SAE Aerospace
An SAE International Group

AEROSPACE RECOMMENDED PRACTICE

SAE ARP4287

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Automatic Presentation of Supplemental Oxygen Masks

RATIONALE

ARP4287 has been reaffirmed to comply with the SAE five-year review policy.

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1. SCOPE:

This SAE Aerospace Recommended Practice (ARP) provides design, operation, construction, test and installation recommendations for equipment that automatically presents supplemental oxygen masks to cabin occupants in the event of loss of cabin pressure. It specifically covers automatic presentation for transport category aircraft that operate above 30,000 ft (9144 m) altitude, although it also provides guidance for similar equipment used in non-transport category aircraft, or aircraft operated below 30,000 f (9144 m) altitude.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

ARP1176	Oxygen Systems and Component Cleaning and Packaging
AIR1133	Chemical Oxygen Equipment
AIR1390	Convenient Location of Oxygen Masks for Both Crew and Passengers of Aircraft
ARP1398	Testing of Oxygen Equipment
AS916	Oxygen Flow Indicators
AS1304	Continuous Flow Chemical Oxygen Generators
AS8010	Aviators Breathing Oxygen Purity Standard
AS8025	Passenger Oxygen Mask

2.1.2 RTCA Documents: Available from Radio Technical Commission for Aeronautics Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, DC 20036.

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

2.2 Related Publications:

The following publications are provided for information purposes only and are not a required part of this SAE Aerospace Technical Report.

2.2.1 FAA Publications: Available from Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

FAR 25/JAR 25	Airworthiness Standards: Transport Category Airplanes
FAR 121	Air Carriers and Commercial Operators of Large Aircraft
FAR 135	Air Taxi Operators and commercial Operators
FAA TSO-C64a	Oxygen Mask Assembly, Continuous Flow, Air Carrier Aircraft

3. DEFINITIONS:

3.1 SUPPLEMENTAL OXYGEN MASKS:

Devices that supply supplemental oxygen to the cabin occupants. In FAR 25, the supplemental oxygen delivery device is called “oxygen dispensing unit”. The most commonly used oxygen dispensing unit is an oronasal mask (the term ”mask” is used in this document for simplicity). However this term is also intended to include any other device that satisfies the oxygen dispensing requirement.

3.2 CABIN OCCUPANTS:

Passengers and flight attendants. This document does not apply to supplemental oxygen equipment used by flight deck crew members.

3.3 PRESENTATION:

Making the masks immediately accessible to the cabin occupants either by deploying them from their stowage location or by leaving them in their stowage location and making them visible and obtainable to the cabin occupants.

3.4 AUTOMATIC PRESENTATION:

Masks are presented without requiring any action by the cabin occupants.

3.5 EQUIPMENT:

The components, sub-assemblies and structures necessary to house and automatically present the masks.

3.6 TYPES:

This recommended practice covers, but is not limited to, the following types of automatic mask presentation equipment:

3.6.1 Type I Equipment, Gaseous Oxygen.

3.6.2 Type II Equipment, Chemical Oxygen.

4. REQUIREMENTS:

4.1 General Function:

The presentation equipment shall automatically present the masks in the event of a cabin decompression. The masks and their associated oxygen supply shall deliver supplemental oxygen to the cabin occupants at the rate and duration required by the applicable airworthiness requirements.

4.2 Type I and Type II Equipment:

The equipment normally consists of:

a. An oxygen supply which may be self-contained or may be delivered to the equipment from a remote source.

b. Oxygen masks connected to the oxygen supply.

c. A container or enclosure to hold the masks and other components that can be automatically opened to present the masks.

d. A means to initiate oxygen flow to the masks.

e. Mounting provisions for adequately securing the equipment.

f. Manual means to present the masks.

4.3 Interchangeability:

All parts having the same part number shall be completely interchangeable as regards form, fit and function.

4.4 Materials:

4.4.1 Compatibility with Oxygen: Those materials that contact oxygen shall be compatible with oxygen. Materials that contaminate oxygen shall not be used.

