AEROSPACE INFORMATION REPORT

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Superseding AIR1390A

Convenient Location of Oxygen Masks for Both the Crew and Passengers of Aircraft

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

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FOREWORD

Changes in this revision are format/editorial only.

INTRODUCTION

The purpose of this document is to provide basic guidelines for use by aircraft interior designers so that oxygen masks connected to oxygen supply systems and oxygen masks made available for use by passengers and crew members are readily accessible and the total system utilized in the event the necessity arises for use of oxygen during flight operations.

1. SCOPE:

   There are four basic conditions requiring the dispensing of oxygen through oxygen masks to aircraft occupants in turbine powered aircraft during flight.

   The following conditions are derived from the Federal Aviation Regulations (FAR) as listed in Section 2.

   Condition 1: When the mission of the pressurized aircraft or the operational flight capability is in excess of flight level 300...

   All cabin occupants must be serviced by an automatic oxygen mask presentation system connected to an operational oxygen source which is activated automatically and/or oxygen flow initiated by the occupant displacing the actuating mechanism when pulling and placing the mask in position on his face in the event of an emergency pressurization failure. An additional 10% of oxygen masks and outlets are to be provided, uniformly distributed throughout the cabin of the aircraft.

   Masks, attached to an operational oxygen source and immediately available (ready position), must be provided each flight deck crew member. Observers must have emergency oxygen, either passenger or crew type.

1. (Continued):

Condition 2: When the mission of the pressurized aircraft or the operational altitude of the aircraft is not in excess of flight level 300, but above flight level 250...

Oxygen masks which are stowed connected to an oxygen supply and can be obtained immediately by each cabin occupant wherever seated when the aircraft is operating above flight level 250, must be available in the event of an emergency pressurization failure.

Demand masks, connected to an operational source, must also be immediately available and within easy access of each flight deck crew member. Observers must have emergency oxygen, either passenger or crew type.

Condition 3: When the mission of the pressurized aircraft or the operational altitude of the aircraft is between 10,000 feet and flight level 250...

Oxygen masks, which have been distributed or are stowed and are readily accessible to each cabin occupant when the aircraft is operating above 10,000 feet, must be available in the event of an emergency pressurization failure.

Oxygen masks, connected to an operational source, must also be available and within easy access of each flight deck crew member and observer.

Condition 4: When the mission of a non-pressurized aircraft is operating above 12,500 feet...

Oxygen masks which can be connected to an operational oxygen source must be available and distributable to all occupants of the aircraft during such flight operations.

This document defines the accessibility requirements which should be considered in the placement of oxygen masks for presentation to the user and the connections for such oxygen masks to the operational oxygen systems. This is of interest when designing the interior of the aircraft, placing the seats in relationship to such outlets and mask connections, or placing oxygen mask outlets in relationship to the seats.

Certain Federal Aviation Regulations (FAR's) cover the functional characteristics and requirements of the oxygen systems for aircraft in the mission and operational categories defined above. These should be referred to for the exact functional performance requirements. It is not the intent of this document to insure conformance with these regulations, but only to recommend general concepts for the location of the oxygen masks and oxygen system outlets for proper accessibility by the aircraft occupants, whether cabin occupants or crew members. Nor does this document provide any technical information for oxygen system design or function. Please refer to other SAE documents for such information.

2. REFERENCE DOCUMENTS:

2.1 Government Documents:

FAR Part 25	Airworthiness Standards, Transport Category Aircraft
FAR Part 121	Certification and Operations: Domestic, Flag and Supplemental Air Carriers and Commercial Operators of Large Aircraft
FAR Part 91	General Operating and Flight Rules
FAR Part 23	Airworthiness Standards: Normal, Utility and Acrobatic Category Airplanes

TSO Authorizations

TSO-C64	Oxygen Mask Assembly, Continuous Flow, Passenger (For Air Carrier Aircraft)
TSO-C78	Crew Member Demand Oxygen Masks
TSO-C89	Oxygen Regulators, Demand
TSO-C99	Protective Breathing Equipment
TSO-C103	Oxygen Mask Assembly, Continuous Flow (For Non-Transport Category Aircraft)

2.2 SAE Documents:

AS452A	Oxygen Mask Assembly, Demand and Pressure Breathing, Crew
AIR822	Oxygen Systems for General Aviation Aircraft
AIR825	Oxygen Equipment for Aircraft
AIR847	Oxygen Equipment for Commercial Transport Aircraft Which Fly Above 45,000 ft (13,716 m)
AS861	Oxygen Systems, Minimum General Standards for
AIR1069	Crew Oxygen Requirements Up to a Maximum Altitude of 45,000 ft (13,716 m)
AIR1169	Oxygen, Effects of, on Ignition and Combustion of Materials, Bibliography of References Pertaining to
AS1194	Oxygen, Regulator, Diluter Demand, Automatic Pressure Breathing (This document supersedes and cancels in Part AS463)
AS1197	Oxygen Regulator, Continuous Flow (This document supersedes and cancels in Part AS463)
AS1224A	Continuous Flow General Aviation Oxygen Masks

