ASME QME-1–2002

(Revision of ASME QME-1–2000)

Qualification of Active Mechanical Equipment Used in Nuclear Power Plants

The American Society of Mechanical Engineers

The American Society of
Mechanical Engineers

AN AMERICAN NATIONAL STANDARD

QUALIFICATION OF ACTIVE MECHANICAL EQUIPMENT USED IN NUCLEAR POWER PLANTS

ASME QME-1–2002
Revision of ASME QME-1–2000

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The next edition of this Standard is scheduled for publication in 2004. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard.

The American Society of Mechanical Engineers
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FOREWORD

Federal regulations applicable to nuclear power plants 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 active mechanical equipment is qualified for specified service conditions. As determined by federal regulators and/or nuclear power plant licensees, this Standard may be applied to future nuclear power plants, or existing operating nuclear power plant component replacements, modifications, or additions.

In the early 1970s, initial development of qualification standards was assigned to the ANSI N45 Committee. 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 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 active 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 ASME Committee on Qualification of Mechanical Equipment Used in Nuclear Power Plants (QME) and designated as the Subcommittee on Qualification of Valve Assemblies and the Subcommittee on Qualification of Pump Assemblies.

In June 1977, an IEEE/ASME agreement was formulated giving primary responsibility for qualification standards to IEEE and quality assurance standards to ASME. This arrangement remained in effect until ASME established the current Committee on Qualification of Mechanical Equipment Used in Nuclear Power Plants.

During 1985, the Committee on Qualification of Mechanical Equipment Used in Nuclear Power Plants researched the various formats this Standard could take. Based on the wide acceptance of ASME Section III's format for multiple classes, the Committee adopted a similar organizational format to accommodate multiple equipment types covered by this Standard. As IEEE Standards 323 and 627 had already been in use many years for electrical equipment, these standards were also studied for appropriate content that should be addressed for mechanical equipment. Subsequently, the following Organization Guide was developed for this Standard and submitted to the ASME Board on Nuclear Codes and Standards for approval. On January 16, 1986, the Board on Nuclear Codes and Standards approved QME's approach and outline for this Standard.

Consistent with the guidance in ASME SI-9, [ASME Guide for Metrication of Codes and Standards SI (Metric Units)] regarding metrication, SI units have been provided in narrative portions of QME-1 for general information only, and the U.S. Customary units are the standard. Either U.S. Customary units or SI units may be used, but one system shall be used consistently throughout construction of the component. Should the owner or his agent desire metric units, it sill be set forth in the design specifications.

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

Requests for interpretation or suggestions for improvement of this Standard should be addressed to the Secretary of the ASME Committee on Qualification of Mechanical Equipment

Used in Nuclear Power Plants, The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

In 1996 the Board of Nuclear Codes and Standards requested all committees reporting to it to add SI (metric) units to all documents by replacing Customary (English) units with SI units or by showing SI units in a dual format with Customary units. The decision as to the extent of the conversion and format was left to the various committees. The Committee on Qualification of Mechanical Equipment for Nuclear Power Plants voted in 1996 to present SI units in the QME document, with Customary units in parentheses. A group of proposed changes was prepared at that time. The changes encountered a good deal of opposition. The Committee on Qualification of Mechanical Equipment for Nuclear Power Plants revisited this decision at its February 29, 2000 meeting and voted to publish QME-1 with dual units, Customary as the primary units, with SI units in parentheses. This decision was further modified by the Committee to make the change apply to textual material only. Tables and figures were not to be modified. The changes made herein confirm with those decisions. The changes apply to the text as it appeared in the 1997 edition of QME-1.

This Standard was approved as an American National Standard on October 31, 2002.

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

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ORGANIZATION OF QME-1

1 GENERAL

ASME QME-1 is divided into sections that are designated by capital letters: the letter Q, which stands for qualification, followed by a second letter that generally indicates the subject matter of the section. This Standard consists of three major sections as follows:

(a) Section QR: General Requirements
(b) Section QP: Qualification of Pump Assemblies
(c) Section QV: Qualification of Valve Assemblies

2 SECTIONS

Sections are divided into articles, subarticles, paragraphs, and, where necessary, subparagraphs and subsubparagraphs.

