AEROSPACE STANDARD

AS8026™	REV. B

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Reaffirmed 2024-09

Superseding AS8026A

Crewmember Demand Oxygen Mask for Transport Category Aircraft

RATIONALE

Various aspects of the existing document have become outdated. Among these are content related to flammability, material choices, and cleaning methods. This document serves as the Minimum Performance Standard for TSO/ETSO C78 and recent revisions to this TSO/ETSO have taken exception to several aspects of this document's content. This revision updates the content of the Standard to reflect state-of-the-art current practices and to harmonize this standard with the most recent version of the TSO/ETSO.

AS8026B has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This standard covers oxygen masks and breathing valves used with both panel mounted and mask mounted demand and pressure-demand oxygen regulators. Mask mounted oxygen regulators are covered under other standards, but when the mask mounted regulator incorporates an integral exhalation valve, the performance of this valve shall meet the requirements of this standard.

1.1 Purpose

This standard establishes the minimum performance standards for the manufacture of demand type crewmember oxygen masks to be used with straight demand, diluter-demand, and pressure-demand oxygen systems.

2. REFERENCES

NOTE: Within this document, specific revisions and/or revision dates of certain references are cited in order to maximize the extent of harmonization between this document and the relevant TSO/ETSO. If a party desires to utilize a more recent revision that achieves equal or better performance, this possibility should be coordinated with the responsible Airworthiness Authority.

2.1 Applicable and Related 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. Materials listed but not subsequently referenced are included to provide the reader with additional information that may be useful but is not necessarily required for compliance.

To facilitate use of equipment in the broadest range of locales, it may be appropriate to consider simultaneously complying with regulations from multiple regions (e.g., FAA requirements for the U.S. and EASA requirements for the EU) to the extent feasible.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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For more information on this standard, visit
https://www.sae.org/standards/content/AS8026B/

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.

AIR825B	Oxygen Equipment for Aircraft
ARP1176	Oxygen System and Component Cleaning
AS1046	Minimum Standard for Portable Gaseous, Oxygen Equipment
AS1194	Regulator Oxygen, Diluter Demand, Automatic Pressure Breathing
AS8027	Crewmember Oxygen Regulators, Demand
AS8031	Personal Protective Devices for Toxic and Irritating Atmospheres, Air Transport Flight Deck (Sedentary) Crewmembers

2.1.2 ASTM Publications

Available from ASTM International, 100 Bar Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D572-81	Rubber-Deterioration by Heat & Oxygen
ASTM D750-85	Rubber Deterioration in Carbon-Arc Weathering Apparatus
ASTM D1149-86	Rubber, Deterioration-Surface Ozone Cracking in a Chamber
ASTM D1171-86	Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D2228-83	Rubber Property-Abrasion Resistance (Pico Abrader)

2.1.3 EASA Publications

Available from European Aviation Safety Agency, Ottoplatz, 1, D-50679 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

EASA ETSO C78	Crewmember Oxygen Masks
EASA ETSO C89a	Crew Member Oxygen Regulators, Demand
EASA ETSO C99a	Flight Deck (Sedentary) Crewmember Protective Breathing Equipment
EASA ETSO C139a	Aircraft Audio Systems and Equipment
EASA CS-25	Large Aeroplanes

2.1.4 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

FAA AM-78-41	FAA Report, Optical Properties of Smoke Protective Devices
FAA TSO C78a	Crewmember Demand Oxygen Masks
FAA TSO C89a	Crewmember Oxygen Regulators, Demand

FAA TSO C99a Flight Deck (Sedentary) Crewmember Protective Breathing Equipment

FAA TSO C139a Aircraft Audio Systems and Equipment

2.1.5 FAR Publications

Available from Federal Aviation Regulations, https://www.faa.gov.

FAR Part 25 Airworthiness Standards, Transport Category Aircraft

FAR Part 91 General Operating Flight Rules

2.1.6 Other Publications

American National Standard (ANSI) Z87.1-1979, Practice for Occupational and Educational Eye and Face Protection.

MIL-L-38169, Lenses, Goggle & Visor, Helmet, Optical Characteristics, General Specification For (Now renumbered as MIL-PRF-38169).

