

ASME QME-1–2017
(Revision of ASME QME-1–2012)

Qualification of Active Mechanical Equipment Used in Nuclear Facilities

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

This is a preview. [Click here to purchase the full publication.](#)

ASME QME-1–2017
(Revision of ASME QME-1–2012)

Qualification of Active Mechanical Equipment Used in Nuclear Facilities

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

This is a preview. [Click here to purchase the full publication.](#)

Date of Issuance: August 23, 2017

The next edition of this Standard is scheduled for publication in 2022.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Periodically certain actions of the ASME QME Committee may be published as Cases. Cases and interpretations are published on the ASME Web site under the Committee Pages at <http://cstools.asme.org/> as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Committee Pages can be found at <http://cstools.asme.org/>. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

ASME is the registered trademark of The American Society of Mechanical Engineers.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not “approve,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

Copyright © 2017 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.

This is a preview. [Click here to purchase the full publication.](#)

CONTENTS

Foreword	vi
Committee Roster	viii
Organization of QME-1	ix
Summary of Changes	xi
Section QR General Requirements	1
QR-1000 Scope	1
QR-2000 Purpose	1
QR-3000 References	1
QR-4000 Definitions	1
QR-5000 Qualification Principles	3
QR-6000 Qualification Specification	4
QR-7000 Qualification Program	4
QR-8000 Documentation and Certification Requirements	6
Mandatory Appendix to Section QR	
QR-I Qualifications and Duties of Registered Professional Engineers for Certification Activities	8
QR-I-1000 Scope	8
Nonmandatory Appendices to Section QR	
QR-A Seismic Qualification of Active Mechanical Equipment	10
QR-A-1000 Scope	10
QR-A-2000 Purpose	10
QR-A-3000 References	10
QR-A-4000 Definitions	10
QR-A-5000 Earthquake Environment and Equipment Response	12
QR-A-6000 Seismic Qualification Requirements	14
QR-A-7000 Qualification Methods	18
QR-A-8000 Documentation	25
Appendix QR-A Tables	
QR-A-6210-1 Damping Values: Percent of Critical Damping	15
QR-A-7422-1 Reduction Factors	23
QR-B Guide for Qualification of Nonmetallic Parts	27
QR-B-1000 Scope	27
QR-B-2000 Purpose	27
QR-B-3000 References	27
QR-B-4000 Definitions	27
QR-B-5000 Requirements	27
QR-B-6000 Methods of Qualification	29
QR-B-7000 Documentation	32
QR-C Sample Registered Professional Engineer Certification Statements	33
Appendix QR-C Forms	
QR-C-1 Sample Qualification Specification (QP, QV) Certification Statement	34
QR-C-2 Sample Qualification Specification (QDR) Certification Statement	34
QR-C-3 Sample Qualification Report (QP, QV) Certification Statement	35
QR-C-4 Sample Qualification Report (QDR) Certification Statement	35
QR-C-5 Sample Application Report (QP, QV) Certification Statement	36
QR-C-6 Sample Application Report (QDR) Certification Statement	36

Section QDR	Qualification of Dynamic Restraints	37
QDR-1000	Scope	37
QDR-2000	Purpose	37
QDR-3000	Definitions	37
QDR-4000	Qualification Principles and Philosophy	38
QDR-5000	Qualification Specification	40
QDR-6000	Qualification Program	41
QDR-7000	Documentation Requirements	46
Mandatory Appendix to Section QDR		
QDR-I	Qualification Specification for Dynamic Restraints	48
QDR-I-1000	Scope	48
QDR-I-2000	Purpose	48
QDR-I-3000	References	48
QDR-I-4000	Definitions	48
QDR-I-5000	Qualification Specification Contents	48
QDR-I-6000	Filing Requirements	50
Nonmandatory Appendices to Section QDR		
QDR-A	Restraint Similarity	51
QDR-A-1000	Scope	51
QDR-A-2000	Examples of Design Similarity	51
QDR-B	Typical Values of Restraint Functional Parameters	52
QDR-B-1000	Scope	52
QDR-B-2000	Functional Parameters	52
QDR-B-3000	Aging and Service Condition Simulation Qualification Program	53
Section QP	Qualification of Active Pump Assemblies	54
QP-1000	Scope	54
QP-2000	Purpose	54
QP-3000	References	54
QP-4000	Definitions	54
QP-5000	Qualification Principles and Philosophy	55
QP-6000	Qualification Specification	55
QP-7000	Qualification Program	56
QP-8000	Documentation	60
Mandatory Appendix to Section QP		
QP-I	Qualification Specification for Active Pump Assemblies	62
QP-I-1000	Scope	62
QP-I-2000	Purpose	62
QP-I-3000	References	62
QP-I-4000	Definitions	62
QP-I-5000	Qualification Specification Contents	62
Nonmandatory Appendices to Section QP		
QP-D	Pump Similarity Checklist	70
QP-D-1000	Scope	70
QP-D-2000	Pump Design	70
QP-D-3000	Process Design	70
QP-E	Guidelines for Shaft-Seal System Material and Design Consideration	71
QP-E-1000	Scope	71
QP-E-2000	Purpose	71
QP-E-3000	Definition	71
QP-E-4000	Material Considerations	71
QP-E-5000	Design Considerations	71