2.3 Others:

FAA Technical Reports ADS-20, June 1964

3. ACCESSIBILITY TO OXYGEN MASKS AND OXYGEN SYSTEM OUTLETS FOR AIRCRAFT CABIN OCCUPANTS:

3.1 Recommendations for “Condition 1”:

When the aircraft is operated above flight level 300, masks must be automatically presented to all cabin occupants when required. These masks must be presented within reach and sight of each cabin occupant when seated with seat belt fastened as defined by Figure 1. The masks are to be presented at an appropriate altitude during the rise of the cabin pressure altitude, prior to an altitude of 15,000 ft. The masks are usually stowed in a recess area provided with a door[1] that automatically opens as a result of the function of the system and either allows the mask to fall in front of the occupant or to be presented still affixed to the door of the assembly, or be available to the occupant and readily visible to, and reachable by, the occupant in his seated position. The receptacle or storage boxes for the masks can be located overhead, in the backs of the seats, the bulkhead in front of the occupant, or in the sidewalls of the aircraft adjacent to the individual seat, depending on aircraft interior configuration.

Flow of oxygen into the mask may be started automatically at the time the masks are presented or by the occupant taking the mask from its “ready” position and placing it on his face, which activates a mechanical device initiating oxygen flow into the mask hose. In some installations, a mask may drop from a ceiling stowage box or service module to a distance within reach of the occupant, tethered by a length of hose or lanyard. The act of pulling the mask further to the face causes the hose or lanyard to activate a device in the oxygen service module, initiating flow of oxygen into the mask hose assembly. When taken from inside the door of the oxygen service module or inside the box, the same lanyard or attachment device to the dispensing mechanism starts the flow into the hose and the mask. In either case, it must not be possible for the occupant to apply the mask to the face without activating the flow mechanism. These requirements then necessitate that an area of reach of a given size occupant be defined in “reach arcs” or areas to the front, sides, and above the occupant. To obtain the dimension area in relation to the seat, a normally proportioned 5 ft (1.52 m) person has been used. Figures 1 through 3 of this document define the area into which masks should be made available in accordance with the above conditions.

Since mask accessibility is of the utmost urgency in case of a rapid decompression, under the seat or lower locations around the seat should not be considered, because of possible inconvenience, confusion and delays in obtaining the mask.

3.2 Recommendations for “Condition 2”:

Oxygen requirements for occupants under “Condition 2” are not quite so severe as at the higher altitude. It is necessary however, for the occupant’s well-being that he receive oxygen as rapidly as possible and therefore, an automatic system should be considered. It is necessary that oxygen masks be immediately available to all occupants of the cabin and that these masks be already connected to oxygen outlets which will provide appropriate oxygen flow requirements in relation to the cabin pressure altitude. The outlets must be easily accessible to each individual occupant, either

1. The door primarily protects the masks and other equipment in the mask stowage box from dirt, damage, and tampering.

in the arms of the seats, on the sidewalls of the cabin, or on the backs of the seats in front of the occupant (if not, an automatic presentation system as required for Condition 1 must be provided).

Serious considerations should be given to installing the automatic presentation-type system as suggested in “Condition 1” if the aircraft is certified for flight operations above flight level 250, because Federal Aviation Requirements necessitate that oxygen masks be distributed to occupants and be connected to the supply source during operations between flight level 250 and 300. Locations should be within the limits set forth in Figures 4 through 9.

3.3 Recommendations for “Condition 3”:

Requirements for oxygen by occupants under “Condition 3” are less physiologically stringent than those required for “Condition 2”, as the operational altitude will not exceed flight level 250. However, it is necessary that oxygen masks be available and that oxygen outlets be accessible for 100% of the occupants of pressurized aircraft operating between 12,500 feet altitude and flight level 250, and that these be easily distributable to all of the occupants in the event of a pressurization failure.

Therefore, it is required that all the oxygen outlets which are a part of the operational oxygen system, be readily visible to all occupants and well within the reach definitions defined in Figures 7 through 9 of this document.

3.4 Recommendations for “Condition 4”:

Oxygen is provided for passengers on the following schedule:

10 percent after 30 minutes at altitudes between 10,000 and 14,000 feet, 30% at altitudes between 14,000 ft and 15,000 feet, and all passengers above altitude of 15,000 ft.

All occupants must be provided with oxygen masks that may be easily connected and have hoses of sufficient length to accommodate all occupants. Reasonable locations for outlets are defined in Figures 7 through 9 of this document.

