ASME QME-1–2025
(Revision of ASME QME-1–2023)

Qualification of Mechanical Equipment Used in Nuclear Facilities

AN AMERICAN NATIONAL STANDARD



The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers
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FOREWORD

Federal regulations applicable to nuclear facilities require that measures be established to ensure that certain equipment operates as specified. This Standard sets forth requirements and guidelines that may be used to ensure that mechanical equipment is qualified for specified service conditions. As determined by federal regulators and/or nuclear facility licensees, this Standard may be applied to future nuclear facilities or existing operating nuclear power plant component replacements, modifications, or additions.

In the early 1970s, initial development of qualification standards was assigned to the N45 Committee of the American National Standards Institute (ANSI). The N45 Committee in turn established a task force to prepare two series of standards to ensure that pumps and valves used in nuclear plant systems would function as specified. The N45 Committee's valve task force (N278) was reassigned in 1974 to the American National Standards Committee B16 and designated Subcommittee H. The first qualification standard to be issued for valves was ANSI N278.1-1975, which covered the preparation of functional specifications. In 1982, the task force was reassigned to The American Society of Mechanical Engineers (ASME) Committee on Qualification of Mechanical Equipment Used in Nuclear Power Plants (QME) and designated the Subcommittee on Qualification of Valve Assemblies. As an interim measure, in 1983, ANSI B16.41 was issued to cover functional qualification requirements for power-operated valve assemblies for nuclear power plants.

The N45 Committee's pump task force (N551), established in 1973, was assigned to ASME Nuclear Power Codes and Standards along with N278 as part of the Subcommittee QNPE, Qualification of Nuclear Plant Equipment. Both N551 and N278 operated as Subcommittee QNPE until 1982, when they were reassigned to the QME Committee and designated as, respectively, the Subcommittee on Qualification of Pump Assemblies and the Subcommittee on Qualification of Valve Assemblies. In June 1977, an agreement between the Institute of Electrical and Electronics Engineers (IEEE) and ASME was formulated, giving primary responsibility for qualification standards to IEEE and for quality assurance standards to ASME. This arrangement remained in effect until ASME established the Committee on Qualification of Mechanical Equipment Used in Nuclear Power Plants, now known as the Committee on Qualification of Mechanical Equipment Used in Nuclear Facilities.

The various parts of ASME QME-1–1994 were approved by ANSI on the following dates: Section QP, September 22, 1992; Section QR, June 8, 1993; Section QR, Nonmandatory Appendix A, October 7, 1993; Section QR, Nonmandatory Appendix B, May 14, 1993; and Section QV and its Nonmandatory Appendix A, February 17, 1994. Section QV was a revision and redesignation of ANSI B16.41-1983.

ASME QME-1-2002 was published in 2003. In September 2003, it was recognized that the Standard had aspects, such as the process for valve qualification, that could better use new computer analytical techniques and that were proscriptive in nature. In addition, seismic qualification needed to be updated to recognize new industry guidance. New sections were needed on standardization of experience-based seismic equipment qualification and the qualification of dynamic restraints. At the time, industry experience had demonstrated that qualification to ASME QME-1 was required without the specification of the parameters for which equipment needed to be qualified. The use of this Standard requires that a Qualification Specification be provided.

ASME QME-1–2007 was endorsed by the Nuclear Regulatory Commission (NRC) and was the first edition of ASME QME-1 to be so endorsed. It was approved as an American National Standard on June 25, 2007.

The 2012 edition of this Standard was approved as an American National Standard on September 17, 2012. The 2017 edition of this Standard was approved as an American National Standard on March 21, 2017.

The 2025 edition of ASME QME-1 was revised in its entirety.

Following approval by the ASME QME Committee, ASME QME-1–2025 was approved by ANSI as an American National Standard on January 28, 2025.

ASME QME COMMITTEE
Committee on Qualification of Mechanical Equipment Used in Nuclear Facilities

(The following is the roster of the committee at the time of approval of this Standard.)