MIL-STD-417, Rubber Composition, Vulcanized General Purpose, Solid.

An Anthropometric Sizing Program for Oral Nasal Oxygen Masks Based on 1967 US Air Force Survey Data, AMRL Technical Report 75-51, J. T. McConville and Milt Alexander.

Anthropometric Sizing and Fit-Test of MC-1 Oral-Nasal Oxygen Mask, WADC Technical Report 58-505, March 1959, I. Emanual, M. Alexander and E. Churchill.

Anthropometry of Air Force Women, AMRL Technical Report 70-5, April 1972, C. D. Clauser, et al.

Recommended Subject Selection and Test Procedure for Quantitative Respirator Testing, J. T. McConville, E. Churchill and A. Hack, HEW Contract HSM-99-75-15, November 30, 1973.

Anthropometry for Respirator Sizing, J. T. McConville, E. Churchill and L. L. Lauback, HEW Contract HSM-099-71-11, April 30, 1972. 2.3.

2.2 Definitions

ETSO: A technical standard order issued by EASA.

Lbf: pound-force – a unit of force or weight used in some systems of measurement, including English Engineering units.

N: Newton – an international unit for measurement of force equal to 1 kilogram meter per second squared.

Oxygen Mask: The oxygen masks to be used for transport aircraft shall be of the oronasal type covering the mouth and nose, or a full-face type which includes coverage of the eyes as well as the mouth and nose. Within this document the term “mask” is used as a shortened alternative to “oxygen mask.”

TSO: Technical Standard Order. This term frequently refers to technical standard orders issued by the FAA in the U.S. but also is sometimes used generically to refer to a technical standard order issued by an Airworthiness Authority.

2.3 Classification

This standard covers, but is not limited to the following types of oxygen masks:

Type I - Quick donning mask with integral breathing valve(s),

Type II - Quick donning mask without integral breathing valve(s),

Type III - Non-Quick donning mask with integral breathing valve(s),

Type IV - Non-Quick donning mask without integral breathing valve(s),

Type V - Other.

3. GENERAL REQUIREMENTS

3.1 Materials

3.1.1 General

Use materials of a type, grade, and quality that experience and/or tests have shown suitable for the purpose. Do not use materials that contaminate oxygen or are adversely affected by continuous service with oxygen. Use the following test methods to verify compliance with materials requirements established in a design specification.

a. Resistance to Flammability

Except for small parts like knobs, triggers, fasteners, seals, and electrical parts that don't contribute significantly to fire propagation, materials including packaging must comply with 14 CFR § 25.853(a) and Appendix F, Part I(a)(1)(iv) in effect on October 27, 2004. Note that "including packaging" means packaging employed when the equipment is installed in its stowed configuration on the aircraft, rather than shipping packaging.

b. Resistance to Ozone Degradation

ASTM D1149-86, "Rubber, Deterioration-Surface Ozone Cracking in a Chamber"

MIL-STD-417, "Rubber Composition, Vulcanized General Purpose, Solid"

c. Resistance to Ultra Violet Degradation ASTM D750-85, "Rubber Deterioration in Carbon-Arc Weathering Apparatus"

d. Resistance to Wear and Tear (Abrasion) ASTM D2228-83, "Rubber Property-Abrasion Resistance (Pico Abrader)"

e. Oxygen Compatibility

Manufacturer's data on raw materials or on finished products, ASTM D572-81, "Rubber-Deterioration by Heat & Oxygen" or ASTM D1171-86, "Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (triangular specimens)."

f. Odors

Sniff test by a panel of six different persons.

g. Resistance to Deformation while in Stored Condition

ASTM D1171-86 or D572-81, as noted in paragraph (e) above.

h. Optical Quality and Resistance to Shattering (Lenses)

American National Standard (ANSI) Z87.1-1979, "Practice for Occupational and Educational Eye and Face Protection" and Military Specification MIL-L-38169 (USAF).

3.1.2 Facepiece

Materials in contact with the skin shall be selected to be as non-irritating, non-allergenic, and as soft and compliant to the facial configuration as possible.

