

CHAPTER

35

Oxygen

CHAPTER 35
OXYGEN

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OXYGEN

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OXYGEN**

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OXYGEN - INTRODUCTION

Purpose

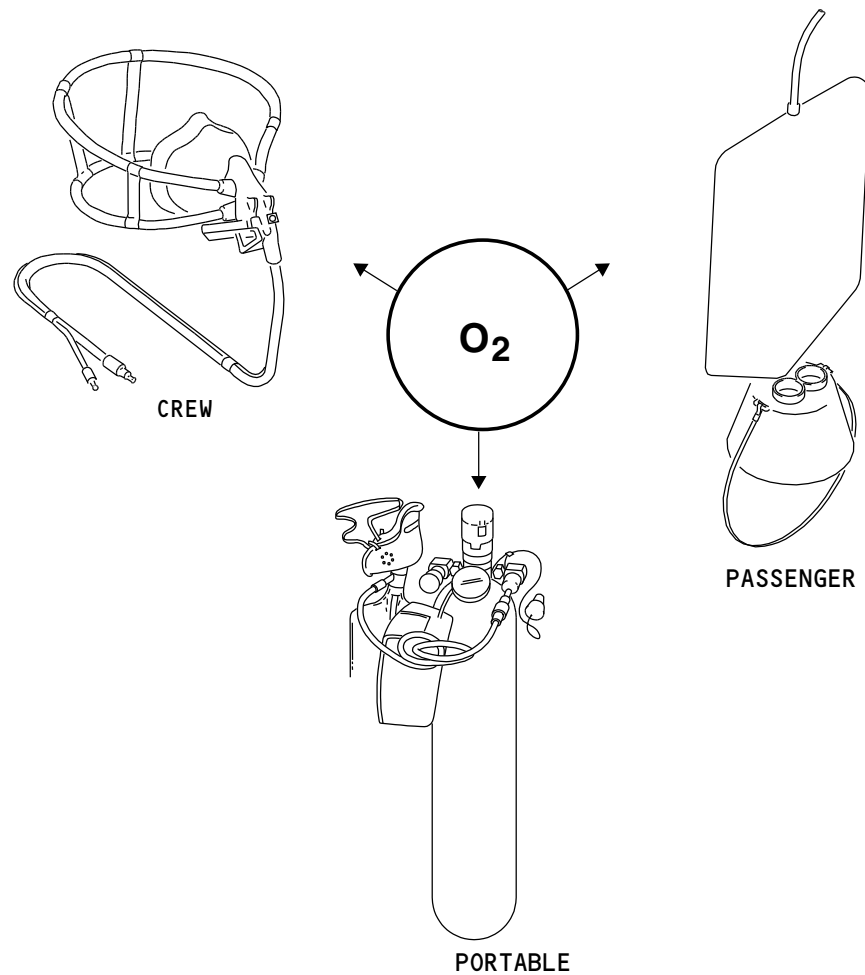
The oxygen systems supply oxygen to the flight crew, cabin attendants, and passengers.

Location

There are separate systems in the flight deck and passenger compartment. There are also portable oxygen units.

Abbreviations and Acronyms

- AIMS - airplane information management system
- CSS - cabin services system
- EICAS - engine indicating and crew alerting system
- ELMS - electrical load management system
- MEC - main equipment center
- MFD - multi-functional display
- PSU - passenger service unit



OXYGEN - INTRODUCTION

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OXYGEN - INDICATIONS - STATUS PAGE

General

The status page shows oxygen pressure data.

You use the status display switch on the display select panel (DSP) to select the status page on the multifunction display (MFD).

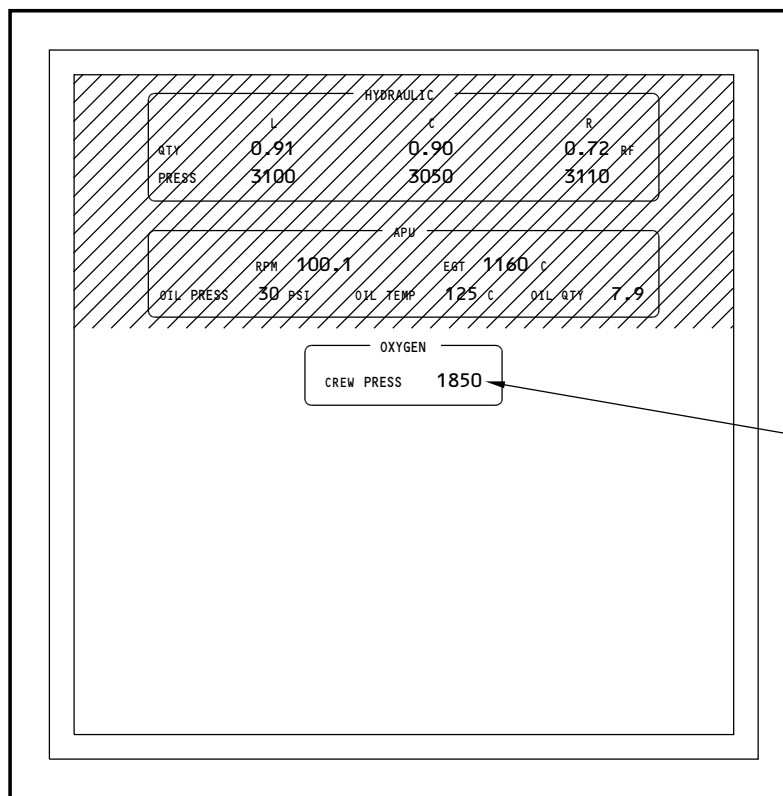
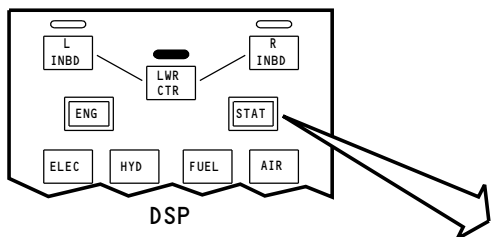
Crew Oxygen

Crew oxygen pressure shows in units of psi. The display shows to the nearest 10 psi.

