfactorily.
- e. Verify that equipment used for process monitoring, tests, and/or data collection is calibrated and maintained in accordance with approved calibration procedures and vendor requirements.
- f. Verify that procedures ensure that craft and quality control inspection personnel performing installation and testing activities are qualified to perform their work.

Guidance. The construction procedures should be reviewed, along with specifications, drawings, design reports and other relevant design documents, to ensure that the work activities discussed in sections 02.02 through 02.06 below are being performed in compliance with the procedural controls and design details. The inspector should also review the quality control procedures, design reports as well as applicable codes, standards and Regulatory Guides, to confirm that the licensee's quality assurance is effective and complies with commitments.

02.02 Foundation Work. Selection of an appropriate foundation depends on the geotechnical characteristics of the underlying soil or rock, groundwater conditions, and the foundation preparations. The bearing capacity and settlement estimates will dictate the type of foundation based on foundation loads and subsurface conditions. Alternatives include foundations directly on soil or rock, and on friction piles or bearing piles. For most nuclear power plant sites, an excavation of existing soil or rock to competent material is typical. This results in using compacted fills to ensure that the correct elevation for the structure base is achieved. Although rock or pile foundations may be used, the focus of this inspection is on engineered backfill construction including the refilling of previously excavated space with approved compacted material. Guidance for the inspection of basemat related work activities is included in inspection procedure 65001.02 "Inspections of ITAAC-Related Structural Concrete."

- a. Backfill operations.
 - 1. Verify that the specifications and design drawings define the type, characteristics, and compaction efforts of material to be used for backfill and that the licensee has controls in place for periodically verifying that the material meets the specifications.
 - 2. Verify that the characteristics and type of compaction equipment used is as specified.
 - 3. Verify that procedures define the maximum loose-lift thickness (typically six to twelve inches) for placement of backfill material and that ongoing quality control inspections verify conformance with this requirement.

4. Verify that the field density testing is performed by qualified testing personnel using the correct methodology and calibrated test equipment since backfill material characteristics can change during delivery and storage. Also verify that current proctor test results accurately reflect the material being placed. Changes in backfill material may require new proctor laboratory testing even though the material still meets design specifications.
5. Verify that the frequency and location of the quality acceptance in-place density tests is specified and adhered to.

b. Rock foundations.

1. Verify that the soundness of the exposed rock is checked and determined to be solid and in an unfractured condition by qualified personnel.
2. Ensure that if the removal of rock below foundation level is required, the resulting excavation is backfilled in a controlled manner with approved materials.

c. Pile foundations.

Verify that the installation of piles is supervised by qualified personnel and that the driving resistance of the piles and a specified pile load test are used to verify the design capacity.

Guidance. Experience has shown that the most severe deficiencies in foundation work occur because of improper backfilling procedures and inadequate construction control. These include: allowing lift thicknesses that are inconsistent with equipment capabilities and thicker than allowed by the specifications; failing to require that the fill be built up uniformly in a well-defined pattern; placing backfill in adverse weather; and failing to perform sufficient field density testing in all areas. It is therefore important to observe backfill placement activities to ensure that work is being accomplished in accordance with design requirements. In-process testing, including in-situ testing, should also be observed to ensure that acceptable compaction prior to placement of subsequent lifts is being controlled by qualified personnel and that appropriate records are being reviewed and approved by cognizant engineers.

02.03 Key Site Parameters. Review the key site parameters that are specified for the design of safety-related aspects of structures, systems, and components in the applicable **licensing basis**. Verify that the existing site foundation characteristics fall within the design parameters.

Verify that the required values for average allowable static bearing capacity and maximum allowable dynamic bearing capacity for normal plus safe shutdown earthquake, typically expressed in pounds per square foot, have been met at the excavation depth.

Guidance. Due to the difficulties in performing work on completed foundations and in conducting effective post-installation foundation inspections, measuring existing site soil parameters accurately is critical. Consideration should be given to performing these first inspection activities with a Civil Engineer as the lead inspector. As part of this inspection, the engineering design features and programmatic controls for foundation work should be reviewed. Consideration should be given to the possible effects from groundwater intrusion and weather on the foundation preparation. Adequate drainage control measures should be established to ensure that the exposed surface will not be degraded by water accumulation.

