

**SECTION 2-16  
OXYGEN**

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## **GENERAL**

The oxygen system is divided into two different and separate systems: a gaseous-type for crewmembers (pilot, copilot and observer) and a chemical generation-type one for passengers and flight attendants.

The crewmembers oxygen is a conventional, high pressure gaseous-type system, in which the oxygen is stored in a cylinder at high pressure and distributed at low pressure to the masks.

The passengers oxygen system is supplied through chemical oxygen generators, which is distributed through dispensing units in several different locations in the cabin.

In addition to the flight crew and passenger oxygen systems, equipment for smoke protection and fire fighting is provided both in the cockpit and in the passenger cabin.

The system is monitored so that all the necessary parameters are informed to the flight crew and flight attendants.

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## **FLIGHT CREW OXYGEN**

The flight crew is provided with oxygen through a conventional high-pressure gaseous system. The system employs a 50-cu.ft cylinder in which the oxygen is stored at high pressure (1850 psi), installed on the right side of the cockpit/passenger cabin partition, to feed the cockpit crew masks.

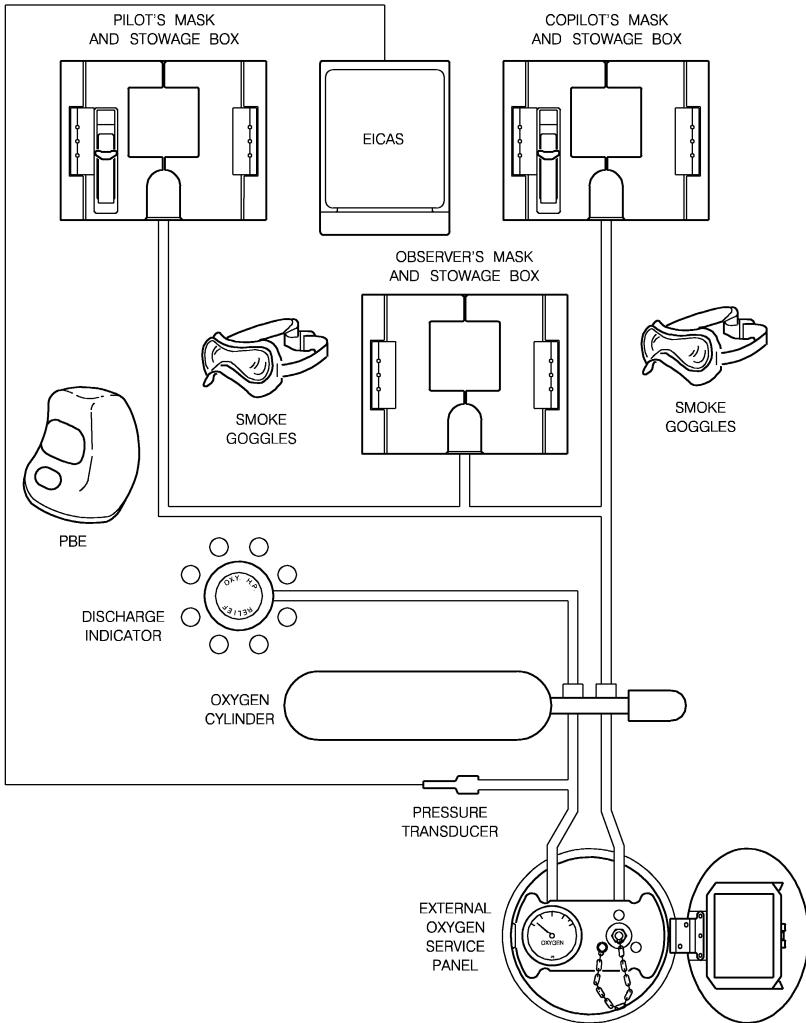
The system is protected from overpressurization by a safety disc located on the lower right side of the aircraft's nose. Discharge through the safety disc may be visually verified when the discharge indicator (green disc) has been blown out. If the cylinder pressure drops below 400 psi, a caution message is presented on EICAS.

The cylinder is provided with an integrated shutoff/regulator valve, that controls oxygen outlet pressure. The regulator valve at the ON position supplies the crew distribution lines at low pressure rate (70 psi). A relief valve opens if the pressure exceed 90 psi.

The cockpit is provided with a quick-donning diluter/demand-type mask, available inside mask stowage boxes adjacent to each crew station, and a smoke protection kit. The smoke protection kit consists of two smoke goggles to be used with the diluter/demand masks by the pilot and copilot, and one Protective Breathing Equipment (PBE) unit for fire fighting.

Two additional PBE units are also available in the passenger cabin to protect crewmembers or flight attendants from smoke during fire fighting operation.

An oxygen service panel, located on right side of the front fuselage, allows access to the oxygen cylinder and monitoring of oxygen quantity through a pressure gauge. Some airplanes may have a factory incorporated removable panel located behind the copilot's seat that provides access to the oxygen cylinder and its replacement. The cylinder pressure is also indicated on the MFD (ECS page).

