
INSPECTION PROCEDURE 69020 APPENDIX E

INSPECTION OF PIPING SUPPORTS AND RESTRAINTS AT NON-POWER PRODUCTION AND UTILIZATION FACILITIES

Effective Date: March 25, 2025

PROGRAM APPLICABILITY: IMC 2550

69020.E-01 INSPECTION OBJECTIVES

- 01.01 To determine if work and related quality assurance program activities associated with safety-related pipe supports and restraints at non-power production and utilization facilities (NPUF) are being performed in accordance with regulatory requirements, the licensing basis, specifications, drawings, and work procedures.
- 01.02 To determine if the applicant/licensee system's for preparing, reviewing, and maintaining records relative to safety-related pipe supports and restraints activities is functioning properly, and to determine if the records reflect work accomplishment consistent with specifications and procedures.
- 01.03 To verify if the as-built condition of safety-related pipe supports and restraints meets the specified design requirements, specifications, and drawings.
- 01.04 To determine that the implementation of the quality assurance program (QAP) related to work activities for safety-related pipe supports and restraints is effective and to verify that deviations from requirements are appropriately resolved.

69020.E-02 INSPECTION REQUIREMENTS

- 02.01 For the safety-related piping supports and restraints 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. pre-installation activities
 - b. installation activities
 - c. dynamic pipe supports
 - d. rigid, constant, and variable-type supports
 - e. component supports
- 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 piping supports and restraints activities. Determine if examination, inspection, and test personnel associated with performing tests and inspections of supports and restraints activities are qualified and/or certified to perform their assigned work.

- 02.03 Determine if the following safety-related piping supports and restraints activities are being controlled and accomplished in accordance with the requirements of the documents reviewed in Section 02.01, above:
- a. as-built activities
 - b. pre-installation activities
 - c. installation activities
 - d. dynamic pipe supports
 - e. rigid, constant, and variable-type supports
 - f. component supports
 - g. configuration management
- 02.04 Review the documentation generated for the safety-related piping supports and restraints 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 inspection and material certification (if applicable)
 - b. installation inspection
 - c. nonconformance/deviation record(s)
 - d. training/qualification records of craft, and quality inspection personnel (as required)
 - e. configuration management records

69020.E-03 INSPECTION GUIDANCE

General Guidance

Pipe supports include pipe hangers, restraints, supports, shock and sway suppressors, etc. that directly support the pipe. Pipe whip restraints, such as structural steel or concrete barriers that do not normally contact the pipe, are not covered by this procedure.

Inspectors should review the facility description in the safety analysis report (SAR) or equivalent and be familiar with the requirements for piping supports and restraints receipt, inspection, and testing of safety-significant piping systems 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 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 piping supports and restraints. Inspectors should also coordinate this appendix with inspection of piping (IP 69020, Appendix D) for efficiency, if possible.

Inspectors should contact the applicant/licensee prior to the on-site inspection to help determine what supports and restraints are to be inspected. Observation during in-progress

construction/installation of the supports and restraints is desirable but not required. If necessary, inspectors may select completed supports and restraints for inspection. Inspectors should not attempt to inspect all supports and restraints on the site but may expand if significant concerns with the applicant/licensee's control of supports and restraints 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, piping supports and restraints 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 piping supports and restraints 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.

Definitions

- a. Dynamic Pipe Supports. A pipe-support assembly or restraint, with a hydraulic or mechanical control unit-designed to prevent unrestrained pipe motion during an earthquake or vibratory pipe movements brought on by the actuation of a water hammer, steam hammer, pump/start/stop, or safety and relief valve. Thermal expansion of piping is not restrained by dynamic supports (snubbers, shock suppressors, etc.).
- b. Rigid, Constant, and Variable Type Supports. Pipe support assemblies used for mounting pipes without hydraulic or mechanical control units (hangers, base supports, saddle supports, spring hangers, sliding and rolling supports, etc.).
- c. Component Supports. Metal elements that transmit loads between plant components and the building structure whose function includes carrying the weight of components or providing them with structural stability.
- d. Component Standard Supports. Pipe-support assemblies consisting of one or more units usually referred to as catalog items and generally mass-produced (anchors, guides, restraints, rolling or sliding supports, spring hangers, snubbers, sway braces, vibration dampeners, clamps, etc.).

