



Standard Specification for Special Requirements for Valves Used in Gaseous Oxygen Service¹

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1. Scope

1.1 This specification covers the special requirements for valves used in gaseous oxygen service. It is intended that this specification be invoked as an additional requirement in conjunction with primary valve specifications.

1.2 The values stated in this specification in inch-pound units are to be regarded as the standard. The SI equivalent shown in parenthesis are provided for information only.

2. Referenced Documents

2.1 ASTM Standards:

G 63 Guide for Evaluating Nonmetallic Materials for Oxygen Service²

G 88 Guide for Designing Systems for Oxygen Service²

G 93 Practice for Cleaning Methods for Materials and Equipment Used in Oxygen-Enriched Environments²

G 94 Guide for Evaluating Metals for Oxygen Service²

2.2 American National Standards Institute (ANSI):

B1.1 Unified Screw Threads³

2.3 American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code⁴

2.4 Military Standards and Specifications:

MIL-STD-1330 Standard Practice for Precision Cleaning and Testing of Shipboard Oxygen, Helium, Helium-Oxygen, Nitrogen, and Hydrogen Systems⁵

MIL-V-5027 Valves, Check, Oxygen, High Pressure⁵

MIL-STD-278 Fabrication, Welding and Inspection; Casting Inspection and Repair for Machinery, Piping and Process Vessels in Ships of the United States Navy⁵

MIL-STD-271 Non-destructive Testing Requirements for Metals⁵

MIL-P-46122 Plastic Molding and Extrusion Material, Polyvinylidene Fluoride Polymer and Copolymer⁵

3. Ordering Information

3.1 Ordering documentation for valves under this specification shall include the following information, as required, to describe the equipment adequately.

3.1.1 ASTM Designation and Year of Issue.

3.1.2 Primary Valve specification (see 1.1).

3.1.3 End Preparations, if different than specified in 4.4.

3.1.4 Supplementary requirements, if any (see S1 through S4).

4. Valve Design and Construction

4.1 Valves shall incorporate the features specified in 4.2-4.6.

4.2 *Materials of Construction*—Material requirements shall be as follows:

4.2.1 The pressure containing/retaining envelope (including any bolting, union nuts, or other fastening devices establishing the integrity of the pressure containing/retaining envelope), bellows (where applicable), and end nipples, shall be Nickel-Copper (70-30). Internal trim which is in contact with the line media shall be Nickel-Copper (70-30), Bronze, Nickel-Aluminum-Bronze, Inconel Alloy 600, Brass, or other materials which are compatible with oxygen service.

4.2.2 Non-metallic Seat, Seat Insert, or seals. These materials shall be selected from TFE, Reinforced TFE, CTFE, plastic in accordance with MIL-P-46122, Polyamide (Vespel), or PEEK. The materials for O-rings and gaskets shall be compatible for Oxygen service.

4.2.3 *Lubricants*—Materials for lubricants shall be Halocarbon (25-5S), Dupont (Krytox 240 AC, 240 AZ), Braycote 601 or other lubricants compatible with oxygen service.

4.2.4 Guidance on the selection of materials for Oxygen service can be found in ASTM G 63, and G 94. Guidance on designing Systems for Oxygen service can be found in ASTM G 88.

4.3 General Requirements:

¹ This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁴ Available from American Society of Mechanical Engineers ASME International Headquarters, Three Park Ave., New York, NY 10016-5990.

⁵ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

4.3.1 *Fire Prevention*—Valves shall be constructed to minimize the possibility of initiating ignition in gaseous oxygen service. This shall be accomplished by the following:

4.3.1.1 Materials for parts in contact with oxygen shall have the highest spontaneous ignition temperatures and the lowest impact sensitivities compatible with construction and performance limitations.

4.3.1.2 Surfaces in contact with oxygen shall be smooth with well rounded edges and without sharp or thin sectioned protrusions (that is, all parts shall have a high ratio of volume to surface area). Sharp exterior corners are prohibited, and interior corners shall have fillets to prevent the retention or entrapment of machining chips, burrs, or foreign material.

4.3.1.3 Nonmetallic materials (O-rings, gaskets, etc.) other than the seating insert, if applicable, shall be well removed from the main flow path.