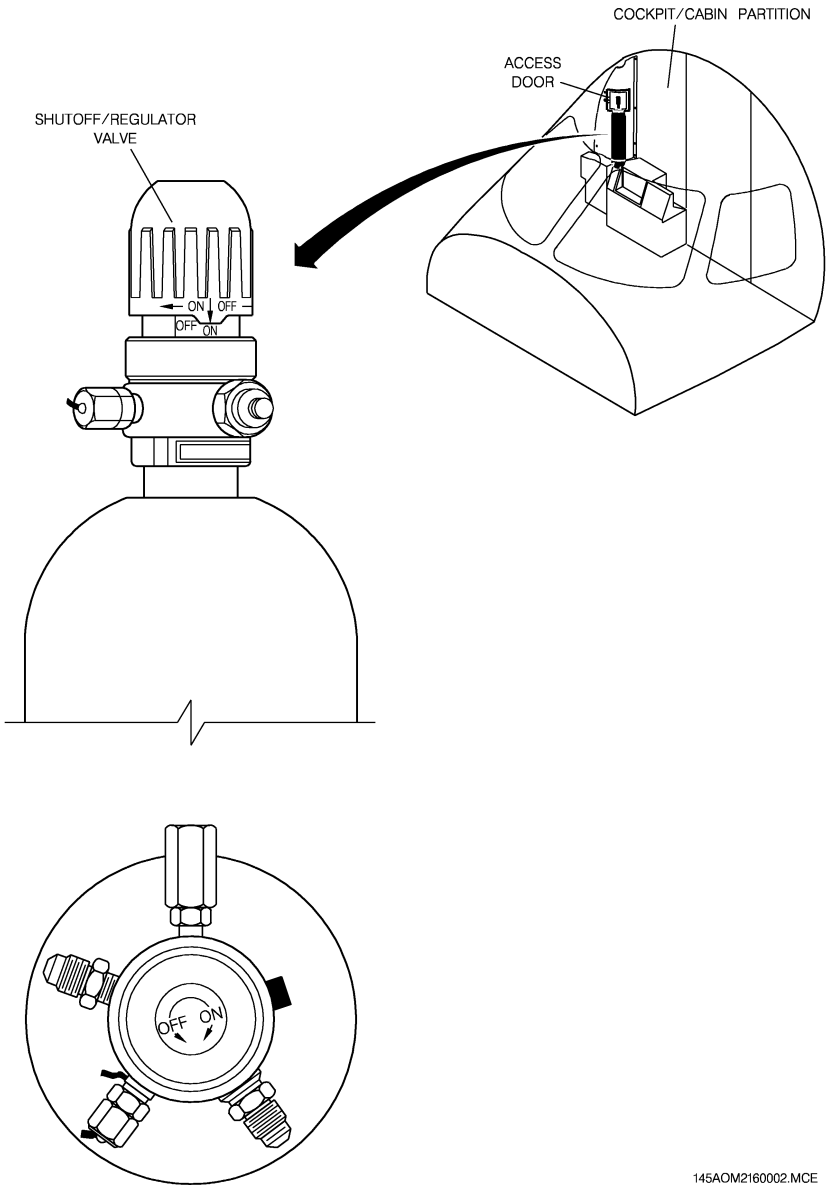


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## FLIGHT CREW OXYGEN SYSTEM SCHEMATIC

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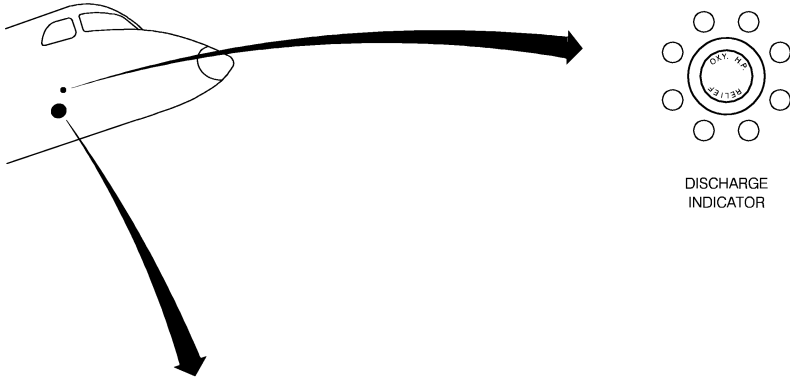
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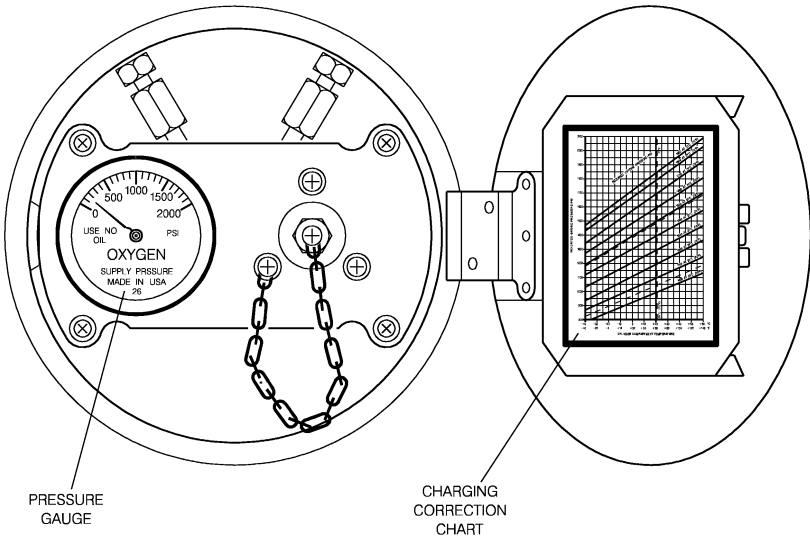
**MAIN OXYGEN CYLINDER**

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DISCHARGE  
INDICATOR



PRESSURE  
GAUGE

CHARGING  
CORRECTION  
CHART

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**OXYGEN SERVICE PANEL**

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**EICAS MESSAGE**

| TYPE    | MESSAGE         | MEANING  |
|---------|-----------------|--|
| CAUTION | OXYGEN LO PRESS | Oxygen cylinder pressure below 400 psi. Remaining oxygen sufficient for about 12 minutes for pilot, copilot, and observer. |

**ECS PAGE ON MFD**

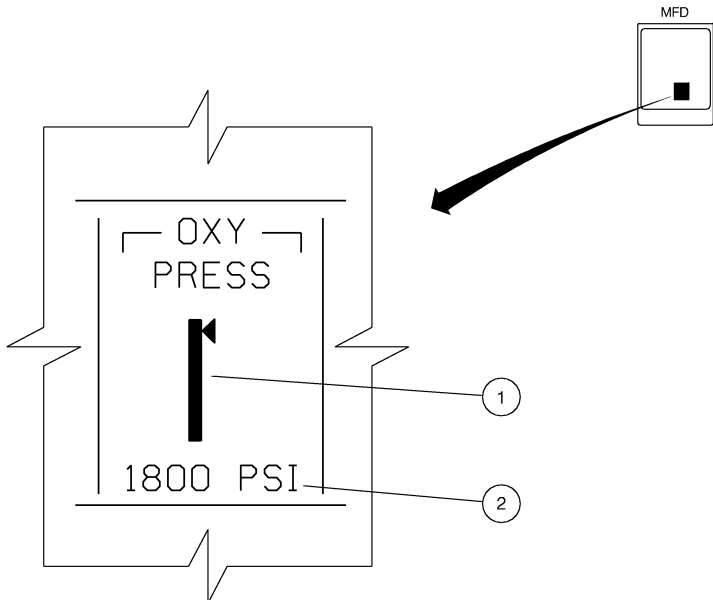
**1 - ANALOGIC OXYGEN PRESSURE INDICATION**

Pointer:

- Green between 410 to 1850 psi.
- Amber between 250 to 400 psi.
- Red between 0 to 240 psi.

**2 - DIGITAL OXYGEN PRESSURE INDICATION**

- Ranges from 0 to 1850 psi, with a resolution of 10 psi.
- Digits are green between 410 to 1850 psi.
- Digits are amber between 250 to 400 psi.
- Digits are red between 0 to 240 psi.



## CREW MASK STOWAGE BOXES

The crew mask stowage boxes are directly connected to the oxygen distribution line and to the communication system. The pilot and copilot boxes incorporate a shutoff valve, which keeps the mask regulator unpressurized while in the stowed position.

When the box doors are opened, the shutoff valve is brought to open position, thus allowing the oxygen flow to the mask.

After the mask has been taken out of the stowage box, the doors can be closed without interrupting oxygen supply to the mask. To stop the oxygen flow, it is necessary to close the left door and activate the Test/Shutoff Sliding Control.

Pilot and copilot mask stowage boxes are also provided with a flow indicator.