03.01 Inspection Requirement 02.01

- a. For safety-related piping supports and restraints selected for inspection, review procedures, specifications, drawings, and other relevant design documents to verify they conform to the commitments contained in the licensing basis, including construction specifications:
 - 1. pre-installation activities
 - 2. installation activities

3. dynamic pipe supports
 4. rigid, constant, and variable-type supports
 5. component supports
- b. For the procedure review, consider the following attributes:
1. Controls to ensure that the type and classification of pipe supports and restraints comply with approved drawings and/or specifications and meet licensee commitments.
 2. Instruction and precautions to ensure that welding, cutting, forming, heat treating, and machining are performed in a manner that will prevent the impact properties of the material from being degraded below specified values.
 3. Means to ensure that bolts, nuts, and washers (including lubricant, if used) are of the proper type, size, and material, with required identification-markings; are correctly installed; and, where required, bolt pre-loading (torquing), minimum bolt embedment, and thread engagement criteria are imposed.

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 in their licensing basis for safety-related piping supports and restraints activities.
- b. Review audit program to verify if examination, inspection and test personnel associated with performing tests and inspections of supports and restraints 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

Determine if the following activities are being controlled and accomplished in accordance with the requirements of the documents reviewed in Section 02.01, above:

- a. As-Built Activities.
 1. By direct observation, interviews, or independent evaluation of work performance, works in progress, and/or completed work, determine if activities regarding pipe support and restraint systems are being accomplished, in accordance with NRC requirements, the licensing basis, and licensee procedures. The intent is to determine if pipe supports and restraints are being installed according to properly approved drawings, either the original design drawings or properly approved revisions
 2. Obtain as-built/final design-pipe-support structural drawings and compare several selected supports with the actual installation. Determine pipe-anchor locations on the as-built drawings. These anchor locations are designed to restrict individual pipe movement in all directions. Visually examine these anchors and compare them with the drawings, to ensure agreement as to their location and function.

3. 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 on a current basis for engineering review, approval, and subsequent incorporation into final as-built drawings.
4. If design revisions are in process, these changes should be properly handled in accordance with established procedures. Appropriate standards can be used as a guide in this area. In general, where changes to previously verified designs have been made, design verification is typically required for the changes, including evaluation of the effects of those changes on the overall design.
5. Changes may be made to these supports, during construction, that are different from the original design. Such changes will result in the accumulation of various types of design-change documents and/or marked up drawings. Since these changes reflect as-built conditions, they should be adequately controlled so they will be readily available for use with affected original design documents during future evaluation 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 original/master drawings and specifications to incorporate such changes.
6. The inspectors should assure that required identification of the item is maintained by heat number, part number, serial number, or other appropriate means, either on the item or on records traceable to the item and that required markings are on the item.
7. The inspectors should note markings on material and equipment and verify that the markings represent material and equipment as specified by the design drawings and specifications. In the case of fasteners, compliance with the applicable material specification] should be verified by required markings on bolts and nuts and certified material test reports or certificates of conformance. In the case of vendor supplied equipment assemblies containing fasteners, samples should be inspected to verify compliance with approved vendor drawings and specifications, and other information, such as materials used for equipment qualification tests and/or analyses. Caution should be exercised to ensure that the required markings on material and equipment, including fasteners, not only exist, but that the markings indicate the correct material and grade, as specified.
8. Most of the welding, cutting, and forming operations covered by this procedure pertain to component-support structures, support members, and brackets, and do not require preheat treatment or post-weld heat treatment. However, those pipe supports, support flanges, or support brackets that are directly welded to safety-significant piping may be subject to preheat and/or post-heat treatment. Applicable heat treatment procedures are necessary for this type of installation. Records of heat treatment (time, temperature) should be generated and reviewed for building code compliance.

b. Pre-installation Activities.

1. Pre-installation checks are made to ensure hydraulic units are not installed if there is evidence of excessive leakage of hydraulic fluid (possible damage or deterioration of seals), physical damage, or corrosion of polished sliding surfaces. (Not required if hydraulic snubbers are not used.)

2. Pre-installation checks on variable type supports are performed for obvious damage, rust, or other conditions that may interfere with their proper operation.
3. Pre-installation checks are made to ensure that bolts, nuts and other fastener items are available and are of the correct type, size, and material with required identification markings.
4. Any pre-installation field repairs or adjustments to the units are performed in accordance with the manufacturers' instructions and specifications, to ensure that performance requirements are met.
5. Installation equipment such as torque wrenches and other testing and measuring devices are properly controlled, calibrated, and adjusted at specified periods.
6. Personnel engaged in the installation of pipe supports and restraints have received adequate training to perform special processes contained in relevant work performance and inspection procedures.