02.04 Key Dimensions and Volumes. Review the appropriate dimensions and volumes listed in the Design Control Document that are associated with the ITAAC selected for inspection. Once the key dimensions have been identified, assess the method and controls the licensee used to verify that the as-built dimensions conformed to the **licensing basis**. Verify that appropriate records document that the completed work meets the design specifications and acceptance criteria.

- a. Verify that measuring and surveying activities and associated calculations are conducted in accordance with the licensee's quality assurance program requirements.
- b. Verify that surveying and measuring equipment is properly maintained, calibrated, or certified by a qualified M&TE program. Refer to Inspection Procedure 65001.C Construction Testing for additional guidance.
- c. Verify that personnel performing surveys or measurements are qualified and knowledgeable.

Guidance. Independent measurements by the inspector are not required by this procedure. Therefore, this inspection must ensure that the licensee has adequate controls in place to ensure that dimensional requirements have been met. If possible, observation of field measurements should be conducted to verify that work is being performed in accordance with appropriate procedures. The observation of field crews recording data should ensure that they are verifying daily logs for accuracy and systematically assuring that the construction layout conforms to plans. A review of field data should also be conducted to ensure that it is being correctly translated into permanent records. Ensure that any identified deviations are documented in accordance with the licensee's quality assurance program.

02.05 Steel Structures. Fabrication and erection of steel structures activities should be inspected to provide verification and general construction quality and performance. This inspection will assess the adequacy and effectiveness of procurement, implementing procedures, qualification of personnel, ongoing construction activities, and records.

- a. Select a sample of procurement documents for structural steel and verify the following:
 1. The shape, size, dimensions, type, and grade of material conform to the approved specifications and design drawings.

2. Certified mill test reports or a certified report of tests made by the fabricator or qualified testing laboratory are available.
 3. Verify by direct inspection that the items on-site are what was ordered by procurement.
- b. Verify that process controls ensure the following:
1. An adequate marking system is used to maintain the identity of material from storage to installation.
 2. Structural steel is protected from corrosion caused by exposure to weather, and that corrosion limits match design criteria. Refer to design drawing or specifications for governing codes for the site in question.
 3. Nonconforming material is adequately identified and segregated.
- c. Verify the following construction attributes as they relate to the accepted design:
1. Fit-up tolerances for length, depth, and straightness of structural members and bolt holes are as specified.
 2. Base plate elevations and degree of levelness as well as limits for contact bearing for column compression joints are as specified.
 3. Finish for column bases and for thermally cut edges are as specified.
- d. Verify that the following attributes are as specified for anchor bolts, embedded weldments, and anchor plates:
1. Minimum concrete edge distance for bolts, studs, or bars with shear loading is as specified.
 2. Concrete expansion anchor testing is as required.
 3. Maximum and minimum edge distance for slotted, oversize, and standard bolt holes is as specified.
 4. Maximum and minimum hole size for standard, oversize, short slotted, and long slotted holes for bolted connections is as specified.
 5. Minimum spacing requirements for bolt holes are as specified.
 6. Calibration of torque wrenches is as specified.
 7. Tightening and tensioning of normal or high-strength bolts is as specified and the minimum thread engagement is also as specified. Bolt tension may be accomplished by using load indicating washers, torque wrenches or turn-of-the-nut method.

8. For cast-in-place anchors, the critical items shall be as specified. These include anchor size, material, length, embedment detail, length of embedment, projection above concrete, thread lengths, sleeve types, sleeve sizes, sleeve lengths, and grouting requirements.
- e. For structural steel welding, refer to IP 65001.B for inspection attributes, and verify that procedures adequately address the following:
 1. The identification of welds and welders is maintained for each weld.
 2. Welding procedures and welders are qualified in accordance with the American Welding Society requirements for structural steel welding, and other codes or standards referenced by the product specifications.
 3. Welding material and processes are adequately controlled as specified and referenced in Inspection Procedure 65001.B.
 4. Nondestructive examination methods and acceptance criteria are as specified. Procedures specify the minimum visual examination of weld length requirements and the required inspection sampling for full-penetration and partial-penetration welds.
 - f. Verify that foreign material exclusion (FME) controls are appropriately utilized as specified.