**NOTE:** The observer's mask stowage box is not provided with Test/Shutoff Sliding Control (EROS Mask) or Test/Reset Button (PURITAN Mask) and, although the masks are permanently pressurized, oxygen will flow only on demand.

## CREW MASK

The crew mask is a quick-donning oro-nasal type that allows oxygen flow on demand or under pressure, as required.

The mask is provided with an automatic oxygen dilution system that provides pure oxygen with cabin altitude over 33000 ft. It can also be manually selected to the 100% position to provide pure oxygen at all altitudes or to EMERGENCY position to maintain positive pressure in the venting orifice.

The quick-donning operation is as follows:

- Hold the mask with one hand by the hose and the inflation control valve (red ears).
- Pull the mask out of the box.
- Press the inflation control valve (red ears) firmly. The harness inflates rapidly, and takes a shape large and rigid enough to allow the user to don it quickly.
- Release the regulator ears. The harness will then deflate, securing the mask to the user's face.

**NOTE:** The EROS Mask is provided with two red ears, while the PURITAN Mask possesses one red ear and one black ear.

The pilot and copilot masks are provided with a venting valve, a venting orifice (refer to smoke goggles in this section) and a microphone.

The observer's mask is similar to that of the pilot and copilot, with the exception that the observer's mask has no venting valve and features a flow indicator installed in the supply hose.

## **CONTROLS AND INDICATORS (EROS MASK)**

### **MASK STOWAGE BOX/CREW MASK**

#### **1 - TEST/SHUTOFF SLIDING CONTROL (spring-loaded in the pilot and copilot boxes only)**

- When pressed, with the mask stowed, allows testing of the oxygen mask. Flow indicator turns yellow for a short time. The OXY ON flag appears on the lid face.
- When pressed, with the mask not stowed and the left door closed, shuts off oxygen to the mask. The OXY ON flag disappears on the lid face.

#### **2 - OXY ON FLAG (white)**

- Appears when the box shutoff valve is open and oxygen is supplied to the mask.

#### **3 - FLOW INDICATOR (pilot and copilot boxes only)**

- A yellow star appears when oxygen is flowing.

#### **4 - VENTING VALVE CONTROL (pilot and copilot masks only)**

- When actuated forward, opens the venting valve.
- A red band is visible to indicate that the control is actuated.

#### **5 - HARNESS INFLATION CONTROL VALVE (red ear)**

- When pressed, inflates the harness and allows mask donning.

#### **6 - FLOW INDICATOR (observer mask only)**

- The black shutter disappears when pressure is applied to the mask.

#### **7 - TEST/EMERGENCY SELECTOR KNOB**

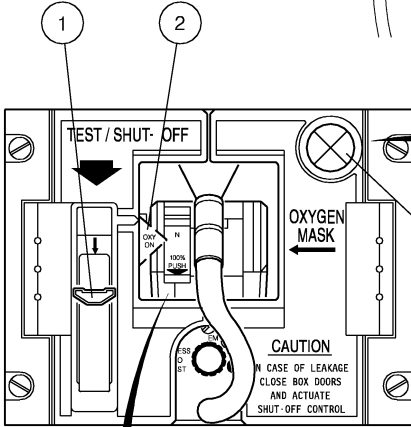
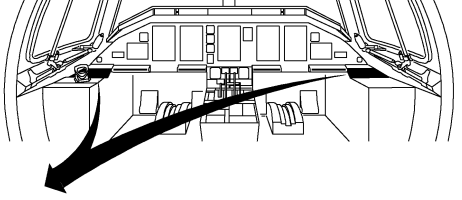
- When rotated clockwise, 100% oxygen is supplied under positive pressure at all cabin altitudes. This mode must be selected when using smoke goggles.
- When pressed, tests if the regulator demand mechanism operates satisfactorily.

#### **8 - NORMAL/100% SELECTOR**

N - Oxygen/air mixture is supplied on demand. Mixture ratio is dependent on the cabin altitude. Above 33000 ft, pure oxygen is supplied.

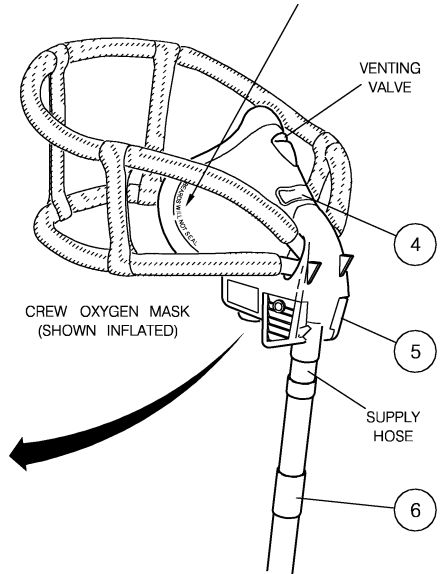
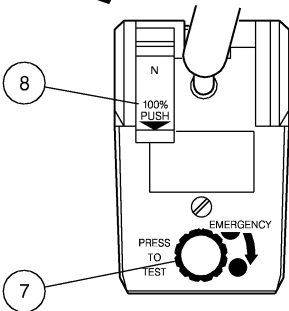
100% - Pure oxygen is supplied at all cabin altitudes on demand. This mode must be selected in conjunction with EMERGENCY position, when protective breathing is required.

PILOT AND COPILOT CONSOLES



MASK STORAGE BOX

BEARDS WILL NOT SEAL



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**MASK STORAGE BOX/CREW MASK (EROS MASK)**

## **CONTROLS AND INDICATORS (PURITAN MASK)**

### **MASK STOWAGE BOX/CREW MASK**

#### **1 - FLOW INDICATOR (pilot and copilot only)**

- A bright star appears when oxygen is flowing.

#### **2 - TEST/RESET Button (spring-loaded in the pilot and copilot boxes only)**

- When pressed, with the mask stowed, allows testing the oxygen mask. Flow indicator shows a bright contrast for a short time. The OXY ON flag appears on the lid face.
- When pressed, with the mask not stowed, shuts off oxygen to the mask. The OXY ON flag disappears on the lid face.

#### **3 - OXY ON FLAG (white)**

- Appears when the box shutoff valve is open and oxygen is supplied to the mask.

#### **4 - PURGE VALVE (pilot and copilot masks only)**

- Automatically opens when the smoke goggles are donned.
- Supplies oxygen only in EMERGENCY position.

#### **5 - FLOW INDICATOR (observer mask only)**

- Indicates oxygen pressure.
- Color: Green for proper pressure.  
Red for low pressure.

#### **6 - HARNESS INFLATION CONTROL VALVE (red ear)**

- When pressed, inflates the harness and allows mask donning.

#### **7 - CONTROL KNOB**

- When rotated, allows selection of oxygen supply modes.
- Oxygen supply mode is indicated by a white mark.

#### **8 - NORMAL POSITION**

- Oxygen/air mixture is supplied. Mixture ratio depends on the cabin altitude.
- In the event of an emergency decompression, a 100% oxygen flow will be provided.

