

INSPECTION TECHNICAL PROCEDURE

I-117

ELECTRICAL RACEWAY INSTALLATION INSPECTION

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INSPECTION TECHNICAL PROCEDURE I-117, REV. 0 ELECTRICAL RACEWAY INSTALLATION INSPECTION

1.0 PURPOSE

This procedure provides guidance for assessing activities the Contractor used in constructing the system of electrical cable trays and conduits classified as important-to-safety. This guidance is based on the requirements set forth in the Safety Requirements Document (SRD), the Integrated Safety Management Plan (ISMP), and the Quality Assurance Manual (QAM).

This inspection procedure assesses the adequacy and effectiveness of the following:

- Procedures and programs developed to implement construction activities for electrical raceways
- Construction activities related to installing electrical cable trays and conduits
- Personnel training and qualification program developed to implement construction activities for electrical raceways
- The records system demonstrating the management and accomplishment of the electrical raceway construction activities.

2.0 OBJECTIVES

This procedure verifies the Contractor has established and implemented effective programs and procedures for (1) implementing authorization basis and engineering requirements for constructing electrical cable trays and conduits; (2) managing and providing oversight to ensure that electrical cable trays and conduits are installed according to specifications, drawings, and procedures; and (3) managing and providing oversight to ensure the as-constructed condition of the equipment is according to the design and authorization basis requirements.

This inspection procedure is one component of a complete construction inspection program. This inspection procedure and others will be used, as needed, to ensure construction activities are being conducted as required by authorization basis commitments and Contractor procedures. During the construction phase, a significant portion of this inspection procedure is expected to be accomplished at least once for each major Contractor/subcontractor involved with the activities addressed by this procedure. However, the entire procedure is not expected to be completed during any one inspection or every time the inspection procedure is used.

3.0 INSPECTION REQUIREMENTS

3.1 Adequacy and Effectiveness of Construction Implementing Procedures

- 3.1.1 The inspector should verify the Contractor and any subcontractors with responsibilities for electrical raceways classified as important-to-safety have approved procedures describing the administrative controls and work processes to be implemented to ensure the electrical raceways are constructed as specified by authorization basis and engineering requirements. (QAM, Policy Q-05, Sections 3.1.1 and 3.3; ISMP, Table 1-3, item 5; and SRD, Safety Criterion (SC) 4.1-2 and 7.3-5)
- 3.1.2 The inspector should verify procedures provide for inspections to ensure important quality-related aspects of the electrical raceway construction work are verified and documented. (QAM, Policy Q-05.1, Section 3.5.1; ISMP, Table 1-3, items 5 and 8; and SRD SC 4.1-2, and 7.3-7)
- 3.1.3 The inspector should verify the Contractor has established procedures for ensuring craft and inspection personnel performing work implementing the construction and inspection requirements of important-to-safety equipment are qualified to perform their assigned work. (QAM, Policy Q-02.2, Section 3.3.2; and ISMP, Table 1-3, item 2)

3.2 Adequacy and Effectiveness of Construction Activities

The inspector should verify the electrical raceway construction work is accomplished under controlled conditions according to the Contractor's authorization basis, approved procedures, and engineering drawings. (QAM, Policy Q-05.1, Section 3.1.1; SRD, SC 4.1-2 and 7.3-5; and ISMP, Table 1-3, item 5)

3.3 Adequacy and Effectiveness of the Training and Qualification of Personnel

The inspector should verify craft and quality control (QC) personnel involved in performing electrical raceway construction and inspection activities are qualified to perform their job functions. (QAM, Policy Q-05.1, Section 3.1.1; SRD, SC 7.3-5; ISMP, Table 1-3, item 5)

3.4 Adequacy and Effectiveness of the Records System

The inspector should verify training, qualification, and installation records reflect that specified technical and quality requirements of the electrical raceway construction have been achieved and they are as specified by approved procedures, reviewed for accuracy and assurance that the recorded information meets project requirements, approved, and stored and maintained sufficient to support technical requirements and contractual regulatory compliance. (QAM, Policy Q-17.1,

Sections 3.1.2, 3.3.1 and 3.6.1; SRD, SC 4.0-3, 4.1-2, and 7.3-4; ISMP, and Section 8 and Table 1-3, item 4)

4.0 INSPECTION GUIDANCE

For each of the inspection elements, the inspector should (1) obtain a copy of the Contractor's procedures and the related industry codes and standards committed to by the Contractor; (2) become familiar with the contents of the procedures and standards; and (3) assess whether the procedures and implementation of the procedures adequately conform to the applicable commitments. Suggested sample selections are included in some of the inspections elements described below. However, use judgment in determining sample selection based on construction progress, completion of Contractor quality assurance/QC reviews, or inspector experience, focusing on examining the most important aspects of the particular activity being inspected. The intent is to establish a high level of assurance that the end product meets requirements.