4. ACCESSIBILITY TO OXYGEN MASKS FOR AIRCRAFT FLIGHT DECK CREW MEMBERS:

4.1 Recommendations for “Condition 1”:

Pressurization loss above flight level 300 can be serious, in that the cabin pressure altitude approaches the operational altitude very rapidly. Therefore, donning the mask and immediately breathing oxygen is essential and the first step prior to any emergency procedures by crew members.

It is necessary that a crew member have easy access to an oxygen mask which is connected to an oxygen source which supplies oxygen in accordance with the cabin pressure altitude requirements to maintain his operational well-being. It is required that the crew member be able to grasp an oxygen mask of “rapid donning” design from the “ready” position with one hand and easily place the mask in proper and secure position on his face. He shall be breathing oxygen, and able to communicate within a maximum time period of five seconds from the time an indication of a pressurization failure

has occurred.

Since crew member seats are sometimes provided with adjustment in three directions...1) up and down, 2) side by side, 3) forward and reverse...the area location for ready donning, or what is termed to be in the “ready” position, is extremely important and is restricted. This area is defined in Figure 10 for the left hand side of a crew member (opposite for the right hand side of a crew member). The crew member should be keenly aware of the location of his mask and experienced in obtaining it with the proper hand-hold so that donning the mask is a “reflex” reaction.

4.2 Recommendations for “Condition 2”:

Since the operational altitude related to this condition is between flight level 250 and flight level 300, and a cabin pressurization failure is still somewhat critical, the same considerations must be given to the location in a “ready” position of the “quick donning” type mask assembly. Therefore, all crew members on flight deck duty, and the observer, should be provided with masks situated conveniently as defined in Figure 10.

4.3 Recommendations for “Condition 3”:

Operations of pressurized aircraft between 10,000 feet and flight level 250 tend to be less critical as far as the urgency for oxygen is concerned. In some cases, a different type of oxygen system for crew members is utilized if the limitation of the aircraft flight altitude is based on flight level 250. It is, however, necessary that oxygen be acquired and therefore, recommended that the oxygen mask and the operational plug-in for such mask be located conveniently on the sidewall of the aircraft and that the mask be stowed within reach so that the crew member can attach the mask and don it conveniently without moving from his seated position.

Recommended locations for the mask have not been provided as there are a considerable number of such locations around the crew member seat. It is recommended, however, that the outlet be located in an area as defined in Figures 7 through 9. The same requirements would exist for any observer within the flight operations area.

4.4 Recommendations for “Condition 4”:

When the mission of an unpressurized cabin airplane is between 10,000 feet and 12,000 feet, oxygen must be provided and used by each crew member on flight deck duty and must be provided for other crew members after 30 minutes of flight at these levels. Above 12,000 feet, oxygen must be provided for, and used by, each crew member on flight deck duty, and must be provided for all other crew members. For this reason, it is only essential that oxygen outlets be situated conveniently to the crew member in a similar location as is defined in Figures 7 through 9.

4.5 Lavatory and Cabin Attendants’ Stations:

Oxygen masks are a requirement in the lavatories of pressurized aircraft. It is recommended that two masks be available in each lavatory (to cover an adult and child). Figure 11 defines the presentation system area in relationship to the commode and also to the position of the cabin attendants’ stations.

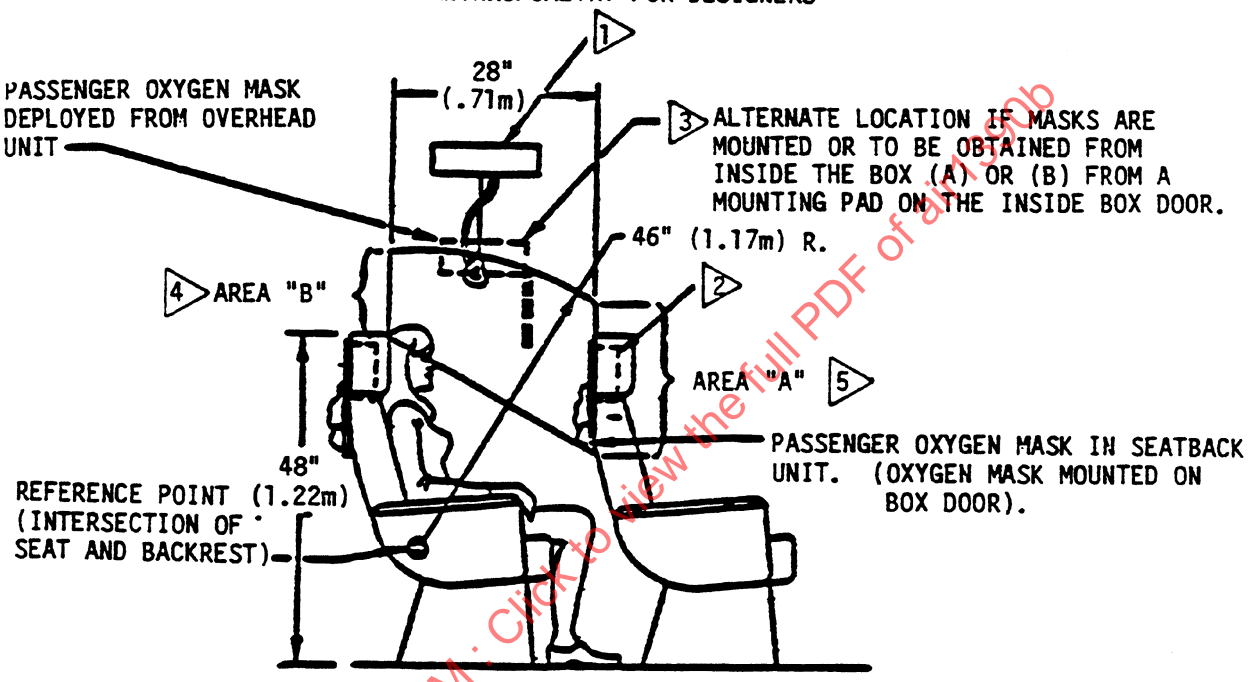
A clearly visible placard is recommended indicating the location of the oxygen mask stowage compartment in the lavatory.