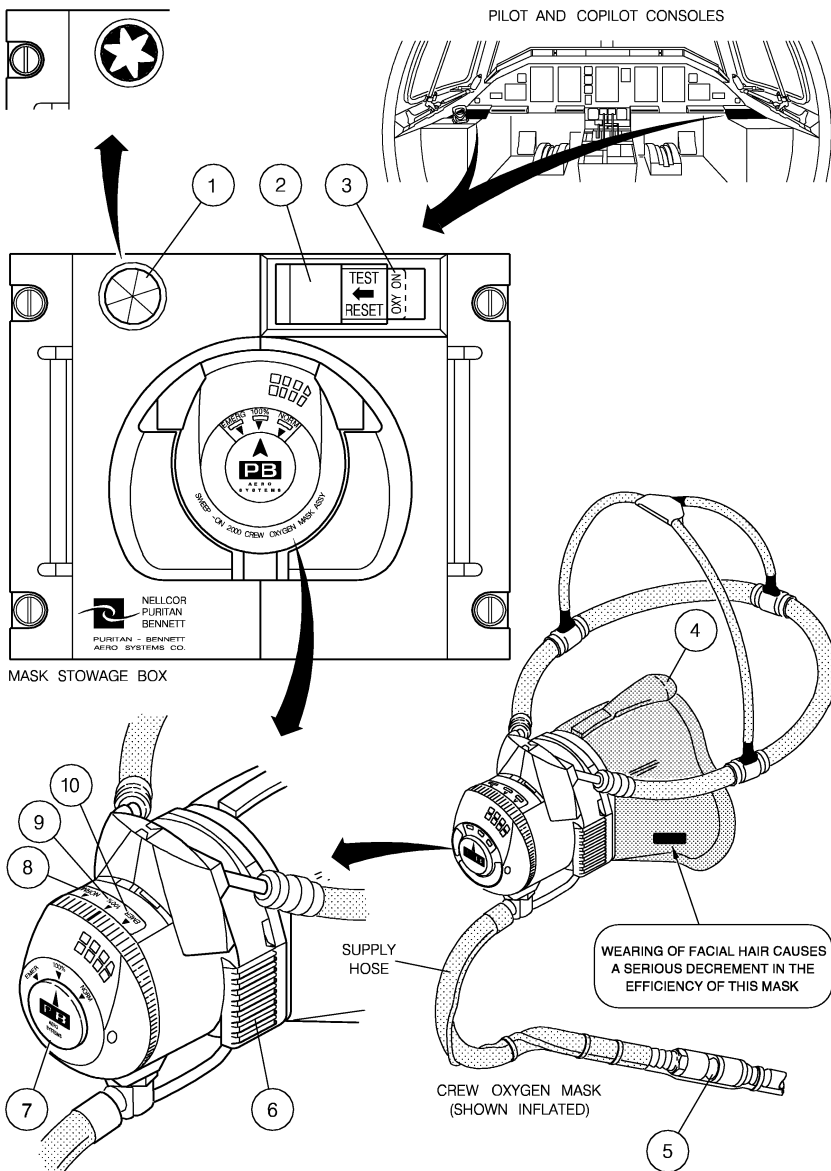
#### **9 - 100% POSITION**

- Pure oxygen is supplied at all cabin altitudes.

#### **10 - EMERGENCY POSITION**

- Pure oxygen with a slight positive pressure is supplied at all cabin altitudes.

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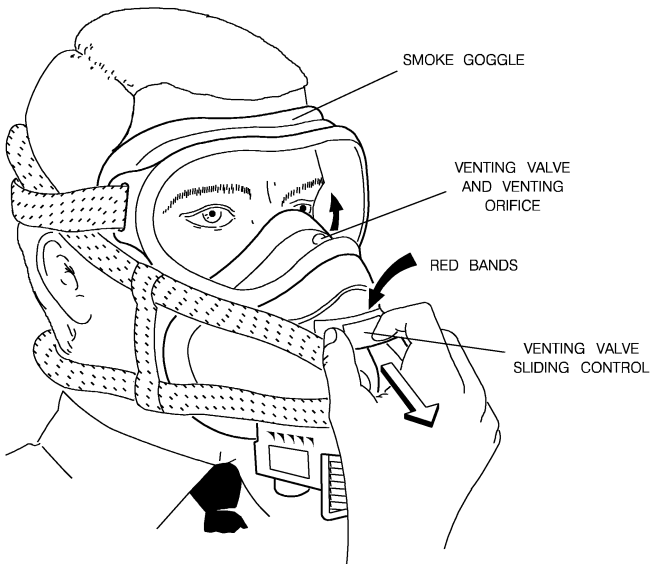
**MASK STORAGE BOX/CREW MASK (PURITAN MASK)**

## SMOKE GOGGLES

The smoke goggles were designed for use with the crew mask assembly, matching the mask face cone. The venting valve, located on the mask shell and manually actuated by the user, allows direct communication between venting orifice and goggles.

When mask regulator is selected to emergency position, a metered oxygen flow will be directed to the goggles' cavity so as to allow continuous venting and preventing any infiltration of harmful gases.

**NOTE:** For the Puritan Mask, the purge valve automatically opens when the smoke goggles are donned.



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## SMOKE GOGGLES

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## **PASSENGER OXYGEN**

Oxygen supplied to the passengers and flight attendants comes from chemical oxygen generators and continuous-flow masks installed in proper dispensing units.

The dispensing units are located in the right and left overhead bins, lavatory, and flight attendant stations. Some airplanes may be optionally equipped with an additional dispensing unit installed at the galley area. Each unit may be equipped with one, two or three continuous flow masks. The oxygen masks are held in a mask retainer. The mask must be pulled out of the retainer.

The Passenger Oxygen Control Panel is located on the right lateral console, above the copilot mask stowage box. The system is automatically activated, provided the Passenger Oxygen Selector Knob is set to the AUTO position and cabin pressure altitude is above 14000 ft (\*). The system may manually be activated, at any altitude, by setting the Passenger Oxygen Selector Knob to MANUAL position.

**NOTE:** (\*) For airplanes equipped with High Altitude Takeoff and Landing system, passengers masks will deploy at 14500 ± 500 ft cabin altitude.

The automatic presentation of the continuous-flow masks is assured by a dedicated altimetric switch and electric latches to open the dispensing units. A timer circuit is provided to maintain electric latches energized during 6 seconds on automatic or manual mode activation. The oxygen ON indicator light, on the Passenger Oxygen Control Panel, illuminates to indicate that the electric latches are energized. In this case, the NO SMOKING and FASTEN SEAT BELTS signs in the passenger cabin are automatically illuminated. These indicators and passenger advisory lights remain illuminated until the oxygen system is reset.