4.1 Adequacy and Effectiveness of Implementing Procedures

- 4.1.1 The inspector should review the Contractor's procedures for installing electrical cable trays and conduit systems and ensure the appropriate requirements of the Institute of Electrical and Electronics Engineers, Inc. (IEEE) Standard 628-1987 and the "National Electric Code" (Articles 300, 318, and 346, in particular) are implemented by the procedures. Some of the more significant attributes that should be addressed are identified in Section 4.2 below. The intent of this inspection is to ensure the Contractor's procedures are consistent with industry standard commitments in the authorization basis.
- 4.1.2 The inspector should review the Contractor's procedures to ensure inspections and tests are specified to verify completed electrical raceway installations conform to engineering drawings and authorization basis requirements.
- 4.1.3 No additional guidance.

4.2 Adequacy and Effectiveness of Construction Activities

During the field observations, the inspector should carry a copy of the procedure(s) and engineering drawings pertinent to the planned observations. The inspector should observe electrical raceway work in progress and ensure the work is being accomplished as required by approved procedures and drawings.

The inspector should interview a sample of the craft and QC personnel performing the observed activities, focusing on determining whether job and procedure knowledge is satisfactory. Obtain the names and job functions of those interviewed and use them to verify proper implementation of personnel qualification requirements, as specified in Sections 4.3 and 4.4 below.

The inspector should select three completed cable tray installations and three completed conduit installations for examination. The lengths of the completed installations selected should be large enough to contain a representative sample of supports of different types and designs. Select at least three different support types installed in tray installations and three different support types installed in conduit installations. Obtain copies of the engineering drawings for the tray and conduit installations selected, including a drawing of each selected support type. Observe the following attributes to verify conformance with procedure requirements and engineering drawings:

- Location and routing of trays and conduits
- Proper identification of raceways
- Locations and types of cable tray and conduit supports to ensure they meet allowable span distances
- Raceway isolation and separation distances
- Raceway grounding installation to verify that the raceway grounding is electrically connected to the facility ground grid
- Torquing of threaded fasteners and anchor bolts to verify thread engagement conforms to specified requirements. The acceptance criteria for thread engagement is that the nut surface be at least flush with the surface of the penetrating bolt, although less engagement can be justified by specific engineering analysis. Some subcontractors require the bolt extend above the nut surface by at least one thread. Be aware of the specific requirements of the subcontractor in question.
- Surfacing and elimination of burrs on the edges of cable dropouts from trays and conduit to preclude damage to the cable insulation during cable-pulling activities or normal operation. Conduit should not be attached to or in contact with cable trays or panels.
- Sum of the bends in a conduit run between cable pull points. The acceptance criteria is usually 360 degrees. Also, verify the bend radius of conduit is not less than procedure requirements.
- Support configuration for welded raceway supports. Use the appropriate guidance of Inspection Procedure I-115, "Structural Steel Welding Inspection." In particular, ensure the proper procedure was used, the welder was qualified, and the completed weld conforms to design drawing requirements. By visual inspection, verify the applicable acceptance criteria was met regarding throat thickness, weld buildup, absence of arc strikes, weld surface condition, and undercut.

4.3 Adequacy and Effectiveness of the Training and Qualification of Personnel

The inspector should review the Contractor's procedures specifying the requirements for education, experience, training, and certification of craft and QC personnel associated with performing and inspecting electrical raceway installations. If not accomplished in Section 4.2 above, interview and collect the names of at least the following personnel:

- Three craftsmen involved in implementing the electrical raceway installation requirements of the procedures
- Three QC personnel involved in performing electrical raceway inspections.

During the interviews, the inspector should verify the personnel are sufficiently knowledgeable of applicable procedure requirements. Examine the training and qualification records of the craft and QC personnel interviewed and determine whether the records demonstrate conformance with the Contractor's requirements for personnel training, qualification, and certification.

4.4 Adequacy and Effectiveness of the Records System

The inspector should examine a sample of completed records generated during the construction and inspection of the electrical raceway installation activities observed in Section 4.2 above. Examine these records and records of the training and qualification of personnel to verify they have been approved by the proper authority and stored and maintained according to procedural requirements.

5.0 REFERENCES

IEEE Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc., IEEE Standard 628, 1987 Edition.

Integrated Safety Management Plan (ISMP), 24590-WTP-ISMP-ESH-01-001, Rev. 1, Bechtel National, Inc., 2002.

National Fire Protection Association, "National Electric Code," NFPA-70, 1999 Edition.

Quality Assurance Manual (QAM), 24590-WTP-QAM-QA-01-001, Rev. 0a, Bechtel National, Inc., 2002.

Safety Requirements Document (SRD), Volume I, 24590-WTP-SRD-ESH-01-001-01, Rev. 0, Volume 2, 24590-WTP-SRD-ESH-01-001-02, Rev 0d, Bechtel National, Inc., 2002.

6.0 LIST OF TERMS

IEEE	Institute of Electrical and Electronics Engineers, Inc.
ISMP	Integrated Safety Management Plan
QAP	Quality Assurance Program
QC	Quality Control
RPP	River Protection Program
SC	Safety Criteria
SRD	Safety Requirements Document
WTP	Waste Treatment Plant