

INSPECTION TECHNICAL PROCEDURE

I-122

ELECTRICAL EQUIPMENT INSTALLATION INSPECTION

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INSPECTION TECHNICAL PROCEDURE I-122, Rev. 0

ELECTRICAL EQUIPMENT INSTALLATION INSPECTION

1.0 PURPOSE

The purpose of this procedure is to provide guidance for assessing the Contractor's activities for installing electrical equipment. This guidance is based on the requirements set forth in the Safety Requirements Document (SRD), the Quality Assurance Manual (QAM), and the Integrated Safety Management Plan (ISMP).

This procedure provides guidance for inspectors to assess the adequacy and effectiveness of the following:

- Electrical equipment installation procedures
- Electrical equipment installation
- Training and qualification of personnel
- Records system demonstrating the accomplishment of the required electrical equipment installation activities.

2.0 OBJECTIVES

The objective of this procedure is to provide guidance for inspectors to verify that the Contractor has developed and implemented an effective program for installing important-to-safety electrical equipment at the River Protection Project-Waste Treatment Plant (WTP). This includes addressing programs for the following: (1) implementing commitments regarding the installation of electrical equipment; (2) managing and providing oversight to ensure that electrical equipment installation and related quality control have been adequately addressed by specifications, drawings, and procedures; (3) managing and providing oversight to assure that the as-installed condition of electrical equipment is in accordance with the design; and (4) recording installation activities for important-to-safety electrical equipment.

This inspection procedure is designed to be used as a component of a complete construction inspection program. This and other inspection procedures will be used on an on-going basis, as needed, to provide assurance that construction activities are being conducted as required by authorization basis commitments and Contractor procedures. Although it is expected during the construction phase that a significant portion of this inspection procedure will be accomplished at least once for each major Contractor or subcontractor involved with the activities covered by this procedure, it is not expected that completion of the entire procedure will be accomplished 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 inspectors should verify that all Contractor or subcontractors with construction responsibilities for electrical equipment installation have approved implementing procedures describing administrative controls and work processes implementing the design requirements. (QAM Policy Q-05.1, Sections 3.1.1 and 3.3; ISMP Section 1.3.9, 1.3.13, 3.5, and Table 9-2; and SRD, Safety Criterion (SC) 4.1-2 and 7.3-5)
- 3.1.2 The inspectors should verify procedures provide for QC inspections of important-to-safety installations to ensure that the as-installed condition of electrical equipment meet specified engineering requirements and drawings. As part of the assessment of the QC inspection procedures, ensure the procedures include or reference appropriate quantitative or qualitative acceptance criteria for determining that the prescribed activities have been accomplished satisfactorily. (QAM Policy Q-05.1, Section 3.5.1; ISMP Section 1.3.9, 1.3.13, 3.5, and Table 9-2; and SRD, SC 4.1-2 and 7.3-7)
- 3.1.3 The inspectors should verify the Contractor has established procedures for ensuring craft and QC inspection personnel, performing quality related electrical equipment installation and testing activities, are qualified to perform their assigned work. (QAM Policy Q-02.2, Section 3.3.2; SRD, SC 7.2-2 and 7.3-3; and ISMP, Section 1.3.12, 3.5, 3.15, 6.1.3, and Table 9-2)

3.2 Adequacy and Effectiveness of Construction Activities

The inspectors should verify the installation of electrical equipment is being accomplished under controlled conditions using the Contractor's approved procedures. (QAM Policy Q-05.1, Section 3.1.1; SRD, SC 4.1-2 and 7.3-5; and ISMP Sections 1.3.9, 1.3.13, and 3.5 ISMP, Section 1.3.12, 3.5, 3.15, 6.1.3 and Table 9-2)

3.3 Adequacy and Effectiveness of the Training and Qualifications of Personnel

The inspectors should verify craft, testing, and QA and QC personnel involved in the performance of electrical equipment installation and inspection activities are qualified to perform their job functions. (QAM Policy Q-02.2, Sections 3.2.2, 3.3.1, and 3.3.3; ISMP, Section 1.3.12, 3.15, and Table 9-2; and SRD, SC 7.3-3)

3.4 Adequacy and Effectiveness of Records

The inspectors should verify that the as-built records of electrical equipment installation and testing are as specified, reviewed by the Contractor for accuracy and assurance that the recorded information meets project requirements, approved, stored, and maintained sufficient to support

technical and Contract requirements. (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; and ISMP, Section 8 and Table 8-1)

4.0 INSPECTION GUIDANCE

Electrical equipment installation instructions are unique to the specific equipment and the equipment manufacturer. Accordingly, equipment suppliers specify installation requirements in the technical manual supplied with the equipment, and installers use the manufacturers instructions for installation. The installation requirements included in the Contractor's procedures will be dependent on the equipment supplier. Care should be taken to ensure the requirements important to the operation of the equipment in the manufacture's technical manual(s) are included in the Contractor's procedures.

