
INSPECTION PROCEDURE 69020 APPENDIX J

INSPECTION OF INSTRUMENTATION AND CONTROL SYSTEMS AT NON-POWER PRODUCTION AND UTILIZATION FACILITIES

Effective Date: March 25, 2025

PROGRAM APPLICABILITY: IMC 2550

69020.J-01 INSPECTION OBJECTIVES

- 01.01 To determine if construction/modification work and related quality control activities associated with safety-related instrumentation and control (I&C) systems are being performed in accordance with 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 related I&C system activities is functioning properly, and to determine if the records reflect work accomplishment consistent with specifications and procedures.
- 01.03 To verify the as-built condition of safety-related I&C systems meets the specified design requirements, specifications, and drawings.
- 01.04 To determine if the implementation of the quality assurance program (QAP) related to construction/modification work activities for safety related I&C system is effective and to verify that deviations from requirements are appropriately resolved.

69020.J-02 INSPECTION REQUIREMENTS

- 02.01 For the safety related I&C systems selected for inspection, determine if appropriate and adequate procedures in the following areas are compatible with the QAP and prescribe adequate methods to meet the specifications:
 - a. receipt inspection
 - b. storage
 - c. installation
 - d. construction testing and calibration
 - e. construction quality control inspection
- 02.02 Determine if the applicant/licensee has an established audit program (including plans, procedures, and audit schedule) for assessing the adequacy of work control functions and requirements for I&C system activities. Determine if examination, inspection, and test personnel associated with performing tests and inspections of I&C system activities are qualified and/or certified to perform their assigned work.

02.03 Determine if the following safety related I&C system activities are being controlled and accomplished in accordance with the requirements of the documents reviewed in Section 02.01, above:

- a. receipt
- b. storage
- c. installation (in-process, completed work, as-built verification)
- d. construction testing and calibration
- e. construction quality control inspection
- f. configuration management

02.04 Review the documentation generated for the safety related I&C system activities. Determine if the applicant/licensee/contractor system for documenting safety-related work is functioning properly. Records should be complete, reviewed by quality control, engineering personnel, or designee, and readily retrievable. Review safety-related records in the following areas:

- a. receipt and storage inspection
- b. installation inspection
- c. construction testing and calibration records
- d. construction quality control inspection
- e. nonconformance/deviation record(s)
- f. training/qualification records of craft, and quality inspection personnel (as required)
- g. configuration management records

69020.J-03 INSPECTION GUIDANCE

General Guidance

Inspectors should review the facility description in the safety analysis report (SAR) or equivalent and be familiar with the requirements for safety significant I&C systems being installed 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 changes made to the design described in the SAR comply with the licensee's configuration management program.

Inspectors should also be familiar with the licensee's QAP and use IP 69021, "Inspections of Quality Assurance Program Implementation During Construction of Non-Power Production and Utilization Facilities," to perform "vertical slice" inspections as described in the body of this IP.

Inspectors should complete this appendix by inspecting the attributes listed in this appendix with a focus on safety-related I&C systems.

Inspectors should contact the applicant/licensee prior to the on-site inspection to help determine what I&C systems are to be inspected. Observation during in-progress installation of the I&C systems is desirable but not required. If necessary, inspectors may select completed I&C systems for inspection. Inspectors should not attempt to inspect all I&C systems on the site but may expand if significant concerns with the applicant/licensee's control of I&C systems installation/construction arise. Samples should include components or systems within

risk-significant areas of the facility. Samples should include work of different subcontractors and work performed at various times throughout the project.

Inspectors should collect applicant/licensee procedures, I&C systems specifications, and work completion records in advance, if possible. If unable to review these documents in advance of the on-site 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 related I&C systems and review the areas listed in Sections 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. However, inspectors should gain an understanding of the applicant/licensee's program to the extent necessary to determine if the applicant/licensee conforms to regulatory requirements. Not all items in the inspection requirements section will be applicable or required in all situations for all safety-related structures, systems, and components.