c. Installation Activities

1. If installation activities are on-going at the time of the inspection, observe portions of the installation activities to verify the following:
 - a) The latest issue (revision) of applicable drawings or procedures is available to the installers.
 - b) Appropriate personnel approve significant modifications to supports, before implementation.
 - c) The use of jacks or rigging to pull piping into position for hanger installation or welding does not exceed cold-spring allowances for that particular material, size, and length of pipe run.
 - d) Clearances existing between the pipe and restraints are as specified.
2. If installation activities are on-going at the time of the inspection, observe portions of the installation and testing of concrete anchor bolts for component-support elements to verify that anchor-bolt type, diameter, embedment length, shoulder-to-cone measurements, and torque requirements meet installation requirements.

d. Dynamic Pipe Supports. Inspect installed restraints (if possible, select different load classifications and at various degrees of accessibility) and determine, by visual examination, whether the following conditions meet applicable requirements:

1. Components are free from corrosion or other signs of deterioration.
2. Support plates, extension rods, and connecting joints are not bent, deformed, loose, or otherwise out of specification.
3. Bolts, nuts, washers, locking devices, and other fasteners are tight and secure and are of the correct type, size, and material, with required identification markings. Where required, bolt-tension specification requirements have been met through the use of properly calibrated bolt-torquing wrenches and torque multipliers.

4. Bleed holes are open and free from foreign material.
 5. Lubricants and sealants are applied as specified and there does not appear to be excessive leakage.
 6. Seals are not deteriorated (if visually observable without dismantling).
 7. Connecting joints, moving parts, piston shafts, seals, etc., are free from foreign material such as concrete, dropped paint, excessive dust and dirt, or other material that may obstruct proper operation.
- e. Rigid, Constant, and Variable-Type Supports
1. Inspect installed spring-hanger assemblies covering different load ratings and observe the following:
 - a) Hanger rods for supporting (2-inch) pipe are not less than (3/8-inch) diameter, and for (2-1/2-inch) pipe or larger, not less than (1/2-inch) diameter.
 - b) Spring hangers are provided with indicators to show the approximate "hot" or "cold" position, as appropriate.
 - c) Spring hangers enclosed in spaces that will be subjected to high ambient temperatures during facility operation have suitable service ratings to accommodate the expected operating-temperature range.
 2. Inspect installed pipe supports of different sizes (load rating) and at various degrees of accessibility. Determine, by visual examination, whether the following conditions exist:
 - a) No deformation or forced bending is evident.
 - b) No deterioration or corrosion is evident.
 - c) Where pipe clamps are used to support vertical lines, shear lugs are welded to the pipe (if required by installation drawings) to prevent slippage.
 - d) Movements of pipe from vibration, thermal expansion, etc., will most likely not cause contact with other pipes, supports, equipment, nor components. (As best as can be determined after installation, but before initial operation.)
 - e) Sliding or rolling supports are provided with material and/or lubricants suitable for the environment and compatible, sliding-contact surfaces.
 3. Inspect small-bore or instrumentation lines that have been designed by a simplified seismic criterion. Determine, by visual examination, whether the following conditions meet applicable requirements:
 - a) The functional restraint direction is proper and in accordance with the design drawings.
 - b) The gaps between the piping and support appear adequate to allow thermal axial expansion.

- c) The gaps between the piping and support are not excessive for dynamic loads.
- f. Component Supports. Inspect installed component supports, including, if possible, multiple pipe supports, and determine, by visual examination, whether the following conditions exist:
 - 1. Component-support elements are located and installed as specified on the drawings.
 - 2. The surfaces of welds meet applicable Code requirements. Check weld surfaces for grooves, abrupt ridges, valleys, undercuts, cracks, discontinuities, or other detrimental indications that appear to exceed Code limitations.
 - 3. Materials used in the construction of the component supports have been certified by reviewing material-test reports or a certificate of compliance.
 - 4. Where special bolting materials are specified, check for compliance with specifications including preload (torquing) requirements.
 - 5. Support clearances are as specified.
- g. 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

Determine if for the piping supports and restraints activities, the applicant/licensee/contractor system for documenting safety-related work is functioning properly.