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CREW OXYGEN
PRESSURE

STATUS PAGE

OXYGEN - INDICATIONS - STATUS PAGE

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CREW OXYGEN - INTRODUCTION

Purpose

The crew oxygen system gives oxygen to the flight crew for emergencies and procedures that make its use necessary.

Component Locations

The crew oxygen masks and storage boxes are in the flight compartment.

The oxygen cylinders and the bleed valve are in the main equipment center (MEC).

The overboard discharge indicator is external, on the airplane skin.

The remote fill panel and fitting are in the forward equipment center.

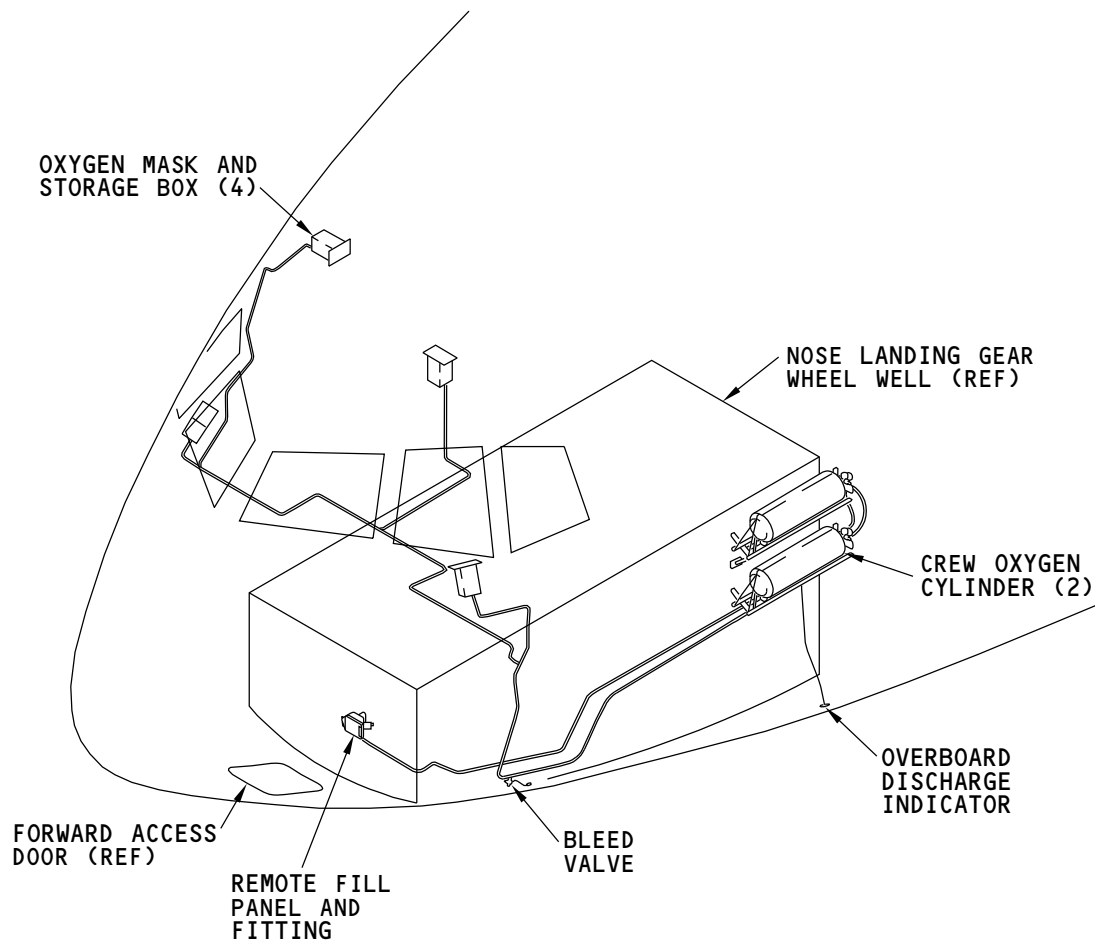
General Description

The cylinders in the MEC hold pressurized oxygen. A line connects the cylinders to oxygen masks in the flight deck. A regulator at the cylinders and diluter/demand valves at the masks decrease oxygen pressure to the correct pressure for crew use.

The diluter/demand valve also mixes an applicable amount of flight deck air with the oxygen. The valve uses flight deck air pressure to make the decision on the quantity of oxygen to mix. The crew can also set the valve for 100 percent oxygen.

The remote fill panel and fitting lets maintenance personnel put oxygen in the cylinders while the cylinders are in the airplane.

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CREW OXYGEN - INTRODUCTION

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**CREW OXYGEN - REMOTE FILL PORT****Purpose**

The remote fill port lets you fill the crew oxygen cylinder(s) on the airplane.

Location

The remote fill port is in the forward equipment center on the left side of the nose landing gear wheel well forward bulkhead.