This procedure is applicable to the following types of electrical equipment:

- Large pump motors
- Motor control centers
- Electrical switch gear enclosures
- Emergency batteries
- Battery chargers
- Control panels (e.g. egress lighting panel)
- Motor-generator sets
- Circuit breakers
- Transformers
- Ventilation fan motors (if not installed with the fan).

NOTE: This is not meant to be a complete listing of important electrical equipment.

Included in Section 4.2 below, are suggested sample selections. The inspector can follow the suggestions or choose samples more appropriate for the inspection due to construction progress, completion of Contractor's QA and QC reviews, or inspector experience. The inspector should use judgement in determining sample selection, focusing on examination of 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 Construction Implementing Procedures

- 4.1.1 The inspectors should review the implementing procedures for installation of important-to-safety electrical equipment provided by the Contractor. Select three different types of electrical equipment from the list in Section 4.0 above and verify that the procedures (1) are approved and (2) specify the requirements from the manufacturer's technical manual(s) and any codes or standards identified by the Contractor. The adequacy and effectiveness of the Contractor's procedures is assessed by how well the procedures

conform to the requirements in the manufacture's manual(s) and the requirements of any identified codes or standards that are necessary to ensure safe operation of important-to-safety electrical equipment.

4.1.2 Review the Contractor's procedures for the electrical equipment selected in Section 4.1.1 (above) to ensure inspections and tests are scheduled to verify the installed condition of the selected equipment conforms to the design, applicable codes and standards, and the manufacture's requirements.

4.1.3 No additional guidance.

4.2 Adequacy and Effectiveness of Construction Activities

Prior to performing work observation inspections in the field, the inspector should review the Contractor's procedures, manufacturer's technical manuals, and applicable codes or standards which apply to the work that will be observed to ensure familiarity with the requirements and acceptance criteria pertinent to the planned observations. During the field observations, the inspector should carry a copy of the sections of the procedure and industry standards pertinent to the planned observations, and verify that work is being accomplished using procedures of the proper revision.

Select three different types of electrical equipment from the list in Section 4.0 that have installation in progress (include in the selection the equipment selected in Section 4.1.1, if possible). Work observation inspections should verify the equipment is located, installed, assembled, and connected to conform to the latest approved-for-construction drawings, installation specifications, technical manual requirements, and procedures. The following attributes are suggested for inspection during work observation activities:

- Area of equipment installation is clean and clear of construction debris
- Clearances and tolerances conform to drawing requirements
- Spreader bars are used when lifting equipment. Cable pull angle should not exceed 30 degrees from vertical
- Leveling and alignment conforms to drawing requirements
- Location, routing, and support of electrical cables conform to drawing requirements
- Electrical connections (amps, volts) are in accordance with manufacturer's requirements. Terminations are in accordance with the termination procedure
- Thread engagement and tightness of fasteners for mounting and installation of equipment conform to engineering drawings and technical manuals
- Identification and markings conform to the Contractor's procedures for marking

- Physical integrity is maintained - loose or damaged parts are replaced or repaired
- Equipment is suitably protected from damage or debris from construction activities.

During the field observations, the inspector should interview and obtain the names of a sample of the craft and QC personnel performing the observed activities to assess whether their knowledge of the job and procedures is satisfactory. The sample size will be determined by the number of Contractor personnel performing the activity and generally should be one to four for each discipline (craft and QC personnel). Information on these same personnel will be used pursuant to Section 4.3, below, to determine the adequacy of their experience and training.

4.3 Adequacy and Effectiveness of the Training and Qualification of Personnel

During the observation of work activities (Section 4.2, above), the inspector should carry a copy of the procedures specifying the Contractor's requirements for education and experience levels, training, and certification. The inspector should interview four craft and four QA or QC personnel involved in the performance of electrical equipment installation activities, and record which jobs they were performing. The inspector should verify that the personnel were sufficiently knowledgeable of procedure requirements. The inspector should also review the training and qualification records for those individuals to determine whether they met the requirements.

4.4 Adequacy and Effectiveness of Records

The inspector should select a sample of records that were generated during the conduct of electrical equipment installation activities, and records of qualification for those craft and QA or QC personnel selected during the performance of Section 4.3, above. The inspector should verify that the records selected for examination were approved by proper authority and were stored and maintained in such a manner as to demonstrate conformance with procedure requirements.

5.0 REFERENCES

10 CFR 830, "Nuclear Safety Management Regulation," *Code of Federal Regulations*, as amended, Section 830, Subpart A, "Quality Assurance Requirements."

Integrated Safety Management Plan, ABCN-24590-01-00008, Rev. 0, BNI Inc., 2001.

Quality Assurance Manual, 24590-WTP-QAM-QA-01-001, Rev. 0, BNI Inc., 2000.

Safety Requirements Document, BNI-5193-SRD-01-02, Rev. 4, BNI Inc., 2000.

6.0 LIST OF TERMS

IEEE	Institute of Electrical and Electronics Engineers
ISMP	Integrated Safety Management Plan
QA	quality assurance
QAM	Quality Assurance Manual
QC	quality control
RPP	River Protection Program
SC	Safety Criterion
SRD	Safety Requirements Document
WTP	Waste Treatment Plant

Attachments: None