Activating the system causes the masks to drop from their dispensing units. Each oxygen generator is activated when any mask in the associated dispensing unit is pulled down. Pulling one mask down causes all masks in that unit to come down and 100% oxygen flows to all masks. Oxygen flows for approximately 12 minutes and cannot be shut off.

**CAUTION:** ONCE ACTUATED, EACH CHEMICAL GENERATOR SUPPLIES OXYGEN CONTINUOUSLY, WHETHER THE MASKS CONNECTED TO IT ARE BEING USED OR NOT.

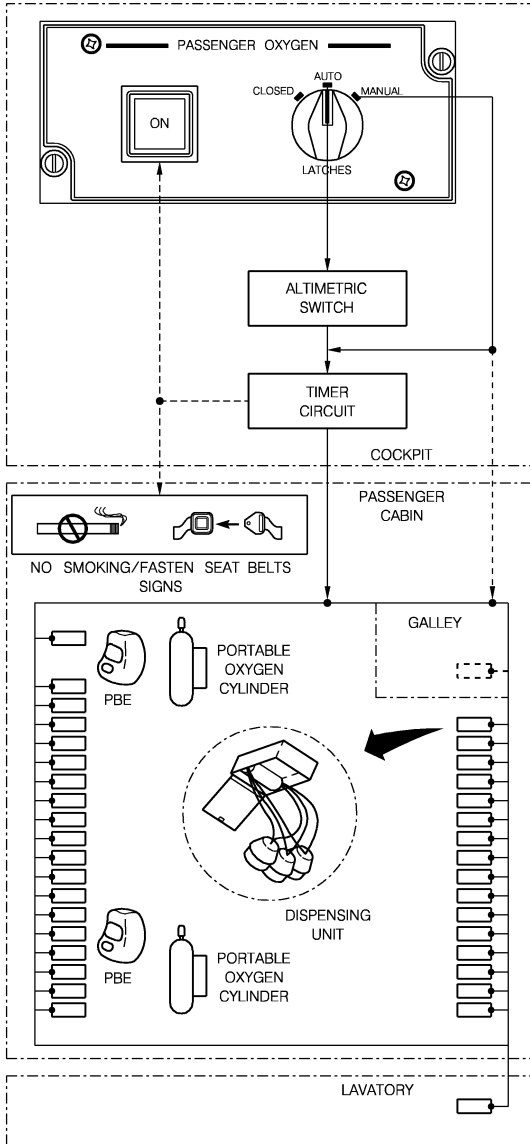
**NOTE:** When oxygen is supplied, high temperature is produced in the oxygen chemical generator.

An in-line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask.

If the system is activated and the door of a dispensing unit does not open, the masks may be dropped manually by the attendant through a door-opening tool located near the cabin attendant stations.

A portable oxygen cylinder and a Protective Breathing Equipment (PBE) unit are installed near each cabin attendant station.

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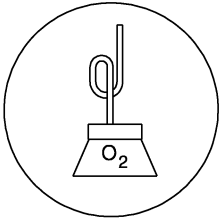
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**PASSENGER OXYGEN SYSTEM SCHEMATIC**

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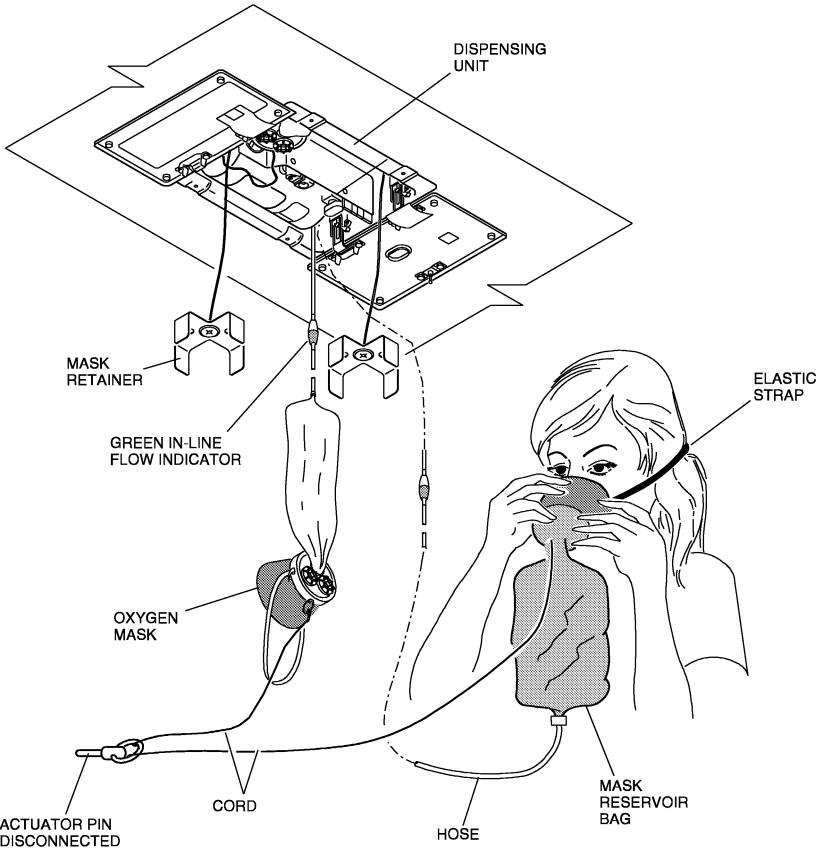
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ADDITIONAL OXYGEN  
MASK INDICATION

**NOTE:** DISPENSING UNITS WITH THIS INDICATION  
INCLUDE AN ADDITIONAL OXYGEN MASK.

AIRPLANES EQUIPPED WITH THREE MASKS  
IN ALL DISPENSING UNITS LOCATED IN THE  
RIGHT OVERHEAD BINS DO NOT HAVE THIS  
INDICATION.



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**DISPENSING UNITS/PASSENGER MASKS**

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## **CONTROLS AND INDICATORS**

### **PASSENGER OXYGEN CONTROL PANEL**

#### **1 - OXYGEN ON INDICATOR LIGHT (white)**

- Indicates that the electric latches are energized.

#### **2 - PASSENGER OXYGEN SELECTOR KNOB**

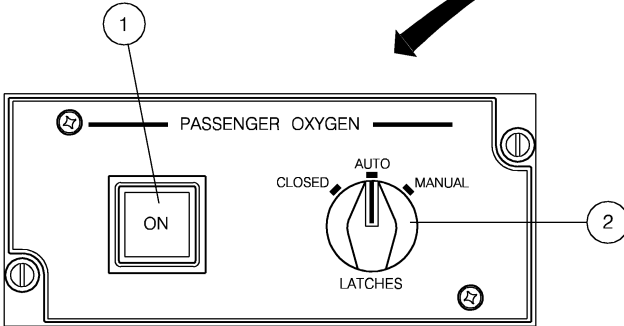
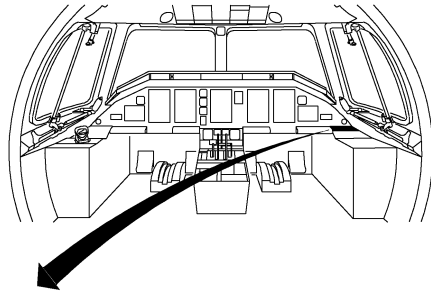
**CLOSED** - Disables the automatic deployment of passenger masks. Also resets oxygen ON indicator and passenger cabin signs after system activation either on automatic or manual mode.