INFORMATION PROVIDED HEREIN DOES NOT COVER ANY LOCATION REQUIREMENTS FOR PORTABLE OXYGEN SOURCES UNLESS SUCH PORTABLE OXYGEN SOURCES ARE UTILIZED FOR EMERGENCY DECOMPRESSION PURPOSES.

AUTOMATIC MASK PRESENTATION
ABOVE FLIGHT LEVEL 300

TYPICAL REACH DISTANCE FOR A SUBJECT 5' (1.52m) TALL

NASA REF. PUBLICATION 1024 ANTHROPOMETRIC SOURCE BOOK VOL. I,
ANTHROPOMETRY FOR DESIGNERS



NOTES:

1. LOCATION OF OVERHEAD OXYGEN CONTAINER SHOULD DEPLOY MASKS TO THE 46" (1.17m) RADIUS LINE OR BE LOCATED WITHIN THE AREA. FLOW OF OXYGEN IS ACCOMPLISHED BY PASSENGER PULLING MASK TOWARDS FACE.

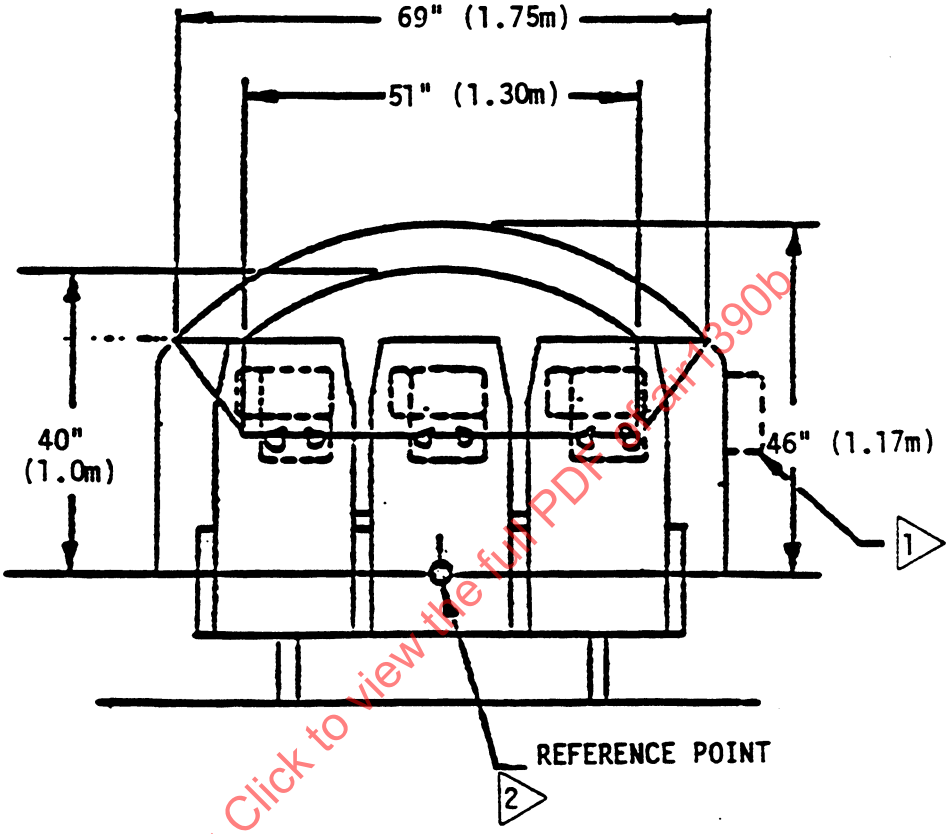
2. OXYGEN CONTAINER MOUNTED IN SEATBACK OR ON BULKHEAD, MUST PRESENT MASK WITHIN AREA "A". FLOW OF OXYGEN MAY BE ACCOMPLISHED BY PASSENGER PULLING MASK TOWARDS FACE.

