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# ISTD Implementation and Service-Life Monitoring

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## Abstract

Subsection ISTD of ASME's *Operation and Maintenance of Nuclear Power Plants* (OM Code) is the required code for preservice and inservice examination and testing of dynamic restraints (snubbers). This code replaced the inspection requirements of Article IWF-5000, "Inservice Inspection Requirements for Snubbers," in Section XI, "Inservice Inspection of Nuclear Power Plant Components," of the ASME *Boiler and Pressure Vessel Code* after the publication of the 2006 addenda to Section XI, which deleted Article IWF-5000. When the requirements of IWF-5000 were deleted, the requirements for examination and testing of snubbers, as required by Section 50.55a, "Codes and Standards," of Title 10, "Energy," of the *Code of Federal Regulations* (10 CFR 50.55a) became those specified by Subsection ISTD of the ASME OM Code. Therefore, when nuclear power plant owners prepare their ten-year inservice testing (IST)/inservice inspection (ISI) program updates that incorporate the 2006 (or later) addenda to Section XI, the snubber requirements will be required to be in accordance with those of Subsection ISTD of the latest approved edition and addenda of the ASME OM Code (2004 Edition with Addenda through 2006). This edition of the ASME OM Code is cited in the NRC Rulemaking which was published on June 21, 2011.

Because this is a change in requirements, owners should be asking some of the following questions: What is the difference between our existing program requirements and those included in Subsection ISTD of the ASME OM Code? How will this change our existing program or the way the current snubber examination and testing program is implemented? How much effort will be required to implement this program change? This paper will provide some specific guidance for the implementation of the ISTD Code and will identify typical areas where changes may be required to existing snubber examination and testing programs. It will also describe some approaches to satisfy the requirements of ISTD-6000, "Service Life Monitoring," which might not have been included in the previous requirements under Section XI.

## Introduction

The ASME OM Code as cited by 10 CFR 50.55a(b)(3) includes the general portion of the ASME OM Code (Subsection ISTA, "General Requirements") as well as Subsection ISTD, "Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Nuclear Power Plants." Therefore, when owners state they plan to meet the ISTD Code, they are also committing to adopt the overall requirements of the ASME OM Code, including those of Subsection ISTA that apply to snubber examination and testing programs and to other IST programs for pumps and valves. For example, paragraph ISTA-3200(a) requires IST Plans to be filed with the Regulatory authority having jurisdiction at the plant site. This applies to snubber program plans beginning with ten-year interval updates incorporating the 2006 Addenda and later approved editions of the OM Code. Additional guidance on test plans can be found in Non-Mandatory Appendix A.

ISTA-1100 establishes the scope of snubbers to be included in the snubber program. Some additional general requirements in ISTD are snubber-specific and are not included in ISTA. Therefore, in order to implement ISTD, one must satisfy both the specific and general requirements of ISTD as well as the general requirements of ISTA. Within the sections about general requirements are such things as applicability, definitions, owner responsibilities, examination boundaries, transient dynamic events, supported component or system evaluations, and snubber repair/replacement requirements. It is noted that although snubber examination and testing requirements no longer appear in Article IWF-5000 in Section XI, both repair and replacement actions are still required to be in accordance with Section XI as cited in ISTD-1500 and ISTD-1600.

Three main elements in ISTD together establish the basis of the snubber examination and testing program. All three elements must be properly implemented in order to conform to the requirements of Subsection ISTD of the ASME OM Code. These three elements are shown in Figure 1.