**AUTO** - Automatically deploys the passenger masks provided that cabin pressure altitude is above 14000 ft (\*).

**NOTE:** (\*) For airplanes equipped with High Altitude Takeoff and Landing system, passengers masks will deploy at 14500 ± 500 ft cabin altitude.

**MANUAL** (momentary position) - Actuates the passenger oxygen system at any altitude, overriding the altimetric switch, and may be used in case of AUTO mode failure.

COPILOT CONSOLE



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**PASSENGER OXYGEN CONTROL PANEL**

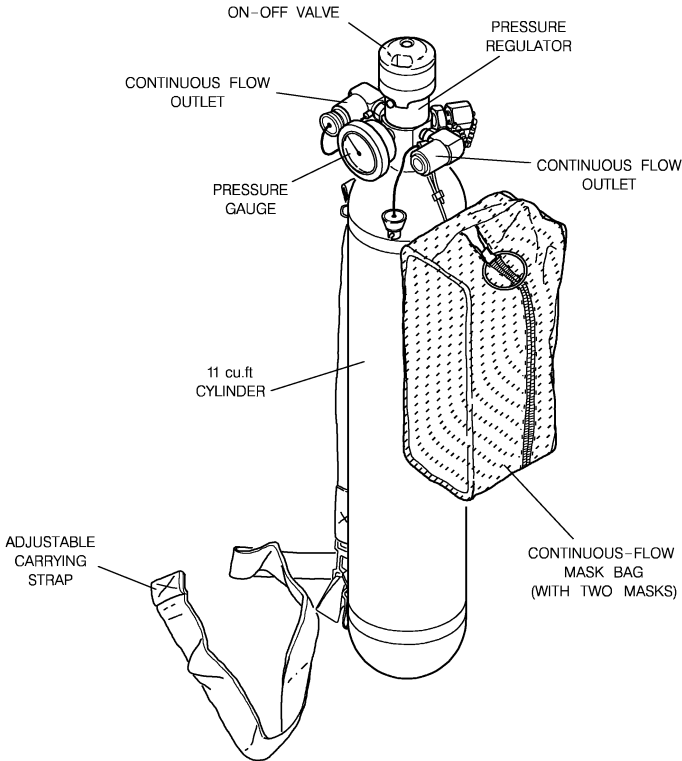
## PORTABLE OXYGEN CYLINDER

The cylinder has 312 liters (11 cu.ft) holding 280 liters of usable oxygen and is provided with an ON-OFF regulator installed on the cylinder neck. Two continuous-flow masks go with the cylinder.

A gauge is provided to monitor the cylinder pressure.

The cylinder is equipped with two outlets that permit the connection of the continuous-flow masks furnished in the cylinder bag. The supplied masks when connected to either outlet on the bottle are designed to deliver a minimum of 4 liters per minute of oxygen.

The cylinders are positioned near the cabin attendant stations and are to be used exclusively for therapeutic first-aid purposes.



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## PORTABLE OXYGEN CYLINDER



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## **PROTECTIVE BREATHING EQUIPMENT**

The airplane is equipped with three EROS or PURITAN smoke hood-type Protective Breathing Equipment (PBE) units. The PBE unit is an emergency equipment that offers a 15-minute minimum oxygen supply for crewmember and flight attendant protection against the effects of smoke, toxic gases, and hypoxia.



## **EROS (AIR LIQUIDE) PBE UNIT**

Operation automatically starts when the hood is donned, with no additional device actuation. An actuation lever is pushed up to a vertical position by user head and thus breaks a frangible valve that releases oxygen into the hood. User can hear oxygen flow release inside the hood..

Due to the neoprene neck collar, phonic membrane, and regulated overpressure inside the hood, no toxic gases or smoke can enter the hood.

The rigid visor cannot be folded and features an anti-fogging treatment for good visibility. The phonic membrane allows good communications characteristics. The hood protects user's head from flames or incandescent objects that may fall from burning structures or interiors parts.

The smoke hood is stowed inside a vacuum-sealed aluminized bag, itself contained and attached to the bottom, internal side of a rigid flat orange box that is provided with a green "good condition" indicator, which indicates that the mentioned bag was not opened yet. Should the indicator be red, this indicates that there no longer exists a vacuum inside the bag and the PBE unit must be replaced.

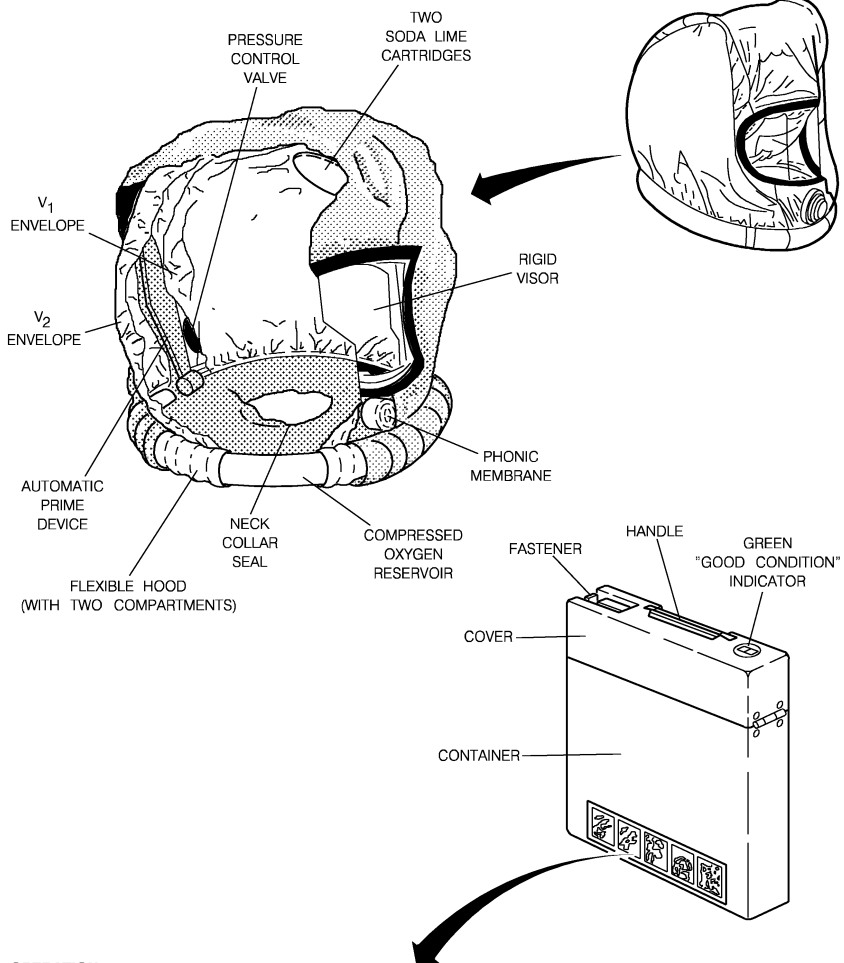
Extraction of the hood automatically tears the aluminized container bag and thus allows a direct presentation of the hood.

