
INSPECTION PROCEDURE 88200 APPENDIX H

INSPECTION OF ELECTRICAL COMPONENTS AND SYSTEMS AT FUEL CYCLE FACILITIES

Effective Date: May 28, 2025

88200.H-01 INSPECTION OBJECTIVES

- 01.01 To determine if safety-significant electrical components and system work is being performed in accordance with regulatory requirements, the licensing basis, specifications, drawings, and work procedures.
- 01.02 To determine if the applicant/licensee's system for preparing, reviewing, and maintaining records relative to safety-significant electrical components and system activities reflects work accomplishment consistent with specifications and procedures.
- 01.03 To determine if the as-built condition of safety-significant electrical components and systems meets the specified design requirements, specifications, and drawings. For installation of electric cable, refer to Appendix G of this inspection procedure (IP).
- 01.04 To determine if the implementation of the management measures related to work activities for safety-significant electrical components and systems associated with items relied-on for safety (IROFS) is effective and to verify that deviations from requirements are appropriately resolved.

88200.H-02 INSPECTION REQUIREMENTS

- 02.01 For the safety-significant items and services (SSIS) selected for inspection of electrical components and systems, determine whether procedures exist in the following areas, are compatible with the management measures program for IROFS, and prescribe adequate methods to meet the licensing basis and construction specifications, where applicable:
 - a. receipt inspection
 - b. storage and handling
 - c. installation activities
 - d. construction testing
 - e. configuration management
- 02.02 Determine whether the applicant/licensee has an established audit program (including plans, procedures, and audit schedule) for assessing the adequacy of work control functions and requirements, as applicable in their licensing basis, in the area of electrical components and system activities, and for ensuring that examination, inspection, and if required, test personnel associated with performing tests and inspections of safety-significant activities are qualified and/or certified to perform their assigned work.

- 02.03 Ascertain whether the following safety-significant electrical components and system activities, as required by licensing commitments and applicable construction codes, are being controlled and accomplished in accordance with documents reviewed in Inspection Requirement 02.01, above:
- a. receipt inspection
 - b. storage and handling
 - c. installation activities
 - d. construction testing
 - e. configuration management
- 02.04 Review the documentation generated for the safety-significant electrical components and system activities, as required by the licensing basis. Determine whether the applicant/licensee/contractor system for documenting safety-significant work is functioning in accordance with requirements. Records should be complete, reviewed by quality control, engineering personnel, or designee, as required, and readily retrievable.
- a. receipt inspection and material certification
 - b. installation inspection
 - c. nonconformance/deviation record(s)
 - d. training/qualification records of craft, and quality inspection personnel (as required)
 - e. configuration management records

88200.H-03 INSPECTION GUIDANCE

General Guidance

Inspectors should review the facility description in the integrated safety analysis, integrated safety analysis summary, or equivalent and be familiar with the SSIS being constructed at the site. The purpose of these as-built inspections is to verify that the assumptions and critical attributes reviewed during the licensing review process remain valid; the design was appropriately translated to construction specifications; the licensee/applicant constructed the facility in accordance with these specifications; and any modifications performed comply with the licensee's configuration management program and does not impact any NRC licensing decisions.

Electrical components and systems consist of those elements of the facility that are designed to supply, use, control, transform, condition, or interrupt electric power. This IP applies, but is not limited, to the following safety-significant electrical components and associated items:

(1) raceways; (2) raceway hangers and other supports; (3) switchgear; (4) motor control centers; (5) transformers; (6) batteries and racks; (7) battery chargers; (8) inverters; (9) motor generator sets; (10) circuit breakers; (11) relays; (12) electrical penetration assemblies; (13) motors; (14) motor operators on valves; (15) electrical-control panels; (16) local cabinets; (17) limit switches; (18) solenoid valves; (19) emergency power system for principal safety-significant loads, and (20) other protective devices.

Penetration assemblies, as covered by electrical IPs, refer to assemblies installed in a containment structure opening (sleeve, nozzle, or barrel) and not to the opening itself. The containment opening is considered to be a part of the containment structure.

Inspectors should also be familiar with the licensee's management measures and/or quality assurance program, if applicable, and the licensing basis associated with these measures. It is not the objective of this IP to verify the adequacy of the applicant/licensee's management measures program, but inspectors should be prepared to identify potential gaps in the implementation of management measures for future inspections. Inspectors should complete this appendix by inspecting the attributes listed in this appendix for as-built electrical components and system work with a focus on SSIS, such as IROFS, or regulatory requirements, as applicable. Inspectors should also coordinate this appendix with inspection of electrical cables (Appendix G of this IP) for efficiency.

