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AMERICAN NATIONAL STANDARD

REACTOR PLANTS AND THEIR MAINTENANCE

Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard

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THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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FOREWORD

(This foreword is not part of American National Standard Self-operated and Power-operated Safety-Related Valves Functional Specification Standard)

This standard is one of a series of power plant equipment standards provided to assure that safety-related equipment will function as specified. The standard was developed under sponsorhip of the American Society of Mechanical Engineers (ASME) as an effort by the American National Standards Committee N45 on Reactor Plants and Their Maintenance. This committee has been chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components specifically for this purpose.

In October of 1972, the N45 Committee of ANSI established a task force to prepare a series of standards to assure that safety-related valves would function as specified. This standard provides for the specification of the required functional characteristics of these valves. Utilization of this standard will provide assurance that the functional requirements of valves are fully described so that valves can be designed to provide safe, reliable operation for all foreseeable conditions including preoperational tests and extreme limits of plant design conditions.

Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to the secretary, American National Standards Committee N45, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, New York 10017.

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TABLE OF CONTENTS

SECTION		PAGE
1.	SCOPE	1
2.	DESIGN SPECIFICATION RELATIONSHIP	1
3.	FUNCTIONAL SPECIFICATION	1
	3.1 Valve Application Characteristics	1
	3.2 Structural Requirements	1
	3.3 Operational Requirements	2
	3.4 Seat Leakage Limits	2
	3.5 Pressure Relief Valve Characteristics	2
	3.6 Special Material Requirements	3
	3.7 Installation Requirements	3
	3.8 Maintenance Requirements	3

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AMERICAN NATIONAL STANDARD

FUNCTIONAL SPECIFICATION STANDARD

1 SCOPE

This standard establishes requirements for functional specification for safety-related self-operated and power-operated valves for applications in a nuclear power plant.

2 DESIGN SPECIFICATION RELATIONSHIP

This standard provides detailed definition of functional requirements that supplements piping and valve codes and standards applicable to valves in safety-related piping systems whose safety-related function is to open, close, or regulate fluid flow. The requirements of this standard may be provided as part of the Valve Design Specification or as a separate document. Compliance with the requirements of this standard is intended to assure that the operating conditions and safety-related functions of the valve have been adequately defined, permitting valve and actuator manufacturers to identify designs of products and materials to be used in the manufacture of those products that will be adequate for the service.

3 FUNCTIONAL SPECIFICATION

It is the responsibility of the Owner who intends a valve to be in compliance with this standard to provide or cause to be provided a Functional Specification which identifies the safety-related function of the valve and provides for the delineation of the following.

a. Structural Requirements, see Section 3.2
b. Operational Requirements, see Section 3.3
c. Seat Leakage Limits, see Section 3.4
d. Pressure Relief Valve Characteristics, see Section 3.5
e. Special Material Requirements, see Section 3.6
f. Installation Requirements, see Section 3.7
g. Maintenance Requirements, see Section 3.8

3.1 Valve Application Characteristics

The application characteristics of each valve shall be identified by listing whichever of the following descriptive terms are appropriate.

a. Power-operated
b. Self-operated
c. Pressure relief
d. Frequent use
e. Infrequent use
f. Low leakage
g. Nominal leakage
h. Normally open
i. Normally closed

3.1.1 *Frequent use* is defined as requiring functional operation, including exercising and testing, in excess of 500 times over the life of the valve.

3.1.2 *Low leakage* is defined as valves in which the Manufacturer's main seat leakage acceptance test limit is 2 cubic centimeters of water per hour per inch of diameter of nominal valve size.

3.1.3 *Nominal leakage* is defined as valves in which the Manufacturer's main seat leakage acceptance test limit is 10 cubic centimeters of water per hour per inch of diameter of nominal valve size.

3.1.4 The leakage definitions described above are not applicable to those flow-control valves which are not intended to also serve as isolation or stop valves.

3.2 Structural Requirements

The following information shall be specified.

a. The design pressure and temperature.
b. The normal operating pressure and temperature.
c. The flow capacity at a stated pressure differential.
d. Time-temperature data for significant thermal transients, with number of cycles (see ASME Boiler and Pressure Vessel Code, Section III NB 3500).
e. The seismic acceleration and dynamic loadings that the valve assembly shall be capable of withstanding without loss of functional capability.
f. Loadings from structural supports and restraints acting directly on valve, if any.
g. Fundamental frequency of valve assembly.

