English Translation Version for Reference Only

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Approved by：Yang Zhenmei

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Crewmember Portable Protective Breathing Equipment

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for crewmember portable protective breathing equipment (PBE) CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards(MPS) that PBE must first meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new application submitted after its effective date. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21R4.

3. Requirements.

a. New models of crewmember portable PBE identified and manufactured on or after the effective date of this CTSO must meet the

MPS qualification and documentation requirements in SAE International's Aerospace Standard (AS) 8047, Performance Standard for Cabin Crew Portable Protective Breathing Equipment for Use During Aircraft Emergencies, dated June 2002, as modified by appendix 1 of this CTSO. Crewmember portable PBE are separated into four classes suitable for use by crewmembers during the following scenarios:

Class 1-- For an in-flight cabin or accessible compartment smoke/fire conditions at normal cabin altitude (up to 8,000 ft equivalent).

Class 2-- In addition to the requirements of Class 1, protection against a subsequent depressurization to 40,000 ft while wearing the unit.

Class 3-- Emergency ground evacuation of the aircraft during fire/smoke conditions, operating escape systems and assisting passengers.

Class 4-- In flight emergency and ground evacuation during smoke/fire conditions (as per Class 1 & 3 combined).

b. Functionality. This CTSO's standards apply to equipment intended to provide crewmembers with portable PBE (using a breathable gas) that can be used during emergency conditions to locate and combat a fire in the airplane cabin, or any other accessible compartment at cabin altitudes. This equipment may be suitable to administer supplemental oxygen or first aid oxygen to occupants, if oxygen is used as the breathable gas.

c. Environmental Qualification. Test the equipment according to the

requirements of AS 8047 and the conditions specified in appendix 1 of this CTSO.

d. Deviations. For using alternative or equivalent means of compliance to the criteria in this CTSO, the applicant must show that the equipment maintains an equivalent level of safety. Apply for a deviation under the provision of 21.368(a) in CCAR-21R4.

4. Marking.

a. Mark at least one major component permanently and legibly with all the information of 21.423(b) in CCAR-21R4, except for 21.423(b)(2). Use the name, type, and part number. Do not use the optional model number.

b. In addition, permanently and legibly mark the crewmember portable PBE with the class (see paragraph 3.a above).

c. Also, mark the following permanently and legibly, with at least the manufacturer’s name, subassembly part number, and the CTSO number:

(1) Each component that is easily removable (without hand tools).

(2) Each interchangeable element.

(3) Each subassembly of the article that the manufacturer determined may be interchangeable.

d. Identify any deviations granted to the article by marking “Deviation. See installation/instruction manual (IM)” after the CTSO

number.

e. Optional marking is permitted to allow aircraft-specific or operational-specific installation limitations, such as: “FOR USE ON {insert aircraft type or serial number} ONLY,” “FOR USE ON AIRCRAFT USED IN PART {insert number} OPERATIONS ONLY,” or “SEE DRAWING NO. {insert number} FOR INSTALLATION LIMITATIONS.”

5. Application Data Requirements.

The applicant must furnish the responsible certification personnel with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353(a)(1) in CCAR-21R4 and one copy each of the following technical data:

a. Operating instructions and equipment limitations, sufficient to describe the equipment’s operational capability. Describe any deviations in detail. If needed, identify equipment by part number, version, revision, and criticality level of software/hardware, classification for use, and environmental categories.

b. Installation procedures and limitations, sufficient to ensure that the crewmember portable PBE, when installed according to the installation procedures, still meets this CTSO’s requirements. Limitations

must identify any unique aspects of the installation. Finally, the limitations must include a note with the following statement:

"This article meets the minimum performance and quality control standards required by a CTSO. Installation of this article requires separate approval."

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. List of components, by part number, that make up the crewmember portable PBE complying with the standards prescribed under this CTSO. Include vendor part number cross references, when applicable.

f. A component maintenance manual (CMM), covering periodic maintenance, calibration, and repair, for the continued airworthiness of installed crewmember portable PBE. Include recommended inspection intervals and service life. Describe the details of deviations granted, as noted in paragraph 5.a of this CTSO.

g. Material and process specifications list.

h. The quality system description required by section 21.358 of CCAR-21R4, including functional test specifications. The quality system should ensure that it will detect any change to the approved design that could adversely affect compliance with the CTSO MPS, and reject the article accordingly.

i. Manufacturer’s CTSO qualification test report.

j. Nameplate drawing with the information required by paragraph 4 of this CTSO.

k. List of all drawings and processes (including revision level) that define the article’s design. For a minor change, follow the directions in 21.369 of CCAR-21R4. Show any revisions to the drawing list only on CAAC request.