Physical Description

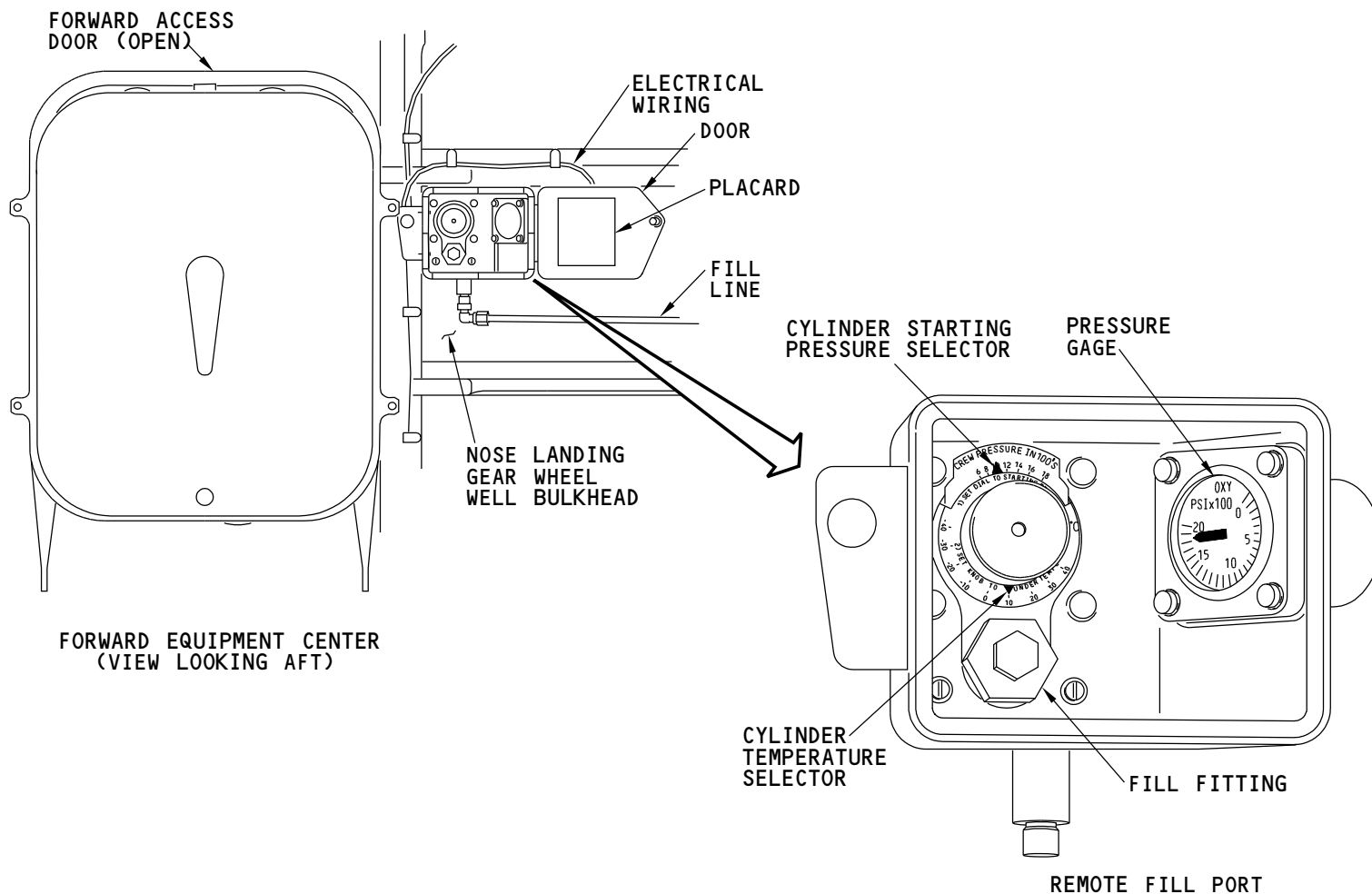
The remote fill port has these components:

- Cylinder starting pressure selector
- Cylinder temperature selector
- Pressure gage
- Fill fitting.

A fill line connects the fill port to the oxygen cylinder(s).

Training Information Point

The procedure to fill the cylinder is on a placard that is on the inside of the panel door.



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CREW OXYGEN - REMOTE FILL PORT

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CREW OXYGEN - CYLINDER

Purpose

The crew oxygen cylinder contains oxygen for the flight crew.

Location

The cylinders are on the left side of the main equipment center (MEC), forward of the E3 rack and the ladder to the MEC access hatch.

General Description

The cylinder is made of composite materials. It holds 115 cubic feet (3150 liters) of oxygen at 1850 psi. It has a fitting at one end. These items are on the fitting:

- Direct reading pressure gage
- Shutoff valve
- Threaded connection (not shown) for B-nut on the thermal compensator and overboard discharge line
- Thermal relief frangible disc (not shown).

A cylinder support structure holds the cylinder to the airplane. There are retainer rings at both ends of the structure. The forward ring is set and cannot move. The aft ring is movable. Fittings on the bottom of the aft ring let you connect it to the structure and turn it up over the end of the cylinder.

One end of the retainer strap connects to the set ring. The other end of the strap has a tee bolt. It goes through the top of the movable ring. A nut holds the ring and bolt together.

The B-nuts on the thermal compensator and overboard discharge line connect them to the cylinder fitting.

The high pressure supply line lets oxygen flow into the thermal compensator and cylinder. It also lets oxygen flow out of the cylinder to the mask supply line.

The thermal relief frangible disc in the fitting breaks to release oxygen to the overboard discharge line when cylinder pressure gets above safe cylinder limits.

