



# AEROSPACE STANDARD

AS1248™

REV. B

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Superseding AS1248A

(R) Minimum Standard for Gaseous Oxygen Pressure Reducers

## RATIONALE

Recent certification requirements have defined requirements of the oxygen systems more precisely with an effect on the design requirements for oxygen pressure reducers. This update makes the designer aware about these requirements: as the need for Oxygen Hazard Analysis, recommended test methods for oxygen intrinsic hazards verification (pressure shock tests and promoted ignition tests) and requirements for pressure factors (max operating pressure, proof, burst and transient pressures). In addition, this version considers actual references and editorial changes.

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## 1. SCOPE

This standard applies to pressure reducers for gaseous breathing oxygen systems and for all performance profiles without regard to particular inlet or outlet pressures. Attention is given, however, to construction requirements for reducers with maximum supply pressures to 2250 psig (155 bar) and reduced pressures of 50 to 150 psig (3.4 to 10.5 bar).

## 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.

#### 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](http://www.sae.org).

AIR825/13	Guide for Evaluating Combustion Hazards in Aircraft Oxygen Systems
AIR4071	Lubricants for Oxygen Use
AIR5742	Packaging and Transportation of Oxygen Equipment
ARP1176	Oxygen System and Component Cleaning
AS861	Minimum General Standards for Oxygen Systems
AS4395	Fitting End, Flared, Tube Connection, Design Standard
AS5202	Port or Fitting End, Internal Straight Thread, Design Standard
AS8010	Aviator's Breathing Oxygen Purity Standard
AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
AS71051	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT - Design and Inspection Standard

#### 2.1.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-PRF-27401	Propellant Pressurizing Agent, Nitrogen
MIL-STD-810	Environmental Test Methods
MIL-PRF-27210	Oxygen, Aviator's Breathing Liquid and Gas

#### 2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

ASTM G63	Evaluating Non-Metals for Oxygen Service
ASTM G88	Designing Systems for Oxygen Service

ASTM G94 Evaluating Metals for Oxygen Service

ASTM G175 Standard Test Method for Evaluating the Ignition Sensitivity and Fault Tolerance of Oxygen Pressure Regulators Used for Medical and Emergency Applications

#### 2.1.4 Other Publications

A-A-59503 Nitrogen, Technical

BB-A-1034 Compressed Air, Breathing

CGA S-1.1 Pressure Relief Device Standards, Part 1- Cylinders for Compressed Gases

EUROCAE ED 14/RTCA/DO-160 Environmental Conditions and Test Procedures for Airborne Equipment

ISO 10524-1 Pressure regulators and pressure regulators with flow-metering devices

#### 2.1.5 Airworthiness Requirements

CS 25 Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (EASA)

CS 25.1441 (b) Oxygen equipment and supply

CS AMC 25.1441(b) Risk assessment related to oxygen fire hazards in gaseous oxygen systems

CS 25.1453 Protection of oxygen equipment from rupture

14 CFR Part 25 Airworthiness Standards, Transport Category Airplanes, Federal Aviation Administration (FAA)

FAR 25.1441 (b) Oxygen equipment and supply

FAR 25.1453 Protection of oxygen equipment from rupture

#### 2.2 Reference Documents

49 CFR Part 173 SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

DOT 173.302 (f) Compressed oxygen and oxidizing gases by aircraft.

#### 2.3 Definitions

OHFRA: Oxygen Hazard and Fire Risk Analysis – an oxygen equipment and systems combustion risk assessment.

REDUCER OR REGULATOR: A pressure reducing device. The terms 'reducer' and 'regulator' are often used interchangeably.

### 3. TECHNICAL REQUIREMENTS

#### 3.1 General Requirements

##### 3.1.1 Materials and Workmanship

Applicable are the general requirements of AS861. Any material that is easily deteriorated or otherwise affected adversely by continued service when used with oxygen shall not be used. All materials shall be suitable for the purposes intended. An OHFRA shall be performed to determine the material compatibility. For this, the pressure levels in the different areas of the reducer under consideration of failure cases need to be determined. This analysis shall be made using the guidelines provided by ASTM G88 or appropriate standards.