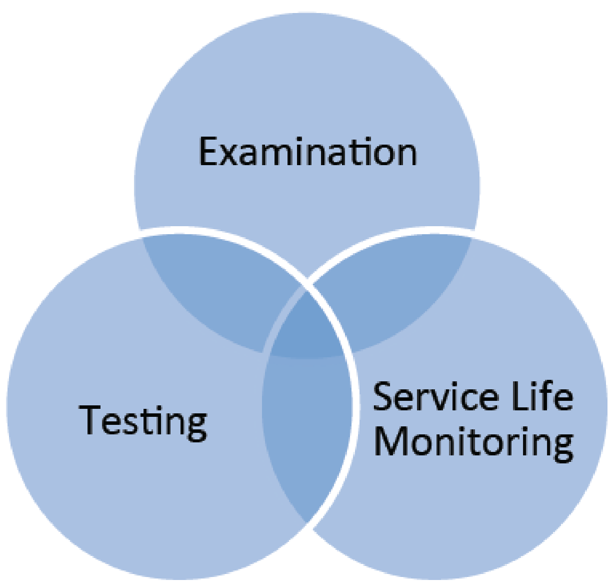


**Figure 1: Elements of ISTD**

Visual examination of snubbers is the first element of the ISTD Snubber Program. The examination requirements for snubbers are found in Article ISTD-4000. This section of ISTD replaces the visual inspection requirements previously found in IWF-5200(a) and IWF-5300(a). It includes both preservice and inservice examination requirements. The preservice examinations confirm proper installation of the snubber and confirm that the snubber will restrain load. The inservice examination requirements begin after power operation and are performed on a schedule determined in accordance with ISTD-4252 and the application of Table ISTD-4252-1. The frequency of visual examination may vary depending on the results of the previous examination campaign. If the results include several visual examinations that are determined to be unacceptable, the next examination interval could be reduced. Changes to Technical Specification (Tech Spec) or Technical Requirements Manual (TRM) requirements may be necessary in order to meet the frequency requirements of Subsection ISTD. Further guidance on the use of Table ISTD-4252-1 can be found in Non-Mandatory Appendix G.

In addition, an approved Code Case, OMN-13, allows the extension of the visual examination interval to a maximum of ten years after the prerequisite requirements listed in the OMN-13 Code Case have been satisfied. In order to use this Code Case, the existing snubber program must meet all of the requirements of both ISTA and ISTD. The OMN-13 Code Case may not be used without first adopting the OM Code.


**Figure 2: OMN-13 Visual Interval**

The boundary for snubber examination as defined in ISTD-3110 is from pin to pin, inclusive. ISTD does not cover the attachments to the building structure or the piping. This may differ from the previous owner-controlled program or Tech-Spec-controlled program in which the structural attachment and piping attachment might also be included in the examination program as part of the Section XI ISI Program. These structural attachments remain in the Section XI component support ISI examination program schedule. Coordination with the ISI program owner is required to ensure that the structural attachments have the proper examinations performed when they are included in the component support examination schedule. Some plants keep these inspections under the snubber program using VT-3-qualified individuals to complete the Section XI ISI work. ISTA-1500(e) requires the owner to use qualified individuals, who may or may not be VT-3-qualified. They must, however, be snubber-qualified.

One provision of ISTD-4240 visual examination requirements allows the recategorization of an unacceptable snubber examination to be considered acceptable after the satisfactory completion of a functional test. This test must demonstrate snubber operational readiness and confirm that the unacceptable condition did not affect the snubber’s operational readiness.

### Testing

Functional testing of snubbers is the second element of the ISTD snubber program. The testing requirements for snubbers are found in Article ISTD-5000. This section includes both preservice and inservice testing requirements. The preservice tests confirm proper operational readiness of the snubber before installation in the plant. The preservice testing requirement may be satisfied using the manufacturer's test performed at the factory, or it could be satisfied with a functional test performed by the owner just before installation of the snubber. The inservice testing requirements begin after plant power operation and testing is performed once every fuel cycle as required in ISTD-5200; however, testing may begin no earlier than 60 days before a scheduled refueling outage as stated in ISTD-5240. The sample plan testing required under ISTD is intended to provide an acceptable confidence level using a statistical snapshot in time to determine the overall condition of the snubber population.

The functional testing must use one of the two sampling test plans identified in ISTD-5260. Generally, the 10 percent plan is used for a population size less than 370 snubbers and the 37 plan is used for populations larger than 370 snubbers. The initial sample size using the 10 percent plan is 10 percent of the snubber population identified for each Design Test Plan Group (DTPG). The 37 plan requires an initial sample of 37 of the population identified for each DTPG. Further guidance on use and strategy for choosing one of the two sample plans can be found in the Non-Mandatory Appendices D and E.

<u>Design Test Plan Groups (DTPG)</u>

Snubbers may be grouped in various DTPGs according to the criteria outlined in ISTD-5250. The purpose of this grouping is to combine snubbers of like design, application, size, or type. The size of the sample is a function of the size of the DTPG while using the 10 percent plan. ISTD-5253 requires a separate DTPG for large equipment snubbers attached to steam generators or reactor coolant pumps on pressurized-water reactors.

Examples:
Population size is 635 mechanical snubbers of various sizes; however, they are all made by the same manufacturer.