Appendix QP-E Tables		
QP-E-4200-1	Shaft-Seal System Specification	72
QP-E-5300-1	Limits for Unbalanced Seals	73
Section QV	Qualification Requirements for Active Valve Assemblies for Nuclear Facilities	74
QV-1000	Scope	74
QV-2000	Purpose	74
QV-3000	References	74
QV-4000	Definitions	74
QV-5000	Qualification Principles and Philosophy	75
QV-6000	Qualification Specification	75
QV-7000	Qualification Program	75
QV-8000	Documentation Requirements	87
Section QV Table		
QV-7300-1	Valve Assembly Qualification Requirement Matrix	77
Mandatory Appendix to Section QV		
QV-I	Qualification Specification for Active Valves	89
QV-I-1000	Scope	89
QV-I-2000	Purpose	89
QV-I-3000	References	89
QV-I-4000	Definitions	89
QV-I-5000	Qualification Specification Contents	89
QV-I-6000	Actuator Requirements	90
QV-I-7000	Self-Operated Check Valve Characteristics	90
QV-I-8000	Pressure Relief Valve Characteristics	91
QV-I-9000	Special Material Requirements	91
QV-I-10000	Installation Requirements	91
QV-I-11000	Maintenance Requirements	91
QV-I-12000	Qualification Requirements	91
QV-I-13000	Inservice Testing	91
QV-I-14000	Filing Requirements	91
Nonmandatory Appendix to Section QV		
QV-B	Static Side Load Testing for Power-Actuated and Relief Valve Assemblies	92
QV-B-1000	Scope	92
QV-B-2000	Purpose	92
QV-B-3000	Definitions	92
QV-B-4000	General Requirements	92
QV-B-5000	Test Method	93
QV-B-6000	Evaluation of Results	94
QV-B-7000	Extrapolation of Results for Power-Operated Valves	95
Section QVG	Guide to Section QV: Determination of Valve Assembly Performance Characteristics	96
QVG-1000	Scope	96
QVG-2000	Introduction	96
QVG-3000	References	96
QVG-4000	Definitions	97
QVG-5000	Valve Assembly Performance Characteristic Requirements	97
QVG-6000	General Considerations	97
QVG-7000	Power-Actuated Valve Assembly Considerations	100
QVG-8000	Valve Considerations	101

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 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 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 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.

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 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 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.

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 Facilities, The American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

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.)

STANDARDS COMMITTEE OFFICERS

M. A. Pressburger, *Chair*
T. M. Adams, *Vice Chair*
L. Powers, *Secretary*
K. Verderber, *Secretary*

STANDARDS COMMITTEE PERSONNEL

T. M. Adams , S&A, a Jensen Hughes Co.	M. A. Pressburger , Sargent & Lundy, LLC
R. W. Barnes , Anric Enterprises, Inc.	S. A. Norman , <i>Alternate</i> , Sargent & Lundy, LLC
K. G. DeWall , Idaho State University	T. P. Ruggiero , Consultant
R. E. Fandetti , Consultant	M. S. Shutt , Duke Energy Corp.
J. R. Holstrom , Val-Matic Valve & Manufacturing Corp.	H. R. Sonderegger , Fluoroseal Valves USA
I. T. Kisisel , Sargent & Lundy, LLC	D. C. Stanze , Consultant
H. S. Koski, Jr. , Altran Solutions	K. Verderber , The American Society of Mechanical Engineers
K. A. Manoly , U.S. Nuclear Regulatory Commission	R. D. Yeardley , Consultant
L. Powers , The American Society of Mechanical Engineers	N. Paterson , <i>Contributing Member</i> , Rolls-Royce