3 ARTICLES

Articles are designated by the applicable letters indicated above for the sections, followed by Arabic numbers, such as QR-1000, QP-2000, and QV-6000. Whenever possible, articles dealing with the same topics are given the same number in each section in accordance with the following general scheme:

Article Number	Title
1000	Scope
2000	Purpose
3000	References
4000	Definitions
5000	Qualification Principles and Philosophy
6000	Qualification Specification Criteria
7000	Qualification Program
8000	Documentation

The numbering of the articles and the material contained in the articles may not, however, be consecutive. Due to the fact that the complete outline may cover phases not applicable to a particular section or article, the rules have been prepared allowing some gaps in the numbering. In Section QV of this Standard, subarticles QV-1200, QV-1300, and QV-1400 describe exceptions to this general numbering system, which may apply to paras. 4 through 8.

4 SUBARTICLES

Subarticles are numbered in units of 100, such as QR-7100 or QV-7200. When more than nine subarticles are required, numbering is done by paragraph and units of 1 starting with 10.

5 SUBSUBARTICLES

Subsubarticles are numbered in units of 10, such as QR-8310, and generally have no text. When a number such as QR-8320 is followed by text, it is considered a paragraph. When more than nine subsubarticles are required, numbering is done by paragraph and units of 1 starting with 10.

6 PARAGRAPHS

Paragraphs are numbered in units of 1, such as QR-8321 or QV-8322.

7 SUBPARAGRAPHS

Subparagraphs, when they are major subdivisions of a paragraph, are designated by adding a decimal followed by one or more digits to the paragraph number, such as QR-8321.1 or QV-8321.2. When they are minor subdivisions of a paragraph, subparagraphs may be designated by lowercase letters in parentheses, such as QR-8321(a) and QV-8321(b).

8 SUBSUBPARAGRAPHS

Subsubparagraphs are designated by adding lowercase letters in parentheses to the major subparagraph numbers, such as QR-8321.1(a) and QV-8321.1(b). When further subdivisions of minor subparagraphs are necessary, subsubsubparagraphs are designated by adding Arabic numbers in parentheses to the subsubparagraph designation, such as QR-8321.1(a)(1) and QV-8321.1(a)(2).

9 REFERENCES

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

(a) References to Other Portions of This Standard. When a reference is made to another article, subarticle, or paragraph, all numbers subsidiary to that reference shall be included. For example, reference to QR-5000 includes all material in Article QR-5000; reference to QR-7300 includes all material in Subarticle QR-7300; reference to QR-7320 includes all material in Subsubarticle QR-7320.

(b) References to the Boiler and Pressure Vessel Code and to Other Standards. When a reference is made to any Section of the BPVC, or to other standards, it shall be understood to mean the designated article, paragraph, figure, or table in the designated document. All such

references shall be identified in the text of this Standard by the document's issuing source and the document's unique identification number, e.g., ASME III Subsection NF, IEEE Std 627, or 10CFR50 Part A. If required, further reference to unique articles or paragraphs of the referenced document may also be described, e.g., ASME III Subsection NF paragraph NF-3211.1(a). Each short reference made in the text shall be described in more complete detail in Article 3000 by issuing source, unique identification number, year of publication being referenced, and full title, e.g., IEEE Std 382-1980, Standard for Qualification of Safety Related Valve Operators. References listed without year of publication suggest that the latest version of the reference was utilized in the development of this Standard. It should be noted by users of this Standard that regulatory requirements and Codes of Record for a particular nuclear power plant may take precedence over references used within this Standard. Section QR references applicable for both pumps and valves shall be described in Article QR-3000, while references unique to Section QP or QV only will be described in Article QP- or QV-3000, as applicable.

(c) References to Appendices. Two types of appendices may be used in this Standard, designated Mandatory and Nonmandatory. Both types of appendices are designated by the prefix Q. This is followed by a letter, which is the same one used by the section to which the appendix applies, e.g., QR. Mandatory appendices contain requirements that must be followed in qualification; such references are then uniquely identified by a roman numeral, e.g., Appendix QR-I and its specific title. Nonmandatory appendices provide information or guidance; such references are designated by a capital letter, e.g., Appendix QR-A, and its specific title.