3.1.3 Cleaning and Sanitizing

Make the oxygen mask of materials that permit cleaning and sanitizing without adverse effects, and without major disassembly. The cleaning method must be either manufacturer-recommended, or according to ARP1176. Include cleaning and sanitizing procedures in the CMM (Component Maintenance Manual).

3.1.4 Elastomeric Components

Attach to the mask a tag or leaflet describing service life limits of elastomeric components and a suggested method to inspect for deterioration in these components. If not attached, include the tag with the packaged mask as delivered to the user. Silicone rubber parts, having unlimited shelf life, are exempt from this requirement. Include life limits and inspection procedures in the CMM.

3.1.5 Fungus

Components of the oxygen mask assembly shall be fungus-proofed by selection of parts and materials that are non-nutrient to fungus, or by treating the parts and materials with a biocidal material that is compatible with human wear and activity.

3.1.6 Dissimilar Metals

Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in contact with each other.

3.2 Workmanship

3.2.1 General

The oxygen mask shall be fabricated and finished in accordance with the highest-grade practice in the manufacture of this type of life saving equipment. The finished mask and all internal parts shall be clean throughout and free of fins, burrs, scale, oils, foreign materials, or other conditions which might adversely affect the safe operation of the mask. All components shall be resistant to snags, breaks, tears, and other harmful actions which could lead to malfunction of the mask in the course of normal handling and use during its service life.

3.2.2 Finish

All materials which are not inherently corrosion resistant shall be finished with a protective treatment or coating to minimize the effect of exposure to environmental conditions which may be encountered in the service for which the oxygen mask is intended. The protective treatment or coating shall not chip, flake, powder, or otherwise contaminate the mask. Protective coatings must be safe and non-irritating for human contact and respiratory uses.

3.3 Identification

3.3.1 Required

The oxygen mask assembly shall be marked in accordance with applicable airworthiness requirements. If the article is covered by a TSO/ETSO, marking shall comply with requirements stated there. In the absence of other requirements, the following minimum information shall be permanently marked in a readily visible location on the oxygen mask assembly:

Part Name
Manufacturer's Part Number
Manufacturer's Name and Address
Elastomer Cure Date (except Silicone Rubber)
Size (if more than one size is offered)
Type (see 2.4)
Maximum Altitude to Which Qualified
Government Agency Approvals

3.3.2 Optional

The following additional information may appear on the oxygen mask identification label at the option of the manufacturer and or the purchaser:

Airframe Manufacturer's Approvals
Airline or other users Part Number
Manufacturer's CAGE Code (Commercial and Government Entity Code)
Instructions for use or Warning Labels

3.4 Facepiece Assembly

3.4.1 Sizing Criteria

The professional flying population - male and female - presents a very wide range of facial type and sizes, thus the intended user of an oxygen mask must personally assure that a good fit can be achieved using the standard mask provided by the airplane operator. Aircraft operators should provide oxygen masks which offer an adequate fit and protective level to the widest possible range of their aircrew members. An individually fitted mask should be furnished when an aircrew member cannot be fitted by the standard masks regularly supplied.

Manufacturers are encouraged to provide masks of universal size whenever feasible. When multiple sizes are required to fit the full range of anticipated users, the mask assembly is to be clearly marked or identified as to its size or intended user type.

Facepiece designers should consider extremes of Naison-Menton, Bizygomatic, Bigonial, and Naison-Supramentale measurements and other applicable anthropometric information as required to provide a product with adequate fit. Suggested sources of anthropometric data are listed in Section 2.

3.4.2 Fit

The oxygen mask facepiece shall be of sufficient resilience, size and shape as to conform readily to clean shaven facial contours using no more pressure than is supplied by the mask suspension device. In determining that a mask provides an acceptable fit under this Aerospace Standard, a mask need not demonstrate compliance with 4.1.1, on test subjects with beards, heavy facial hair, or deep wrinkles. Published studies have shown that all known masks will leak where beards or heavy facial hair lies between the skin and sealing surface of the mask, or where deep wrinkling prevents a seal.

3.5 Suspension/Stowage

Store the oxygen mask facepiece of Type I and Type II masks in a container, mounted (panel or sidewall) or attached to a suspension device. The mask assembly must be donned using only one hand and operating in 5 seconds or less, without disturbing eyeglasses. After donning, the mask must not prevent immediate communication between crewmembers of the airplane intercommunications system.