6. Manufacturer Data Requirements.

Besides the data given directly to the authorities, have the following technical data available for review by the authorities:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO.

b. Equipment calibration procedures.

c. Corrective maintenance procedures within 12 months after CTSOA.

d. Schematic drawings.

e. Wiring diagrams.

f. Material and process specifications.

g. Results of the environmental tests conducted per paragraph 3.c of this CTSO.

7. Furnished Data Requirements.

If furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy data in paragraphs 5.a through 5.f of this CTSO. Add any other data needed for the proper installation, certification, use, or for continued airworthiness, of the crewmember portable PBE .

8. Availability of Referenced Documents.

a. Order SAE documents from:

Society of Automotive Engineers, Inc.

400 Commonwealth Drive, WARRENDALE, PA 15096-001, USA.

You may also order them online from www.sae.org.

b. Order RTCA documents from:

Radio Technical Commission for Aeronautics, Inc.

1150 18th Street NW, Suite 910, Washington D.C. 20036.

You may also order them online from www.rtca.org.

APPENDIX 1. MPS FOR CREWMEMBER PORTABLE PBE

The applicable standard is SAE AS 8047, Performance Standard for Cabin Crew Portable Protective Breathing Equipment for Use During Aircraft Emergencies, dated June 2002. It is modified as follows：

SAE AS 8047citation	**Modification**
Section 1.1 Scope:	Disregard.
Paragraph 2.1 Applicable Documents:	Add the following documents: AS 8026A, Crewmember Demand Oxygen Mask for Transport Category Aircraft AS 1303A, Portable Chemical Oxygen Revise the following to read: CCAR-121R4, Rules on operation certification on large aircraft commercial transport operation CCAR-25R4, Part 25, Airworthiness Standards: Transport Category Airplanes AS 8010C, Aviator’s Breathing Oxygen Purity Standard AS 8031A, Personal Protective Devices for Toxic and Irritating Atmospheres, Air Transport Crew Members CTSO-C99a, Protective Breathing Equipment CTSO-C69c, Emergency Evacuation Slides, Ramps and Slide/Ramp Combinations ASTM D1149, Standard Test Method for Rubber Deterioration Surface Ozone Cracking in a Chamber ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers ASTM D750, Standard Test Method for Rubber Deterioration Using Artificial Weathering Apparatus ASTM D228, Abrasion Resistance ASTM D1922-REVA, Standard Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method ASTM D1004, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting ASTM D2582, Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.

SAE AS 8047citation	Modification
Paragraph 3.1.1	Add the following paragraphs: 3.1.1 Unit must be a self-contained device, (containing a supply or source of breathable gas) which will not increase the risk to the user or the aircraft during storage or use, and must satisfy the applicable sections of 25.1439 and 121.337. 3.1.1.1 Breathable gas source may be either oxygen or air. 3.1.1.2 Use of a chemical oxygen generator is an acceptable alternative. 3.1.1.3 Breathable gas must meet the gas standard for purity, SAE AS8010 Rev C, Aviator's Breathing Oxygen Purity Standard. For air, comply with the purity standards in AS 8010C Table 2, Constituent Maximum Concentrations for Chemical Oxygen. Use Type IV chemically-generated oxygen for emergency-use.
Paragraph 3.1.2	Revise to read: 3.1.2 Portable PBE unit must adequately protect any adult (within the 5th percentile female [107 lbs,11.1 inch neck circumference] to 95th percentile male [220 lbs,16.4 inch neck circumference] body dimensions), including spectacle users. To demonstrate compliance with spectacles, eyeglasses must be a minimum of 152mm (6inches) wide by 51mm (2 inches) high. 3.1.2.1 Facepiece designers should consider extremes of Naison-Menton, Bizygomatic, Bigonial and Naison-Supramentale measurements and other applicable anthropometric data to provide a device with adequate fit. Sources of data are listed in paragraph 2. 3.1.2.2 Include limitations/recommendations for using portable PBE with long hair and/or beards in the IM/CMM (required in paragraph 5.b of this CTSO), which is furnished with the manufactured units. 3.1.2.3 Size of the portable PBE unit when donned must allow the wearer to pass through any access opening 18 inches (460mm) x 18 inches (460mm) to investigate and/or combat an in-flight fire.
Paragraph 3.1.4	Revise to read: 3.1.4 Failure of the unit to operate or to cease operation must be apparent to the user. This must be accomplished with aural and/or visual warning that also must activate at gas supply exhaustion.
Paragraph 3.1.5	Disregard. Reference to gas standard is now in paragraph