03.01 Inspection Requirement 02.01

- a. Review construction specifications related to safety related I&C systems and determine if the specified technical requirements conform to the commitments contained in the licensing basis. Review I&C systems procedures and verify that 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.
- b. Review the IPs and compare with the requirements in the applicable codes and construction specifications. Evaluation should indicate if adequate quality-related IPs are established and are based on appropriate criteria, and further, if the results of the licensee's inspection will be transmitted to responsible quality assurance and management personnel.
- c. Procedures should be reviewed to ensure that technical requirements in the licensing document are reflected in construction specifications, drawings, work instructions, and work procedures. Areas to review should include, but are not limited to, the following:
 1. I&C system components (type, range, accuracy, materials, etc.) are identified, located, oriented, and supported as specified by design.
 2. Physical separation and independence requirements of redundant components are met.
 3. Instrument sensing lines are sloped to meet applicable requirements. Instruments connected to chemical processes for which it is not feasible to use direct sensing lines might be connected via armored capillary tubing and/or diaphragm seals which have been appropriately protected from potential damage from construction or operating activities. Appropriate and adequate construction specifications, procedures and other work instructions for a particular activity are required to be approved and available before that activity is started.
- d. Determine if appropriate and adequate procedures in the following areas are compatible with the QAP, and prescribe adequate methods to meet the construction specifications:

1. Receipt Inspection. Receipt inspection and related procedures provide means to ensure that:
 - (a) Material is in good condition, not damaged in shipment and that shipping and handling requirements have been met.
 - (b) Inputs from other groups or other organizations to be used during receiving inspection activities are properly utilized, such as the results of source inspections, environmental qualification tests, and other required quality tests.
 - (c) Procurement requirements 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.
2. Storage. Storage procedures provide means to ensure that the proper storage environments (as specified by the construction specifications and the manufacturer's instructions) are established for the various types of I&C system components and meet applicable storage classification levels regardless of the location of the stored item.
 - (a) Special storage requirements are typically specified by the manufacturer or an industry standard. The requirements should include such things as identification and markings on I&C components, protective covers, preservatives, etc.
 - (b) The inspector should verify that the storage procedures have provisions for initial and periodic inspection of storage conditions for components which have special storage requirements. Procedures should be available for conducting periodic "storage inspections" of components which have been installed during the time period between installation and turnover to the operations staff.
 - (c) The inspector should consider verifications of proper firmware, component versions, and verify that unauthorized substitutions have not been made (This is over and above certain environmental considerations, e.g., humidity and temperature for electronic components.)
3. Installation Activities. Work procedures are established to ensure that:
 - (a) Licensing document commitments are properly translated into the work procedures (construction specifications, drawings and work instructions) for adequate control and installation of safety related I&C system components and associated items. Determine if construction drawings incorporate the most recent design requirements.
 - (b) Interface controls are adequate when multiple contractors are involved.
 - (c) Procedures cover special handling, installation, termination, and maintenance requirements, including those pertaining to protection, preservation of internal cleanliness, and maintenance of component qualification requirements. For example, all covers, seals, plugs, internal preservatives, and protective coatings are left intact until installation and/or use, as appropriate.

- (d) Determine if responsibility assignments for procedures preparation, review and approval, include groups with necessary technical expertise
 - (e) Determine if licensee individuals or contractors that review and approve quality records are required to have the necessary technical expertise to ensure that the information to be recorded meets applicable requirements.
4. Construction Testing and Calibration Procedures. Procedures are established to ensure that special conditions of testing and calibration of process instruments (prerequisites, sequence, special handling, removal, precautions, etc.) are included and described in proper detail as required to conduct and monitor the work performed. For example, if density compensation is required for a liquid level instrument, the proper technique for density correction should be included in the calibration procedure. The licensee should reference general testing and calibration requirements, and work procedures should provide detailed instructions. Additionally, the QAP may include general surveillance procedures relative to the calibration of process instruments, i.e., calibration activities should be monitored (inspected or audited, as appropriate) in accordance with established procedures. These procedures may include verification of the following:
- (a) Calibration data sheets (or equivalent) are being used as specified.
 - (b) Calibration ranges and accuracies are current and approved for use. (Accuracy requirements should be defined.)
 - (c) Calibration and instrument setting procedures are current and approved for use, including identification of any special calibration test equipment or test equipment minimum accuracy specifications needed for safety-related instruments. Such specifications should be consistent with the project instrument set point and loop accuracy procedure requirements.
 - (d) Calibration techniques are appropriate for the component to be calibrated. For example, if density compensation is required for a liquid level instrument, the proper technique or correction for density should be included in the calibration procedure. Although density compensation is a basic requirement for accurate level measurement, it is periodically overlooked for water-calibrated instruments.
 - (e) Controls for removal and handling of components during calibration.
5. Construction Quality Control Inspections. Verify construction quality control inspection procedures is established to ensure that:
- (a) All safety-related aspects of construction specifications, drawings, and work instructions are included in the scope of planned inspections.
 - (b) The technical aspects of inspection requirements and acceptance criteria are sufficient to determine if the components and their installation (including terminations and interface seals), calibration, test, maintenance, and protection conform to applicable design and construction specifications.