Type III and Type IV oxygen masks may be similarly installed, and may be designed to require use of two hands and/or take more than 5 seconds to don.

3.6 Compatibility with Eyeglasses and Smoke Goggles

All types of oxygen masks - quick donning or non-quick donning oronasal masks, oronasal masks with integral goggles, or full-face type masks - shall be designed so that it is possible to don and wear the mask while wearing corrective eyeglasses. Quick donning Type I and Type II masks and their suspension devices shall be designed to meet the one-hand, 5-second donning requirement of 3.5 when donning over eyeglasses. Oronasal type masks shall be designed to permit the wearing of smoke goggles with the mask and over eyeglasses. For purposes of demonstrating compliance with this paragraph, eyeglasses must be a minimum of 152 mm (6 inches) wide by 51 mm (2 inches) high. (Refer to TSO/ETSO C-99a for guidance relating to performance of smoke goggles for use on flight deck.)

3.7 Lenses in Full Face Masks and/or Integral Goggles

The lens or lenses used in full face masks or goggles integrally attached to oronasal masks shall be free from defects or flaws that impair optical quality. The lens(es) shall be demonstrated to show compliance with the following:

3.7.1 Range of Vision

The lens(es) shall permit peripheral vision in the horizontal meridian of at least 120 degrees (60 degrees on each side of the center point) and in the vertical meridian of at least 60 degrees (40 degrees above and 20 degrees below the center point) when evaluated by standard arc perimeter techniques.

3.7.2 Fogging

Lens(es) of all full-face masks or smoke goggles integrally attached to oronasal masks shall be designed to minimize moisture condensation on the inside surface or shall include a means for removing any moisture that may condense on surfaces essential to vision.

3.7.3 Optical Quality

Light transmission, refractive deviation, optical haze, and distortion shall be tested in accordance with and meet the requirements of ANSI Standard Z87.1-1979, as described in FAA Report FAA-AM-78-41.

3.8 Frost

The oxygen mask shall be designed to prevent the formation or accumulation of frost which would interfere with the function of the inhalation or exhalation valves, unless it can be demonstrated that the wearer can remove frost by external manipulation without removing the mask.

3.9 Oxygen Supply Tube

Oxygen mask assemblies, including those designed for use with remotely located oxygen flow regulators, shall include a flexible, kink-resistant oxygen supply tube.

3.10 Oxygen Supply Tube Connector

Oxygen masks equipped with oxygen supply tubes designed for quick disconnection from the oxygen supply regulator shall incorporate a device to alert the user when his oxygen supply tube has been disconnected. When disconnected the device shall permit inhalation, but a noticeable resistance shall be introduced to indicate that disconnection has occurred. This paragraph does not apply if the quick disconnect device incorporates means to positively prevent inadvertent separation.

3.11 Accumulation of Expired Gases

Oxygen masks shall be designed to have the minimum practical internal volume to prevent the accumulation of more than 200 mL of expiratory gases within the facepiece chamber.

3.12 Communications

Oxygen mask design shall permit the installation of a microphone and connecting communications cable. When microphones are furnished with the masks, these must conform to FAA TSO C139 or an FAA approved equivalent.

4. PERFORMANCE REQUIREMENTS

4.1 Leakage

4.1.1 Seal to the Face

The seal between the mask facepiece and the skin of the face, or of a suitable head/face form simulating a human face, shall be such that:

a. The inboard leakage into the mask cavity does not exceed 5% of the pulmonary ventilation when the mean pressure in the mask cavity is between 0 kPa and 1 kPa (4 inches water gauge) less than that of the environment.

b. The outboard leakage does not exceed the limits given below at the indicated mean pressures in the mask cavity:

Table 1

Mean Pressure in Mask Cavity Relative to the Environmental Pressure		Maximum Outboard Leakage
kPa	(Inches Water)	L/min (NTPD)[1]
1.0	(4.0)	1.8
3.0	(12.0)	6.0

NOTE: The 3.0 kPa requirement applies only to masks rated for operation above 12200 m (40000 feet)

[1] NTPD – Normal Temperature (21.1 °C, 70 °F), Normal Pressure (760 mm Hg, 14.7 psi, 1.013 bars, 101.3 kPa), dry.