Inspectors should contact the applicant/licensee prior to the onsite inspection to help determine what samples are to be inspected. Observation during in progress activities, like construction, installation, and testing, is desirable but not required. If necessary, inspectors may select completed systems for inspection. Inspectors should not attempt to inspect all available samples but may expand if significant concerns with the applicant/licensee's control of installation/construction arise in this functional area.

Inspectors should collect applicant/licensee procedures, specifications, and work completion records in advance. If unable to review these documents in advance of the onsite inspection, then the licensee should be notified that these documents, and any other relevant documents, should be available when the inspector(s) arrives at the site.

Inspectors should choose one or more safety-significant electrical components and systems and review the areas listed in Inspection Requirements 02.01 through 02.04 to the extent practical and may use their judgment in determining which areas to concentrate on if time is limited.

03.01 Inspection Requirement 02.01

- a. Review construction specifications related to safety-significant electrical components and systems and ascertain whether the specified technical requirements conform to the commitments contained in the licensing basis.
- b. Review electrical components and systems procedures and as applicable, verify they specify provisions for adequate onsite engineering direction, are appropriate and adequate related to procurement and use of materials, specify adequate control of hold points, and provide adequate controls for design changes and incorporation of design changes into as-built drawings.
- c. Determine if appropriate and adequate procedures in the following areas are compatible with the management measures program, and prescribe adequate methods to meet the construction specifications, where applicable:
 1. receipt inspection
 2. storage and handling
 3. installation activities
 4. construction testing
 5. configuration management

- d. For the procedure review, consider the following attributes:
 - 1. Controls to ensure that the type and classification of electrical components and systems comply with approved drawings and/or specifications and meet licensee commitments.
 - 2. For IROFS, determine if procedures are compatible with the management measures program, and prescribe adequate methods to meet the construction specifications.

03.02 Inspection Requirement 02.02

- a. Review applicant/licensee's established audit program (including plans, procedures, and audit schedule) for assessing the adequacy of work control functions and requirements, as applicable, in their licensing basis, in the area of safety-significant electrical components and system construction activities.
- b. Review audit program to verify if examinations and inspections are performed in accordance with applicant/licensee's requirements and if test personnel associated with performing tests and inspections of electrical components and system construction activities are qualified and/or certified to perform their assigned work.
- c. Verify records establish that required audits, as applicable, were performed and that deficiencies identified during audits were tracked and corrected.

03.03 Inspection Requirement 02.03

- a. Select a sample of electrical systems and components for inspection. Inspection should be accomplished by observation and evaluations of both in-process and completed work if possible. Sample selection should be based on importance to operational safety.

Choose a sampling of safety-significant electrical components and systems. The sampling may include a variety of locations, uses and types (e.g., large motors; diesel generators; motor-operated valves; solenoid valves; control centers; control room panels and cabinets; local panels and cabinets; coaxial and triaxial connectors; fiber optic connectors; and stress-cone terminations).

- b. Ascertain whether the following applicable safety-significant electrical components and systems activities, as required by licensing commitments and applicable construction codes, are being controlled and accomplished in accordance with the requirements of the documents reviewed in 02.01, above:
 - 1. Receipt Inspection. Observe and evaluate portions of receiving-inspection activities pertaining to the electrical components and systems selected for inspection in the appropriate subsections of Section 02.03, above.
 - (a) Determine whether receiving-inspection activities are being controlled and performed in a manner that will ensure requirements, as applicable. Samples may include:
 - (1) Identification appears on components and in receiving documents.
 - (2) Physical conditions (damage, deterioration, etc.) are indicated.