Training Information Point

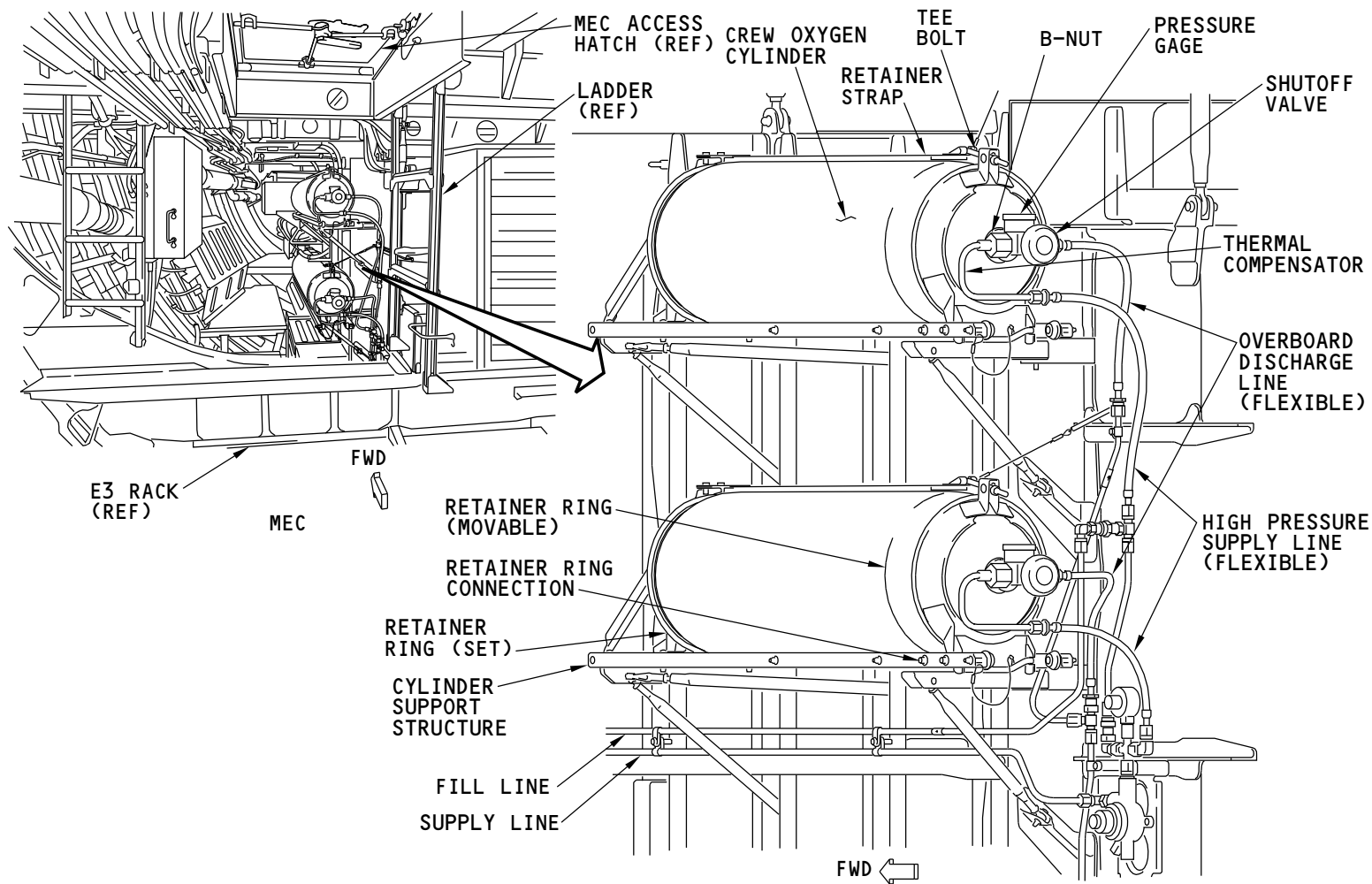
There are two positions for the movable retainer ring on the cylinder support structure. One position lets the structure hold a composite cylinder. The other lets it hold a steel or carbon fiber oxygen cylinder.

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CREW OXYGEN - CYLINDER

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**CREW OXYGEN - OVERBOARD DISCHARGE INDICATOR****Purpose**

The overboard discharge indicator shows when overpressure causes an oxygen release from the flight crew oxygen cylinders.

Location

The indicator is to the left of the nose landing gear wheel well.

Physical Description

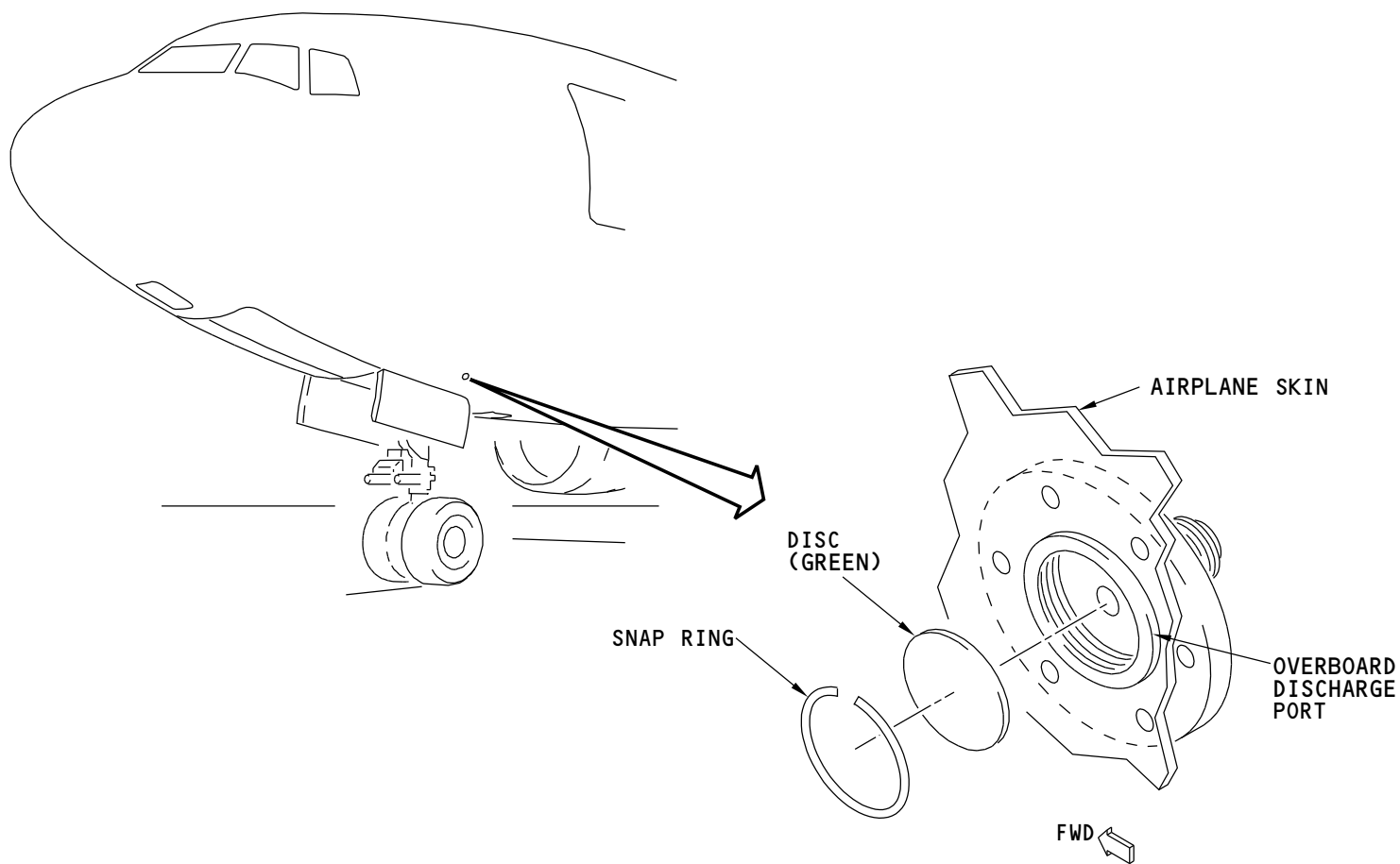
The indicator is a green disc. A snap ring holds it in position.