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Revisions and Errata. The committee processes revisions to this Standard on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published in the next edition of the Standard.

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive email notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases

(a) The most common applications for cases are

(1) to permit early implementation of a revision based on an urgent need

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Standard

(4) to permit the use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Standard.

(c) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Standard and the paragraph, figure, or table number

(4) the editions of the Standard to which the proposed case applies

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

Interpretations. Upon request, the committee will issue an interpretation of any requirement of this Standard. An interpretation can be issued only in response to a request submitted through the online Inquiry Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic email confirming receipt.

ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers can track the status of their requests at https://go.asme.org/Interpretations.

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Interpretations are published in the ASME Interpretations Database at https://go.asme.org/Interpretations as they are issued.

Committee Meetings. The QME Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at https://go.asme.org/QMEcommittee.

ORGANIZATION OF ASME QME-1

1 GENERAL

ASME QME-1 is divided into Parts that are designated by capital letters: the letter "Q," which stands for "qualification," followed by one or more letters that generally indicate the subject matter of the Part. Each Part is divided into Sections as follows:

(a) Section QR-1, General Requirements
(b) Section QR-2, Qualifications and Duties of Certifying Engineers for Certification Activities
(c) Section QR-3, Seismic Qualification of Mechanical Equipment
(d) Section QR-4, Qualification of Nonmetallic Parts
(e) Section QR-5, Qualification of High-Temperature Materials
(f) Section QR-6, Sample Certifying Engineer Certification Statements
(g) Section QR-7, References
(h) Section QR-8, Glossary
(i) Section QDR-1, Qualification Specification for Dynamic Restraints
(j) Section QDR-2, Qualification of Dynamic Restraints
(k) Section QDR-3, Restraint Similarity
(l) Section QDR-4, Typical Values of Restraint Functional Parameters
(m) Section QP-1, Qualification Specification for Pump Assemblies
(n) Section QP-2, Qualification of Pump Assemblies
(o) Section QP-3, Pump Similarity Checklist
(p) Section QV-1, Qualification Specification for Valves
(q) Section QV-2, Qualification Requirements for Valve Assemblies for Nuclear Facilities
(r) Section QV-3, Static Side Load Testing for Power-Actuated and Relief Valve Assemblies
(s) Section QV-4, Determination of Valve Assembly Performance Characteristics

2 SECTIONS

Sections are divided into subsections, paragraphs, and, where necessary, subparagraphs and sub-subparagraphs.

3 SUBSECTIONS

Subsections are designated by the Section designator (e.g., QR-1) followed by a decimal and a numeral, e.g., QR-1.1. Whenever possible, subsections dealing with the same topic are given the same decimal number in each Section.

4 PARAGRAPHS, SUBPARAGRAPHS, AND SUBSUBPARAGRAPHS

Paragraphs, subparagraphs, and subsubparagraphs are designated by the subsection designator (e.g., QR-1.5) followed by one or more additional decimal numbers. For example, subsection QR-1.5 divides into paras. QR-1.5.1 through QR-1.5.3. Paragraph QR-1.5.2 divides into paras. QR-1.5.2.1 through QR-1.5.2.5. Lists within paragraphs, subparagraphs, or subsubparagraphs are designated with parenthetical letters [(a), (b), (c), etc.] and sub lists with parenthetical numbers [(1), (2), (3), etc.].

5 REFERENCES

References cited within this Standard generally fall into one of the following categories:

(a) Cross-References. When this Standard references a subsection or paragraph within the Standard, the reference includes all paragraphs, figures, tables, etc., subsidiary to that cross-reference. For example, reference to subsection QR-1.5 includes all paragraphs, figures, tables, etc., in subsection QR-1.5; reference to para. QR-1.5.3 includes all subparagraphs, figures, tables, etc., in para. QR-1.5.3.

