ETSO-C78
Date : 24.10.03

European Aviation Safety Agency

European Technical Standard Order

Subject: CREWMEMBER DEMAND OXYGEN MASKS

1 - Applicability

This ETSO gives the requirements which 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

Standards set forth in the attached „Federal Aviation Administration Standard, Crewmember Demand Oxygen Masks".

3.1.2 - Environmental Standard

As stated in the Federal Aviation Administration Standard.

3.1.3 – Computer Software

None

3.2 - Specific

None

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

FAA Standard associated with ETSO–C78

FEDERAL AVIATION ADMINISTRATION STANDARD
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.

2.0 Design and Construction of Mask.

To be eligible for approval under a Technical Standard Order authorization, 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 fullface 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 30" hg. and 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 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 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 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 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 6.0 inches of water.

(b) Inhalation valves installed in pressure-demand masks must not backleak more than 0.015 LPM, STPD, when subjected to a suction pressure differential of 0.1" H_2O and not more than 0.15 LPM, STPD, when subjected to a suction pressure differential of 12.0" H_2O.

(c) The oxygen supply tube assembly must not leak when subjected to an internal pressure of 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 (inches H_2O)	*Flow Rate (LPM)*
0.6	20
1.5	70
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 (inches H_2O)	*Flow Rate (LPM)*
1.0	20
2.0	70
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 20 mm Hg and the pressure in the supply tube is 15 to 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 70° F. within 15 minutes after being stored at a temperature of 160° F. for 12 hours, and within 15 minutes after being stored at 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 70° F. after being stored at a temperature of 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 20° F. after being stored at a temperature of 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 12 p.s.i.a. to not less than 2.7 p.s.i.a. for a straight or diluter-demand kind, or to not less than 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 value 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 17" H_2O and must relieve the differential pressure to a value not exceeding l6" H_2O within 5 seconds. During the 5-second interval, the pressure differential must not exceed a value of 20" H_2O. The pressure relief valve must close at a differential pressure of 14" H_2O.

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 Federal Aviation Administration (see FAR § 37.5), on the basis of evaluation of the applicant's quality control systems (see § 37.5 (a) (3)).

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 DILUTER-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, 32.2 feet/ second^2.
Tidal volume	Volume of air inspired per breath.

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