

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

**Subject: CREWMEMBER OXYGEN MASK**

### **1 - Applicability**

This ETSO gives the requirements which the crewmember constant flow mask or crewmember demand oxygen masks that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

### **2 - Procedures**

#### **2.1 - General**

Applicable procedures are detailed in CS-ETSO Subpart A.

#### **2.2 - Specific**

None.

### **3 - Technical Conditions**

#### **3.1 - Basic**

##### **3.1.1 - Minimum Performance Standard**

Both crewmember constant flow mask and crewmember demand oxygen masks must meet the standards set forth in the attached **Appendix 1**: "Standard for Crewmember Demand Oxygen Masks" and, when applicable, additional specific requirements as described here after in paragraph 3.2 – Specific.

##### **3.1.2 - Environmental Standard**

None.

##### **3.1.3 - Computer Software**

None.

#### **3.2 – Specific**

##### **3.2.1 - Breathing Bag Volume**

If a breathing bag is installed it shall meet the requirements of the Society of Automotive Engineers Inc (SAE) Aerospace Standard (AS) N° AS 8025,

"Passenger Oxygen Mask", Rev. A, dated January 1999, paragraphs 4.3 (volume) and 5.5.1 (strength).

### **3.2.2 - Oxygen Flow Indicators**

If an oxygen flow indicator is installed it shall meet the requirements of the Society of Automotive Engineers Inc (SAE) Aerospace Standard (AS) N° AS 916, "Oxygen Flow Indicators", Rev. B, dated July 1996, paragraph 3.2 (Low pressure continuous flow type).

### **3.2.3 - Flammability**

For flammability the applicable paragraphs of CS 25, Appendix F shall apply.

## **4 - Marking**

### **4.1. - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

### **4.2. - Specific**

#### **4.2.1 - Each constant flow mask shall be marked with:**

- (i) the term "Constant Flow Mask";
- (ii) the maximum environmental (cabin) altitude the mask is qualified for.

#### **4.2.2 - Each demand flow mask shall be marked to indicate:**

- (i) whether it is a "non-pressure demand" or a "pressure demand" mask;
- (ii) the maximum environmental (cabin) altitude for which it is qualified.

## **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3.

## APPENDIX 1

### STANDARD FOR CREWMEMBER DEMAND OXYGEN MASKS

#### 1.0 Purpose.

This Standard contains minimum performance standards for the manufacture of demand type oxygen masks for use with non-pressure demand (straight-demand and diluter-demand) and pressure-demand oxygen systems. It is based on the equivalent FAA standard for crewmember demand oxygen masks and the Agency has added values that are in imperial units also in SI units

#### 2.0 Design and Construction of Mask.

To be eligible for approval under a European Technical Standard Order Authorisation, the oxygen mask must possess the following design and construction characteristics.

2.1 Masks designed for use with a remotely located oxygen flow regulator must include a flexible oxygen supply tube fixed or detachable at the mask or at the regulator or at both. Oxygen supply tubes used in conjunction with mask-mounted oxygen flow regulators are not subject to this paragraph.

2.2 The mask must be designed for respiration through the nose and mouth (oronasal). The mask may also include integral goggles designed to protect the eyes from smoke and harmful gases (fullface).

2.3 The mask must be constructed of materials that –

- (a) do not contaminate air or oxygen;
- (b) are not adversely affected by continuous contact with oxygen; and
- (c) are at least flame resistant.

2.4 The mask must be designed to prevent the accumulation of hazardous quantities of expiratory gases within the facepiece chamber.

2.5 The mask must be designed to prevent the formation of accumulation of frost which would interfere with the function of the exhalation valve, unless it can be shown that the frost can be removed by external manipulation without removing the mask from the face of the user.

2.6 The full-face mask must be designed to include means for the prevention or the removal of condensation from the inside surfaces of the goggle lenses.

2.7 Masks equipped with oxygen supply tubes designed for quick disconnection at the mask or at the regulator must incorporate means to alert the user when his oxygen supply tube has become disconnected. Such means must not restrict the flow of ambient air through the oxygen supply tube by an amount exceeding 25 percent. This section does not apply if the quick disconnect device incorporates means to prevent inadvertent separation.

#### 3.0 Performance.

Five masks of each kind for which approval is sought must be shown to comply with the minimum performance standards set forth in paragraphs 3.1 through 3.12, except that only one mask of each kind is required to comply with the provisions of paragraphs 3.6, 3.8, 3.9, and 3.11. Tests must be conducted at ambient atmospheric conditions of approximately 102 KPa (30" hg.) and 21 °C (70°F.), except as otherwise specified. Gas flow rates and pressures must be corrected to STPD.

3.1 *Quick-disconnect Coupling.* The force required to separate quick disconnect couplings not designed to prevent inadvertent separation must not be less than 45 N (10 pounds) exerted along the axis of symmetry of the oxygen supply tube.

3.2 *Strength.*

(a) The mask must be capable of sustaining a pull force on the suspension device attachment fittings of not less than 156N (35 pounds) in any direction for a period of not less than 3 seconds.

(b) The oxygen supply tube assembly must be capable of sustaining a pull force of not less than 134 N (30 pounds) exerted along the axis of symmetry of the tube for a period of not less than 3 seconds.

(c) The oxygen supply tube assembly must be capable of sustaining an internal pressure of 10 KPa (1.5 p.s.i.g)

3.3 *Leakage.*

(a) The total inward leakage rate, with the complete mask positioned on the face or on a suitable test stand in a manner which simulates normal use, must not exceed 0.10 LPM STPD at any negative differential pressure within the range of from zero to 1.5 KPa (6.0 inches of water).