- (c) Records of initial and follow-up inspections include the specific results of the inspection. This should include the specific characteristics being inspected (or the actual measured values), the inspector's determination of acceptability, and identification of any nonconformance(s) found.

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 for safety related I&C system construction activities.
- b. Review audit program to verify if examination, inspection, and test personnel associated with performing tests and inspections of I&C system construction activities are qualified and/or certified to perform their assigned work.
- c. Verify records establish that the required audits were performed and that deficiencies identified during audits were appropriately resolved.

03.03 Inspection Requirement 02.03

- a. Inspection of selected components and associated items of the instrument systems listed below may be accomplished by observation, record review and/or independent evaluation of in-process and/or completed work. Sample selection should be based on importance to operational safety and should include redundant components and a diversity of components and locations if practical. Before inspection of selected items, review the specifications, drawings, work procedures, and work schedules applicable to the systems and components selected for inspection. Below are examples of types of samples the inspector(s) may use during this inspection: safety-related items including emergency control systems and display instrumentation.
- b. Determine if the following applicable safety related I&C system activities are being controlled and accomplished in accordance with the requirements of the documents reviewed in 02.01, above:
 - 1. Receipt Inspection. Observe and evaluate a sample of receipt inspection activities pertaining to instrumentation components and associated items. Determine if receiving inspection activities are being controlled and performed in a manner which will ensure that applicable requirements are satisfied in the following areas:
 - (a) I&C components and receiving documents are properly identified.
 - (b) Physical condition (damage, deterioration, etc.).
 - (c) Documentation relative to quality requirements (e.g., results of functional and qualification testing) received with components and associated items is reviewed and meets the requirements. Where qualification testing of components to be placed in a harsh environment is not a requirement of the specification, review existing documentation that establishes acceptance criteria and environment requirements that define what means will be used to assure that applicable environmental qualification will be satisfied.
 - (d) Control of nonconforming components.

- (e) Adequate number of qualified personnel are available to perform the receiving inspection function.
 - (f) The licensee should identify and describe all instrument components which must operate in a hostile environment (e.g., high radiation, temperature, humidity) during or subsequent to an accident. Where environmental qualification testing, or other qualification provisions (such as seismic) are specified, receiving inspection activities should include verification that required testing has been satisfactorily completed.
 - (g) All required documentation may not be received with the components. If not, the inspector should at this time determine that the licensee is following their system for identifying, controlling, and maintaining the status of the required documentation. This system should ensure eventual documentation of satisfactory completion of required testing.
2. Storage. Observe and evaluate a sample of storage activities and conditions for the inspection samples. Determine if:
- (a) Components are stored in the proper storage level designation.
 - (b) Components are properly identified.
 - (c) Storage conditions (temperature, humidity, cleanliness, etc.) are controlled and monitored as specified.
 - (d) Licensee and contractor inspection and monitoring activities are being performed in accordance with procedural requirements.
 - (e) Nonconforming items placed in storage are identified and/or segregated.
 - (f) In-place storage requirements are satisfied.
 - (g) Provisions should include procedures for monitoring or surveillance of locally mounted instruments by inspection (QC) personnel. They should ensure that maintenance requirements while “stored in place” are satisfied and that adequate protection is provided against possible damage from adjacent construction activities, including construction traffic. (Where protective means used during construction may affect proper operation, provisions should be provided for timely removal.)
 - (h) Control of storage conditions for equipment stored in place usually requires special effort. The inspector should note if the procedurally required storage conditions are being maintained.
 - (i) Readily visible and permanently marked tags or other identifying scheme should be used for all nonconforming components and materials, and records relative to the nonconformance should be available at the site and readily retrievable.