Example 1:
Grouping – one DTPG
Use 37 Plan – initial sample size is 37 snubbers.
Use 10% Plan – initial size is 64 snubbers.

Example 2:
Grouping – two DTPG's, small snubbers = 150, all others = 485
Use 37 Plan on other sizes – initial sample size is 37 snubbers.
Use 10% Plan on small sizes – initial size is 15 snubbers

Depending on which of the example approaches above is used, different expanded testing scope requirements would result from test failures. Whichever test plan is chosen (10 percent or 37 plan), once the testing begins it must be continued through to the end of testing and must be concluded in accordance with ISTD-5330 for the 10 percent plan or ISTD-5430 for the 37 plan.

Test Parameters:

Test parameters are identified in ISTD-5210. An activation test is required for all snubbers, both hydraulic and mechanical. For hydraulic snubbers, a release-rate test is also required, as applicable to the snubber design. For mechanical snubbers, a drag-force measurement is required. Tests are to be performed in both the tension and compression directions. ISTD does not identify acceptance values for these tests, because that could depend on the design criteria used for each plant. Testing loads are not specified; however, ISTD-3210 requires tests to be performed at sufficient loads to verify the required test parameters.

Inservice Tests:

Inservice tests must be performed in the "as found" condition to the fullest extent possible as stated in ISTD-5221. This prohibits any preconditioning to improve the operation of the snubber, which might bias the test results before performing the "as found" test. The purpose of the inservice test is to determine whether the snubber is, in fact, ready to operate when called on to do so. In addition, the test result could also provide indication of degradation by observed decline in performance characteristics. ISTD allows the use of various test methods to accomplish the "as found" test: bench test, in-place test, subcomponent test, and indirect measurement. These differing approaches are described under ISTD-5220. Additional information on test parameters and methods can be found in Non-Mandatory Appendix H, "Test Parameters and Methods." If a hydraulic snubber is tested without the application of a load to the snubber piston rod, the snubber fluid must be evaluated and piston seal integrity verified as required by ISTD-6400.

<u>Test-Failure Evaluation:</u>

All test failures must be evaluated to determine the cause of the failure (ISTD-5271) and to consider any potential damage to the supported system or component (ISTD-1800). Test failures trigger requirements to perform additional testing until the equations (ISTD-5331 or ISTD-5431) of the test plan used are satisfied. When failures and a distinguishable failure mode are identified, a failure-mode group (FMG) may be established. The benefit of establishing an FMG may limit the additional testing to the group of snubbers identified to be in the FMG. Owner-controlled programs may not have the ability to establish an FMG for continued testing as is permitted by the ISTD Code. Snubbers placed in the same location as a previously failed snubber test must be subjected to a retest during the next fuel cycle as stated in ISTD-5500. There may be some confusion over this requirement in some programs. However, it is the location that is suspect, not the specific snubber. Therefore, if a snubber is removed from service because of an unacceptable inservice test and then refurbished before being installed in a new location, that snubber will not require a retest during the next fuel cycle.

**Service-Life Monitoring**

Service-life monitoring (SLM) is the third element of the OM Code's ISTD snubber program. Although all owner-controlled snubber programs will have an element of examination and some type of testing, they may be lacking in the documentation of an effective service-life monitoring program, which is required by ISTD. Most programs monitor performance of their snubbers from a reactive viewpoint. When there is a problem, it is addressed. Alternatively, they establish a seal-life expiration date for hydraulic snubbers and replace seals before they expire, calling that "service-life monitoring." The requirement described in ISTD-6000 must be proactive. It requires the prediction of service life for each snubber location in order to take appropriate action in advance of encountering a problem. When implementing an ISTD snubber program, significant programmatic work may be required in the area of service-life monitoring. Snubber programs may approach service-life monitoring by performing some kind of preventive maintenance on a number of snubbers. However, they may fail to document service life history on an individual snubber location basis, or define a service life strategy and approach toward maintaining an overall healthy snubber population.
A properly implemented service-life monitoring program should identify and address snubber degradation before the snubber ever reaches the end of its service life or shows up as a snubber test failure. In developing an effective service-life monitoring program, the program owner must consider various approaches and develop an effective strategy to maintain the health of the snubber population.