3. OXYGEN MASK LANYARD, WHICH IS ATTACHED TO ACTUATION DEVICE OR ANY ALTERNATE METHOD OF INITIATING OXYGEN FLOW, MUST NOT POSITION MASK IN RELATION TO PASSENGER FACE SO IT IS POSSIBLE TO DON MASK WITHOUT ACTIVATING FLOW CONTROL DEVICE.

4. AREA "B" HEIGHT = 13" (.33m) APPROX. DEPENDING ON SEAT MANUFACTURER'S SEAT DESIGN.

5. AREA "A" HEIGHT = 18" (.46m) APPROX. DEPENDING ON SEAT MANUFACTURER'S SEAT DESIGN.

FIGURE 1



NOTES:

1. OPTIONAL LOCATION OF OXYGEN CONTAINER IN SIDEWALL FOR SINGLE OR DOUBLE SEATS ONLY.

2. REFERENCE POINT IS SHIFTABLE FOR EACH SEAT AND SHOULD BE UTILIZED FOR EACH SEAT TO DETERMINE IF MASK LOCATION IS WITHIN REACH OF PASSENGER SEATED IN EACH SEAT.

FIGURE 2

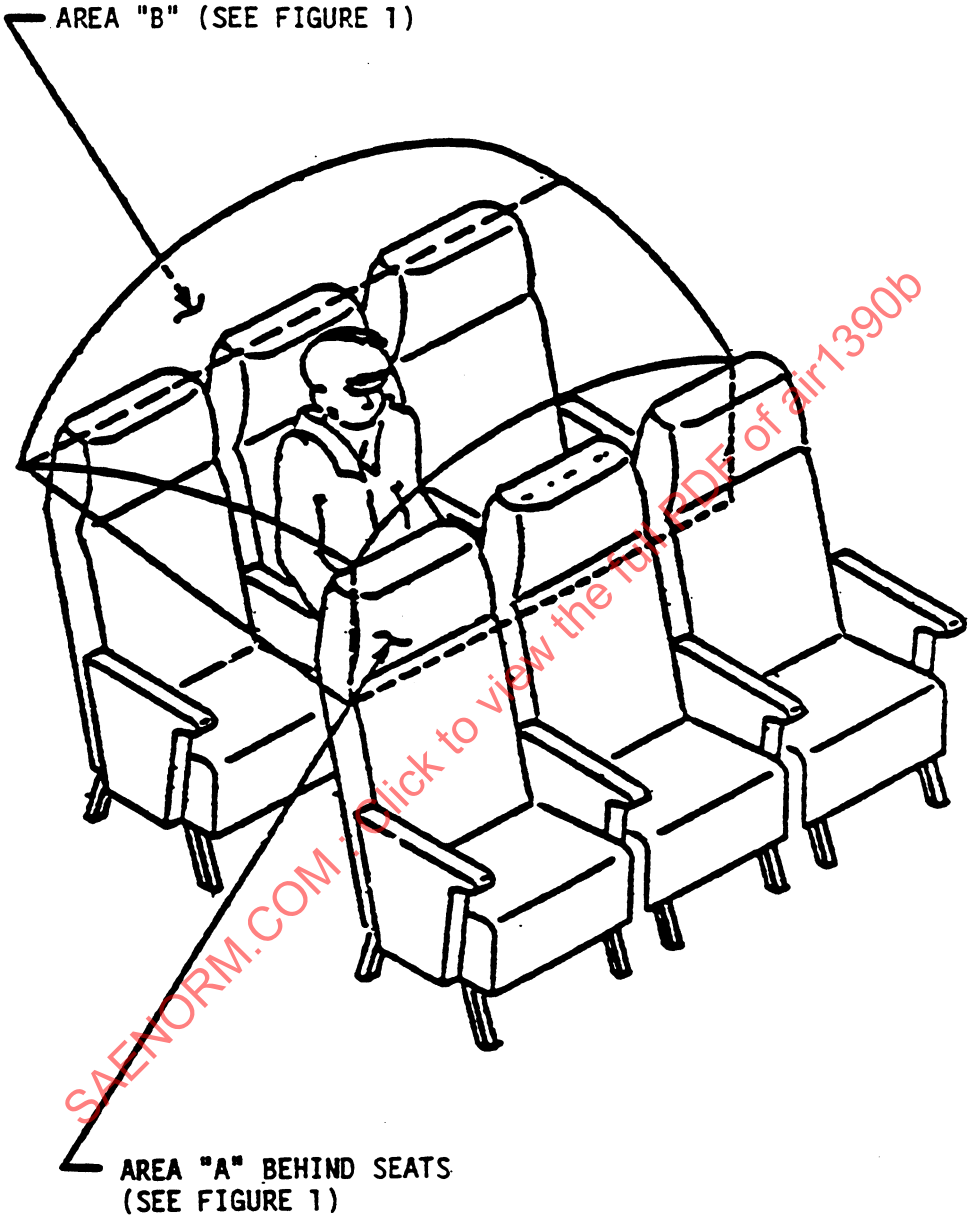
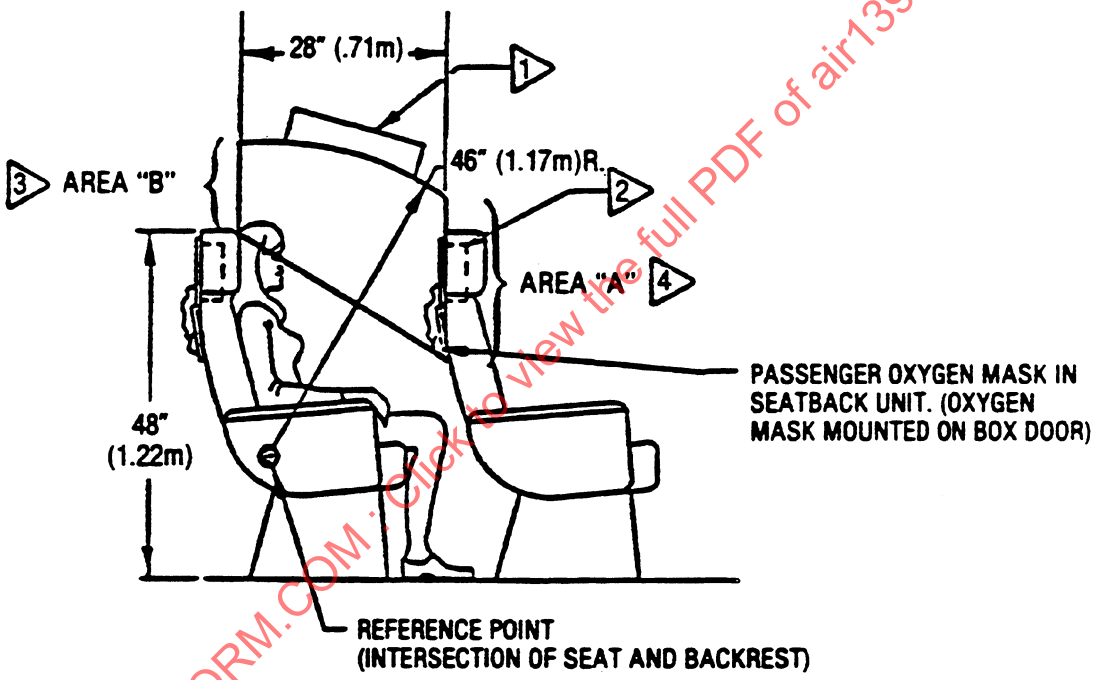


