INSPECTION PROCEDURE 75001 ATTACHMENT 08

HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS

Effective Date: April 1, 2026

PROGRAM APPLICABILITY: IMC 2573

75001.08-01 INSPECTION OBJECTIVES

To verify that safety-related (SR) and non-safety-related, safety-significant (NSRSS) heating, ventilation, and air conditioning (HVAC) systems can perform their required safety functions (RSFs).

75001.08-02 INSPECTION REQUIREMENTS

02.01 Vertical Slice Inspection of Quality Assurance:

Verify the licensee, manufacturer, or project vendor is effectively implementing its quality assurance (QA) and quality control (QC) requirements, in accordance with the quality assurance program (QAP) for activities associated with SR and NSRSS HVAC systems. Inspection guidance for this portion of the inspection is provided in IP 75001, Appendix A.

02.02 SSC Inspection Samples:

Verify the HVAC systems and components are designed and constructed in accordance with the applicable codes and standards, design requirements, and the safety analysis report (SAR).

Verify testing activities for the SR and NSRSS as-built HVAC systems and components conform to applicable codes and standards, design requirements, the SAR, and the licensee's testing requirements.

02.03 ITAAC Inspections: (Only applicable for construction under a COL)

Verify the inspections, tests, and analysis (ITA) are performed and that the acceptance criteria (AC) in the combined license (COL) are met.

02.04 Operational Program Inspections:

Inspect implementation of the applicable operational programs related to Pre-Service Testing (PST); Reliability Assurance Program (RAP), and Environmental, Seismic, and Functional Qualification of SSCs. For the purposes of this procedure, HVAC includes the air distribution and environmental control systems, thereby including all mechanical, electrical, and instrumentation and controls equipment that is directly related to HVAC function or performance. Examples of HVAC components include, but are not limited to

air handling units, dampers, valves, operators, piping, ducts, filters, absorbers, chillers, fans, pumps, compressors, refrigerant piping, insulation, access doors, supports, sensors, air storage tanks, control room envelope, etc.

Inspectors should use the project-specific Inspection Scoping and Planning Matrix (Scoping Matrix) for guidance on number of inspection samples. Inspectors will augment SSC technical inspection with an inspection of applicable quality assurance processes utilized in the manufacture, construction, installation, and testing of the SSCs. Processes may include fabrication, storage/handling, modification, testing, and corrective actions for nonconformances. This “vertical slice” approach is an important technique for inspectors to establish a reasonable assurance determination with respect to the construction area. Refer to IP 75001, “Inspection of Manufacturing and Construction Quality for Advanced Power Reactor Structures, Systems, and Components,” for additional requirements and guidance.

75001.08-03 INSPECTION GUIDANCE

General Guidance

The purpose of this inspection procedure is to provide insights into the quality of work being performed in the inspection area for HVAC systems and components. These insights will support the Advanced Reactor Construction Oversight Program’s (ARCOP) continual assessment process described in Inspection Manual Chapter (IMC) 2572, “Assessment of Advanced Reactor Construction Projects. “

The specific components selected for inspection, and the depth and breadth of inspection may vary widely between inspections and will depend on the structure, system, and component’s (SSCs) risk significance for the design, the timing and location of the inspection, and the construction activities completed or in progress at the time of inspection.

Each inspection using this IP will constitute at least one inspection sample, regardless of how many sections are implemented during the inspection. As described in IMC 2572 and IMC 2573, “Inspection of the Advanced Power Reactor ‘Quality of Reactor Plant Construction’ Strategic Performance Area,” the number of inspection samples needed to complete inspections in the inspection area are determined by the specified range of inspection samples listed in the project-specific inspection scoping matrices and on the results of the continual assessment process.

This IP is used for various advanced reactor designs and is scalable and flexible. Completion of every section/step of this IP is not expected or required for individual inspections or to complete the baseline inspection program for a project. Inspectors should perform the inspection activities in the following sections of this IP, as available.

In addition to the guidance below, inspectors may refer to supplemental inspection guidance in other IPs as necessary to aid in completing the inspections in this procedure.

Specific Guidance

03.01 Quality Assurance Implementation

The inspectors should refer to IP 75001 and IP 75001, Appendix A, “Implementation of the Quality Assurance Program,” for additional inspection guidance. The inspectors should select a sample of QA attributes to inspect during each inspection based on the scope and content of the planned inspection, the prior completed samples, and indication of potential issues for a particular attribute.

03.02 SSC Inspection Samples

a. Installation

1. Verify installation requirements such as proper location, placement elevation, volume, quantity, material type/shape/size, special features such as coatings and insulation, orientation, alignment, seismic and other mounting requirements (including torquing of bolts and expansion anchors), flow direction, leak testing, pressure testing, flow volume verification, flow distribution, residence time, tolerances, and electrical features such as proper grounding and terminations, are met. The inspector must be aware of the testing schedule, as HVAC testing is frequently performed on a section of the system in a sequential method.