Functional Description

An overpressure condition causes the frangible disc in the oxygen cylinder to break. The oxygen flows through the overboard discharge line to the overboard discharge port. The pressure pushes the indicator disc out of the snap ring. The disc falls away.

Training Information Point

If the disc is gone, do a check to see if the oxygen cylinders are empty.



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CREW OXYGEN - OVERBOARD DISCHARGE INDICATOR

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CREW OXYGEN - HIGH PRESSURE DISTRIBUTION COMPONENTS**General**

These are the high pressure distribution components:

- Pressure transducer
- Pressure regulator
- Check valve
- Thermal compensator.

Purpose

The pressure transducer tells the airplane information management system (AIMS) the pressure in the oxygen cylinders when the cylinder shutoff valves are open.

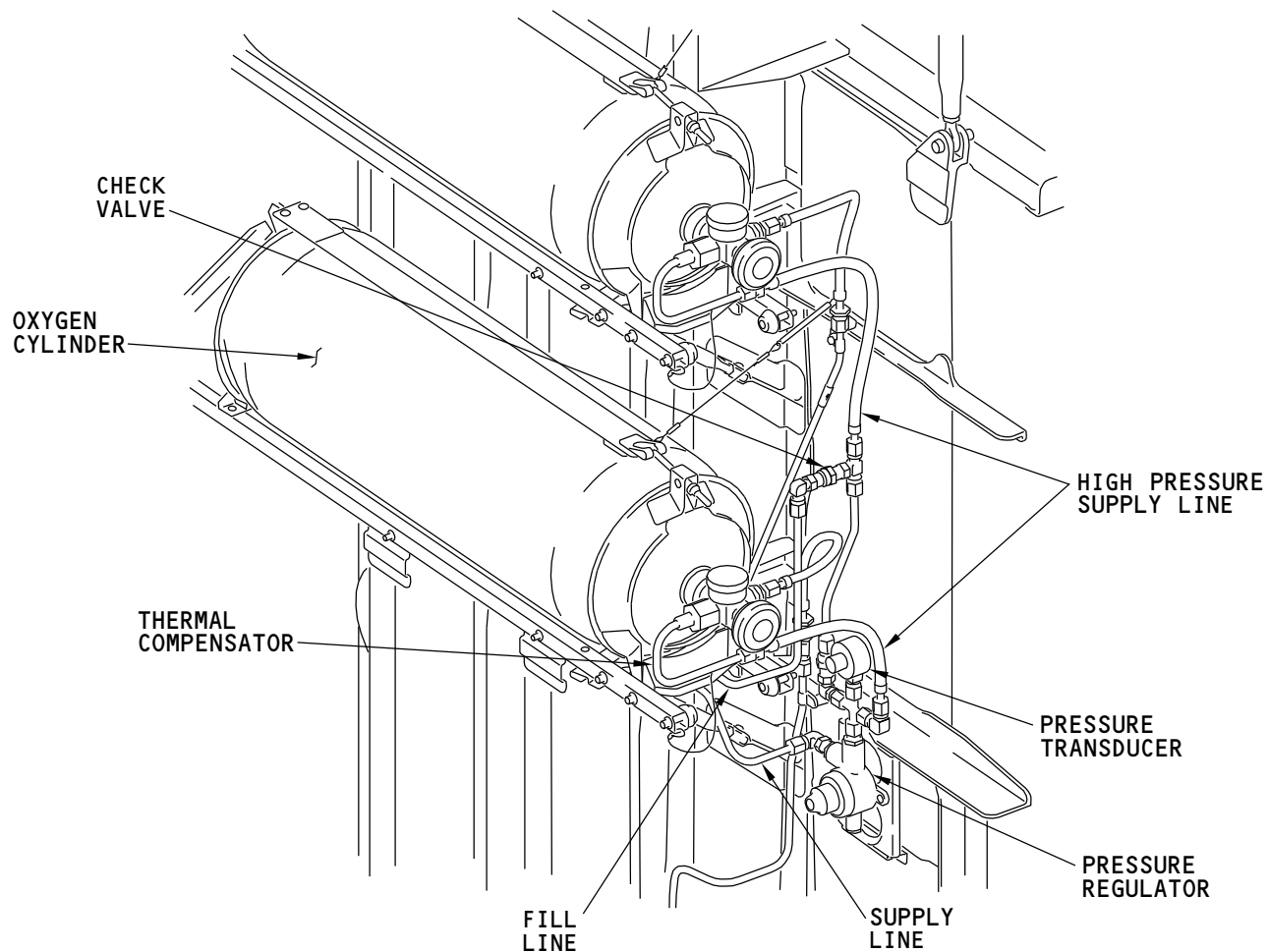
The pressure regulator reduces cylinder pressure to 70 psi in the supply line to the masks.