FIGURE 3

MANUAL MASK PRESENTATION
BELOW FLIGHT LEVEL 300

TYPICAL REACH DISTANCE FOR A SUBJECT 5' (1.52m) TALL

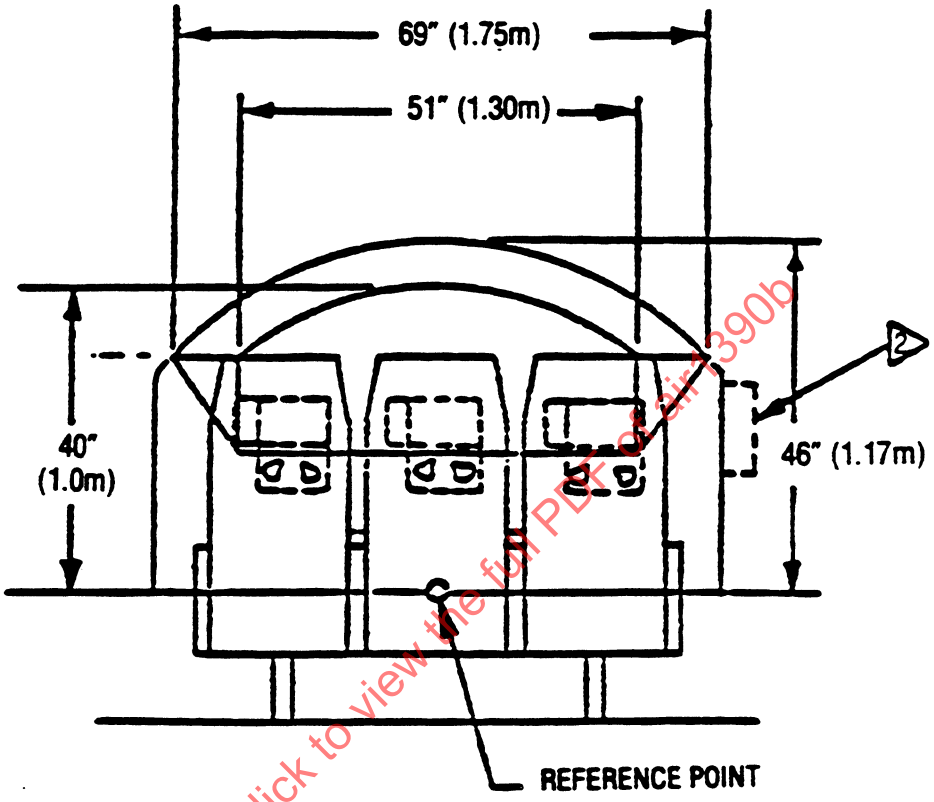
BASED ON ANTHROPOMETRIC DATA BY HENRY DREYFUSS, 1959 PUBLICATION
NASA REF. PUBLICATION 1024 ANTHROPOMETRIC SOURCE BOOK VOL I, ANTHOPOMETRY FOR DESIGNERS