- (3) Documentation regarding quality requirements (e.g., results of functional and qualification testing) received with components is reviewed to, and meets, requirements. Where qualification testing of components to be placed in a harsh environment (e.g., inside containment) is not a requirement of the specification, follow-up with the licensee to determine what means will be used to ensure that applicable environmental qualification will be satisfied.
 - (4) Control of nonconforming electrical components and associated items is conducted in accordance with applicable procedures and meets requirements.
 - (5) An adequate number of qualified personnel are available to perform the receiving-inspection function.
 - (b) Received components are as specified, properly identified, and controlled or otherwise noted.
 - (c) Verify procurement requirements, as applicable, such as qualification tests, certificate of conformance, functional tests and other quality tests (material, physical, and chemical) have been successfully completed or status of how and when such requirements will be satisfied is documented and adequately controlled. Refer to the applicant/licensee's licensing basis for tests and criteria requirements.
2. Storage and handling. Special storage requirements, as applicable, are typically specified by the manufacturer or an industry standard, committed to by the licensee. The requirements should include such things as taping or sealing cable ends, controlling material and cable or cable reel identification, maintaining proper ambient temperature, separation from nonconforming items, and placement on dunnage.
- (a) Observe and evaluate storage activities and conditions for the components selected in the appropriate subsections of Inspection Requirement 02.03. Verify the following, if applicable:
 - (1) Components are stored in the proper storage-level designation.
 - (2) Components are properly identified.
 - (3) Storage conditions (temperature, humidity, cleanliness, etc.) and requirements are controlled and monitored as directed by the applicable specification and by the manufacturer's specifications.
 - (4) Licensee and contractor inspection and monitoring activities are being performed in accordance with procedural requirements, if in progress during NRC inspection.
 - (5) Nonconforming items placed in storage are identified and/or segregated as required.
 - (6) In-place storage requirements are satisfied.

- (7) An adequate number of qualified personnel are available to perform the required storage functions.
- (b) Observe and evaluate handling activities and conditions for the components selected in the appropriate subsections of Section 02.03. Verify if conditions are controlled and performed, as required, during receipt, storage, and installation of large electrical equipment:
 - (1) attachment points,
 - (2) use of rigging,
 - (3) positioning,
 - (4) special handling requirements, and
 - (5) temporary covers.

3. Installation Activities.

- (a) In-Process Installation. If possible, observe and evaluate in-process installation pertaining to the components and associated items selected in the appropriate subsections of Inspection Requirement 02.03. Determine whether, as applicable:
 - (1) The latest approved revision of applicable construction specifications, drawings, and/or construction procedures are available and used by the installers.
 - (2) The components are as specified, such as type, size or rating, and material.
 - (3) The components are installed in the proper location and orientation by qualified craft personnel using suitable equipment and tools.
 - (4) Associated mounting hardware, supports, and anchors are of the type (welded, bolted, etc.,) and material specified, and are properly located.
 - (5) The required component identification is properly established or maintained.
 - (6) Installed components are adequately protected from damage by adjacent construction activities.
 - (7) Licensee and contractor inspections are performed or scheduled to be performed, before “covering up” the work to be inspected; quality control hold points are observed.
 - (8) Inspection activities are completed in a timely and proper manner by qualified personnel.
 - (9) Documentation of installation and inspection activities is completed in a proper and timely manner.
 - (10) Nonconformance’s are identified and handled in accordance with established procedures. Where corrective action is being taken, determine whether it meets the appropriate requirements.

- (b) Completed Work. Evaluate the completed installation of electrical components and associated items selected in the appropriate subsections of Section 02.03. Determine whether, as applicable:
- (1) Components are installed in accordance with design, construction specifications, and work procedures; components are at the correct location, configuration, and orientation.
 - (2) Specified materials are used.
 - (3) Bolts, anchors, weldments, other fasteners, and supports are as specified and properly mounted and secured. Anchor bolts holding or mounting electrical components should be of the type, size and length specified. Provisions should exist to prevent indiscriminate cutting of reinforcement steel during the drilling of anchor holes.
 - (4) Protective coatings, softeners, bushings, and other specified materials have been used as specified.
 - (5) Equipment and item identifications have been maintained.
 - (6) Equipment and components are protected from hostile environments, such as high-pressure pipe, rotating equipment, and non-seismically supported equipment.
 - (7) Electrical components, such as conduit, tray, motors, and power distribution centers maintain specified physical and electrical separation and independence between redundant components.
 - (8) Statuses of completion, maintenance, and readiness for pre-operational testing are indicated or otherwise documented.
 - (9) Adequate actions or provisions have been taken and/or maintained (as needed) to ensure that the validation of the environmental qualification of components is maintained.
- (c) As-Built Verification. When electrical components and associated items, as selected in appropriate subsections of Section 02.03, are completely (or essentially) installed and inspected, review construction specifications and other applicable work instructions referenced by the drawings or otherwise applicable to the installation. Compare the actual installation with the above drawings and associated documents. For each drawing selected, determine whether several components shown on the drawing are of the type specified, as required and as applicable (function, range, qualification, material, etc.), and whether they have been installed, located, oriented, supported, protected, etc., in accordance with this drawing.
- (1) Before performing the above, verify the number and statuses of outstanding design changes on the selected drawings (and related specifications).
 - (2) Discrepancies observed may result from in-process changes, such as those initiated in the field. If in-process changes are involved, determine whether

the licensee has properly controlled and documented these changes for engineering review, approval, and subsequent incorporation into the as-built drawings.

