AEROSPACE STANDARD

AS1197™ REV. B

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Superseding AS1197A

(R) Continuous Flow Oxygen Regulator

RATIONALE

Various aspects of the existing document have become outdated. Among these are content related to applicable regulations and standards cited, as well as installation specific requirements based approach to testing. This revision updates the content of the Standard to reflect state-of-the-art current practices.

AS1197B has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This standard covers regulators of the following types:

Type I - Automatic Continuous Flow
Type II - Adjustable Continuous Flow
Type III - Pre-Set Continuous Flow
Class A - Cylinder Mounted
Class B - Line Mounted

1.1 Purpose

To establish requirements for construction, performance, and testing of continuous flow oxygen regulators. This document supersedes in part AS463, which is cancelled.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR825/13	Guide for Evaluating Combustion Hazards in Aircraft Oxygen Systems
AIR825/14	Basic Aircraft Oxygen Systems Design
ARP1176	Oxygen System and Component Cleaning
AS861	Minimum General Standards for Oxygen Systems
AS1046	Minimum Standard for Portable Gaseous, Oxygen Equipment
AS8010	Aviator's Breathing Oxygen Purity Standard

2.1.2 Other Publications

49 CFR 173.302	Department of Transportation
A-A-59503	Defense Logistics Agency Aviation, Commercial Item Description, Nitrogen, Technical
ASTM G93	Standard Practice for Cleaning Methods and Cleanliness Levels for Material and Equipment Used in Oxygen-Enriched Environments
BB-A-1034	Naval Air Systems Command, Federal Specification, Compressed Air, Breathing
Compressed Gas Association Pamphlet S-1, Part I	
CS-25	Certification Specifications for Large Aeroplanes (EASA)
MIL-PRF-27210	Oxygen Aviator's Breathing, Liquid and Gas; Department of Defense
RTCA/DO-160	Environmental Conditions and Test Procedures for Airborne Equipment (RTCA, Inc.)

2.2 Definitions

The regulator types are defined as follows:

CLASS A: The regulators in this class are designed to be cylinder mounted.

CLASS B: The regulators in this class are intended for use in line between the oxygen source and the dispensing unit.

TYPE I: This type of regulator provides an output flow or pressure which varies automatically with cabin pressure to ensure adequate delivery to the mask.

TYPE II: This type of unit may be manually adjusted to deliver the proper amount of pressure or flow as determined by altitude.

TYPE III: This regulator has a fixed outlet flow or pressure which has been pre-set to provide adequate flow up to an indicated altitude.

3. DESCRIPTION

The regulators described herein are intended to perform as oxygen supply regulators in aircraft supplemental oxygen breathing systems. The output of the regulator is delivered to a suitable sized outlet orifice at the pressures prescribed herein.

4. REQUIREMENTS

4.1 General

The requirements set forth in AS861 and AS1046 shall be considered as part of this standard, except that should there be any conflict, the requirements of this standard shall take precedence.

4.2 Oxygen Safety

Pressurized oxygen requires maintaining suitably clean components from the time they are manufactured throughout the time they are in use. Information regarding cleaning can be referenced in ARP1176.

Oxygen equipment should follow established design practices to minimize the risk of oxygen enriched fires. This topic is discussed in AIR825/13 and ASTM G93 to provide guidance.

4.3 Design

4.3.1 Class A Regulators

Class A regulators are intended to be mounted directly on the oxygen cylinder and in addition to the pressure regulating characteristics shall include the following provisions:

4.3.1.1 On-Off Control

A means shall be provided for manually turning the flow on or off. Both positions shall be clearly and permanently marked.

4.3.1.2 Cylinder Contents Indicator

A pressure gauge or other comparably suitable means shall be provided to give continuous indication of cylinder contents.

4.3.1.3 Charging

A self-closing charging valve or other comparably suitable means shall be provided for charging the oxygen cylinder. Manually closing charging valves can also be used, provided proper regulated pressure is supplied and relief valves are in place to prevent over-pressurization.