4.4.2 Corrosion Resistance: Materials not inherently corrosion resistant shall receive protective treatment. Dissimilar metals shall not be in contact with each other unless suitably protected against electrolytic corrosion.

4.4.3 Cleaning: Exposed surfaces shall be capable of being cleaned with approved agents without deterioration. Surfaces that contact oxygen shall be cleaned in accordance with ARP1176 or equivalent.

4.4.4 Facepiece: Materials used in the mask that contact the skin when worn shall be non-irritating and non-allergenic.

4.4.5 Odors: Materials that are in contact with the breathing gases shall be free of objectionable odors.

4.5 Construction:

4.5.1 General: The equipment and components shall be constructed of materials suitable for the intended application.

4.5.2 Workmanship: The workmanship of the equipment and the components shall exhibit the high quality representative of the aircraft industry.

4.5.3 Environment: The design and construction of the equipment and the components shall withstand the environments and conditions to which they will be exposed in service.

4.6 Flammability:

All materials used in the equipment shall comply with the applicable sections of FAR 25.853.

4.7 Operation:

4.7.1 Presentation Requirement: The equipment shall automatically present the mask to each passenger and flight attendant before the cabin pressure altitude reaches 15,000 ft (4572 m).

4.7.2 Presentation Methods: Mask presentation may be accomplished by automatically opening the door on the equipment which allows the masks to deploy or by making them visible and available when still stowed in or attached to the equipment.

4.7.2.1 Mask Presentation Locations: When presented, the masks must be within reach of each seated and belted passenger and flight attendant in accordance with AIR1390.

4.7.2.2 Mask Deployment: Masks automatically presented by deployment, must fall reliably from the container to the desired presentation position. In some installations, a deployed flag or streamer may be employed to bring the mask within reach of the user.

4.7.2.3 Mask Presentation: When multiple masks are presented, the oxygen supply tubes and actuation lanyards (if applicable), should not prevent acceptable presentation of the masks to the users and shall not prevent initiation of oxygen flow to the users. The cabin occupants should not be confronted with a confusing array of masks.

4.7.3 Door Opening: Automatic door opening may be accomplished by electrical operation of a door release device (such as a solenoid latch) or pneumatic operation using the gaseous oxygen supply, or by other reliable means.

4.7.4 Oxygen Availability: For both equipment types, oxygen shall be readily available to the equipment at the time of the cabin decompression and reach the required full flow in no more than 10 s after flow initiation.

4.7.4.1 Type I Equipment: For gaseous oxygen equipment, "immediately available" means gaseous oxygen shall be delivered to the masks at the required pressure before the cabin pressure altitude reaches 15,000 ft (4572 m).

4.7.4.2 Type II Equipment: For Type II equipment, "immediately available" means the chemical oxygen generators reach the specified flow within 10 s after generator initiation.

4.7.5 Oxygen Flow Initiation: Oxygen flow to each mask can be initiated by the cabin occupant when he/she pulls the mask to his/her face, or oxygen flow initiation can be simultaneous with mask presentation (not requiring cabin occupant initiation).

4.7.5.1 User Initiated Oxygen Flow: For equipment in which oxygen flow is initiated by the user by the act of drawing the mask towards his/her face, the masks shall be presented in a manner such that they shall not reach the face of a seated and belted cabin occupant's face without actuating the flow (Reference AIR1390).

4.7.5.2 Automatic Oxygen Flow: Presentation equipment that automatically supplies oxygen to each mask without manual initiation shall not represent a hazard in the event the door fails to open automatically.

4.7.6 Manual Door Opening: The equipment shall have a manual means for the flight attendants to access the mask compartment and present the masks should the automatic system fail. The manual means also allows the door to be opened for inspection of the internal components during maintenance operations.

4.7.7 Effect of Failure: Failure or malfunction of the presentation equipment shall not create a hazard to the cabin occupants or to the aircraft.

4.7.8 Oxygen Flow Rates: The equipment shall be capable of supplying oxygen to each mask at the rates compatible with the specific mask and the cabin emergency descent profile for the aircraft in which the equipment is installed.