(b) Inhalation valves installed in pressure-demand masks must not back leak more than 0.015 LPM, STPD, when subjected to a suction pressure differential of 0.03 KPa (0.1" H<sub>2</sub>O) and not more than 0.15 LPM, STPD, when subjected to a suction pressure differential of 3 KPa(12.0" H<sub>2</sub>O).

(c) The oxygen supply tube assembly must not leak when subjected to an internal pressure of 10 KPa (1.5 p.s.i.g)

3.4 *Flow Resistance.*

(a) The inspiratory resistance of the mask and oxygen supply tube including the oxygen supply connector when inserted in an appropriate mating fitting must not exceed the following negative differential pressures at the corresponding oxygen flow rates:

Differential Pressure KPa (inches H <sub>2</sub> O)	Flow Rate (LPM)
0.15 (0.6)	20
0.37 (1.5)	70
0.62 (2.5)	100

(b) The expiratory resistance of the mask must not exceed the following positive differential pressures at the corresponding oxygen flow rates:

Differential Pressure KPa (inches H <sub>2</sub> O)	Flow Rate (LPM)
0.25 (1.0)	20
0.50 (2.0)	70
0.75 (3.0)	100

3.5 *Pressure-Demand. Exhalation Valve Performance.* The exhalation valve installed in a pressure demand mask must open when the pressure within the facepiece is 2.7 KPa (20 mm Hg) and the pressure in the supply tube is 2.0 KPa (15 mm Hg) to 2.7 KPa (19.9 mm Hg).

3.6 *Vibration.* The flow of gases during the respiratory process must not cause vibration, flutter, or chatter which would interfere with the satisfactory operation of the mask.

3.7 *Acceleration Load.* The exhalation valve must not inadvertently operate under a 3g load applied in any direction.

3.8 *Extreme Temperature.* The mask must comply with paragraphs 3.3 through 3.5 in an ambient temperature of 21°C (70°F.) within 15 minutes after being stored at a temperature of 71°C (160°F.) for 12 hours, and within 15 minutes after being stored at -18°C (0°F.) for 2 hours. The relative humidity during storage must vary from 5 to 95 percent. The mask facepiece must not be gummy or sticky and must provide a normal seal after the high temperature exposure.

3.9 *Low Temperature Test Delay.*

(a) The mask must function properly, without apparent delay, at a temperature of 21°C (70°F.) after being stored at a temperature of -7°C (20°F.) for not less than 2 hours.

(b) The mask must function properly, without apparent delay, and continue for a period of not less than 15 minutes when tested at a temperature of -7°C (20°F) after being stored at a temperature of 21°C (70° F.) for not less than 12 hours.

3.10 *Decompression.*

(a) A mask not equipped with a pressure relief valve must not suffer damage and must comply with paragraphs 3.3 through 3.5 after being subjected to a decrease in ambient pressure from 83 KPa (12 p.s.i.a.) to not less than 19 KPa (2.7 p.s.i.a.) for a straight or diluter-demand kind, or to not less than 14 KPa (2.1 p.s.i.a.) for a pressure demand kind, within a period of not more than 1 second. This decompression test must simulate the condition that could be imposed on a mask being worn by a crewmember during the specified decompression.

(b) A mask equipped with a pressure relief valve must be subjected to the decompression specified in subparagraph (a) of this section during which the pressure relief valve must open at a differential pressure of 4.2 KPa (17" H<sub>2</sub>O) and must relieve the differential pressure to a value not exceeding 4 KPa (16" H<sub>2</sub>O) within 5 seconds. During the 5 second interval, the pressure differential

must not exceed a value of 5 KPa (20" H<sub>2</sub>O). The pressure relief valve must close at a differential pressure of 3.5 KPa (14" H<sub>2</sub>O).

3.11 *Cycling*. The mask must comply with paragraphs 3.3 through 3.5 after being subjected to the following simulated breathing schedule for a total of 50,000 cycles:

Respiratory Cycles	Minute Flow Rate LPM, STPD	Volume, Tidal Liters
20,000	20	1.0
25,000	30	1.5
5,000	70	2.0

A constant time interval must be maintained between respiratory cycles.

3.12 *Microphone*. If the mask is designed to include a microphone, the installation of the microphone must not interfere with the operation of the mask.

#### 4.0 Quality Control.

4.1 *Production Tests*. Each mask must be shown to comply with the provisions of paragraph 3.3(a), total leakage.

4.2 *Random Tests*. One mask must be selected at random from each lot and must be shown to comply with paragraph 3.1 through 3.12. The lot size must be selected by the applicant, subject to the approval of the Agency, on the basis of evaluation of the applicant's quality control systems (see 21A.139b).

#### 5.0 Maximum Environmental (cabin) Altitude.

The minimum pressure to which the mask has been shown to decompress satisfactorily in accordance with paragraphs 3.10(a) or (b) of this standard determines the maximum environmental altitude of the mask, except that it shall not exceed the value shown in the following table:

Maximum Environmental (Cabin) Altitude	Kind of Mask
40,000 feet	Straight or Diluted-Demand
45,000 feet	Pressure-Demand

#### 6.0 Abbreviations and Definitions.

LPM	Liters per minute.
STPD	Standard temperature and pressure, dry (0°C. 760 mm.Hg.)
p.s.i.g.	Pounds per square inch, gage.
p.s.i.a.	Pounds per square inch, absolute.
g	Acceleration or gravity, 9.81 m/second <sup>2</sup> (32.2 feet/ second <sup>2</sup> ).
Tidal volume	Volume of air inspired per breath.