4.3.1.4 Wrench Flats

The valve body shall have adequately sized wrench flats to grip without causing damage and be sturdy enough to withstand removal from the cylinder and attachment of outlet fittings.

4.3.1.5 Standpipe/Dip-Tube

A standpipe shall be provided in the valve inlet to minimize the possibility of moisture and loose foreign matter from entering the regulator when the cylinder is inverted.

4.3.1.6 Safety Outlet

A high pressure safety outlet shall be provided in accordance with DOT 49 CFR, Section 173.302, and CS 25.1453(d). The safety outlet shall be the frangible disc type with no fusible metal and shall be designed to provide force equilibrium while relieving.

4.3.1.7 Oxygen Inlet Filter

A filter capable of filtering materials as required per ARP1176 (greater than 50 µm) shall be provided in the oxygen inlet port and filler valve port where applicable.

4.3.1.8 Relief Valve

A relief valve shall be provided to protect the regulator outlet from over-pressurization on all regulators somewhere in the downstream system in accordance with CS 25.1453(e).

4.3.2 Class B Regulators

Class B regulators are intended to be mounted in line downstream of a cylinder and valve or other suitable oxygen source. Its function is simply one of pressure regulation.

4.3.2.1 Oxygen Inlet Filter

A filter capable of filtering materials as required per ARP1176 (greater than 50 µm) shall be provided in the oxygen inlet port and filler valve port where applicable.

4.3.2.2 Relief Valve

A relief valve shall be provided to protect the regulator outlet from over-pressurization on all regulators somewhere in the downstream system in accordance with CS 25.1453(e).

4.3.3 Type II Regulator

A means shall be provided to indicate setting of the manual flow control. Such means shall be clearly marked for proper altitude.

4.3.4 Type III Regulator

This regulator shall be clearly and permanently marked to show maximum altitude at which the regulator will provide sufficient oxygen to meet physiological requirements.

4.4 Performance

The regulator shall meet the requirements specified in 4.5 when subjected to the applicable tests of 4.6.

4.5 Quality Assurance Provisions

4.5.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein.

4.5.2 Visual Examination

The regulator shall be examined to determine conformance to this specification and applicable drawings with respect to materials, workmanship, construction, and marking.

4.6 Testing

4.6.1 Test Media

The test media shall be dry oxygen, aviators breathing, conforming to MIL-PRF-27210 or AS8010, Type I. Similarly clean and dry alternative test gasses (i.e., nitrogen per A-A-59503, and air per BB-A-1034) may be used in place of oxygen with the use of adjustment factors, while considering the gas composition and standardized test conditions.

4.6.2 Qualification

Qualification at a minimum will include RTCA/DO-160 environmental exposures, in addition to aircraft-specific requirements.

4.6.3 Leakage

All sealed equipment is prone to some level of leakage. The ability to detect and measure a leak is reliant on the method and test instrumentation utilized with regard to sensitivity and accuracy. Acceptable levels of leakage are dependent on the specific installation. Oxygen safety, maintenance intervals, and mission plans, among other factors, are to be considered.

4.6.3.1 Internal Leakage

Operating minimum and maximum supply inlet pressures, based on the system requirements, shall be applied to the regulator with zero flow conditions and pressures shall be maintained for a period of time suitable to the test setup. Leakage will be identified by an increase of outlet pressure relative to the initial pressure downstream, or another acceptable equivalent method such as monitoring the supply pressure drop or the use of an inline flowmeter.

4.6.3.2 External Leakage in “Off” Position (Class A Regulators Only)

Inlet pressures ranging from the minimum to the maximum operating pressures shall be applied to the regulator with the on-off control in the off setting. Evidence of leakage between mating components may require additional steps to quantify the leak rate. This test focuses on the high pressure stage of the regulator.

4.6.3.3 External Leakage

Inlet pressures ranging from the minimum to the maximum operating pressures shall be applied to the regulator with the on-off control in the off setting. Evidence of leakage between mating components may require additional steps to quantify the leak rate. All external connections and fittings shall be examined for leakage.