### **OPERATION**

When use of hood is needed:

- 1 - Take the box and push the spring lock.
- 2 - Pull the box cover upward.
- 3 - Extract the hood and deploy the hood by a brisk downward movement.
- 4 - Open the neck collar seal by placing thumbs in front of the red pointers to facilitate hood donning, especially when spectacles are worn by user.
- 5 - Don the hood. Next, pick up the fire extinguisher and combat the onboard fire and/or smoke.

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**OPERATION**



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**HOOD SCHEMATIC AND STOWAGE - EROS**

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## PURITAN BENNET PBE UNIT

During the donning sequence, a chlorate candle is automatically actuated as the adjustment straps are pulled to secure the oronasal mask cone against the face. The oxygen generated by a chlorate candle will inflate the hood, providing adequate initial breathing volume.

A speaking diaphragm is installed in the oronasal mask cone to enhance communication.

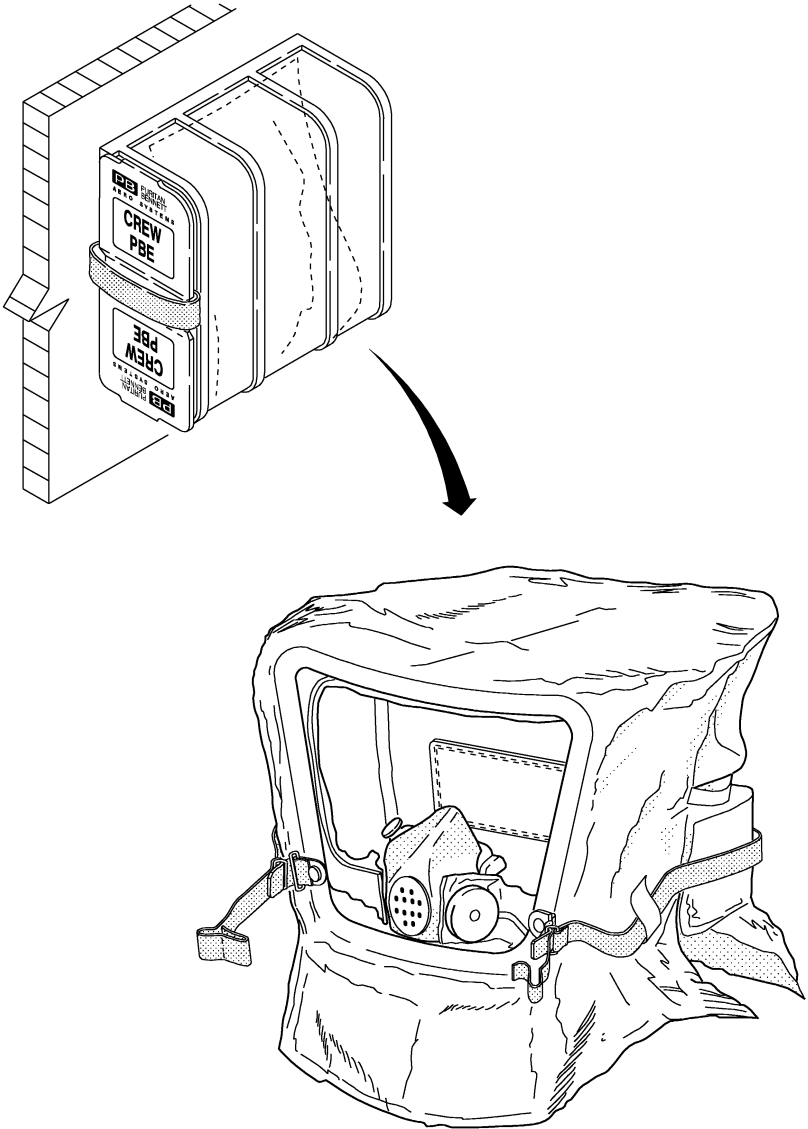
Determining the unit's serviceability consists in visually checking the vacuum seal through the clear access door of the hood's container. If the sealed bag appear tightly compressed, the seal is in good condition. On the other hand, if the sealed bag appears inflated, the unit should be replaced.

### OPERATION

When use of the hood is needed:

- 1 - Grasp and strongly pull red access handle to disengage the cover. Locate red I.D. tag and pull sharply to tear open vacuum-sealed bag.
- 2 - Pull PBE out of sealed bag and shake hood to open.
- 3 - Place both hands inside the neckseal opening with palms facing each other and PBE visor facing downward with the CO2 container resting on top of hands.
- 4 - With the head bent forward, guide PBE neckseal over the top of the head and down over the face using the hands to shield the face and glasses from the oronasal mask cone.
- 5 - With both hands, grasp the adjustment straps at the lower corners of the visor and pull outward sharply to actuate the starter candle. Within 1-5 seconds, a rushing noise of oxygen entering the hood will be heard and inflation will be evident.

**CAUTION:** THE OXYGEN PRODUCED BY PBE UNIT WILL VIGOROUSLY ACCELERATE COMBUSTION. DO NOT INTENTIONALLY EXPOSE THE PBE UNIT TO DIRECT FLAME CONTACT OR REMOVE IT IN THE IMMEDIATE PRESENCE OF FIRE OR FLAME. DUE TO OXYGEN SATURATION OF THE HAIR. DO NOT SMOKE OR BECOME EXPOSED TO FIRE OR FLAME IMMEDIATELY AFTER REMOVING PBE UNIT.



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### HOOD SCHEMATIC AND STOWAGE - PURITAN

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## **MINIMUM OXYGEN PRESSURE FOR DISPATCH**

### **FLIGHT CREW OXYGEN SYSTEM**

Crew Comprising Pilot and Copilot: 1100 psi

Crew Comprising Pilot, Copilot and Observer: 1500 psi

**NOTE:** The minimum oxygen pressure for dispatch was calculated at an ambient temperature of 21°C (70°F). For other temperatures, refer to Oxygen Pressure Correction Chart as a function of the cylinder compartment temperature.

### **PORTABLE OXYGEN CYLINDER**

The minimum portable oxygen cylinder pressure for dispatch is 1200 psi for oxygen bottle P/N 176965-14 (11 cu.ft or 311 liters) and 1550 psi for oxygen bottle P/N 5500A1UBF25A (4.25 cu.ft or 120 liters), both calculated for a maximum utilization period of 30 minutes.