4.3.2 *Fire Containment*—Valves shall be constructed to minimize oxygen escape in the event of an internal or external fire. This shall be accomplished by the following:

4.3.2.1 *Pressure-Boundary Sealing*—Joints for the pressure-boundary seals shall provide an effective barrier to leakage in the event of damage or consumption of the non-metallic sealing elements by providing long, close fitting metal-to-metal leakage or flame paths.

4.3.2.2 *Internal Seating*—The seat design shall be such that in the event that the non-metallic seat is damaged, destroyed or carried away, there will be a secondary metal-to-metal seat to minimize through seat leakage. The construction and location of the nonmetallic seals and seating inserts shall minimize the possibility of ignition under a pressure surge.

4.3.2.3 *Pressure Surge*—Valves shall be designed to prevent pressure surge which could cause auto-ignition.

4.4 *Design Features:*

4.4.1 Manual valves shall be of the packless design, with the stem sealed by a bellows.

4.4.2 *Threads*—Threads shall conform to ANSI B1.1. Use of threads in contact with oxygen shall be minimized. Any threads wetted by oxygen shall be of rolled construction or shall be completely chamfered and deburred to prevent the possibility of sharp edges or machining burrs in contact with oxygen.

4.4.3 *Cleaning*—Prior to assembly and testing, valves shall be degreased and cleaned in accordance with Practice G 93, and thereafter maintained clean for oxygen service.

4.5 *End Preparation*—Unless otherwise specified (see Section 3), end preparation for the valves shall be as follows:

4.5.1 Valves shall be supplied with inline extension nipples welded directly to the valve body or fabricated as an integral part of the valve body. Nipples shall be of the same basic material as the body. The length and schedule of these nipples shall be as specified in Table 1.

4.6 *Welding and Nondestructive Testing*—Welding and Nondestructive testing shall be in accordance with ASME Boiler and Pressure Vessel Code, Sections VIII and IX.

5. Marking

5.1 *Identification Plates*—A metallic corrosion-resisting identification plate shall be securely attached to the valve and shall indicate “Valve specially made for Oxygen Service”.

5.2 In addition, each valve shall be marked in accordance with their applicable primary valve specification requirements.

6. Quality Assurance System

6.1 The manufacturer shall establish and maintain a quality assurance system that will ensure all the requirements of this specification are satisfied.

6.2 A written description of the quality assurance system the manufacturer will use shall be available for review and acceptance by the inspection authority.

6.3 The purchaser reserves the right to witness any tests and inspect the valves in the manufacture’s plant to the extent specified on the purchase order.

TABLE 1 Length and Schedule of Extension Nipples

| Size of Valve | Pipe Schedule | Minimum Length of Extension, inches (Valve Center to End) |
|---|---------------|---|
| ¼ NPS to 1 NPS (13.5 mm to 33.7 mm) | 80 | 7.00 (178 mm) |
| 1-½ NPS to 2-½ NPS (48.3 mm to 73.0 mm) | 160 | 12.0 (305 mm) |

SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements S1, S2, S3, or S4 shall be applied only when specified by the purchaser in the inquiry, contract, or order. Details of those supplementary requirements shall be agreed upon in writing by the manufacturer and purchaser. Supplementary requirements shall in no way negate any requirement of the specification itself.

S1. Supplemental Tests

S1.1 Supplemental tests shall be conducted at a laboratory satisfactory to the customer and shall consist of the examinations and tests selected from those specified in S1.2 through S1.4.

S1.2 *Examination Prior to Testing*—The valve(s) shall be examined visually to determine conformance with the ordering data, dimensions, and workmanship without disassembly.

S1.3 *Nonmetallic Materials Compatibility Test*—Materials shall be subjected to the ozone-resistance and oxygen-bomb tests as specified in MIL-V-5027, with test pressure applicable to the valve under test. No charring or deterioration is allowed.

S1.4 *Nondestructive Testing*—Nondestructive testing shall be in accordance with MIL-STD-271.

S2. Cleaning, Drying, Packaging and Marking Requirements

S2.1 Valves shall be cleaned, dried, packaged, and marked in accordance with MIL-STD-1330. Packaging operations shall be accomplished in an area that will prevent valve contamination by hydrocarbons.