The check valve prevents the flow of oxygen out of the cylinders through the fill line.

The thermal compensators absorb the heat that the pressurized oxygen causes when it fills the unpressurized lines.

Location

These components are adjacent to the oxygen cylinders.



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CREW OXYGEN - HIGH PRESSURE DISTRIBUTION COMPONENTS

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CREW OXYGEN - BLEED VALVE

Purpose

The bleed valve helps to make sure that the AIMS gets correct oxygen cylinder pressure information.

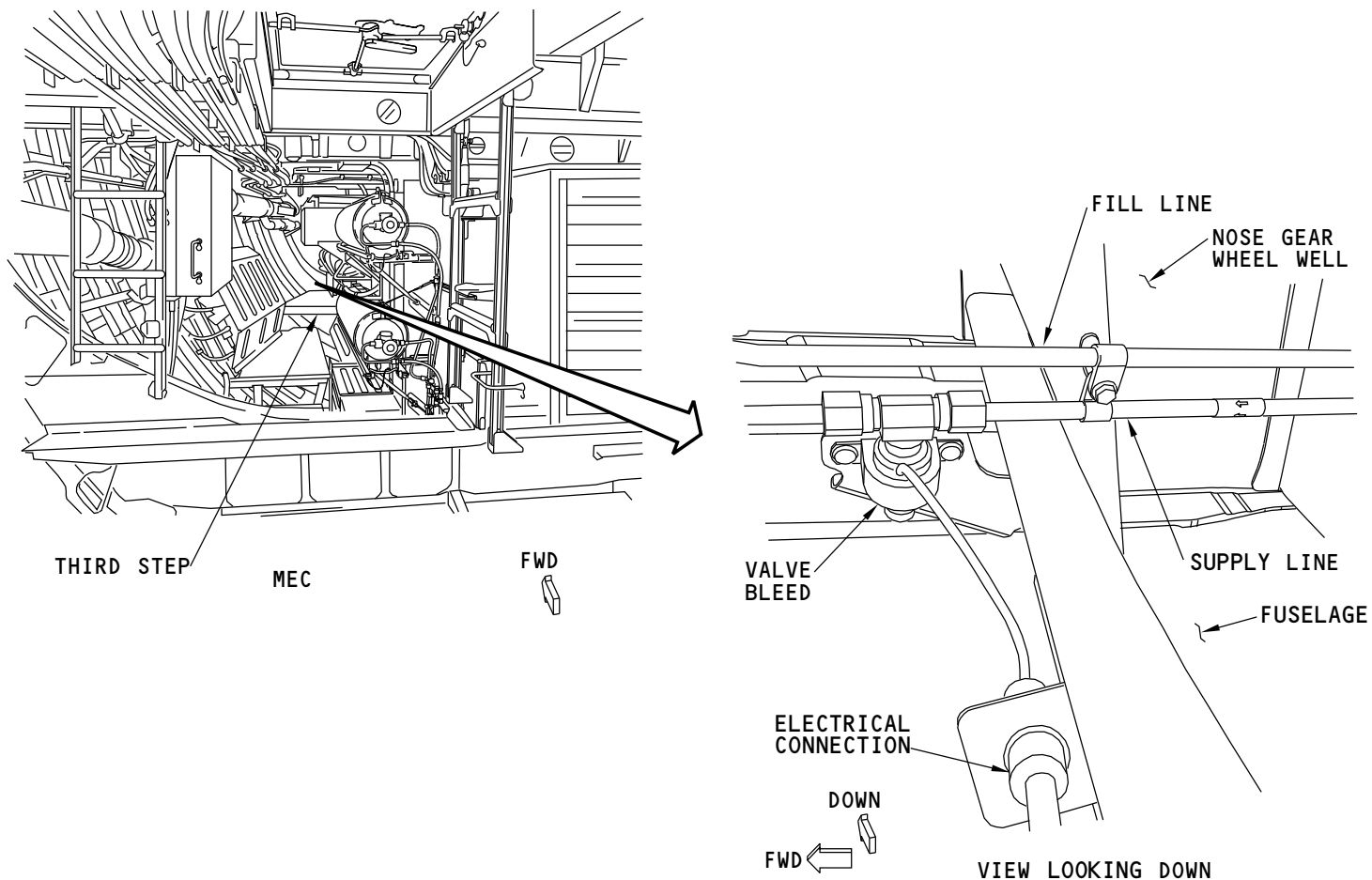
Location

The valve is on the lower, left side of the MEC. It is below and forward of the third step of the walkway.

Physical Description

The valve has a solenoid which supplies the force to open the valve.

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CREW OXYGEN - BLEED VALVE

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**CREW OXYGEN - CREW OXYGEN MASK AND STOWAGE BOX****Purpose**

The crew oxygen mask/regulator assembly lets the flight crew breathe oxygen and protects the eyes from smoke.

The stowage box components have these purposes:

- Mask stowage
- Communications connection
- Oxygen connection
- Oxygen flow control
- Oxygen flow indication.

Location

A crew mask/regulatory assembly and stowage box is adjacent to each crew position.

Physical Description

These components are on the front of the storage box:

- Quick release fastener (4)
- Doors (2)
- Flow indicator
- Reset test lever.