## OXYGEN PRESSURE CORRECTION CHART

An Oxygen Pressure Correction Chart is located on the oxygen service panel door. This chart is provided for the maintenance personnel's use when recharging the oxygen cylinder. Additionally, it may be used by the crew to check if the oxygen cylinder's pressure is above the minimum oxygen pressure for dispatch.

To use the chart for recharging purposes:

Enter the chart with the cylinder compartment temperature (cockpit temperature) and go vertically up to the desired pressure at 21°C. From the intersection point, trace to the left to read the indicated gauge pressure to be attained.

To use the chart for dispatching purposes:

Enter the chart simultaneously with the cylinder compartment temperature (cockpit temperature) and indicated gauge oxygen pressure (on MFD or oxygen service panel). The intersection determines the oxygen cylinder's equivalent pressure at 21°C, by interpolating the two adjacent standard curves.

### EXAMPLE

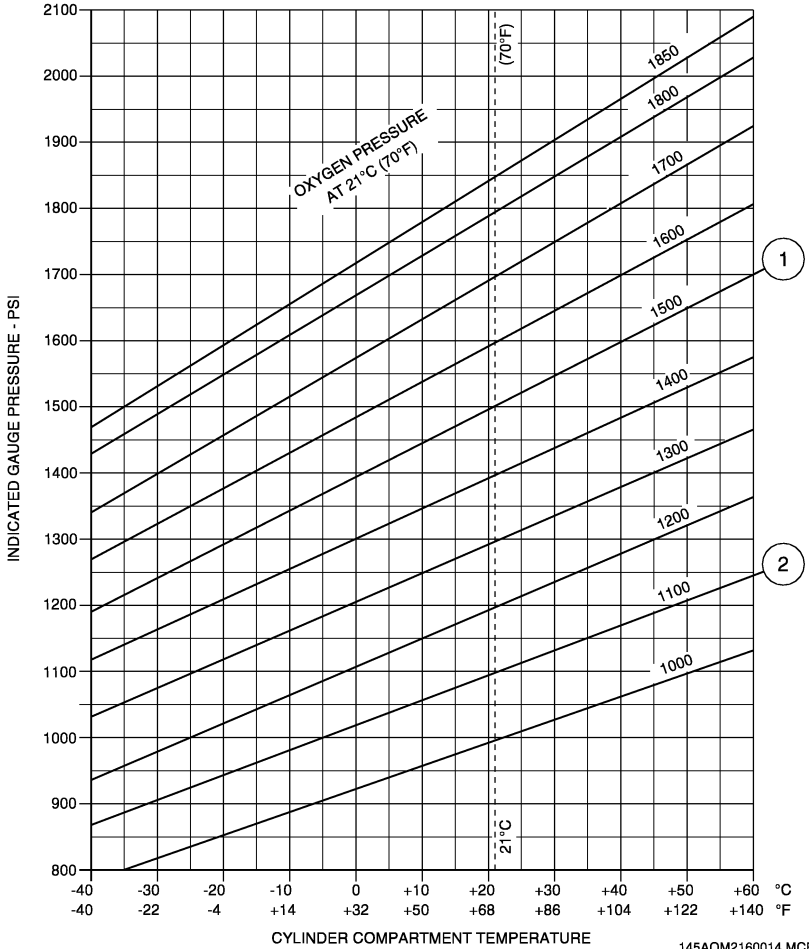
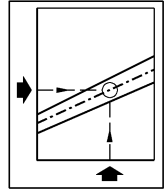
Associated condition:

- Crew .....PILOT, COPILOT  
AND OBSERVER
- Indicated gauge pressure.....1600 PSI
- Cylinder compartment temperature .....30°C

As the intersection is above the dashed line for the associated condition, the airplane may be dispatched.



- 1 MINIMUM FOR 3 CREWMEMBERS
- 2 MINIMUM FOR 2 CREWMEMBERS



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## OXYGEN PRESSURE CORRECTION

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## OXYGEN CONSUMPTION CHART

The Oxygen Consumption Chart is provided to allow the Flight Crew to know the remaining number of pre-flight oxygen mask tests available before the oxygen cylinder recharging is necessary. This chart should be used by the maintenance personnel to choose the best moment to recharge the oxygen cylinder.

The Oxygen Consumption chart has been plotted for 21°C (70°F) conditions. For different temperatures, the Oxygen Pressure Correction chart must be used to obtain the pressure at 21°C and then see what is the number of the remaining oxygen mask tests.

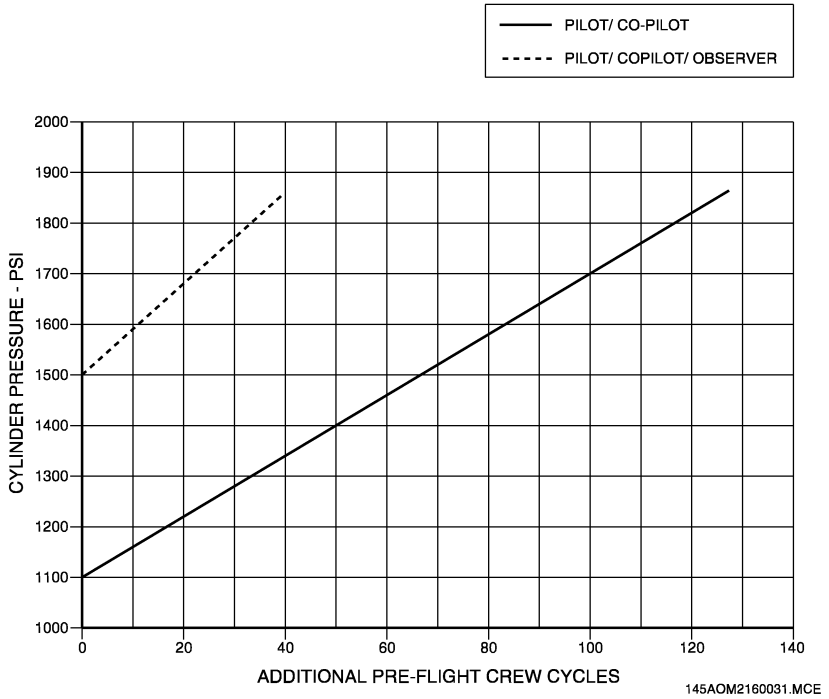
### EXAMPLE

Associated condition:

- Crew .....PILOT, COPILOT,  
AND OBSERVER
- Indicated Gauge Pressure ..... 1750 psi
- Cylinder Compartment Temperature.....30°C

According to the Oxygen Pressure Correction chart, for the associated conditions, the pressure for 21°C is 1700 psi.

According to the Oxygen Consumption chart, for 1700 psi there are approximately 22 remaining pre-flight tests before recharging the oxygen cylinder becomes necessary. The airplane's dispatch being therefore allowed.



**NOTE:** The Oxygen Consumption chart has been plotted for 21°C (70°F) conditions.

### OXYGEN CONSUMPTION



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OCTOBER 02, 2001