

NRC INSPECTION MANUAL

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INSPECTION PROCEDURE 70370

TESTING PIPING SUPPORT AND RESTRAINT SYSTEMS

PROGRAM APPLICABILITY: 2513, 2515 (SUPPLEMENTAL)

70370-01 INSPECTION OBJECTIVES

01.01 To determine proper installation and operation of pipe and component support and restraint systems in accordance with regulatory requirements, licensee's technical specifications (TS), programs, and procedures for the following conditions:

- a. Ambient temperature
- b. Intermediate and normal operating temperature and pressure
- c. After steam transient testing
- d. During required inspection intervals

01.02 To determine whether the surveillance of pipe supports and directional restraint inspections for safety-related piping and equipment is in conformance with TS and commitments.

01.03 To determine whether required records are maintained and properly reviewed and evaluated.

70370-02 INSPECTION REQUIREMENTS

02.01 Evaluation of Licensee's Programs and Procedures. Ascertain whether the licensee established, reviewed, and approved adequate programs and procedures pertaining to the examination and testing of piping support and restraint systems and determine whether the procedures include the following:

- a. Examination of piping support systems at various temperatures from ambient to normal operating temperature to detect interference caused by thermal expansion (Preoperational Stage Only).
- b. Setting and calibration of snubbers, restraints, and vibration arrestors are being performed and checked at predetermined temperatures (Preoperational Stage Only).

- c. Examination of piping support and restraint systems during transient testing to ascertain that pipe motion and vibration are within design limits and that water hammer does not exist (Preoperational Stage Only).
- d. Conduct of vibration tests, including resolution of high vibration (Preoperational Stage Only).
- e. Displacement measurements at ambient and operating temperature (Preoperational Stage Only).
- f. Snubber inspection schedule and sampling procedures are in conformance with the TS.
- g. Pipe support and component support inspection schedule are in conformance with the American Standard of Mechanical Engineers (ASME) Code Section XI and TS.

02.02 Observation at Ambient, Intermediate, and Operating Conditions. Select 15 piping or component supports in each of the following categories and visually examine them with respect to the items specified in each category:

- a. Dynamic piping supports (snubbers, shock suppressors, restraints, and vibration arrestors).
 - 1. Hydraulic fluid in snubbers, shock suppressors, and restraints is at the proper level.
 - 2. Fluid leaks through seals or elsewhere are not evident.
 - 3. Deterioration, corrosion, physical damage, or deformation is not noticeable.
 - 4. Lubricants are applied wherever required.
 - 5. All required bolts, locking devices, nuts, and washers are installed. Fasteners should be tight, secure, and of the correct material and size.
 - 6. Support plates, extension rods, and connecting joints are not bent, deformed, loose, or otherwise out of specification.
 - 7. Connecting joints, moving parts, piston shafts, seals, etc. are free from arc strikes, weld spatter, paint, scoring, roughness, general corrosion, or other materials that may obstruct proper operation.
 - 8. Pipes, supports, or other associated equipment or components are not in contact with other surfaces as a result of thermal expansion (Operational Stage Only).
 - 9. Snubber position is at or near its predicted position and it is not near the limits in either extension or compression.

- b. Fixed piping support (hangers, brackets, clamps, braces, lugs, cradles, saddles, straps, turnbuckles, clevis and base supports).
 - 1. Deterioration and corrosion are not evident.
 - 2. Pipe supports, including associated equipment, are not deformed or loose.
 - 3. If pipe clamps are used to support vertical lines, shear lugs welded to the pipe are provided as specified.
 - 4. Springs in hangers are not obstructed by foreign material.
 - 5. Spring hangers provided with indicators show either "cold" or "hot" position, consistent with plant condition.
 - 6. Threaded connections are secured by locknuts, fasteners, cotter pins, or similar locking devices and conform to the as-built drawings.
 - 7. Sliding or rolling supports are provided with material and/or lubricants suitable for the environment and compatible with sliding contact surfaces.
 - 8. Thermal expansion of the piping system is not restricted by the supports.
- c. Component support structures (brackets, frames, and plates).
 - 1. Deformation is not present.
 - 2. Grooves, abrupt ridges, valleys, undercuts, cracks, discontinuities, or other detrimental indications that appear to exceed ASME Code limitations are not observed on welded surfaces.