4.7.9 Integration: It shall be the joint responsibility of the equipment manufacturer and the airframe manufacturer to demonstrate by test, analysis and/or similarity, that the presentation equipment meets the performance requirements as installed. This should include verification of the compatibility of the equipment with the aircraft.

4.8 Type I Equipment, Gaseous Oxygen:

Gaseous oxygen equipment may have unique performance and/or design requirements.

4.8.1 Gaseous Oxygen Source: Type I presentation equipment may be connected to a central gaseous oxygen distribution network or localized supplies of gaseous oxygen.

4.8.2 Proof and Burst: Each pressurized component and fitting must withstand as a minimum, proof and burst pressures of 1.5 and 3.0 times, respectively, the maximum operational pressure.

4.8.2.1 Burst Protection: Components exposed to greater than 3 MPa (400 psi) oxygen must be suitably protected from rupture unless it can be shown that the complete device has a sufficient design margin to prevent rupture.

4.8.2.2 Leakage: The design and sealing methods should minimize oxygen leakage in the operational and non-operational modes.

4.8.3 Valves: Equipment designed to initiate oxygen flow when the mask is pulled to the user's face may have a common valve for multiple masks or individual valves for each mask.

4.8.3.1 Specific Mask Flow: On equipment where oxygen flow is initiated by pulling the masks to the user's face, the equipment shall ensure flow to the masks being used.

4.8.3.2 Tamper Resistance: Flow initiation valves which are designed to allow the flight crew to shut off flow to individual masks or multiple masks, shall be resistant to accidental shutoff or passenger tampering during the decompression emergency.

4.8.4 Door Release: The doors on Type I equipment are typically released by latches that are pneumatically actuated by increasing the pressure in the oxygen supply, although solenoid actuation latches or other suitable methods may be used.

4.8.4.1 Release Pressure: Pneumatically operated latches must operate at all anticipated line pressure conditions including the effects of reduced cabin pressures and line pressure losses that could occur due to high flows during distribution line filling.

4.8.4.2 Surge Pressure: Type I equipment may be designed to work with an oxygen supply system having a short duration surge pressure (higher pressure) to ensure the pneumatic latches operate reliably.

4.8.5 Maximum Oxygen Flow: For minimum system weight and oxygen conservation, it is preferable that the oxygen flow be limited while still complying with the minimum requirement for the masks used.

4.8.5.1 Oxygen Flow Control: The oxygen flow may be metered by varying the oxygen pressure supplied to the presentation equipment. Alternatively, constant oxygen pressure can be supplied to the equipment and then an internal variable pressure device would meter the flow to the masks.

4.9 Type II Equipment, Chemical Oxygen:

Chemical oxygen equipment may have unique performance and/or design requirements.

4.9.1 Generator Location: Type II presentation equipment may contain a chemical oxygen generator, or the generator may be located sufficiently close to the mask stowage container to allow reliable initiation of the chemical oxygen generator.

4.9.2 Flow Initiation: Oxygen flow can be initiated by pulling the masks to the user's face or by automatic initiation (e.g., electrical squib or other means).

4.9.2.1 User Initiation: If initiation is achieved by pulling the mask, each mask associated with a given generator must be connected such that pulling any one of them will initiate oxygen production.

4.9.3 Passenger Protection: Chemical generators create heat, therefore, adequate means should be provided to prevent the passenger from contacting the hot surface of the chemical generator when activated.

4.9.4 Thermal Protection: Suitable means must be provided to protect other oxygen dispensing equipment components from heat released by the generator. Also, the installation or design of the equipment itself shall be such that adjacent aircraft components will not be adversely affected by the heat released by the generator.

4.9.5 Oxygen Flow Profile: The chemical generator shall provide at least the minimum required amount of oxygen flow to each mask in compliance to the cabin altitude descent plan of the aircraft.

4.9.6 Purity: The oxygen produced by the chemical generator must comply with purity standard AS8010.

4.9.7 Burst Protection: Each chemical oxygen generator shall be suitably protected from burst considering both pressure and temperature.