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AEROSPACE STANDARD

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MINIMUM STANDARDS FOR VALVE, HIGH PRESSURE OXYGEN, CYLINDER SHUT OFF, MANUALLY OPERATED

1. SCOPE:

This standard covers all types of manually operated high pressure oxygen, cylinder shut off valves for use in commercial type aircraft. It is intended that the valve shall be attached to a pressure cylinder storing oxygen under pressure of 1800 to 2100 psig at 70 °F. Upon opening the valve, oxygen will be permitted to discharge from the storage cylinder to the valve outlet and thence to other components of the oxygen system. It shall also be possible to recharge the cylinder through the valve.

1.1 Purpose:

The purpose of this standard is to define general minimum standards for the design, fabrication, test and packaging of manually operated, high pressure breathing oxygen cylinder shut off valves. Applicable is AS861, MINIMUM GENERAL STANDARDS FOR OXYGEN SYSTEMS.

2. REFERENCES:

AS861, Minimum General Standards for Oxygen Systems
Federal Specification O-T-634
Federal Specification TT-C-595
ICC Regulations, Tariff 19, Section 73.302
MIL-O-27210, Type I
Specification BB-N-411
CGA Pamphlet S-1, Part I, Paragraph 5.3.3
CGA Standard No. 540

3. REQUIREMENTS:

3.1 General Requirements:

3.1.1 Construction:

1. Internal Seals - Valves designed to permit the replacement of internal seals without the need to remove the valve from the cylinder may be used provided the valve and body are integrated to allow proper cleaning of the valve and cylinder assembly before reassembly and recharging of the cylinder.

2. Wrench Flats - The valve body shall have adequate wrench flats and be sturdy enough to withstand removal from the cylinder.

3. Gage Guard - If an integral gage is used, an adequate gage guard shall be provided to prevent breakage at the gage mount. No guard is required for flush mounted gages. Gages shall be so designed and/or mounted that they cannot be used as a "carrying handle".

4. Handwheel Color - The handwheel shall be colored "oxygen green" comparable to color no. 14187 of Federal Specification TT-C-595.

5. Locking Device - All valve parts which if loosened or inadvertently removed would cause leakage or escape of oxygen shall be secured by a self locking device or shall be safety wired.

3.1.2 Materials and Workmanship: Applicable are the general requirements of paragraph 3.1 of AS861, MINIMUM GENERAL STANDARDS FOR OXYGEN SYSTEMS. Nonmetallic materials shall be compatible with high pressure oxygen.

3.1.3 Operating Temperatures: The valve shall be operable and permit the normal flow and shut off of oxygen while being subjected to ambient temperatures in the range of -40 °F and +160 °F.

3.1.4 Operating Medium: The operating medium shall be dry oxygen, aviators breathing, per Specification MIL-O-27210 Type I.

3.1.5 Degreasing: All internal parts shall be degreased by using a vapor phase degreaser in accordance with Federal Specification O-T-634. Ultrasonics may be used in conjunction with vapor phase degreasing for the cleaning of components. After completion of the cleaning and when assembled, General Electric Type H leak detector, or equivalent halide testing apparatus shall be used to determine the absence of cleaning compound.

3.1.6 Lubrication: The use of lubricants shall be minimized and then only approved lubricants shall be used. No lubrication shall be applied in any area which will be in direct contact with oxygen, either during charging or discharging operations.

3.1.7 Interchangeability: All parts having the same manufacturer’s designation and part number shall be directly and completely interchangeable with each other with respect to installation and performance.

3.2 Detail Requirements:

3.2.1 Safety Outlet: The safety outlet shall be of a replaceable frangible disc type in accordance with ICC Regulations, Tariff 19, Section 73.302. No fusible metal shall be incorporated in conjunction with the frangible disc. The design of the safety outlet shall facilitate the attachment of an overboard vent line. (NOTE: The purchaser must supply the proper information as to the type and pressure rating of the oxygen cylinder to be used in conjunction with the cylinder valve assembly.)

Force Equilibrium: The safety outlet required in the paragraph above shall be supplied with a cap for use when an overboard vent line is not used. It will be designed to provide force equilibrium while relieving. The oxygen shall discharge in at least two opposite directions in a manner that will not apply a torque to the cylinder due to an unbalanced force.

3.2.2 Opening Characteristics: The valve shall be of a slow opening type; i.e. Flow versus opening characteristics shall not exceed the limits shown in Figure 1 at any inlet pressure from 250 to 2100 psig. The design must be such that contamination of any type will not in any way eliminate the slow-fill feature.

Handwheel Size and Shape: Handwheels must be a minimum of 1.5 inches diameter and must be grooved, lobed, or otherwise shaped to provide a good gripping surface.

3.2.3 Operating Forces: The valve shall be designed to close completely with a torque of 15 in-lb. A maximum torque of 60 in-lb shall not result in damage to the valve mechanism. No calibrated slippage device (clutch, etc.) shall be used which may result in the valve remaining open when slip occurs.

3.2.4 Ports:

1. Inlet Port - The inlet port shall be specified by the purchaser depending on the cylinder to be used. Inlet ports generally shall be external NPT or ANPT.

2. Outlet Port - Unless otherwise specified the outlet port shall agree with the Compressed Gas Association (CGA) Standard No. 540. If the design is such that a cylinder pressure gage is to be part of the valve assembly, a high pressure port with either NPT or ANPT threads shall be provided, except where a flush type of gage is incorporated.