### 3.1.1.1 Metallic Materials

All metallic materials used for the reducers shall be selected with consideration given for metal-oxygen compatibility and shall be of the corrosion resistant type or suitably treated to resist corrosion due to oxygen, salt, spray, or atmospheric conditions related to normal service and storage life. ASTM G94 may be used for reference.

### 3.1.1.2 Elastomers

All elastomers used shall have been compounded within the time recommended by the manufacturer or industry standards after the date of the equipment manufacture. Such cure date shall be shown on the elastomer if sufficient area is available; otherwise, the end product must be identified as to earliest cure date of elastomer components included therein. If silicone elastomers, or others which have indefinite storage or operational life, are used, cure-dating requirements are not applicable. ASTM G63 may be used for reference.

### 3.1.1.3 Protective Treatment

If protective treatments of materials are required, the application and the testing for these shall be documented and supplied with the qualification testing data for the reducer. Ensure that any protective treatments used are not a health hazard.

### 3.1.2 Operating Media

The operating media shall be oxygen, aviator's breathing (ABO), per AS8010 Type I or MIL-PRF-27210 Type I.

### 3.1.3 Component Cleaning and Assembly Cleanliness

Clean reducer and parts in accordance with ARP1176 or equivalent procedures. The reducer has to be assembled in an environment and with methods that will insure cleanliness will be maintained in final reducer assembly.

### 3.1.4 Lubricants

Only those lubricants shall be used which are compatible with and have been approved for use with oxygen within the specified pressure range and the temperature range of the pressure reducer. All lubricants shall be selected in accordance with AIR4071 to assure elastomer compatibility.

### 3.1.5 Interchangeability

All parts having same manufacture designation and part number shall be interchangeable with respect to installation and performance.

## 3.2 Design and Construction Requirements

### 3.2.1 Mounting

Reducers shall be provided with adequate mounting capabilities so that when attached to either rigid plumbing or other components such as a cylinder valve, or mounted to rigid structural members such as bulkheads, the device will withstand shock loads of 15 grams ( $147 \text{ m/s}^2$ ) in any direction or higher if required by the customer specification. Bending and distortion of the mounting may be permitted. There shall be no failure of the mounting attachment.

### 3.2.2 Wrench Flats

Adequate wrench flats for tightening fittings without special tools shall be provided at each connection port.

### 3.2.3 Connections

Inlet and outlet connections shall conform to AS71051, AS5202 for female ports, AS4395 for male flare, or AS33514 for male flareless types. Other connections may be customer specified. To secure threaded connections lock wiring may be used.

3.2.3.1 Inlet and outlet ports shall be permanently identified or the direction of flow shall be permanently indicated on the product. The use of an arrow indicating direction of the flow is recommended.

3.2.3.2 The maximum inlet pressure shall be permanently marked on the inlet or the identification plate of the reducer.

#### 3.2.4 Filtration

Oxygen inlet ports shall have appropriate filtering to prevent the entrance of particulate matter which may be hazardous to the user or which may impair the function of the device. Filtration shall be foreseen at all inlets of the pressure reducer. The filtration component may also be designed to be used as a device to dissipate energy of particulate impact and reduce the risk of ignition (see 3.6).

#### 3.2.5 Low Pressure Relief Valve

A low pressure relief valve shall release from the reduced pressure area of the device, any pressure in excess of that which can be safely contained, or in excess of that which will permit safe performance of the device. The valve shall reclose after release of excess pressure. The relief valve shall keep the pressure to less than or equal to 1.33 times the maximum working pressure (downstream) in case there is a fail open of the pressure regulating component in the reducer with maximum supply pressure at the inlet (reference CS 25.1453).