3. In-Process Installation. If in-process work is occurring at the time of the inspection, observe and evaluate portions of the in-process installation activities for the inspection sample. Determine if:
- (a) The latest approved revision of applicable construction specifications, drawings, and/or procedures are available and used by the installers.
 - (b) The components are as specified, such as: type, range, proof pressure/rating and material.
 - (c) Associated mounting hardware and supports are of the type and material specified and properly located. Anchor bolts holding or mounting instrument 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.
 - (d) The components are installed in the proper location and orientation by qualified craft personnel using suitable equipment and tools.
 - (e) Evaluate sensitivity to grounding connections and lightning protection system down comers.
 - (f) The required component identification is properly maintained or established.
 - (g) Licensee and contractor inspections are performed, or scheduled to be performed, before closing out the work to be inspected.
 - (h) Inspection activities are timely and properly completed by qualified personnel.
 - (i) Installed components are adequately protected from damage by adjacent construction activities.
 - (j) Nonconformance issues are identified and handled in accordance with established procedures. Where corrective action is being taken, determine if it meets the appropriate requirements.
4. Completed Work. Observe and inspect the completed installation of I&C system components. Determine if:
- (a) Location, configuration and installation (including mounting and anchoring) are in accordance with the latest approved design or construction specifications and drawings.
 - (b) Specified instrument components and associated items have been used.
 - (c) Components have been correctly and permanently identified.
 - (d) Cleanliness requirements have been maintained or otherwise satisfied.
 - (e) Installed equipment is adequately protected from adjacent construction activities and protective coatings, plugs, bushings, and other materials have been used as specified.

- (f) Instrument components and associated items, such as sensing lines and power supplies; maintain physical and electrical independence between redundant parts.
 - (g) Protection systems and normal plant control systems are adequately separated and isolated from each other.
 - (h) Nonconforming components or conditions have been identified and controlled in accordance with approved procedures.
 - (i) Status of completion, maintenance, and readiness for pre-operational testing is indicated or otherwise documented.
 - (j) Adequate actions or provisions have been taken or maintained (as needed) to ensure that the validation of the environmental qualification of instrument components is maintained.
 - (k) Wiring and terminations, including grounding, are installed in compliance with construction drawings and specifications.
5. As-Built Verification. Verify I&C system components are installed and inspected by obtaining the latest revision (as-built, if available) of instrument and installation drawings.
- (a) Review construction specifications and other applicable documents referenced by drawing or otherwise.
 - (b) Compare the actual installation of the components selected with the drawings.
 - (c) Discrepancies observed may result from in-process changes, such as those initiated in the field. If in-process changes are involved, determine if the licensee has properly controlled and documented these changes for engineering review, approval, and subsequent incorporation into the final as-built drawings.
6. Construction Testing and Calibration. Observe a sample of construction testing and calibration activities for applicable components from the sample selected in subsections of Section 02.03. Determine if:
- (a) The latest revisions of applicable procedures and/or specifications are available at the work location and used by personnel performing the testing and calibration.
 - (b) Properly identified, traceable and calibrated measuring and test equipment are used.
 - (c) Equipment or components calibrated are able to obtain the set point, degree of accuracy, and/or tolerance specified or otherwise noted.
 - (d) Required testing and calibration results are recorded during the activity, not after the work has been completed.
 - (e) Components are adequately identified as having been tested or calibrated.

- (f) Personnel performing the testing and calibration are properly qualified.
 - (g) Test and calibration personnel adhere to any special handling or removal requirements.
7. Construction quality control inspection. For the activities observed during Inspection Requirement 02.03., items 3 – 6 for in-process installation, completed work, and as-built verification, and construction testing verify if construction quality control inspectors are properly qualified and are present and performing their assigned tasks during handling and installation activities. Verify construction quality control inspections documentation is complete and accurately reflects the inspection performed and results. Nonconformances are appropriately documented and resolved as required.
8. Configuration management. For the activities observed during Inspection Requirement 02.03., 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 QAP.

03.04 Inspection Requirement 02.04

- a. Determine if the applicant/licensee/contractor system for documenting safety related I&C and control system work is functioning properly.
- b. Review licensee and contractor requirements covering the scope of records for safety-related I&C system components to (1) determine who prepares each quality-related record, who reviews the records for accuracy and who ensures that the recorded information meets requirements; and (2) evaluate the information obtained above and determine if the established record management system satisfies QAP and licensing requirements.