3.2.5 Charging: It shall be possible to charge the cylinder through the cylinder valve. Either a self-closing charging valve shall be part of the cylinder valve assembly or the cylinder shall be charged by attaching a source of supply to the valve assembly outlet, opening the cylinder valve and turning on the supply source. The cylinder valve assembly shall be designed to prevent damage to seals in the event high pressure is applied at the outlet prior to the valve being opened.

3.2.6 Standpipe: A standpipe shall be provided in the valve inlet to keep moisture and loose foreign matter from entering the valve.

4. QUALITY ASSURANCE:

4.1 Classification and Scope:

4.1.1 Qualification Tests: Qualification tests shall consist of those tests listed in paragraph 4.3 and should be completed and satisfactorily reported to the procuring agency prior to shipment of production parts.

4.1.2 Acceptance Tests: Acceptance tests shall consist of those listed in paragraph 4.3.1, 4.3.2, and 4.3.8 only, and shall be conducted, except as noted, on each production part prior to shipment.

4.2 Test Media:

The test media shall be 1) dry oxygen, aviators breathing, conforming to MIL-O-27210 Type I, 2) oil-free nitrogen conforming to Specification BB-N-411, or 3) oil-free air equivalent in dryness conforming to Specification BB-N-411 and meeting its contamination requirements.

4.3 Test Methods:

4.3.1 Examination of Product: Each valve shall be examined for visible defects, burrs, and cleanliness to determine conformance to this standard.

4.3.2 Leakage and Operating Torque: The maximum operating pressure (1800 or 2100 psi) shall be applied to the inlet of the valve with the outlet capped. The valve shall be turned fully on and immersed in water. While immersed, the valve shall be turned to the half-open position and observed for leakage. The valve shall then be closed and observed for leakage with the outlet uncapped. The closing and opening torque, with maximum operating pressure applied to the valve inlet, shall not exceed 15 in-lb each. There shall be no evidence of leakage. The valve shall be thoroughly cleaned and dried after this test.

Maximum Torque: With no inlet pressure applied to the cylinder valve assembly, a torque of 58 to 60 in-lb shall be applied to the cylinder valve in both the maximum open and maximum closed positions. The cylinder valve assembly shall then be subjected to and comply with all the requirements of the preceding paragraph.

4.3.3 High and Low Temperature Exposures: The leakage test (4.3.2) shall be repeated after 12 hours conditioning at +160 °F ± 2 °F and after 12 hours conditioning at -40 °F ± 2 °F, except that a suitable leakage-detection method other than water immersion may be utilized. An operational test at a temperature of -20 °F ± 2 °F shall be made after conditioning. The closing or opening torque shall not exceed 15 in-lb. There shall be no evidence of leakage.

4.3.4 Opening Characteristics: The cylinder valve assembly shall be adjusted to the fully closed position. The maximum operating pressure (1800 or 2100 psig) shall be applied to the inlet of the valve assembly with the outlet attached to a suitable flow measuring device. The valve assembly shall then be opened, in increments of 1/2 turns. The maximum flow rate for each 1/2 turn increment shall be recorded. The flow rates for each 1/2 turn shall be within the limits as specified in Figure 1. The above test shall be repeated at an inlet pressure of 250 psig.

4.3.5 Safety Outlet: The safety outlet shall be tested in accordance with the procedures of CGA Pamphlet S-1, Part I, Paragraph 5.3.3. The safety outlet shall comply with the requirements as set forth in CGA Pamphlet S-1, Part I, Paragraph 5.3.3 and/or ICC Regulation Tariff 19, Section 73.302 depending upon which document is applicable.

4.3.6 Vibration: The cylinder valve assembly shall be vibrated for 3 hours, in each of three mutually perpendicular planes, at a frequency from 300 to 3,000 and back to 300 cycles per minute, at a constant rate of change and a double amplitude of 0.018 to 0.020 inch. High pressure gas (1800 or 2100 psig) shall be applied to the inlet of the valve with the valve in the closed position and the outlet capped for 1/2 of the total vibration time. The remainder of the vibration test shall be conducted with high pressure gas (1800 or 2100 psig) applied to the valve in the fully opened position, and with the outlet capped. There shall be no evidence of failure as a result of this test. Use of oxygen shall be avoided if the vibration test facilities permit the presence of oil. The valve shall be thoroughly cleaned and dried after this test.

4.3.7 Endurance Cycling: Valves shall operate satisfactorily for a minimum of 5000 cycles without maintenance. A cycle shall consist of opening and closing the valve fully at maximum operating pressure, relieving downstream pressure after each cycle.

4.3.8 Proof Pressure: Valves tested for qualification per paragraph 4.1.1, shall be subjected to the following test: test media at 1-2/3 times maximum operating pressure (1800 or 2100 psig) shall be applied to the valve in the open position with the safety disc removed and the outlets capped. There shall be no evidence of leakage or distortion of valve components. After relieving the pressure, the valve shall be closed. Normal closing torque shall not exceed 15 in-lb. The same pressure shall be applied to the valve in the closed position with the outlet uncapped. There shall be no evidence of leakage or distortion of valve or components. If leakage is tested by water immersion, dry valve after test. Acceptance testing, per paragraph 4.1.2 shall consist of the tests of this paragraph being conducted on 5% of any one lot of valves.

4.3.9 Burst Pressure: The valve shall not burst when with the outlets sealed and the valve in the open position, a pressure of 2-1/2 times maximum operating pressure (1800 to 2100 psig) is applied to the inlet. The safety disc shall be removed and the safety port capped.