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AMERICAN NATIONAL STANDARD

Functional Qualification Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants

ANSI B16.41 - 1983

PUBLISHED BY

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FOREWORD

(This Foreword is not a part of American National Standard, Functional Qualifications Requirements for Power Operated Active Valve Assemblies for Nuclear Power Plants, ANSI B16.41.)

This Standard is one of a series of power plant equipment standards provided to assure that equipment will function as specified. The Standard was developed under sponsorship of the American Society of Mechanical Engineers (ASME). Its development was initiated by the American National Standards Committee N45 on Reactor Plants and Their Maintenance. In October, 1972, the N45 Committee established a task force to prepare a series of standards to assure that valves would function as specified. In 1974, the task force was reassigned to American National Standards Committee B16 and designated Subcommittee H.

Power operated active valve assemblies are required to perform their functions under specified operating conditions. It is the purpose of the series of standards on active valves to provide requirements for:

(1) the preparation of Functional Specifications;

(2) the qualification of the design of valves, actuators, and the combination thereof (valve assemblies) by test and analysis for the intended service; and

(3) production testing of valve assemblies manufactured for specific applications.

The purpose of the foregoing is to provide assurance that the valve assemblies in service will function as required under all specified operating conditions. Only those conditions considered to uniquely affect the operability of valve-actuator combination (as opposed to either the valve or actuator alone) are developed within ANSI B16.41. Integrity of the pressure retaining boundary of the valve, covered by codes developed by the ASME Boiler and Pressure Vessel Committee, is excluded from the scope of this Standard.

The first standard to be issued in the series is ANSI N278.1-1975, which covers the preparation of Functional Specifications.

This Standard provides a method for qualification of power operated active valve assemblies that will provide an acceptable level of assurance of functional operability. This qualification is based on tests demonstrating the ability of the valve assembly to perform its function under extreme adverse conditions of pressure, mechanical loading, flow dynamics, temperature, and vibration. The testing involves imposition of certain of these conditions in combination, and others individually, all exceeding maximum levels expected in service. It is recognized that in the extremity of certain adverse plant events involving need for valve operation, loading combinations not specifically tested in this qualification may be imposed on valves. The adverse effects of such combinations have been considered by the Committee, and it has been concluded that this qualification will provide a high degree of assurance of functional operability for all such combinations.

It is recognized that in testing a complete series of valves of a given type, for example NPS 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 32, and 36 valves, all Class 600 gate valves, much of the test time, work, and expense will be unproductive, in that no useful information will be produced by the later tests. If the various sizes are uniformly designed and proportioned, it will be expected that all valves will perform uniformly in the tests. Conversely, if on the test of the first valve a specific design weakness is discovered, similar weakness will be found in all the other valve sizes.

It has been proposed that in such case, if for example, an 8 in. valve and 18 in. valve were tested successfully, it should be possible to infer from such results that all the other valves, none being less than half or more than double the size of a valve that *was* actually tested, should be qualified as to acceptable design, provided such untested designs can be shown to be, in fact, geometrically similar to the test-qualified sizes.

Such generic qualification is considered to be potentially acceptable, subject to due consideration of the degrees of variation from exact geometric similarity of two valves of different size, and the possibility of scale

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factors, such as changing relativity between surface roughness vs. length dimensions, having some unanticipated adverse effect on functional performance. In the absence of clear, demonstrable practical limits on extrapolation of functional design qualification, the Committee has made it obligatory for a determination to be made by the plant owner or his designee (ultimately by the licensing agency) that design qualification "by proxy" will be acceptable in each individual case, as a condition for the use of the candidate qualification method.

In this Standard, provision has been made for such qualification, with the expectation that generic qualification *will be* a practical way to maximize the cost-effectiveness of the design qualification process. References in this Standard to "Parent" and "Candidate" valve assemblies are addressing this undertaking. The Term "Parent" is intended to be understood in the family sense, that is, as the elder in a family of generic offspring having strong resemblance to the parent.

The "Candidate" is the nominee for family membership until it is shown that the rules of Annex J are satisfied *and* the Candidate is accepted as Qualified by the owner or his designee.

In recognition of this external control on the candidate qualification process, Annex J is identified as supplementary information which is not an integral part of this Standard. It should *not* be inferred that the Guidance provided in Annex J is optional in the candidate qualification process, but rather that the candidate qualification process is nonmandatory and subject to specific acceptance in each individual case by the owner or his designee.

Annexes A through H and K are integral parts of the body of the proposed Standard which, for reasons of convenience, are placed after the main text. Annex J provides supplementary information that is not an integral part of the Standard.

Approval for the 1983 revision to this Standard was granted by ANSI on January 6, 1983.

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FUNCTIONAL QUALIFICATION REQUIREMENTS FOR POWER OPERATED ACTIVE VALVE ASSEMBLIES FOR NUCLEAR POWER PLANTS

1 SCOPE

1.1 This Standard establishes the requirements for functional qualification of power operated active valve assemblies for nuclear power plants. It is not intended that this Standard be applied to power operated relief valves and self-operated valves such as check and pressure relief valves. It is the responsibility of the plant owner or his designee to identify those active valves which require qualification under this Standard and to identify the functional qualification requirements, as associated with Annexes A through H, which shall be met.

1.2 Functional qualification of a parent valve assembly consists of testing as specified herein to demonstrate that a valve assembly can perform its required function under test conditions. Annex J is a guide to provide functional qualification of a candidate valve assembly by analyses that demonstrate design similarity to a parent valve assembly. Any use of Annex J for qualification of a candidate valve for a specific application in a nuclear power plant shall be the responsibility of the plant owner or his designee.

1.3 Qualification testing, inspecting, and reporting as specified herein shall be performed in accordance with the applicable requirements of ANSI/ASME NQA-1 or its equivalent.

1.4 A Functional Qualification Report(s) is required to document compliance with this Standard. An Application Report(s) is required to document qualification of a valve assembly for a specific nuclear plant application.

2 REFERENCES

The standards or codes referenced in this Standard are listed in Annex K. The text of this Standard indicates whether use of a referenced standard or code is mandatory or reference is for information only.

3 DEFINITIONS

The following definitions are provided to assure a uniform understanding of selected terms as they are used in this Standard.

aging—the cumulative effect of operating cycles and environmental and system conditions imposed on the valve assembly

application report—documentation for a specific application showing that the required pressure ratings, qualification loading levels, and operating condition capabilities are equaled or exceeded by the corresponding pressure ratings, qualification loadings, and operating condition capabilities shown in the Functional Qualification Report(s)

cold working pressure—the valve pressure rating at 100°F (38°C)

design life—the time or operating cycles (or both) for which satisfactory performance is required

Functional Qualification Report—documentation of tests or analyses (or both) performed in accordance with this Standard

maximum motive power—the electrical, fluid, or mechanical power provided when voltage or actuator pressure is at the highest value for which the valve assembly is to be qualified

minimum motive power—the electrical, fluid, or mechanical power provided when voltage or actuator

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