1. Receipt and Storage Records

(a) Receipt Inspection Records

- (1) Receipt inspection documents properly and uniquely identified received instrument components and associated items.
- (2) Applicable engineering and functional specifications (regarding size, type, material, etc.) of received items were met or otherwise noted.
- (3) The required instrument component characteristics, material, performance tests, environmental and seismic qualification tests, nondestructive tests, and other specification requirements were met or otherwise noted.
- (4) Original records or certification system met requirements of applicable criteria.

(b) Storage Records

- (1) Required storage conditions were maintained. (Note: Verification of these conditions may require verification of log sheets recording the ambient conditions or through the use of recorders.
- (2) Storage inspections were properly made at specified intervals.
- (3) Records of nonconforming items in storage areas were properly maintained.

2. Installation Records.

- (a) Most recent and approved design and construction documents were used during installation.
- (b) Specified instrument 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) Required inspections were performed, recorded, reviewed, and evaluated by qualified personnel.
- (e) Inspection records were complete and satisfied documentation requirements.
- (f) Physical separation and independence requirements were met.
- (g) Required protection was provided after installation.
- (h) Verify that required special installation procedures were implemented.

3. Construction Testing and Calibration Records. Calibration data records for process instruments should include information and data specified by industry standards which the licensee is committed to such as:

- (a) Specific identity of the instrument calibrated.
- (b) The specific identity of the measuring and test equipment used to perform the calibration.
- (c) The "as-left" calibration data.
- (d) Date of calibration.
- (e) Identity of the technician performing the calibration.
- (f) Calibration schedule documentation review.
- (g) Approval signature of a responsible individual. Certificates of calibration should be available at the site for measuring and testing equipment used to perform these calibrations. These certificates should show that the standards used to

establish the accuracy of the test equipment are traceable to a nationally recognized standard. Procedures should require that the performance and accuracy of test equipment are demonstrated by periodic checking.

- (h) Required tests and calibrations were performed as required.
 - (i) Records indicate that approved procedures and equipment were used.
 - (j) Test equipment was periodically checked and calibrated as specified.
 - (k) Test data and results were properly documented and evaluated, and corrective action was taken.
4. Construction Quality Control Inspection Records. Review and evaluate a sample of pertinent quality records. Determine if: (1) adequate preparation, control, review, and evaluation of these records have been made; (2) they reflect that regulatory requirements have been met and (3) the system of records is functioning properly. The selection should include records of components in safety control subsystems, emergency control system, sensors, and safety parameter displays.
5. Nonconformance/Deviation Reports. Review and evaluate a sample of nonconformance and deviation reports, and determine if:
- (a) Records are complete and promptly reviewed by qualified personnel.
 - (b) Appropriate reporting requirements were recognized during evaluation and appropriate action was taken where necessary.
 - (c) Records have been routinely processed, timely evaluated, and controlled through established channels for resolution of the root cause as well as the immediate problem.
 - (d) Records are properly identified, stored, indicate current status, and can be retrieved in a reasonable time.
 - (e) Nonconformance reports include the status of corrective action or resolution, and adequate justification is provided for use-as-is disposition.
6. Training/Qualification Records of Craft, and Quality Inspection Personnel. Review and evaluate a sample of personnel qualification records and determine if:
- (a) A system of craft and inspection personnel qualification records meets stated requirements and is being maintained in a current status.
 - (b) The records are sufficient to reasonably support qualification in terms of certification, experience, proficiency, training, testing, etc.
 - (c) Action has been taken by responsible licensee organizations to independently authenticate the record material.

7. Configuration Management Records. Review and evaluate a selected sample of configuration management records, and determine if:
- (a) 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.
 - (b) Records of periodic inspections ensure that only the most recent approved documents, including design changes, were used in the field.
 - (c) 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.
 - (d) Records of nonconformance's 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: Determine if enough adequately qualified quality control inspection personnel are at the construction site, commensurate with the work in progress, and adequately performing their assigned duties through the established organizational structure. A sample of construction quality control inspectors should be interviewed to determine if they are familiar with the quality requirements associated with the instrumentation being inspected, what construction specifications and other criteria are used to determine acceptance, how their inspection results are recorded, etc. The intent is to determine the effectiveness of instrumentation inspection personnel and management systems for indoctrination, training, and qualification of personnel.