SAE AS 8047citation	Modification
	3.1.1.3.
Paragraph 3.1.6	Revise to read: 3.1.6 Unit must not cause a hazard when stored, in use, or during inadvertent operation.
Paragraph 3.1.8	Revise to read: 3.1.8 Portable PBE unit must have a 98% minimum reliability factor at 90% confidence level during its design service life. A shelf life, operational limit and/or maintenance interval must be established an included in the CMM.
Paragraph 3.1.10	Revise to read: 3.1.10 Portable PBE must wear comfortably in use leaving both hands free. It must not displace during normal tasks of locating and combating a fire, such as crawling, kneeling or running.
Paragraph 3.1.11	Revise to read: 3.1.11 Hoods, Full Face Masks with Lenses, and/or Integral Goggles: 3.1.11.1 Range of Vision: Portable PBE must 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. 3.1.11.2 Fogging: Design the portable PBE to minimize moisture condensation on the inside surface or include a means of preventing or removing any moisture that may condense on surfaces during use.
Paragraph 3.1.12	Revise to read: 3.1.12 Portable PBE must allow intelligible two-way communication, including the use of airplane interphone (handset or microphone) and megaphone. User must be able to communicate with another user or nonuser at a distance of at least four meters. Use a background noise of 65db and a user communication sound level of 85db or equivalent method.
Paragraph 3.1.15	Add new paragraph to read: 3.1.15 Material used to fabricate the unit must be puncture/tear resistant.
Paragraph 3.2.1	Revise to read: 3.2.1 Average inspiratory limits must be within the

SAE AS 8047citation	Modification
	following: Carbon dioxide concentration level at mouth/nose must not exceed 4 percent at sea level. Concentration may increase to 5 percent at sea level for a period not to exceed 2 minutes. Carbon monoxide level must not exceed 50 ppm, time weighted average. Chloride level must not exceed 1 ppm, time weighted average.
Paragraph 3.2.2	Revise to read: 3.2.2 When a user puts on portable PBE, the unit must be selfpurging by enough breathable gas to ensure one complete dead volume displacement within 20 seconds of initial operation.
Paragraph 3.2.3	Revise to read: 3.2.3 Portable PBE must protect the user against toxic fumes and smoke. Use the test procedures in AS 8031A. You may use an alternative challenge gas. We don’t accept aerosols, such as sodium chloride (NaCl) or corn oil as an alternative. Component sensitivity to particle size and the potential to precipitate on the unit surface make aerosols unacceptable to measure a contaminant protection factor. User’s eyes, nose, and mouth must be protected to 0.05 mean contaminant protection factor during the work profiles specified in paragraph 3.2.4.
Paragraph 3.2.4	Revise first sentence to read: 3.2.4 Portable PBE must provide the minimum required protection for the following work profiles, at an ambient 70°F (21.1°C) for the intended population (generally 107 to 220 lb).
Paragraph 3.2.5	Revise to read: 3.2.5 Internal temperature of the portable PBE must not exceed 104°F (40°C) wet bulb at an ambient temperature of +70°F (21.1°C).
Paragraph 3.2.6	Revise to read: 3.2.6 Portable PBE must function satisfactorily in a 212°F (100°C) environment, where the internal temperatures must not exceed 122°F (50°C) wet bulb for a 2-minute exposure.
Paragraph 3.2.9	Revise to read: 3.2.9 Portable PBE must operate at a mean positive pressure and incorporate a relief valve(s) to prevent over-pressurization