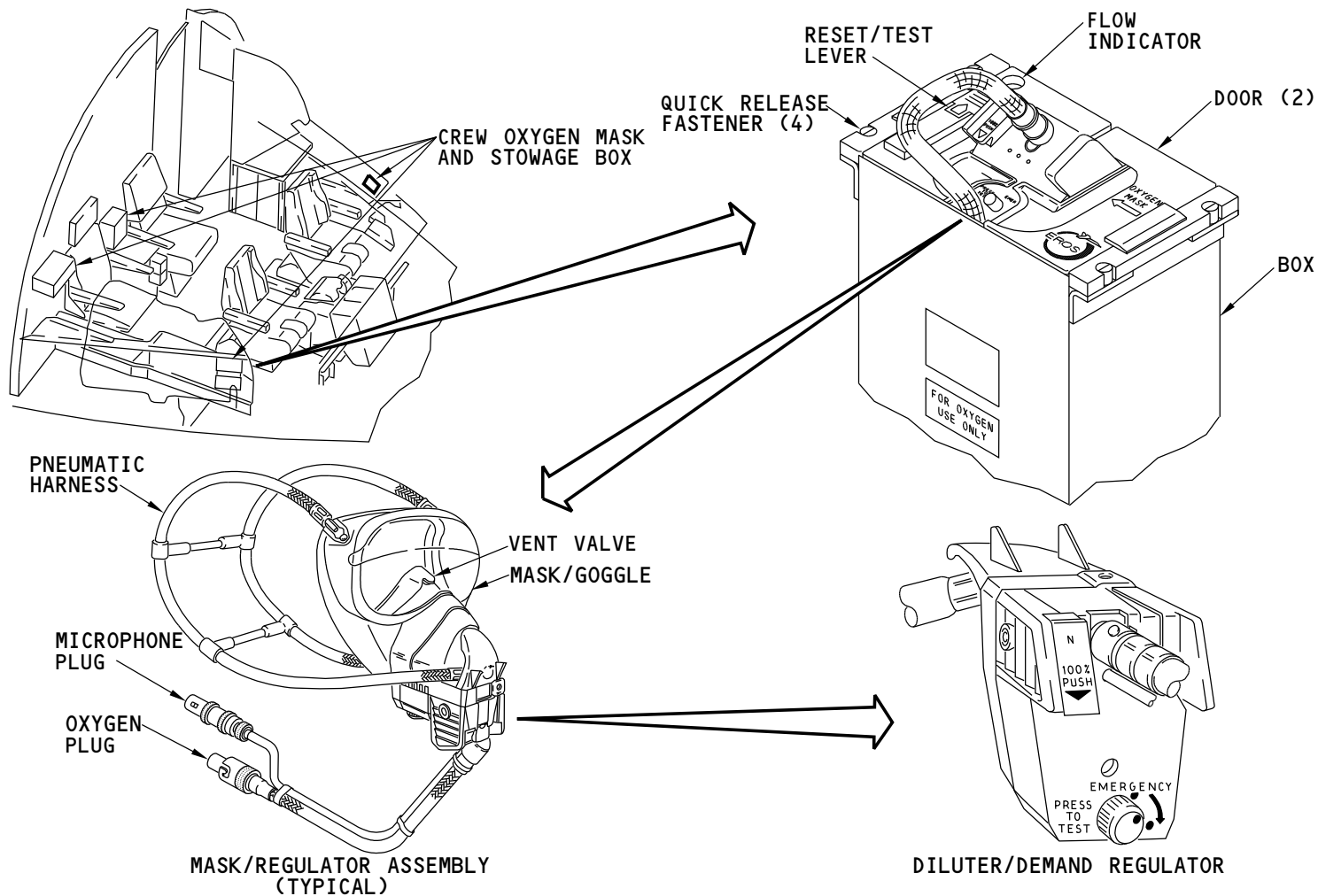
These components (not shown) are inside the box:

- Oxygen shutoff valve
- Oxygen jack
- Microphone jack.

There are connections (not shown) on the back of the box that connect the oxygen and microphone jacks to the oxygen supply line and communications systems.

The mask/regulator assembly has these components:

- Pneumatic harness
- Mask/Goggle
- Vent Valve
- Diluter/demand regulator with controls
- Oxygen plug connection
- Microphone plug connection.



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CREW OXYGEN - CREW OXYGEN MASK AND STOWAGE BOX

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CREW OXYGEN - OPERATION

Operation

Pull on the release levers of the diluter/demand regulator to remove the mask from the box. The shutoff valve opens when the left door opens. You hold the left release lever (inflation control) in as you hold the mask by the diluter/demand regulator. This makes oxygen inflate the pneumatic harness.

You put the harness around your head with the mask and goggles over your face. When you release the release lever, the oxygen that inflates the harness shuts off and bleeds from the harness. Elastic in the harness pulls the mask and goggles tight to the face.

Normally you breathe a mixture of oxygen and compartment air when you set the oxygen dilution control to N (normal). The percent of oxygen has a relation to the pressure altitude in the flight deck. At or above a preset pressure altitude the regulator gives you 100 percent oxygen. You breathe only oxygen at any pressure altitude when you set the dilution control to 100 percent.

Normally, oxygen flows only when you breathe (on demand). The flow indicator shows flow each time you breathe. If you set the emergency demand control to emergency, oxygen will flow continuously (pressure breathing). The flow indicator shows continuous flow. If the emergency demand control is set to its usual position, the regulator gives automatic pressure breathing when pressure altitude in the flight deck is above a preset value. The percent of pressure breathing changes in relation to the pressure altitude. As altitude increases, the percent of pressure breathing increases.

The vent valve (not shown) is part of the mask. The valve lets air and oxygen flow from the mask into the goggles (not shown).

If you close the left door on the box, the oxygen on indicator shows.

You can turn oxygen off at the oxygen box with the shutoff valve. Close the left door and push the reset/test lever sets the valve to the close position.