a. Specific Instrument Components and Associated Devices

I&C system components consist of those elements that are designed to measure, monitor, transmit, modify, display, alarm, record and/or control various plant variables or conditions. This IP, and other instrumentation IPs, apply, but are not limited, to the following safety-related instrument components and associated items: sensors, transmitters, isolators, signal conditioners, controllers and other actuating devices, recorders and other printing devices, indicators, alarms, switches, logic devices, interlocks, bypasses, instrument valves, fittings, tubing, instrument air supplies, internal power supplies or regulators, protective devices, control boards, racks, panels, cabinets, supports, anchor and mounting hardware, communication devices, multiplexers, data concentrators, engineering workstations, human-machine interface devices (e.g., displays), interconnecting means for integrity and applicability, and network management devices and tools.

In addition to observing if specific instrument components and associated devices are as specified (properly identified, located, mounted, etc.), it is important also to determine if certain components or conditions do not exist where prohibited. For example, instrument components are not exposed to potential hazards from other construction activities. Because of the complexity of digital components, and the potential for interconnection between safety components and between safety and non-safety components, the inspector should consider these issues during the inspection. Although the safety sensor

may be hardwired to the controller, the controller may be communicating over a digital bus with other controllers, the operator, or an annunciator system. Also, some sensors are “smart” in that they have on-board diagnostics and calibration tables, so, even though they are “hardwired,” they could still be using some communication link with the controller (e.g., HART superimposes digital monitoring and command signals on an analog 4-20mA signal).

The licensee should identify and describe all safety-related I&C components which must operate in a hostile environment (e.g., high radiation, temperature, humidity) during or after an accident. Where environmental qualification testing, or other qualification provisions (such as seismic) are specified, the licensee should establish means to assure that the results of this testing are documented, reviewed, and determined to be acceptable. If this is not performed when components are received, the procedures should specify the organization that will be performing this review and the controls to ensure that all such documentation requirements are satisfied before the component is placed in use.

The inspector should also be aware of memory-related integrated circuit chips (Programmable read only memory (PROMs), flash memory, etc.) that have certain versions of application code (i.e., specific version of firmware). The inspector should verify that the configuration management program is tracking these versions—not just firmware, but all electronic devices that may have embedded processors, memory, etc. In addition, for safety-related electronic components, the inspector should verify that the supplier or licensee followed the supply chain to ensure no unauthorized replacements have occurred.

Instrument components may be released for installation on the merits of certifications of conformance if the organization involved has established a satisfactory program control and audit requirements in this area. However, certifications of conformance do not release the licensee from having other records (such as environmental or seismic qualification records) for operation and for the life of the plant.

Examples of process variables used by the emergency control system are some manual and automatic controls for power distribution, ventilation, and seismic isolation systems. Associated and interrelated devices include signal conditioning components, isolation devices, interlocks, bypasses, selector switches, resets, overrides, instrument tubing, racks, panels, and their supports, instrument wiring and wiring terminations. The licensing documents should include the specific variables, as well as the logic and devices, used in the system.

Examples of sensors which provide information to automatic controllers are devices for measuring/monitoring temperature, mass, physical dimension, component identification bar codes, and machine tool positions.

Examples of controllers which are required to mitigate accidents are the safety controllers and emergency controls. The licensee should specify the specific variables, as well as the logic and logic devices used in the system.

b. Procedure Review Guidance

Procedures that control activities such as receipt, storage, installation, inspection, calibration, testing, and software modification, upgrading, and/or patching should contain

sufficient detail to assure that the specific work steps which affect the functioning of the installed equipment will be performed properly. These work steps are to be identified and adequately controlled. While reviewing procedures, be aware of and look for inadequacies that could lead to construction deficiencies and/or indicate an inadequate management control system.

It is not considered adequate identification to include only the instrument model number and type. Procedures should specify a unique identification number, along with the model number and name of manufacturer. Adequate (positive) identification is important because similar-looking instrument components can be significantly different with respect to range, output signal, etc. Safety significant instrumentation should be listed in the licensing document.

Procedures should be established to ensure that independence and separation requirements of safety-related functions from normal control functions are met, especially safety functions that provide protection against normal control system malfunctions. This separation should include electrical and data communication isolation. (Note: Given the high automation in new facilities, data communication isolation should be verified from both a random failure and a cyber security perspective.)