Guidance. Before work observation is performed, review the procedures and standards that apply to ensure familiarity with the requirements and acceptance criteria. Receipt inspection reports should be reviewed to verify material conformance. Steel should be inspected for damage and quality of fabrication prior to erection. The nature and extent of any damage that may have occurred because of loading, transit or unloading should be noted along with the identifying piece mark and entered into the corrective action program for proper assessment and disposition. Structural steel stored on the site should be supported off the ground on blocking. After receipt, markings should be used to indicate that the steel is accepted material and that fabrication has been properly performed.

Erection methods should not impart damage to any member. Members must have their ends brought together at the correct relative elevation and held in correct alignment so that heavy drifting is not necessary to align the bolt holes. Sufficient drift pins must be installed to obtain accurate alignment of parts and a sufficient number of bolts must be used to compact the joint before members are released and allowed to deflect. As a rule of thumb, at least 50 percent of the holes must be filled with pins and snug-tight bolts. Due to the possibility of damaging the threads on bolts, any bolts installed prior to installing the drift pins shall be replaced. Drift pins should be cylindrical and not more than 1/32 inch smaller than the diameter of the hole.

Tightening of bolts by the turn-of-the-nut method requires three separate steps: tightening to a snug-tight condition, match marking the protruding end of the bolt and adjacent surface of the nut and tightening the nut the additional specified rotation. Ensure that the match marks are correctly placed so that the relative rotation of the nut to the bolt is measured and not relative to the steel member or splice plate. The subsequent inspection of bolted joints should involve a torque wrench and a recently calibrated tension testing device. Torque wrenches should be calibrated at the beginning of each day of use and for each diameter or length of bolt being tested.

During the welding of structural steel, care must be taken to prevent moisture in the atmosphere from being absorbed by the electrodes which can potentially cause cracking of the weld. Care must therefore be taken to abide by time and temperature restrictions for electrode usage. When ambient weather conditions result in temperatures lower than 50F, the base metal must be preheated prior to welding for materials up to 3/4 inches thick. Thicker materials will require even higher ambient temperatures. Further guidance to ensure welding material and processes are adequately controlled can be found in Inspection Procedure 65001.B.

02.06 Records. Verify that records related to inspected activities are reviewed for accuracy and that the recorded information meets project requirements, **licensing basis** specifications, and ITAAC. Verify that they are approved, and are correctly stored and maintained in such a manner as to demonstrate conformance with design and procedure requirements.

Guidance. Select a sample of records for review. Verify that the records were properly reviewed and approved in the responsible organization. Records of the qualification of craft and quality control personnel associated with the activity should also be reviewed.

02.07 Identification and Resolution of Problems.

Verify that the licensee is identifying problems at an appropriate threshold and entering them into the corrective action program.

| 65001.01-03 RESOURCE ESTIMATE

Resource estimates are currently under development for this inspection procedure. This document will be revised to add this information as it becomes available.

| 65001.01-04 REFERENCES

| ACI Standard 318, "Building Code Requirements for Reinforced Concrete."

ACI Standard 349, "Standard Code Requirements for Nuclear Safety-Related Concrete Structures."

AISC Steel Construction Manual.

ANS/AISC Standard N690, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities."

ASTM Standard D 1556, "Standard Test Method of Soil In Place by the Sand-Cone Method."

ASTM Standard D 2167, "Standard Test Method of Soil In Place by the Rubber-Balloon Method."

ASTM Standard D 3740, "Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction."

| AWS B2.1, "Specification for Welding Procedure and Performance Qualification."

AWS D 1.1, "Structural Welding Code."

| AWS D 1.6, "Structural Welding Code-Stainless Steel."

| Regulatory Guide 1.142, "Safety-Related Concrete Structures for Nuclear Power Plants (Other than Reactor Vessels and Containments)."

END

Attachment 1: Revision History for IP 65001.01

Attachment 1 - Revision History For 65001.01

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number
N/A	10/03/07 CN 07-030	Researched commitments for 4 years and found none. Initial issuance	N/A	N/A
N/A	ML14071A502 04/18/2014 CN 14-010	Researched commitments for 4 years and found none. Periodic update	N/A	ML14071A501