4. Construction Testing. If possible, observe construction-testing activities for the electrical components selected in the appropriate subsections of Section 02.03. Determine whether, as applicable:
 - (a) The latest revisions of applicable test procedures and/or specifications are available at the work location and used by personnel performing the testing.
 - (b) Properly identified, traceable, and calibrated measuring and test equipment are used.
 - (c) Equipment or components are able to obtain the degree of accuracy and tolerance specified, or otherwise meet specified requirements.
 - (d) Required testing results are recorded during the activity; not after the testing has been completed. (Where test results are immediately available to the NRC inspectors, note whether they are within specified limits.)
 - (e) Components that have been tested are adequately identified as to their statuses, (i.e., specified requirements have been met or deficiencies noted).
 - (f) Personnel performing the testing are properly qualified.
 - (g) Test personnel adhere to any special handling or removal requirements.
 - (h) Test discrepancies are properly identified for resolution.
5. Configuration Management. For the activities observed during Inspection Requirement 02.03. for in-process installation, completed work, and as-built verification, and for construction testing, as applicable, verify if changes occurred during these construction activities, the applicant/licensee properly controlled and documented these changes for engineering review, approval, and subsequent incorporation into the final as-built drawings. Verify these actions were completed in accordance with their procedures and management measures.

03.04 Inspection Requirement 02.04

Ascertain whether for the electrical systems and components construction activities, the applicant/licensee/contractor system for documenting safety-significant work is functioning in accordance with requirements.

- a. Receipt Inspection and Material Certification. Select records applicable to the receipt of lots or shipments. Select records applicable to the storage, and storage inspection of lots or groups of electrical systems, components and associated items.
 1. Records confirm that required material characteristics, performance tests, nondestructive tests, environmental qualification tests, and other specification requirements are met.

2. Receipt inspection and storage records indicate that, where appropriate, defective or incorrect components, parts, and materials are controlled and prevented from installation and possible use.
3. Documentation has been prepared and maintained as required by receipt inspection and documentation storage instructions.

b. Installation Inspection.

1. Records confirm that specified materials and components were installed as specified and that the required construction inspections were performed, and acceptance criteria are defined.
2. The records selected should represent a diversity of electrical system, components, and associated items and include some cable and terminations located inside the process facility. Review and evaluate a selected sample of quality records pertaining to installation activities, and determine whether these records reflect the following, as applicable:
 - (a) Most recent and approved design and construction documents were used during installation.
 - (b) Specified electrical components and associated items were installed in the location specified or otherwise noted.
 - (c) Materials and methods used for supports and anchors (including welds) met applicable specifications.
 - (d) Qualified personnel performed, recorded, reviewed, and evaluated required inspections.
 - (e) Inspection records were complete and satisfy documentation requirements.
 - (f) Physical separation and independence requirements were met.
 - (g) Required protection was provided after installation.
3. The licensee may be required to have records relative to protection of the safety-significant related portions of the onsite AC power system from certain fault conditions. Significant aspects of this protection may include: (1) manual and automatic interconnections between buses, buses to loads, and buses to supplies, and capability of components to withstand anticipated fault conditions; (2) interconnections between safety-significant and non-safety-significant buses; (3) circuit protection network (e.g., selective trip), including setting criteria, protection for overvoltage, under voltage, and frequency; and (4) load shedding devices.
4. Review and evaluate pertinent quality records in a sampling of the areas listed below. Determine whether:
 - (a) Adequate preparation, control, review, and evaluation of these records have been made.
 - (b) Records reflect that appropriate requirements have been met.

(c) The system of records is functioning properly.

c. Nonconformance/Deviation Record(s).