02.03 Observation after Steam/Water Transient Testing (Preoperational Stage Only). Select three systems subject to steam transient testing and examine 25% of the piping support and restraint systems of various degrees of accessibility for the following:

- a. Position indicators are in the appropriate position.
- b. Deformation is not evident.
- c. Component support structures are securely attached to the building structure and no cracks can be observed in structure support welds.
- d. Bolts, nuts, and other fastener type devices are secure.
- e. Debris that may affect the operation of piping support or restraint systems is not evident.

- f. Fluid leaks through seals or elsewhere are not evident.

02.04 Inservice Tests for Snubbers (Operational Stage Only). Observe functional testing of hydraulic/mechanical snubbers and verify the following:

- a. Test equipment is calibrated.
- b. Acceptable instructions and procedures are followed.
- c. Force that initiates free movement of the snubber rod (mechanical snubbers only) in either tension or compression is less than the specified maximum drag force.
- d. The force to initiate or maintain motion of the snubber is within the specified range in both directions of travel.
- e. Snubber activation or restraining rate is within the specified range of compression or tension.
- f. Snubber bleed or release rate is within the specified range of compression or tension.
- g. If snubber fails during testing, the cause of snubber failure is determined.
- h. The number of units to be tested is in accordance with the TS.

02.05 Licensee's Pipe Support Surveillances. Coordinate with plant management and arrange to accompany one or more of the licensee's pipe support inspectors during the performance of a routine inspection of snubbers and fixed-pipe or component support structures. Observe the following:

- a. Inspection procedures are followed.
- b. Proper acceptance criteria are utilized.
- c. Deficiencies, if found, are recorded, reviewed, and reported, as required.
- d. Corrective action is implemented, as required.
- e. Frequency of visual inspection is determined, as required by the TS, the ASME Code Section XI, or by plant management requirements developed from manufacturer's instructions.

02.06 Review of Records. Review the records of pipe support testing to verify the following:

- a. Licensee has evaluated all piping support testing.
- b. Results are within the established acceptance criteria.
- c. Identified deficiencies cited in pipe support testing records have been corrected.

General Guidance

- a. This module is intended to provide guidance for both preservice and periodic inservice inspection requirements for piping support and restraint systems. The main purpose of the preop (preservice) program is to verify design assumptions, to ascertain if as-built piping systems can accommodate thermal movements, and correct deficiencies not identified during construction. The purpose of the inservice program is to identify, evaluate, and correct service-induced deficiencies. The inspector should use all the sections in the procedure to perform the preop inspection; section 02.02, "Observation After Steam/Water Transient Testing," is omitted while conducting the inservice inspection. Both the preservice and inservice inspection requirements are mandated by 10 CFR 50.55a(g). In addition, snubber inspection frequency and requirements are discussed in Section XI, Article IWF-5000 of ASME Boiler and Pressure Vessel Code and in the TS.

Snubbers and/or shock suppressors are designed to prevent unrestrained motion under dynamic loads (earthquake or severe transient, etc.) while allowing normal thermal motion such as expansion and contraction during startup and shutdown. Inoperative or defective snubbers for safety-related systems and components prohibit a startup. The observance of any breakdown, leaks, deformation, or deterioration shall provide a basis for more examination or testing to determine the reasons for it.

Restraint systems require consideration of component and pipe movement from temperature changes. It is normal design practice to specify initial (cold) conditions and predict clearances for hot conditions. It should be recognized that actual thermal movement may differ in both magnitude and direction. Thus, tests are required to confirm acceptability of clearances and displacements in the as-built system.

The inspector should coordinate his inspection with licensee's refueling outage and pipe supports and directional restraints inspection program in order to observe some functional testing as well as licensee's adherence to TS and procedures.

Prior to the inspection of surveillance of pipe supports and directional restraints, the inspector should be familiar with the licensee's TS, approved programs, and procedures, especially possible addenda or amendments to TS pertaining to surveillance and test intervals which may vary from 31 days to 18 months.

Inspectors shall periodically observe some of the licensee's surveillance and test activities. Inspectors should use judgment in regard to the use of scaffolds or long ladders, using existing facilities whenever possible, thereby reducing licensee's assistance.

As-built snubber drawings should be used for verifying proper attachment, installation, and piston position.