SAE AS 8047citation	Modification
Paragraph 3.2.10	Revise to read: 3.2.10 Portable PBE must support peak flows of 250 liters per minute (LPM) and must be capable of supporting a minute breathing minute volume of 80 liters for a 30 second period at any time throughout its operation.
Paragraph 3.2.11	Revise to read: 3.2.11 Portable PBE must be easily put on and activated, after the user gains access to the stowed unit within 15 seconds. Design unit so it can be donned and worn by users wearing eyeglasses, as specified in paragraph 3.1.2. Unit face must not displace eyeglasses or be flexible enough to allow adjustment of eyeglasses.
Section 4.	Disregard entire section. Paragraphs have been incorporated in paragraph 3, technical requirements, and paragraph 6.2 below, flammability.
Paragraph 6.	Revise title to read: TESTING PROCEDURES
Paragraph 6.1	Revise first sentence to read: Manufacturer of the portable PBE is responsible for performing the required tests in paragraph 3.2 to verify its performance.
Paragraph 6.2	Disregard. Find marking requirements in paragraph 4 of this CTSO.
Paragraph 6.2	Add a new paragraph to read: 6.2 FLAMMABILITY. All materials used in the portable PBE and any stowage container/case (including insulation on electrical wires) in a typical installed arrangement must be self-extinguishing. Materials must comply with 25.853(a) specifically Appendix F Part I (a)(1)(iv) in CCAR-25R4. 6.2.1 Any exposed portions of the portable PBE and stowage container/case must withstand a radiant heat flux of 1.0 BTU/ft² per second for 60 seconds, and remain functional when exposed to it. 6.2.2 Radiant heat flux source must be of sufficient size so the portable PBE, any stowage container/case, and exposed parts of the unit are exposed in a manner that creates the heat flux at all the surfaces, in a typical as installed arrangement. 6.2.3 Portable PBE must protect the user’s head and neck from dripping 392°F (200°C) plastic materials and withstand an 1832°F (1000°C) flame for 5 seconds without material penetration while operating. 6.2.3.1 Protection from dripping plastic material may be

SAE AS 8047citation	Modification
	tested by several methods. One is to ignite a polypropylene rod and allow the drops to impinge on the various external materials, seams, and transparency. Adjust the drop height so that the drop contact temperature is at least 392°F (200°C). 6.2.3.2 The 5-second 1832°F (1000°C) test is meant to protect a crewmember wearing the portable PBE from an unexpected flame lick. Two main concerns are failure of the unit that would injure the wearer, and leakage of the breathable atmosphere that could produce an explosion or hazard. The test rig must expose the unit, while operating, to an 1832°F (1000°C) flame envelope. One company has used German Teklu burners with a flow rate of about 21 liters per minute. Adjust the flow rate and distance of the burner to the surface of the PBE unit being tested to obtain the required temperature. In most cases the flame plume developed will not expose the complete unit. You can pass a segment through the flame plume to obtain the 5-second exposure period and then rotate it to the next segment and pass it through the flame plume, and so forth, until the complete unit has been tested. Making a visual (videotape) record of this test might be useful documentation, in addition to the measured parameters. 6.2.4 Heat Release and Smoke Density. Exposed panels/surfaces totaling more than one square foot in surface area must meet the heat release and smoke density requirements of 25.853 and Appendix F, Parts IV and V. Find guidance on these test requirements in the Materials Fire Test Handbook, DOT/FAA/AR-00/42. 6.2.5 Battery Qualification. If the equipment uses a lithium battery as a power source, battery must meet the applicable battery standards: 6.2.5.1 CTSO-C142a, Non-Rechargeable Lithium Cells and Batteries (see RTCA, Inc. document RTCA/DO-227, Minimum Operational Performance Standards for Lithium Batteries, dated June 23, 1995), or most current revision. 6.2.5.2 CTSO-C179a, Rechargeable Lithium Cells and Lithium Batteries (see UL 1642, Standard for Safety for Lithium Batteries, fourth edition, dated September 19, 2005).
Paragraph 6.3	Add a new paragraph to read: 6.3 Environmental Qualification.

SAE AS 8047citation	Modification
	6.3.1 High Temperature Exposure: Soak the portable PBE for 12 hours at not less than 160º F (71.1º C). Then transfer the PBE to 70ºF (21.1ºC), ambient temperature. Within 30 minutes of doing this, test the portable PBE to the requirements of paragraph 3.2. 6.3.2 Low Temperature Exposure: Soak the portable PBE device for 2 hours at not greater than -65ºF (-54ºC). Then transfer the PBE to 0ºF (-17.8ºC) for 2 hours to stabilize it. After this, transfer the PBE to 70ºF (21.1ºC), ambient temperature. Within 30 minutes of doing this, test the portable PBE to the requirements of paragraph 3.2. 6.3.3 Operational Shock: Comply with the test requirements in RTCA DO-160F, Section 7, paragraph 7.2. 6.3.4 Humidity: Comply with the test requirements in RTCA DO-160F, Section 6, Category A. 6.3.5 Waterproofness: Comply with the test requirements in RTCA DO-160F, Section 10, Category R. 6.3.6 Fungus Resistance: Comply with the test requirements in RTCA DO-160F, Section 13, Category F. 6.3.7 Decompression (Class 2 only): Devices covered by this document must meet the requirements of paragraph 3.2 when subjected to decompression testing.