S3. Quality Assurance

S3.1 *Scope of Work*—The written description of the quality assurance system shall include the scope and locations of the work to which the system is applicable.

S3.2 *Authority and Responsibility*—The authority and responsibility of those in charge of the quality assurance system shall be clearly established.

S3.3 *Organization*—An organizational chart showing the relationship between management and the engineering, purchasing, manufacturing, construction, inspection and quality control groups is required. The purpose of this chart is to identify and associate the various organizational groups with the particular functions for which they are responsible. These requirements are not intended to encroach on the manufacturer's right to establish, and from time to time to alter, whatever form of organization the manufacturer considers appropriate for its work. Persons performing quality control functions shall have a sufficiently well-defined responsibility and the authority and the organizational freedom to identify quality control problems and to initiate, recommend and provide solutions.

S3.4 *Review of Quality Assurance System*—The manufacturer shall ensure and demonstrate the continuous effectiveness of the quality assurance system.

S3.5 *Drawings, Design Calculations and Specification Control*—The manufacturer's quality assurance system shall include provisions to ensure that the latest applicable drawings, design calculations, specifications and instructions, including all authorized changes, are used for manufacture, examination, inspection and testing.

S3.6 *Purchase Control*—The manufacturer shall ensure that all purchased material and services conform to specified requirements and that all purchase orders give full details of the material and services ordered.

S3.7 *Material Control*—The manufacturer shall include a system for material control that ensures the material received is properly identified and that any required documentation is present, identified to the material, and verifies compliance to the specified requirements. The material control system shall ensure that only the intended material is used in manufacture. The manufacturer shall maintain control of material during the manufacturing process by a system which identified inspection status of material throughout all stages of manufacture.

S3.8 *Manufacturing Control*—The manufacturer shall ensure that manufacturing operations are carried out under controlled conditions utilizing documented work instructions. The manufacturer shall provide for inspection, where appropriate, for each operation that affects quality or shall arrange an appropriate monitoring operation.

S3.9 *Quality Control Plan*—The manufacturer's quality control plan shall describe the fabrication operations, including examinations and inspections.

S3.10 *Welding*—The quality control system shall include provisions for ensuring that welding conforms to specified requirements. Welders shall be qualified to the appropriate standards and the qualification records shall be made available to the inspection authority if required.

S3.11 *Nondestructive Examination*—Provisions shall be made to utilize non-destructive examination, as necessary, to ensure that material and components comply with the specified requirements. Non-destructive examinations shall be authorized by their employer and/or qualified by a recognized national body, and their authorizations/qualification records shall be made available to the inspection authority if required.

S3.12 *Non-conforming Items*—The manufacturer shall establish procedures for controlling items not in conformance with the specified requirements.

S3.13 *Heat Treatment*—The manufacturer shall provide controls to ensure that all required heat treatments have been applied. Means should be provided by which heat treatment requirements can be verified.

S3.14 *Inspection Status*—The manufacturer shall maintain a system for identifying the inspection status of material during all stages of manufacture and shall be able to distinguish between inspected and non-inspected material.

S3.15 *Calibration of Measurement and Test Equipment*—The manufacturer shall provide, control, calibrate and maintain inspection, measuring and test equipment to be used in verifying conformance to the specified requirements. Such calibration shall be traceable to a national standard and calibration records shall be maintained.

S3.16 *Records Maintenance*—The manufacturer shall have a system for the maintenance of inspection records, radiographs and manufacturer's data reports that describe the achievement of the required quality and the effective operation of the quality system.

S3.17 *Sample Forms*—The forms used in the quality control system and any detailed procedures for their use shall be available for review. The written description of the quality assurance system shall make reference to these forms.

S3.18 *Inspection Authority*—The manufacturer shall make available to the inspection authority at the manufacturer's plant a current copy of the written description of the quality assurance system. The manufacturer's quality assurance system shall provide for the inspection authority at the manufacturer's plant to have access to all drawings, calculations, specifications, procedures, process sheets, repair procedures, records, test results, and any other documents as necessary for the inspection authority to perform its duties in accordance with this supplementary requirement. The manufacturer may provide for such access by furnishing the inspection authority with originals or copies of such documents.

S4. Special Fabrication Requirements

S4.1 *Welding Requirements*—Welding shall be in accordance with MIL-STD-278.

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