1. Records include current status of these items. Nonconformance reports include the status of corrective action or resolution (e.g., determine whether adequate corrective action is being taken when test results are not within tolerance or acceptance criteria).
2. For the inspection, review and evaluate a sampling of reports applicable to nonconformances or deviations. Determine whether:
 - (a) Records are complete and promptly reviewed by qualified personnel.
 - (b) Records have been routinely processed, evaluated in a timely manner and controlled through established channels, for resolution of the root-cause as well as the immediate problem.
 - (c) Records are properly identified and stored, indicate current status, and can be retrieved in a reasonable time.
 - (d) Nonconformance reports include the status of corrective action or resolution, and adequate justification is provided for use-as-is disposition.

d. Training/Qualification Records of Craft, and Quality Inspection Personnel. Records establish that quality inspection personnel, as applicable, are adequately qualified for their assigned duties and responsibilities and that craft personnel have been trained in their assigned tasks. Records are complete and current and show which activities inspectors are qualified to perform.

e. Configuration Management Records. Review and evaluate a selected sample of configuration management records, and determine whether:

1. Records associated with design and field changes, as well as related work and IP changes, reflect that timely review and evaluation of design and field change documents have been performed by personnel who are qualified.
2. Records of periodic inspections ensure that only the most recent approved documents, including design changes, were used in the field.
3. Design changes are subject to adequate design control, including consideration of the impact of the change on the overall design and on as-built records.
4. Records of nonconformances to design requirements include preparation of a nonconformance report even if the nonconformance is resolved through the design-change process.

03.05 Additional Guidance

Note: Personnel Interviews. Informal interviews with field-craft and inspection personnel may be randomly conducted to determine how well employees know the requirements of their work activity. Ascertain whether a sufficient number of adequately qualified quality control inspection personnel, if required, are at the construction site, commensurate with

the work in progress, and adequately performing their assigned duties through the established organizational structure.

Prevalent Errors and Concerns. Areas in which the inspector should be alert to potential generic issues. This section is included to provide background for inspectors on past electrical components and systems issues related to construction experience at previous projects. (Note: These are not listed in order of their perceived importance to safety.)

- a. Adequate procedures or other means have not been established to ensure and document that all safety-significant electrical components and subsystems have met applicable acceptance criteria or are nonconforming in specific areas.
- b. IPs do not include adequate inspection requirements and acceptance criteria.
- c. Inadequate means to control location and status of electrical components; especially during removal for repair, modification, or replacement.
- d. Inadequate procedures to control the evaluation, approval, and use of field changes. (The licensee/contractor should establish means to ensure that only the latest approved field changes and other revisions or changes are being used for construction and inspection activities.)

88200.H-04 RESOURCE ESTIMATE

This appendix is intended to provide inspection requirements and guidance applicable to a wide variety of potential construction projects at both existing and new fuel cycle facilities (FCFs). These projects may vary greatly in scope, complexity, and potential risk to public health and safety. Recommended inspection scope and hours for a specific new FCF will be documented in the principal inspection plan (PIP) for that facility developed in accordance with Inspection Manual Chapter (IMC) 2694, "Fuel Cycle Facility Construction and Pre-Operational Readiness Review Inspection Program."

Additionally, this IP can be used to provide additional inspection guidance for plant modification inspections at existing facilities but is not required to be implemented for these projects. Use of this appendix, or sections of this appendix, for modifications at existing FCFs, would be done on a case-by-case basis, in accordance with IMC 2600, Appendix B, "NRC Core Inspection Requirements."

88200.H-05 PROCEDURE COMPLETION

This IP is complete when the applicable appendices or applicable appendix sections are completed for the facility, as determined by the PIP. Inspectors are not expected to complete every activity in the appendices of this IP. Instead, inspectors should prioritize inspection activities based on: (1) importance of the activity to safety, (2) availability of the onsite activity at the time of the inspection, and (3) available inspection resources. This appendix does not need to be completed if there are no SSIS covered by this appendix at a FCF.

88200.H-06 REFERENCES

Refer to licensing basis requirements for applicable codes and standards for each fuel facility.

END

List of Attachments:

Attachment 1: Revision History Table

Attachment 1: Revision History for IP 88200 Appendix H

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional Non-Public Information)
	ML24226A366 05/28/25 CN 25-014	Initial issuance. Discipline specific appendix developed to provide technical inspection guidance for new construction and major modifications activities for fuel facilities with varying technologies, size, licensing requirements, etc.	N/A	N/A