- a. Receipt Inspection and Material Certification (if applicable).
 - 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 defective or incorrect components, parts, and materials are controlled and prevented from installation and possible use.
 - 3. Documentation has been prepared and maintained 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. Review licensee and contractor requirements covering the span of records for piping supports and restraints. Determine the initiation point for those records sampled and, importantly, the effectiveness of those responsible for reviewing the records for accuracy and completeness and ensuring that the recorded information meets documentation requirements. To determine the effectiveness of the licensee or contractor system for documenting work in this area, verify that:
 - a) Type and classification of pipe support or restraint comply with appropriate drawings and specifications.
 - b) Location, spacing, and critical clearances meet licensee's specifications and have been verified by construction quality control inspections.
 - c) The required scope of licensee construction quality control inspections was met.
 - d) Weld identification/location corresponds to respective weld card, drawing, work order, or other welding documentation.
 - e) Welding material used corresponds to the material specified.
 - f) Welders were qualified to the welding procedures used and welding procedures were qualified in accordance with licensing basis and building code requirements.
 - g) The records confirm that for welding activities where attachments are welded directly to piping, the welding specifications used are the same or equivalent to the ones used for pipe welding, including preheat, post weld-heat treatment, and NDE examinations.
- c. Nonconformance/Deviation Record. Records include current status of these items. Nonconformance reports include the status of corrective action or resolution, (e.g., determine if adequate corrective action is being taken when moisture density test results are not within tolerance or acceptance criteria.)
- d. Training/Qualification Records of Craft, and Quality Inspection Personnel. Records establish that quality inspection personnel are adequately qualified for their assigned duties and responsibilities and that craft personnel have been trained in their assigned tasks.
- e. Configuration Management Records. Review and evaluate a selected sample of configuration management records, and determine if:
 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 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 a sufficient number of 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. Considerable impact on the development and structure of this IP has resulted from a series of issues NRC has encountered at nuclear power plants in the area of pipe supports and restraints. These problems and concerns are best summarized in Inspection and Enforcement (IE) bulletins, circulars, and information notices that have been issued over the years. These documents are listed in the reference section below. Information contained in these issuances may be beneficial to the inspectors during implementation of this IP.
- b. Prevalent Errors and Concerns. This section is included to provide background on past problems of a generic nature that have been identified at nuclear power facilities. This section is for information only.
 1. Welders were not properly qualified to applicable Code, and records were not properly maintained.
 2. Personnel-qualification records, including indoctrination, training, examinations, and certifications, were either not being maintained, invalid, or nonexistent for some employees.
 3. Field-design work (redesign, modifications) was not being processed through appropriate review and approval route.
 4. Nonconformance reports were not being processed fully in accordance with established procedures.
 5. Personnel assigned to licensee audit function were not appropriately trained in the assigned audit areas nor independent from areas audited.
 6. Licensees and contractors conduct some audits on schedule but may postpone or omit others entirely. Although audits are carried out to some extent and may be adequately performed, in many instances the audit findings and recommendations are ignored or are filed without appropriate consideration or follow-up action.
 7. Refer to Appendix A of Inspection and Enforcement (IE) Bulletin 79-14, for additional problem areas. Other IE bulletins, circulars, and information notices listed below in the reference section of this IP contain additional information about problem areas.

69020.E-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.E-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.E-06 REFERENCES

The following references describe problems at nuclear power facilities and are for background information only:

Inspection and Enforcement Bulletin, (IE) Bulletin 73-03 (and revision), "Defective Hydraulic Shock Suppressors and Restraints"

IE Bulletin 73-04 (and revision), "Defective Bergen-Paterson Hydraulic Shock Absorbers"

IE Bulletin 75-05, "Operability of Hydraulic Shock and Sway Suppressors"

IE Circular 76-05, "Hydraulic Shock and Sway Suppressors"

IE Circular 76-07, "Damaged Components of Bergen-Paterson Hydraulic Test Stand"

IE Bulletin 78-10, "Bergen-Patterson Hydraulic Shock Suppressors Accumulator Spring Coils"

IE Information Notice 79-01, "Bergen-Paterson Hydraulic Shock and Sway Arrestors Reported Failures"

IE Bulletin 79-02 (and revisions), "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts"

IE Bulletin 79-07, "Seismic Stress Analysis of Safety-Related Piping"

IE Information Notice 79-10, "Nonconforming Pipe Support Struts"

IE Bulletin 79-14 (and revisions), "Seismic Analysis for As-Built Safety-Related Piping Systems"

IE Circular 79-25 (and supplement), "Shock Arrestor Strut Assembly"

IE Information Notice 79-28, "Overloading of Structural Elements Due to Pipe Support Loads"

IE Bulletin 81-01 (and revision), "Surveillance of Mechanical Snubbers"

IE Circular 81-05, "Self-Aligning Rod End Bushing for Pipe Supports."

IE Information Notice 82-12, "Surveillance of Hydraulic Snubbers"

END

List of Attachments:

Revision History for IP 69020 Appendix E

Attachment 1: Revision History for IP 69020 Appendix E

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	ML24264A197 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