(b) References to the ASME Boiler and Pressure Vessel Code and Other Standards. When this Standard references a specific element (e.g., an article, paragraph, figure, or table) from an external source such as the ASME Boiler and Pressure Vessel Code, the reference shall be understood to mean only the specific element cited. When this Standard references an

entire document, e.g., IEEE Std 382, the reference shall be understood to mean the entire document. This Standard cites references in text by the cited document's issuing organization and unique identification number, e.g., ASME BPVC, Section III, Subsection NF; IEEE Std 627; or 10 CFR 50 Part A. Section QR-7 provides a comprehensive alphanumeric reference list, including titles and publishers, of all documents cited in this Standard.

ASME QME-1–2025
SUMMARY OF CHANGES

Following approval by the ASME QME Committee and ASME, and after public review, ASME QME-1–2025 was approved by the American National Standards Institute on January 28, 2025.

ASME QME-1–2025 has been revised in its entirety.

PART QR
REQUIREMENTS COMMON TO ALL EQUIPMENT

SECTION QR-1
GENERAL REQUIREMENTS

QR-1.1 PURPOSE AND SCOPE

This Standard provides the requirements for a Qualification Specification that can either be supplied by the purchaser of the component or plant designer at the time that the component is specified, or it can be supplied to the specifier by a manufacturer that has prequalified the component so that the plant designer can ensure that the required conditions in the facility are enveloped by the manufacturer's qualification.

This Standard provides the requirements and guidance for the qualification of mechanical equipment that perform specified functions at a nuclear facility. These functions shall be identified during the licensing process and included in the Qualification Specification. The specified functions are as accepted by the applicable regulatory authority, or by another method justified by the applicant as part of the licensing process for the nuclear facility based on review and acceptance by the applicable regulatory authority. These components are, for the purposes of this standard, referred to as Mechanical Components.

This standard contains wording such as shall, should, and may. The word "shall" is used to denote a requirement, "should" to denote a suggested recommendation, and "may" to denote permission (neither a requirement nor a recommendation).

QR-1.2 APPLICABILITY

This standard shall be used to qualify the specified functions of mechanical components. The determination of which components shall comply to this standard shall be made by the Owner or Owner's designee as required by the applicable regulatory authority. A component manufacturer or designer may elect to use this standard to prequalify a line of mechanical components subject to acceptance by the Owner or Owner's designee.

This Standard does not apply to electric components such as motors, electric valve actuators, instrumentation, and controls, which are qualified by conformance with appropriate IEEE standards except to the extent that their interface with the mechanical equipment must be qualified.

This Standard does not apply to mechanical components that do not have a specified function whose structural integrity is addressed by other codes and standards. The terms pumps, valves, and dynamic restraints are used for convenience in this standard. However, components within the scope of this standard might have different names and designs in new and advanced nuclear facilities with the following functions:

(a) to generate, allow, throttle, or isolate fluid flow

(b) to provide pressure relief capability

(c) to establish dynamic restraint to ensure the structural integrity of piping systems and their components

The mechanical component shall comply with the requirements of the applicable design and construction codes and standards. This standard assumes that the component is properly sized, specified, and applied and that the component has been appropriately designed for the worst case conditions for which it is to be qualified.

This standard provides requirements based on the applied loads, fluid operating conditions, and external environment during the period that the mechanical function of the component is required.

QR-1.3 QUALIFICATION SPECIFICATION

This subsection provides the requirements for the Qualification Specification.

It is the responsibility of the Owner or Owner's designee to provide a Qualification Specification to define the functional performance requirements for the testing and qualification for the component to be qualified. The Seismic Qualification Specification can be a separate specification, or be included within the Qualification Specification. The following subsections provide the requirements for the Qualification Specification:

(a) subsection QDR-2.4

(b) subsection QP-2.4

(c) subsection QV-2.4

(d) QR-3.3

QR-1.4 QUALIFICATION PRINCIPLES

The principles pertinent to mechanical equipment qualification are provided in the following.