2. Verify that personnel are properly trained and qualified, and that the specified equipment is available and used to meet manufacturer instructions, design basis specifications, and/or Code requirements.

3. Verify that installation requirements, work procedures, construction drawings, and specifications are available to installers and are the most current issued.

4. Verify that hold points are observed and quality inspections are conducted in accordance with standards and procedures.

5. Verify that installation and inspection records meet quality program requirements.

6. Field and design changes are approved in the manner and to the same degree as the original design for the SSCs and in accordance with the licensee’s procedures. The installation records should identify all field and design changes used for the installation.

7. Verify that temporary connections or jumpers are removed after testing to allow proper operation in normal mode.

Inspectors should pay particular attention to the traceability of material and equipment. Inspectors should verify that identification of items is maintained by part number, heat number, serial number, or other means, either on the item or on records traceable to the item, and that unique markings are on the item. In the case of fasteners, compliance with the material specification (e.g. ASTM or ASME material and grade) should be verified by markings present on the bolts or nuts and certified material test reports or Certificates of Conformance (CoC) as required by the procurement drawings and specifications and/or by the codes. In the case of vendor-supplied equipment assemblies containing fasteners, verify compliance with the vendor drawings, specifications, and other

information such as materials used for equipment qualification tests and/or analyses. For activated charcoal filter media, ensure that all of the charcoal is from the same batch/lot that has a CoC and test data that is within the shelf life of the charcoal (usually 5 years).

Records should document the status of installed systems. They should confirm that required inspections have been performed and that the inspector's qualification is current and correct for the inspection.

Typical problems discovered by inspection include inadequate or unclear guidance/instructions for installers and/or inspectors, the use of improper/uncalibrated tools for installation and measurement, weak management coordination leading to skipped hold points in installation, inadequate personnel qualification records, field changes not being processed properly, and record storage and retrieval problems.

b. Welding Guidance

The inspector should determine what specific acceptance criteria are established and select those for observation that are best confirmed through observation. Others should be confirmed through record/data review. The inspector should try to focus on those testing activities related to the more safety significant HVAC systems, which may include control room habitability systems, Class 1E and safety related equipment rooms, and battery room cooling and ventilating systems.

The samples should include observations of a variety of sub-contractors or workgroups performing welding. This scope applies to both observations and record reviews. A variety of non-destructive examination processes should also be included in the inspection sample.

Records should provide traceability of all aspects of the welding activity including weld procedures used, welders, material certifications, inspections performed and their results, inspectors, and qualification records for procedures and personnel. These records, including radiographs, should be retained and stored in accordance with QA requirements.

For further welding and NDE guidance refer to IP 75001.WELD.

c. Post Installation Activities Guidance

Observe as-built HVAC systems and verify that HVAC components, equipment, ducts, and supports are properly maintained until final turnover. Confirm the components are properly protected and if necessary, serviced considering the following attributes, as applicable:

1. Licensee surveillance activities are being performed according to instructions.

2. Protection is provided as required, including protection against such conditions as adverse temperature, humidity, flooding, and foreign materials (e.g., dirt, dust, cans, and general debris).

3. Lubrication, rotation, and electrical resistance checks are performed as specified.

4. Records are maintained, indicating the status of installed components.

5. Recording methods such as stamps, tags, markings, etc. are used to indicate status of licensee inspections, completion of tests, acceptances, and to prevent inadvertent operation.

6. HEPA/Charcoal systems have additional protection requirements and require additional testing/maintenance if Volatile Organic Compound (VOC) producing work such as painting, welding, chemical release, or fire occurs in the communicated areas. RG 1.52 C.7.b provides additional insights.

d. Component Qualification and Testing Guidance

Construction testing of HVAC systems may include the types of activities listed below. Confirm acceptance criteria within design and license bases documentation to inform sample selection for direct observation. Other tests may be confirmed through record/data review. The inspector should prioritize those testing activities based upon safety significance, which may include control room habitability systems, Class 1E and safety related equipment rooms, and battery room cooling and ventilating systems.

1. Testing of installed air ducts for excessive leakage, particularly around access doors and panels.

2. Functional testing of air regulating dampers.

3. Flow balancing of HVAC systems to provide required airflow where needed.

4. Installation and calibration of required HVAC instrumentation.

5. Installation testing, including pressure testing where required, of service water systems which provide heat-transfer support for HVAC systems such as vital room and containment coolers.

6. Verification that the airflow is from low contamination areas to progressively higher potential contamination areas, and as per the HVAC system design specifications.