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3.3 Operational Requirements

Anticipated modes of valve operating including safety-related function (i.e., open, close, remain as-is, etc.) shall be specified. The operating conditions, power versus operation condition, and environmental conditions shall be identified.

3.3.1 Operating Conditions. The number of operational cycles, differential pressure (amount and direction), system fluid, flow (quantity and direction), imposed loads, temperature, and pressure condition for each of the following operational categories shall be specified.

a. Installation Testing
b. System Hydrostatic Testing
c. Preoperational Testing
d. Start-up Testing
e. Normal and Abnormal Plant Operation, including postulated accident conditions
f. In-service Testing and Exercising

Other operational conditions such as likelihood of bonnet pressurization caused by volumetric expansion of contained fluid, dry operation, etc., shall be identified. For check valves, flow rates shall be stated for all operating conditions with maximum total time at each condition.

3.3.2 Power Versus Operation Conditions. The power supply conditions shall be specified as follows:

a. Normal voltage and frequency or normal actuator fluid pressure under normal operating conditions.
b. High voltage limit and frequency or maximum actuator fluid pressure under most severe function requirement.
c. Low voltage limit and frequency or minimum actuator fluid pressure under most severe function requirement.
d. Acceptable operating time requirement and tolerance for operating times in each case of a, b, and c.
e. Motor duty requirements.

3.3.2.1 Electrical Power for Valve Actuators and Control Elements. Electrical power available shall be identified as AC (frequency, single phase and/or three phase) and/or DC and high and low voltage limits.

3.3.2.2 Hydraulic and Pneumatic Power for Valve Actuators and Signal Elements. The following listed characteristics of the actuator fluid, availability, and valve response shall be identified.

a. Type fluid, brand name if applicable.
b. Fluid pressure and temperature range.
c. Limitation of flow rate.
d. Type and degree of filtration, including micron size, particulates, dewpoint, etc., as applicable.
e. Actuator signal; type and range of signal (electric, pneumatic, etc.) and required valve response with increasing and decreasing signal.

3.3.3 Environmental Conditions. The environmental conditions which are postulated to exist at a time safety-related function is required shall be identified and specified.

The need of valve, actuator and actuator accessories to survive normal and abnormal environmental conditions, with or without maintenance shall be stated. The following factors are considered relevant.

a. The atmosphere including chemistry, pressure, temperature, humidity and radioactivity in which the valves will be installed and must operate under normal conditions.
b. The atmosphere including chemistry, pressure, temperature, humidity and radioactivity in which the valves must operate under abnormal (including accident) conditions. The duration of these conditions shall be specified.

3.4 Seat Leakage Limits

Seat leakage limits for valves shall be identified as follows.

a. Acceptance leakage limits for safety relief valves shall be specified as to limits at percentage of set point.
b. Acceptance leakage limits for main closure element for valves identified as "low leakage" and "nominal leakage" shall be as defined in subparagraphs 3.1.2 and 3.1.3.
c. As applicable, the direction of leakage and pressure differential shall be identified.

3.5 Pressure Relief Valve Characteristics

For pressure relief valves the following, as applicable, shall be specified.

a. Fluid
b. Set pressure
c. Set pressure range
d. Set pressure tolerance
e. Discharge capacity with due allowance for the effect of the back pressure on the capacity
f. Overpressure (pressure increase over the set pressure)
g. Blowdown (difference between actual popping pressure and actual reseating pressure)

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h. Static and dynamic back pressure, minimum and maximum
i. Response time (maximum time delay between attainment of set pressure or reception of the energizing signal by the solenoid and valve lift)

3.6 Special Material Requirements

Unique material requirements of the valve, actuator and actuator controls shall be specified. Items to be considered shall include, but not be limited to the following.

a. Unacceptable part or trim materials
b. Halogen limits for gaskets and packing
c. Limitations on nonferrous materials, internal (wetted) or external
d. Special surface preparations or coatings required
e. Unusual process fluid chemistry

3.7 Installation Requirements

The valve orientation shall be specified if unusual. Pressure relief valve piping arrangements and, where used, details of water seal arrangements shall be described.

3.8 Maintenance Requirements

Special provision for valve maintenance shall be specified.

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