ASME QME-1–2002
SUMMARY OF CHANGES

Following approval by the ASME Committee on Qualification of Mechanical Equipment Used in Nuclear Power Plants and ASME, and after public review, QME-1–2002 was approved by the American National Standards Institute on October 31, 2002.

QME-1–2002 includes the following changes identified by a margin note, **(02)**.

Page	*Location*	*Change*
14	Table QR-A6210-1	Revised
52–66	Section QDR	Added
77	Appendix QP-D I(a)(1)	Revised
	Appendix QP-D I(b)(1)	Revised
	Appendix QP-D I(b)(2)	Revised
79	Table QP-E1	Revised
80	QP-E5300(c)	Revised
	QP-E5400(a)	Revised
	Table QP-E2	Revised
81	QV Introduction	Third paragraph revised
94	QVP-7370.1(g)	Nomenclature revised
96	QVP-7381.1(c)	Nomenclature revised
99	QVP-7393.3(a)	Revised
99	QVP-7394.3(a)	Revised
100	QVP-7394.3(c)	Revised
103	QVC-7420.1(a)(2)(a)	Revised
	QVC-7420.1(a)(2)(b)	Revised
	QVC-7420.1(a)(2)(c)	Revised
108	QV-A4000	Definitions of *valves, low leakage* and *valves, nominal leakage* revised
111–119	Section QV-G	Added

SPECIAL NOTE:

The Code Cases to ASME QME-1 follow the last page of this edition as a separate section.

QUALIFICATION OF ACTIVE MECHANICAL EQUIPMENT USED IN NUCLEAR POWER PLANTS

Section QR: General Requirements

QR-1000 SCOPE

This Standard describes the requirements and guidelines for qualifying active mechanical equipment used in nuclear power plants. The requirements and guidelines presented include the principles, procedures, and methods of qualification. Requirements are specifically denoted throughout this Standard and are generally recognized by the accompanying word *shall*, while guidelines are accompanied by the word *should*.

This Standard does not apply to electric components such as motors, electric valve actuators, instrumentation, and control devices, which are qualified by conformance with appropriate IEEE standards. It should be recognized that some qualification aspects are performed when the mechanical/electrical component interface is addressed, e.g., Section QV provides qualification guidance for valve assemblies using electric actuators and Section QP provides qualification guidance for pump assemblies using electric motor drivers that have been previously qualified per the appropriate IEEE standards.

Qualification of active mechanical equipment in accordance with this Standard is the responsibility of the Owner or the Owner's designee. It is also the responsibility of the Owner or the Owner's designee to define specifically any other equipment to which this Standard will be applied. The Owner or the Owner's designee is further responsible for program(s) and associated documentation required to ensure continuation of initial qualification of active mechanical equipment that is beyond the scope of this Standard.

Qualification of mechanical equipment in accordance with this Standard requires utilization of two sections and applicable appendices as a minimum, e.g., Section QR must be used jointly with other sections of the Standard.

QR-2000 PURPOSE

The purpose of this Standard is to provide basic principles and guidance to demonstrate the qualification of active mechanical equipment used in nuclear power plants. Qualification is intended to confirm the adequacy of the equipment to function over the expected range of service conditions, including design basis event and postdesign basis event conditions, as well as in-service inspection and test conditions. Qualification is not intended to confirm adequacy of the equipment to function beyond its specified service conditions even though qualification margins should ensure additional capability.

QR-3000 REFERENCES

The references listed below have provided guidance on concepts, principles, practices, criteria, and parameters in the preparation of this Standard.

ANS 51.1-1988, Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants

ANS 52.1-1988, Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants

Publisher: American Nuclear Society, 555 North Kensington Avenue, La Grange Park, IL 60526

ASME NQA-1 and NQA-2 (1989), Quality Assurance Program Requirements for Nuclear Facilities

Publisher: The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900

IEEE Std 323-1983 (Reaffirmed), Qualifying Class 1E Equipment for Nuclear Power Generating Stations

IEEE Std 334-1974 (Reaffirmed), Standard for Type Test of Continuous Duty Class 1E Motors for Nuclear Power Generating Stations

IEEE Std 344-1987, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

IEEE Std 627-1980 (Reaffirmed), Standard for Qualification of Safety Systems Equipment Used in Nuclear Power Generating Stations