4.1.2 Inhalation Valve Leakage

Inhalation valves installed in pressure demand oxygen masks shall not back-leak more than 0.016 L/min, NTPD, when subjected to a suction pressure differential of 25 Pa (0.25 mbar, 0.1 inches water) and not more than 0.16 L/min, NTPD, when subjected to a suction pressure differential of 2 kPa (20 mbar, 8.0 inches water).

4.1.3 Supply Tube Leakage

The oxygen supply tube assembly shall not leak when subjected to an internal pressure of 34.5 kPa (0.345 bar, 5.0 psig).

4.2 Strength

4.2.1 Mask Assembly Strength

The oxygen mask assembly (suspension, facepiece, and supply tube) shall be capable of sustaining a pull force on the suspension device attachment fittings of not less than 156 N (35 lbf) in any direction for a period of not less than 3 seconds without visible damage or permanent deformation.

4.2.2 Supply Tube Strength

The oxygen supply tube assembly shall be capable of sustaining a pull force of not less than 133 N (30 lbf) exerted along the axis of symmetry of the tube for a period of not less than 3 seconds without visible damage or permanent deformation.

4.2.3 Supply Tube Collapse

The oxygen supply tube shall not collapse when subjected to an internal vacuum of 17 kPa (170 mbar, 68 inches water) for a minimum of 3 seconds.

4.2.4 Rubber Tear Resistance

The rubber used in the oxygen mask facepiece and supply tube shall have a minimum tear resistance of 263 N/cm (150 lbf/in) when tested in accordance with ASTM D624-81, Die B.

4.3 Quick Disconnect Couplings

4.3.1 Coupling Force

The force required to separate quick disconnect couplings which do not have a feature to prevent inadvertent separation shall be a minimum of 44 N (10 lbf) exerted along the axis of symmetry of the oxygen supply tube.

4.3.2 Pressure Drop

When disconnected, the pressure drop through the quick-disconnect device shall be not less than 1 kPa (10 mbar, 4.0 inches of water), nor more than 1.5 kPa (15 mbar, 6.0 inches of water). Immediately prior to disconnection there shall be a test flow of 15 L/min into the mask.

4.4 Flow Resistance

4.4.1 Inhalation Resistance

The inhalation resistance of the oxygen mask and oxygen supply tube, including the oxygen supply connector when inserted into an appropriate mating fitting shall not exceed the following negative differential pressure at the corresponding constant oxygen flow rates:

Table 2

Differential Pressure	Flow Rate NTPD or ATPD	
150 Pa (1.50 mbar, 0.6 in/water)	21.6 L/min	20 L/min
375 Pa (3.75 mbar, 1.5 in/water)	75.6 L/min	70 L/min
625 Pa (6.25 mbar, 2.5 in/water)	108.0 L/min	100 L/min

4.4.2 Exhalation Resistance

The exhalation resistance of the mask shall not exceed the following positive pressure differential pressures at the corresponding constant oxygen flow rates:

Table 3

Differential Pressure	Flow Rate NTPD or ATPD	
250 Pa (2.5 mbar, 1.0 in/water)	21.6 L/min	20 L/min
500 Pa (5.0 mbar, 2.0 in/water)	75.6 L/min	70 L/min
750 Pa (7.5 mbar, 3.0 in/water)	108.0 L/min	100 L/min

4.4.3 Pressure-Demand Exhalation Valve Performance

The exhalation valve installed in a pressure-demand oxygen mask must open when the pressure within the facepiece is no greater than 0.6 kPa (6.0 mbar, 2.4 inches water) higher than the supply tube pressure.

4.4.4 Vibration

The flow of gases during respiration shall not cause vibration, flutter, or chatter which would interfere with the satisfactory operation of the oxygen mask at a maximum flow rate of 108 L/min (NTPD). When tested subjectively, the level of vibration exhibited by the mask assembly shall not be such as to cause annoyance or discomfort to a wearer.