Means should be established, such as procedures or checklists, to ensure that redundant sensing lines are protected from common mode failures. That is, redundant lines will not fail from a single accident; especially an accident or failure for which they are supposed to provide protection.

c. In-Process Installation Guidance

Because of the uncertainties associated with scheduling of in-process installation inspections, it is expected that the scope of these periodic inspections will vary considerably. The intent is to observe the more important installation activities for a variety of instrumentation components and associated items during the time such activities are in progress. While reviewing construction specifications and drawing, also look for missing or inappropriate approvals. Drawing and construction specifications used in the field should be reviewed periodically to ensure that the most recent approved revisions are used and components are as specified.

For some of the supports and anchorages, the inspector should directly measure or otherwise independently verify that requirements pertaining to such items as location of equipment, location of supports, and bolt size are as specified. During installation of equipment, anchorage holes are sometimes drilled in concrete structures. Indiscriminate cutting of reinforcing steel should not be allowed.

The inspector should ensure that proper welding requirements, from codes and standards that the licensee has committed to, are specified and controlled.

Standards may include American Welding Society (AWS) D1.1, Structural Welding Code, for welding of supports. Instrument tubing welds are generally in accordance with welding code requirements associated with the system or component being monitored, e.g., American National Standards Institute (ANSI) B 31.3, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, as appropriate. The inspector should verify that the construction specifications and drawings specify the welding requirements to be used.

Some instrument lines, racks, panels, and their supports, or other anchoring means are required to meet seismic requirements. (The licensing document should indicate where applicable.) If specified for lines, racks, or panels selected for inspection, determine if these requirements are met. If the installation is different from approved drawings and specifications, determine if the change is adequately documented and forwarded for review and approval.

Temporary protection during construction is generally required. Protection from overhead construction activities, especially welding and concrete placement, warrants special attention. Additionally, protection from inadvertent damage during plant operation and maintenance should be adequate and properly installed. Because it can be easily damaged, instrument tubing requires special attention. This is especially important when instrument tubing runs are part of a safety system that may be damaged by an event or accident for which the safety system is supposed to provide protection.

The intent is to determine if instrument components and associated items are being installed according to properly approved drawings and changes, such as engineering, design, field change requests, and changes to correct nonconforming conditions. As this inspection requirement is to verify "as-built" systems, a new sample should be selected if it is found that extensive rework is in progress. However, the NRC inspector should verify that the changes are properly handled in accordance with established procedures.

Changes may be made to instrument systems during construction that are different from the original design. Such changes will result in the accumulation of various types of design change documents. Since these changes reflect as-built conditions, they should be adequately controlled and available for future evaluations on the effect other design changes have on the overall design.

Additionally, the as-built process should result in proper and timely updating of the master drawings and specifications to incorporate such changes. Thus, an excessive number of accumulated changes not incorporated into the as-built records and affected analyses should be pursued. The NRC inspector should determine how the licensee ensures that the effect of each subsequent change will be adequately evaluated.

d. Calibration Inspection Guidance

The inspector should review the specified calibration requirements and procedures before observing these activities. If special requirements are specified, such as density compensation during liquid level instrument calibration, the inspector should verify compliance with these requirements.

If calibration activities are in progress, determine if the most recently approved calibration information is being used, and compliance with required procedures. The values of instrument ranges and zero set points are sometimes changed after receipt of the instruments at the site. The inspector should assure (by selective sampling) that current data are used for checking and calibrating instruments, and that these changes are within the limits of the instrument components involved.

As these inspection requirements cannot be done until testing and calibration activities are in progress, inspection in this area should be scheduled accordingly. Final calibration and trip settings may be done later, usually during pre-operational testing or during startup preparation.

The intent of these requirements is to verify that nonconforming conditions associated with instrument components and systems are identified by the licensee and result in the initiation of the appropriate nonconformance documentation and corrective action.

e. Environmental Qualifications

Where environmental qualification testing, or other qualification provisions (such as seismic) are specified, records should be available to verify that required testing has been satisfactorily completed. If these records are not available at the time of component receipt, the inspection records should identify the need for subsequent receipt and review of these documents.