4.6.4 Strength Pressure

4.6.4.1 Maximum Working Pressure

A pressure in accordance with CS 25.1453(a)(1)(2) shall establish the basis for proof and burst pressure testing while considering variations in the normal operating modes from equipment transients, surges, and the effect of operating temperature changes.

4.6.4.2 Proof Pressure

A pressure in accordance with CS 25.1453(a)(3) of at least 1.5 times the maximum working pressure shall be applied to the regulator inlet with all other ports closed with suitable cap or plug (remove and cap or plug safety outlet of Class A regulator) for a period of 2 minutes minimum. The regulator shall show no evidence of excessive leakage (according to system requirements) or damage and shall meet the requirements of the pressure regulation test (4.6.5).

4.6.4.3 Burst Pressure

A pressure in accordance with CS 25.1453(a)(3) of at least 2.0 times the maximum working pressure shall be applied to the regulator inlet with all other ports closed with suitable cap or plug (remove and cap or plug safety outlet of Class A regulator) for a period of 1 minute minimum. The regulator shall show no evidence of rupture, but some distortion is allowed.

4.6.5 Pressure Regulation

Pressure regulation and flow requirements shall be established by system design analysis. (Refer to AIR825/14 as a guide.) The regulator shall be tested with all specified combinations of minimum and maximum supply pressures, flows, and altitudes. Type I and Type II regulators shall be tested at a maximum of 5000 feet intervals of altitude between minimum and maximum prescribed limits, and Type III regulators shall be tested at maximum rated altitude. The regulated pressures shall be within the design limits at all test points.

4.6.6 Low-Temperature

The regulator shall be subjected to operational low conditions in accordance with the aircraft requirements per the applicable RTCA/DO-160 section while determining performance (aspects of 4.6.5 and 4.6.3.3) during and after the low temperature exposure.

The regulator shall be subjected to survival low conditions in accordance with the aircraft requirements per the applicable RTCA section and determining performance (4.6.3.3) after the low temperature exposure.

4.6.7 High-Temperature

The regulator shall be subjected to operational high conditions in accordance with the aircraft requirements per the applicable RTCA/DO-160 section while determining performance (aspects of 4.6.5 and 4.6.3.3) during and after the high temperature exposure.

The regulator shall be subjected to survival high conditions in accordance with the aircraft requirements per the applicable RTCA section and determining performance (4.6.3.3) during and after the low temperature exposure.

4.6.8 Vibration

The regulator shall be subjected to sine sweeps to identify resonant frequencies in accordance with the installation requirements per the applicable RTCA/DO-160 section.

The regulator at a minimum shall be subjected to aircraft specific derived vibration frequencies and amplitudes in accordance with with the aircraft requirements per the applicable RTCA section while determining performance (aspects of 4.6.5 and 4.6.3.3) during and after the exposure.

4.6.9 Class A Only

4.6.9.1 On-Off Control Cycling

The regulator shall be placed in a test system with an applied maximum working pressure with the test unit open to its maximum specified flow. The control knob shall be cycled from on to off and back to on for a minimum of 1000 cycles. The test shall be repeated with minimum operating inlet pressure ±10 psig (0.7 barg). The regulator shall then be subjected to and meet the requirements of 4.6.5 and 4.6.3.3.

4.6.9.2 Safety Outlet

The safety outlet shall be tested in accordance with the procedures of Compressed Gas Association Pamphlet S-1, Part I. The safety outlet shall comply with the requirements as set forth in Compressed Gas Association Pamphlet S-1, Part I, and/or DOT 49 CFR, section 173.302, and CS 25.1453(d), depending upon which document is applicable.

4.6.10 Relief Valve

In accordance with CS 25.1453(e), the relief valve shall be tested to show the ability to prevent the downstream system pressure from exceeding a factor of 1.33 of the maximum working pressure, when supplied with a pressure equivalent to a malfunctioning regulator (i.e., uncontrolled output to low pressure distribution).