NOTES:

1. OVERHEAD OXYGEN CONTAINER MUST BE LOCATED ON THE 46" (1.17m) RADIUS LINE OR BELOW. DEPLOYMENT OF MASKS WILL BE ACCOMPLISHED BY THE PASSENGER MANUALLY OPENING THE DOOR.
2. OXYGEN CONTAINER MOUNTED IN SEATBACK OR ON BULKHEAD MUST PRESENT MASK WITHIN AREA "A". DEPLOYMENT OF MASKS WILL BE ACCOMPLISHED BY THE PASSENGER MANUALLY OPENING THE DOOR.
3. AREA "B" HEIGHT = 13" (.33m) APPROX. DEPENDING ON SEAT MANUFACTURER'S SEAT DESIGN.
4. AREA "A" HEIGHT = 18" (.46m) APPROX. DEPENDING ON SEAT MANUFACTURER'S SEAT DESIGN.

FIGURE 4



NOTES:

1. DIMENSIONS APPLY TO OVERHEAD INSTALLATION.
2. OPTIONAL LOCATION OF OXYGEN CONTAINER IN SIDEWALL FOR MANUAL OPERATION. (PERSON SITTING NEAR OXYGEN CONTAINER ASSEMBLY WILL HAND MASKS TO OTHER PASSENGERS IN HIS ROW.)