#### 3.2.6 High Pressure Relief Valve

If the device is cylinder mounted, it shall include a safety relief device complying with the requirements of CGA Pamphlet S-1.1. This safety relief device may be part of the hand valve if mounted on the cylinder and being directly connected to the pressure reducer. In this case, no separate high pressure safety relief device is required for the pressure reducer.

#### 3.2.7 Bonding

Provisions for adequate electrical bonding shall be considered and will be specified by the customer specification.

### 3.3 Performance Requirements

Performance requirements related to inlet pressure, reduced pressure, reduced pressure tolerance, reduced pressure tolerance versus decaying inlet pressure, total flow performance versus decaying pressure requirement, total flow, permissible leakage, extreme temperature operation, proof pressure, burst pressure, and service life shall be specified by the customer or the customer specification document.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Classification and Scope

#### 4.1.1 Qualification Testing

Qualification testing by supplier shall consist of those tests required in 3.4 through 3.6 and shall be satisfactorily documented by the supplier for further reference at any time.

#### 4.1.2 Acceptance Test

The acceptance test shall be defined by the customer specification and shall include, at least, the requirements of 3.4.1 through 3.4.3 and 3.4.6.2.

### 4.2 Test Media

The testing media shall be one of the following:

Oxygen per AS8010, Type I or MIL-PRF-27210, Type I

Nitrogen per MIL-P-27401, Type 1 or A-A-59503, Type I, Class 1

Air, equivalent in dryness and contamination levels to oxygen per AS8010, Type I or BB-A-1034, Grade A

### 4.3 Test Conditions

The ambient conditions for testing shall be as follows:

Temperature: 77 °F ± 18 °F (25 °C ± 10 °C)

Relative Humidity: 90% or less

Barometric Pressure: 28 to 32 in Hg (950 to 1080 mbar)

### 4.4 Test Performance

#### 4.4.1 Examination of Product

The equipment shall be carefully examined to verify conformance with applicable drawings with respect to materials, workmanship, finish, dimensions, construction, surface conditions, markings, and cleanliness.

#### 4.4.2 Leakage

At the applied maximum operating pressure, or proof pressure (if required by customer specification), the device shall meet leakage requirements according to the customer specification. Usually the external leakage shall not exceed 1 – 1.5 cm<sup>3</sup>/min at the maximum operational pressure ('bubble free' with a liquid detection fluid).

The maximum allowable internal leakage shall be stated in the customer specification. This shall take into consideration the type of valve seats (soft seated or metal-to-metal) and corresponding system parameters (e.g., system function, downstream volume).

#### 4.4.3 Performance Testing

Performance of the pressure reducer and relief devices shall be measured with a comprehensive flow and pressure testing system to within the tolerances and the performance of the customer specification. If test media other than oxygen is used as outlined in 3.2 of this document proper correction factors shall be applied.

#### 4.4.4 Temperatures

##### 4.4.4.1 Operating Temperatures

The reducer shall be operable and permit normal flow and shut-off of oxygen while being subjected to ambient temperatures in the range of -40 to 55 °C unless otherwise specified in the customer specifications.

##### 4.4.4.2 Storage (Non-operating Temperatures)

The reducer shall be operable and permit normal flow and shut-off of oxygen at temperatures in the operating range, after being subjected to temperatures in the range of -55 to 85 °C unless otherwise specified in customer specifications.

If the pressure reducer is pressurized at the inlet during aircraft on ground storage, the ground survival temperature range needs to be considered.

##### 4.4.4.3 High and Low Temperature Exposure Testing

The unit shall be subjected to a 12 hour soak at 85 °C and -55 °C. After each condition, the unit shall be returned and stabilized to temperatures in the operating range, 55 °C and -40 °C respectively, and subjected to the leakage and performance tests of 3.4.2 and 3.4.3. If the pressure reducer is pressurized at the inlet during aircraft on ground storage, the ground survival temperature range needs to be considered. Customer requirements may require testing at other temperatures.