Whatever service-life monitoring approach is taken, it needs to be documented. ISTD-6000 provides certain prerequisites for an SLM program and discusses various methods to consider in Non-Mandatory Appendix F. Appendix F states that the service-life monitoring program should be based on knowledge of the operating environment, snubber design limits, and service records. Initially, ISTD-6100 requires the prediction of a service life for each snubber based on manufacturer's recommendation or design review. Sometimes service life is confused with the design life of a snubber, which is different. ISTD-2000 defines service life as the period of time an item is expected to meet the operational readiness requirements without maintenance. Even though substantial industry operating experience (OE) documentation to the contrary has been published, many plants still consider the service life of the mechanical snubber to be 40 years. This may be true for some benign environments on low-energy systems, but definitely not for others that are subject to vibration or temperature extremes. Some harsh locations may require snubber refurbishment or replacement during every refueling outage. This is clearly not a 40-year service-life application. An effective SLM program will take the location-specific environment into consideration when establishing the service life of all installed snubbers. Each fuel cycle, the service life for all installed snubbers is to be evaluated and adjusted, if necessary, based on technical data gathered from evaluations performed on snubbers which have seen plant service (ISTD- 6200). This evaluation should include a review of the snubber's history, including whether it has previously been installed in a different location. ISTD- 6300 requires an evaluation to be performed on all snubber failures to determine the cause of the failure, giving consideration to adjusting the service life for that snubber or other similar snubbers based on that evaluation.

Because of differing plant conditions, some snubber locations should be evaluated more often than would be required by either of the ISTD sample plans. For example, areas where a mechanical snubber experiences excessive vibration may reduce the expected service life of the snubber from 20 years to 10 years or less. Therefore, this snubber should come up for a service-life test or evaluation sooner than it would if one is using the normal sample-plan selection process. Alternatively, when a hydraulic snubber is located near a high-temperature source, the seals and fluid may reach the end of their service life earlier than expected if one uses the manufacturer's recommended service life. In this case, the seals would have to be replaced sooner because of the severe operating conditions where the snubber is installed. If the normal sample-plan selection process is to cycle through an entire snubber population in 15 years or longer, these snubbers would not have been selected for testing before the actual service life is exceeded.

When a snubber is selected for sample plan testing, what happens next? Let's say the snubber is tested and passes the acceptance criteria with data below the level recommended by the manufacturer for suggested or required maintenance. Should the snubber return to service for another 15 years without any maintenance? In some instances this may be acceptable; however, in other cases, the next time the snubber is tested it might not pass the acceptance test. Snubber performance is degrading continuously at some rate. An effective service-life monitoring program must know the rate for each snubber location and perform the required maintenance accordingly. Under such a program, unexpected snubber test failures would be rare.

When testing is performed solely for service-life considerations rather than under the sample testing plan, as described in ISTD-6500, the results of such SLM testing do not require testing of additional snubbers when failures occur, as would be required by ISTD-5320 or ISTD-5420. However, appropriate corrective action must still be taken based on an evaluation of the snubber failure. Performing SLM testing is a prudent practice to gain additional information about the condition and performance of the snubber population. However, many snubber-program owners may have difficulty scheduling this “optional” testing that is not a required surveillance by Code or Tech Specs, because of schedule or budget concerns. As previously stated, all snubbers degrade over time once installed in a power plant. The sample plan testing approach provides a statistical snapshot in time to confirm a confidence level that the snubber population is operable. An ineffective service-life monitoring program will eventually result in snubber operability falling below the acceptable range, which will undoubtedly result in sample plan testing expansions during the short refueling-outage testing window. This additional testing will challenge the plant’s ability to complete the required sample plan expansions within the scheduled time frame. Numerous approaches and methods can be implemented to establish an effective SLM program. As previously stated, Non-Mandatory Appendix F provides additional insights for the program owner to establish and implement his or her strategy.

## Conclusion

Subsection ISTD of the ASME OM Code defines the requirements of a comprehensive snubber examination and testing program. ISTD allows the program owner significant latitude to shape the actual implementation tools of the snubber program. However, the three essential elements of ISTD—examination, testing, and service-life monitoring—must all be considered to be equally important in order to reach the goal of a successful snubber program. The transition from an owner-controlled snubber program to an ISTD-compliant program can usually be made without significant pain once there is a solid understanding of these essential elements of the ISTD Code.

## References

ASME (formerly the American Society of Mechanical Engineers), *Operation and Maintenance of Nuclear Power Plants*, 2012 Edition, New York, NY, April 8, 2013.