SUBCOMMITTEE ON QUALIFICATION OF VALVE ASSEMBLIES

S. M. Jones , <i>Chair</i> , Fisher Controls	W. K. Roit , General Electric
H. R. Beck , AREVA	T. P. Ruggiero , Consultant
D. P. Crane , Westinghouse Electric Co.	T. G. Scarbrough , U.S. Nuclear Regulatory Commission
K. G. DeWall , Idaho State University	H. R. Sonderegger , Fluoroseal Valves USA
R. J. Gradle , Flowserve	D. C. Stanze , Consultant
J. R. Holstrom , Val-Matic Valve & Manufacturing Corp.	P. W. Turrentine , National Technical Systems — Huntsville Operations Nuclear Engineering and Test Services
A. M. Kouvolo , Consultant	R. D. Yeardley , Consultant
J. P. Lambin , Crane Nuclear	

SUBCOMMITTEE ON QUALIFICATION OF ACTIVE DYNAMIC RESTRAINTS

M. A. Pressburger , <i>Chair</i> , Sargent & Lundy, LLC	S. A. Norman , Sargent & Lundy, LLC
O. Cable , <i>Secretary</i> , Basic-PSA, Inc.	M. Palmer , Anvil EPS
D. C. Boes , Consultant	L. A. Phares , National Technical Systems — Huntsville Operations Nuclear Engineering and Test Services
W. G. Chatterton , Indiana Michigan Power Co. — Nuclear	R. L. Portmann, Jr. , Duke Energy Corp.
R. E. Fandetti , Consultant	V. H. Salcedo , Gerb Vibration Control Systems, Inc.
D. V. Hoang , U.S. Nuclear Regulatory Commission	D. K. Shetler , Bechtel
H. S. Koski, Jr. , Altran Solutions	M. S. Shutt , Duke Energy Corp.
C. T. Lowe , South Carolina Gas & Electric	

SUBCOMMITTEE ON QUALIFICATION OF PUMP ASSEMBLIES

D. P. Crane , Westinghouse Electric Co.	A. M. Kouvolo , Consultant
------------------------------------------------	-----------------------------------

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 one or more letters that generally indicate the subject matter of the section. This Standard consists of four major sections as follows:

- (a) Section QR: General Requirements
- (b) Section QDR: Qualification of Dynamic Restraints
- (c) Section QP: Qualification of Active Pump Assemblies
- (d) Section QV: Qualification Requirements for Active Valve Assemblies for Nuclear Facilities

2 SECTIONS

Sections are divided into articles, subarticles, subsubarticles, 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 in units of 1,000, such as QR-1000, QP-2000, or QV-6000. Whenever possible, articles dealing with the same topic 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 to allow gaps in the numbering.

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 or QR-8320.

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) or 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) or QV-8321.1(b). When further subdivisions of minor subparagraphs are necessary, subsubsubparagraphs are designated by adding Arabic numbers in parentheses to the subparagraph designation, such as QR-8321.1(a)(1) or 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 (ASME BPVC) 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 BPVC, Section 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 BPVC, Section III, Subsection NF, subpara. 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 the year of publication suggest that the latest version of the reference was used 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 Section QV only will be described in Article QP-3000 or Article QV-3000, as applicable.

(c) *References to Appendices.* Two types of appendix are included in this Standard, designated Mandatory and Nonmandatory. Both types of appendix are designated by the prefix Q. This is followed by letter(s), which are the same 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 uniquely identified by a roman numeral, e.g., Mandatory Appendix QR-I and its specific title. Nonmandatory appendices provide information or guidance; such references are designated by a capital letter, e.g., Nonmandatory Appendix QR-A, and its specific title.