HVAC components may be subject to seismic, environmental, or other such qualification criteria. Review design specifications to determine the specific qualification criteria for a selected component. For example, an HVAC electrical component may be specified to be environmentally qualified in accordance with IEEE-323-1974 or a similar standard. Such qualification may consist of type tests, analyses, or a combination of both. Refer to ASME AG-1 for additional information about requirements.

Refer to 75001.QUAL for further guidance on inspection of component qualification.

03.03 ITAAC Verification

Review the licensee’s plan for completion of applicable ITAAC associated with the work activities being inspected. Review the activities that the licensee intends to credit for future ITAAC closure. For example, if the licensee intends to rely on a specific quality control (QC) observation during the installation of an SSC, then the inspector should review a sample of these QC observations to determine whether the activity was performed in accordance with applicable quality and technical requirements. Because ITAAC has special regulatory significance, licensees should document ITAAC closure

under their QAP. This means that even if an ITAAC is for a non-safety-related SSC, the completion package and subsequent notifications on ITAAC will be controlled by the QAP.

03.04 Operational Program Inspections

Verify the SR and NSRSS as-built HVAC systems and components are appropriately qualified to perform their required safety functions (RSFs), as required, for a harsh environment, seismic conditions, and functional qualification.

Inspectors should verify that HVAC systems and components are seismically, environmentally, and functionally qualified in accordance with the design specification, qualification reports, and the safety analysis report (SAR).

The inspectors should refer to IP 75001 for inspection guidance for environmental, seismic and the functional qualification of electrical components.

Inspectors should review qualification data packages (e.g., seismic test reports, environmental qualification data, interface requirements such as conduit seals, drip loops, T-drains, drain loop seals, airflow distribution, branch duct air flows, residence time, removal efficiencies for both in place and laboratory testing, bypass test results, leak tests, pre-heater tests, chiller package thermal performance data, and heat rejection).

The EQ test report should state that equipment is qualified for its application and meets its specified performance requirements (voltage, current, frequency, accuracy, etc.) when subjected to the conditions predicted to be present and when it must perform its safety function, up to the end of its qualified life.

Seismic qualifications of equipment are grouped into three general categories: (1) analysis, (2) tests, and/or (3) qualify by combination of tests and analysis. One of these methods may be adequate to verify the ability of the equipment to meet the seismic qualification requirements.

Inspectors should confirm that equipment is installed in configurations bounded by qualification testing and that any changes in location, mounting, or interface do not invalidate the qualification.

75001.08-04 RESOURCE ESTIMATE

Resource estimates for this procedure are expected to vary based on design and project-specific variables. Refer to the project-specific scoping matrix for a given project for a more precise resource estimate.

75001.08-05 PROCEDURE COMPLETION

Inspection procedure completion is based on completing sufficient inspection samples to support an assessment of this inspection area and to satisfy the main objective of this IP “to gain a reasonable assurance determination that work on HVAC systems is being performed with adequate quality.” Refer to project-specific inspection scoping and IMC 2573 for guidance on inspection area sample sizes.

75001.08-06 REFERENCES

ASME N509-1989, “Nuclear Power Plant Air-Cleaning Units and Components”

ASME N510-1989, “Testing of Nuclear Air-Cleaning Systems”

ASME N511-2007, “In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air Conditioning Systems”

ASME/ANSI AG-1-1997, “Code on Nuclear Air and Gas Treatment”

NFPA 90A, “Standard for Installation of Air Conditioning and Ventilation Systems”

Regulatory Guide (RG) 1.140, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light Water Cooled Nuclear Power Plants”

RG 1.52, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post Accident Engineered Safety Feature Atmosphere Cleanup Systems in Light Water Cooled Nuclear Power Plants”

RG 1.78, “Evaluating the Habitability of a Nuclear Power Plant Control Room during a Postulated Hazardous Chemical Release”

RG 1.84, “Design, Fabrication, and Materials Code Case Acceptability, ASME Section III”

Sheet Metal Air Conditioning National Association (SMACNA), “HVAC Duct Construction Standards - Metal and Flexible”

AACC (American Association for Contamination Control) CS-8T, “Standard for High Efficiency Gas-Phase Adsorber Cell”

40 CFR 82.157, “Appliance maintenance and leak repair”

40 CFR 82.156, “Proper evacuation of refrigerant from appliances”

Generic Letter 99-02, “Laboratory Testing of Nuclear-Grade Activated Charcoal”

Generic Letter 03-01, “Control Room Habitability”

END

List of Attachments:

Attachment 1: Revision History for IP 75001.08

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Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional Non-Public Information)
N/A	ML26057A072 04/01/26 CN 26-011	Initial Issuance.	N/A	N/A