It is important to ensure that qualification testing has been successfully completed. Qualification documents should be reviewed to substantiate that the equipment is qualified to applicable standards and to the appropriate environment.

f. Record Inspection Guidance

Licensee and contractor inspection personnel should use checklists or other means to ensure proper identification of installed equipment. Checklists or records of inspection should be generated during the inspection, and these records should be readily retrievable for review by the NRC inspector. "Properly installed" means that the installation meets applicable NRC requirements and licensee commitments, including specified separation or installation of protective barriers. The as-installed inspection records should match the applicable requirements. In order for the inspector to ensure that the records reflect actual conditions (identification, instrument range, location, etc.), some instrument components selected should be the same as those selected in Section 02.03 of this procedure. (If the installation differs from the approved installation documents, a nonconformance report and a design change should have been generated.)

During installation of equipment or supporting components for the equipment, anchorage holes are sometimes drilled in concrete structures. The work and/or inspection records should indicate (or at least infer) that no indiscriminate cutting of reinforcing steel was done during drilling of anchor holes. Installation and inspection records should contain sufficient detail to permit identification of the specific revisions or change notices used in these activities. Permanent records should provide a clear audit trail to any applicable change or nonconformance documentation.

In addition to the records indicating satisfactory testing and calibration, the records should reflect that the range, response time, etc., for instrument components are appropriate for postulated accident conditions as well as for normal operating conditions. The procedures for testing and calibration should contain the necessary criteria.

Where special requirements are necessary, such as density compensation during liquid level instrument calibration, the records should reflect that such requirements were adhered to.

g. Prevalent Problems and Concerns. The inspector should be alert to problems of a generic nature, such as:

1. Adequate procedures or other means have not been established to assure and document that all safety-related I&C components have met applicable acceptance criteria or to identify and document non-conformances in specific areas.
2. Inspection procedures do not include adequate inspection requirements and acceptance criteria.
3. Inadequate means to control location and status of instrumentation components—especially during removal for calibration, modification, repair or replacement.
4. Inadequate procedures to control the evaluation, approval and use of field changes. (Means should be established also by the licensee or contractor to assure that only the latest approved field changes and other revisions or changes are being used for installation and inspection activities.)

69020.J-04 RESOURCE ESTIMATE

The appendices, or sections of the appendices, and inspection samples and hours, applicable to a specific facility should be in the range of 40–80 hours. Inspection preparation, including review of licensing basis, safety analysis report (SAR), and applicable codes and standards, is not included in this estimate.

69020.J-05 PROCEDURE COMPLETION

This inspection procedure appendix is complete when one inspection sample is complete. Refer to Section 69020-05, “Procedure Completion,” of IP 69020, “Inspection of Safety Related Items (and Services) During Construction of Non-Power Production and Utilization Facilities,” for details on what constitutes a completed inspection sample. 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. An appendix to this IP need not be completed if there are no safety-related items (or services) covered by that appendix at an NPUF.

69020.J-06 REFERENCES

ANSI/ Institute of Electrical and Electronic Engineers (IEEE) Standard (Std.) 336, “IEEE Standard Installation, Inspection, and Testing Requirements for Power Instrumentation, and Control Equipment at Nuclear Facilities”

ANSI/IEEE 802.3 Standards Series, “IEEE Standards for Local Area Networks: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications”

IEEE Std 518, “IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources”

IEEE Std 1050, “Guide for Instrumentation and Control Equipment Grounding in Generating Stations”

ISA-S12.13-Part 1, "Performance Requirements, Combustible Gas Detectors"

ISA RP12.13-Part II, "Installation, Operation, and Maintenance of Combustible Gas Detection Instruments"

NUREG-0700, "Human-System Interface Design Review Guidelines"

NUREG-0800, Standard Review Plan, Branch Technical Position HICB-11, "Guidance on the Application and Qualification of Isolation Devices"

NUREG-0800, Standard Review Plan, Branch Technical Position HICB-17, "Guidance on Self-Test and Surveillance Test Provisions"

Regulatory Guide (RG) 1.118, "Periodic Testing of Electric Power and Protection Systems"

RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems"

RG 1.75, "Physical Independence of Electric Systems"

RG 3.17, "Earthquake Instrumentation for Fuel Reprocessing Plants"

END

List of Attachments:

Revision History for IP 69020 Appendix J

Attachment 1: Revision History for IP 69020 Appendix J

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 (Pre-Decisional, Non-Public)
N/A	ML24264A202 03/25/25 CN 25-005	Procedure was rewritten for conformance with changes to IMC 2550 and is now a standalone appendix to IP 69020.	N/A	N/A