Piping support and restraint system inspections at operating temperatures should be performed during the hot functional test (for PWRs before, and for BWRs after core loading) and during the power ascension testing program.

b. Definitions

1. Dynamic Piping Support. A piping support or restraint with a mechanical or hydraulic control unit designed to prevent unrestrained piping motion during an earthquake or severe transient, but allowing normal thermal motion.
2. Fixed Piping Support. A piping support without hydraulic or mechanical control units used for mounting pipes.
3. Component Support Structure. A supporting member, such as structural brackets and frames, for component mounting between the building structure and component.

03.01 Specific Guidance

a. Inspection Requirement 02.01

1. Preoperational test programs and procedures for pipe and component supports and restraint systems should include, but not be limited to, the following:
 - (a) Testing programs consistent with licensee's Final Safety Analysis Report commitments should include objectives, prerequisites, and acceptance criteria.
 - (b) Requirements for recording the review and approval of test results.
2. The TS or preoperational programs and procedures may require visual examinations at various temperatures. The results of these inspections should be recorded by the licensee.
3. Procedures should include cold load preset for standard and adjustable supports and the required calibrations for snubbers, restraints, and vibration arrestors. References to vendors' procedures and specifications are acceptable if they are made part of the record system.

- b. Inspection Requirements 02.01, 02.05, and 02.06. The surveillance and audit requirements stated in items 02.01, 02.05, and 02.06 are based on Appendix B to 10 CFR 50. Methods acceptable to the NRC staff for compliance with Appendix B to 10 CFR 50 are discussed in Regulatory Guide 1.33. In addition, Regulatory Guide 1.33 clarifies the use of ANSI N18.7-1976/ANS-3.2, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants."

- c. Inspection Requirements 02.01a, b, c, d, and e. The bases for these inspection items are found in Regulatory Guide 1.68.
- d. Inspection Requirement 02.01c. Excessive water hammer or vibration within the piping system should be recorded and analyzed for resolutions, such as addition of restraints or vibration arrestors. Minor water hammer or vibration should be analyzed for possible effect on the reliability of the pipe support and/or restraint systems.
- e. Inspection Requirement 02.01f. The TS should be consistent with the revision of the standard TS transmitted to the utilities by Generic Letter 84-13.
- f. Inspection Requirements 02.02 and 02.04. Pipe or component support selection should be based on load classification and various degrees of accessibility (easy or difficult). In addition, smaller size mechanical snubbers (e.g., PSA-1/4 and -1/2) are very vulnerable to mechanical damage from lateral loads. Therefore, particular attention should be paid to them following construction or other similar activities near them.
- g. Inspection Requirement 02.02a.5. Locking devices are devices installed to prevent threaded connections, bolts, and nuts from coming loose. During the construction phase, these locking devices may have been removed and not replaced.
- h. Inspection Requirements 02.02a.6 and 02.02c.2. Typical evidence of overstressing would be indications of bending of pipe supports or associated equipment. In addition, cracks in material or welded surfaces are further indication of overstressing. The inspector should be aware that the licensee may not necessarily be committed to the ASME weld requirements. The inspector should review the licensee's construction (hanger erection) procedures and the final as-built drawings to determine whether any discrepancies exist.
- i. Inspection Requirement 02.02a.9. The proper snubber position can be determined using the as-built drawings. If the snubber piston shaft does not have position markings, proper piston extension can be determined by comparing the required snubber piston length listed in the as-built drawings to the actual snubber piston length.
- j. Inspection Requirement 02.04. Snubber inspection requirements can be found in ASME Code Section XI and the TS.
- k. Inspection Requirement 02.05b. Acceptance criteria can be found in ASME Code Section XI, ASME Code Section III, Division 1, subsection NF, and in the TS.
- l. Inspection Requirements 02.05c,d. Described in Regulatory Guide 1.33 and ANSI N18.7-1976/ANS-3.2.

10 CFR 50.55a, "Codes and Standards".

Regulatory Guide 1.68, "Initial Test Program for Water-Cooled Nuclear Power Plants," August 1978.

Regulatory Guide 1.33, "Quality Assurance Program Requirements," October 1978.

Regulatory Guide 1.147, "In-Service Inspection Code Case Acceptability-ASME Section XI, Div. 1," June 1983.

ASME Code Section III, Div. 1, Subsection NF.

ASME Code Section XI.

ANSI/ASME OM4 "Examination and Performance Testing of Nuclear Power Plant Dynamic Restraints (Snubbers)."

Technical Specifications.

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