FIGURE 5

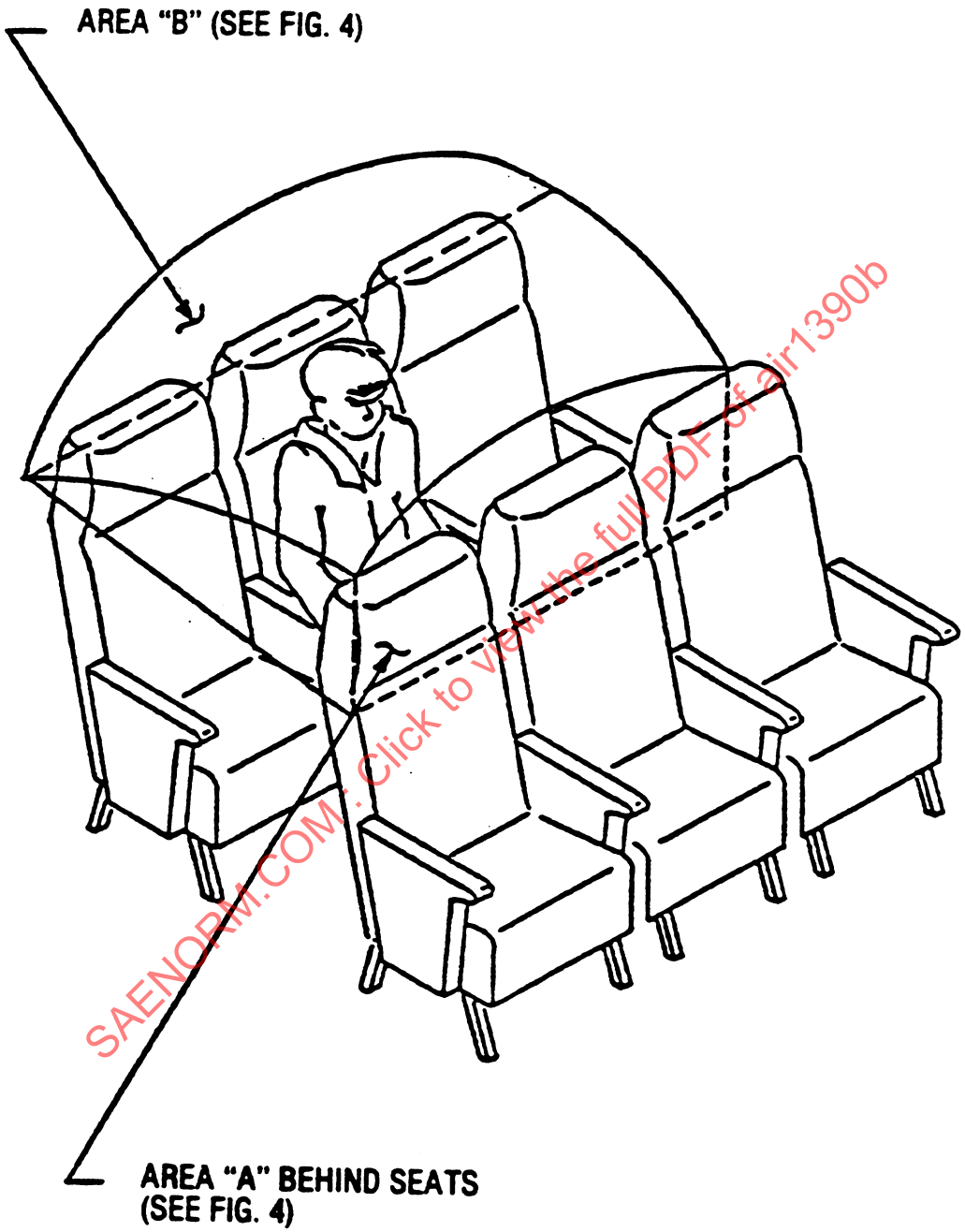
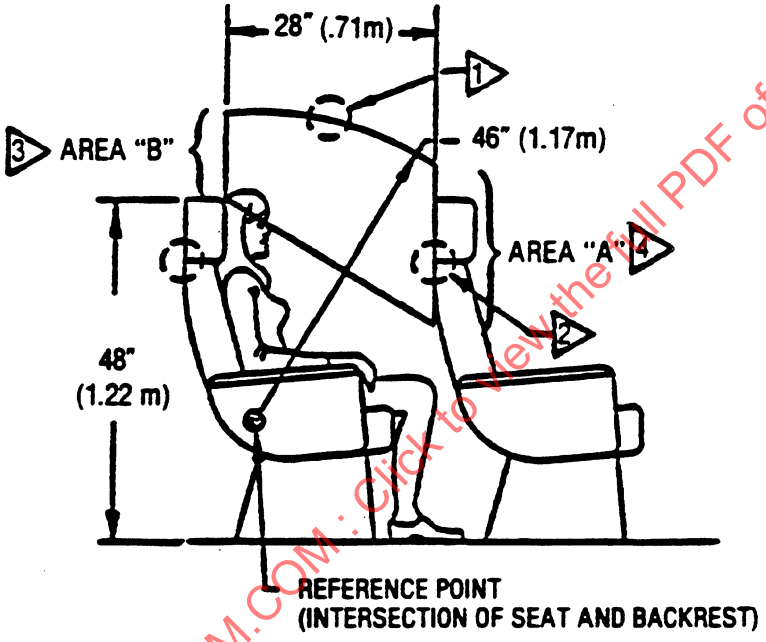


FIGURE 6

OXYGEN MASK CONNECTIONS IN NON-PRESSURIZED AIRCRAFT CABINS

TYPICAL REACH DISTANCE FOR A SUBJECT 5' (1.52m) TALL

BASED ON ANTHROPOMETRIC DATA BY HENRY DREYFUSS, 1959 PUBLICATION
NASA REF. PUBLICATION 1024 ANTHROPOMETRIC SOURCE BOOK VOL. I, ANTHOPOMETRY FOR DESIGNERS



NOTES:

1. LOCATION OF OXYGEN OUTLETS SHOULD BE ON THE 46" (1.17m) RADIUS LINE OR BELOW. FLOW OF OXYGEN IS ACCOMPLISHED BY ATTACHING THE MASK CONNECTOR TO THE OXYGEN OUTLET.
2. OXYGEN OUTLET CONNECTORS IN SEATBACK OR ON BULKHEAD MUST BE LOCATED WITHIN AREA "A". FLOW OF OXYGEN IS ACCOMPLISHED BY ATTACHING THE MASK CONNECTOR TO THE OXYGEN OUTLET.
3. AREA "B" HEIGHT = 13" (.33m) APPROX. DEPENDING ON SEAT MANUFACTURER'S SEAT DESIGN.
4. AREA "A" HEIGHT = 18" (.46m) APPROX. DEPENDING ON SEAT MANUFACTURER'S SEAT DESIGN.

FIGURE 7