Mask Storage

To return the mask to the box, set the test and emergency demand control to the normal position. Put the wire, hose, and harness into the box. Place the mask into the box so the tabs are against the upper stop and the mask is against the lower stop in the box. Close the left door. Push down on the reset/test lever to close the shutoff valve and retract the oxygen on indicator. Move the mask to the left. Close the right door.

Test

Push down and hold the reset/test lever. The flow indicator should show a momentary flow.

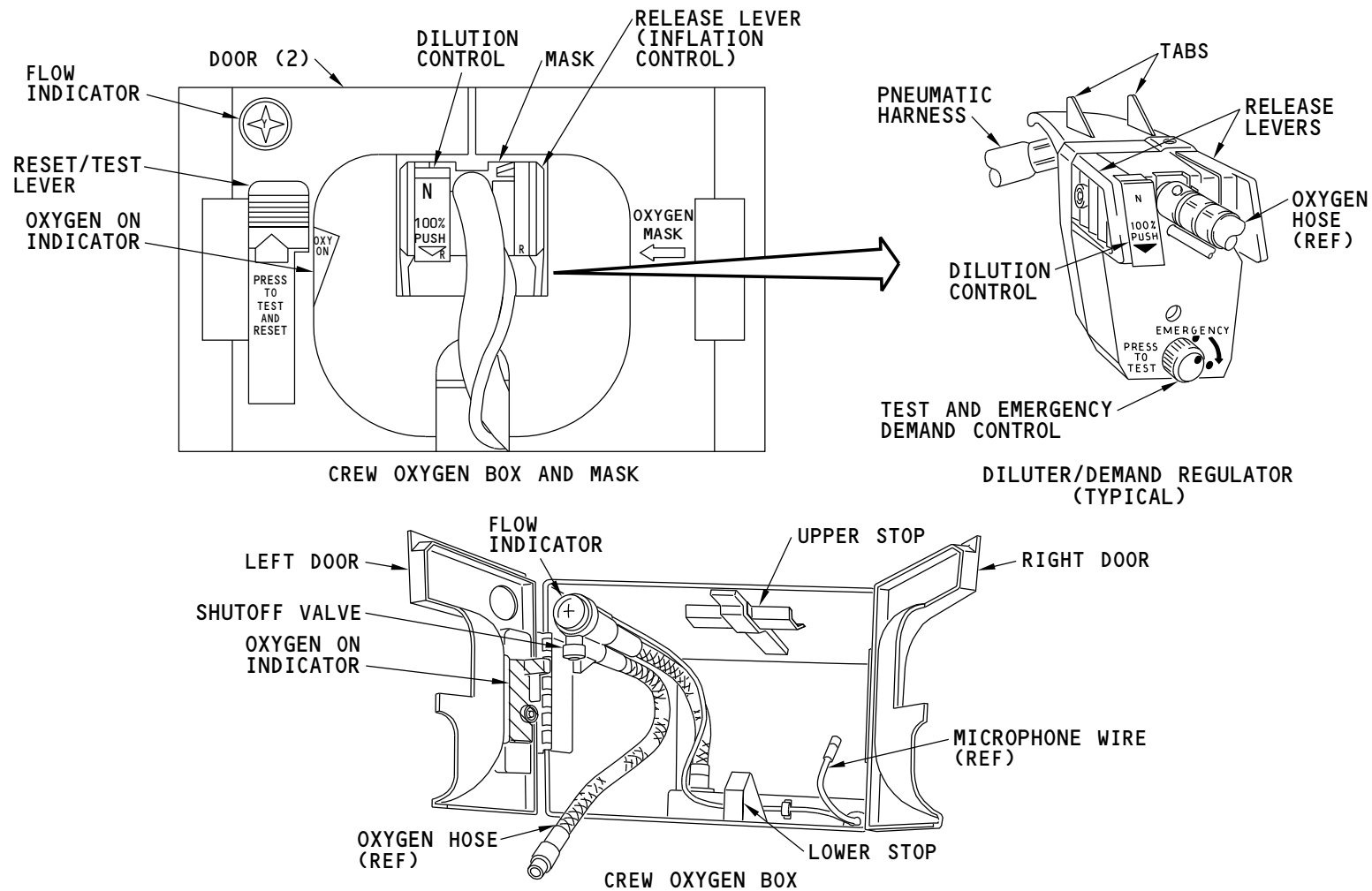
Push down and hold the reset/test lever. Push in on the test and emergency demand control. The flow indicator should show a continuous flow.

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CREW OXYGEN - OPERATION

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**CREW OXYGEN - FUNCTIONAL DESCRIPTION****Supply and Regulation**

The cylinders supply oxygen through the shutoff valves, pressure regulator, and supply line to the masks in the flight deck. The supply line pressure regulator decreases the bottle pressure to 70 psi. The diluter/demand regulator/mask supplies the flow and pressure that the crew needs.

Remote Fill Port

You use the remote fill port to fill the oxygen cylinders in the airplane. The check valve will not let oxygen go from the cylinders to the panel.

Indications

The gauge on the cylinder shows cylinder pressure. A pressure transducer also measures the pressure. Then the information goes to the gauge on the remote fill panel and to the AIMS. The pressure shows on the status display. An advisory message shows if the bottle pressure goes below 500 psi.

Bleed Valve

The bleed valve operates one time after the airplane lands (air to ground change) and when all of these conditions occur:

- Airplane is on the ground
- Both engines off
- You start an engine.

The ELMS causes electrical power to go to a solenoid for 25 seconds. The solenoid opens the bleed valve to let oxygen pressure out of the line. If the cylinder shutoff valve is closed, the line will not repressurize when the bleed valve closes. The pressure transducer sends the line pressure information to the AIMS.

Overboard Discharge

The frangible disc breaks if cylinder pressure gets above safe limits (2500 - 2750 psi). The oxygen flows overboard through the overboard discharge indicator.

Oxygen Shutoff Valve/Indicator

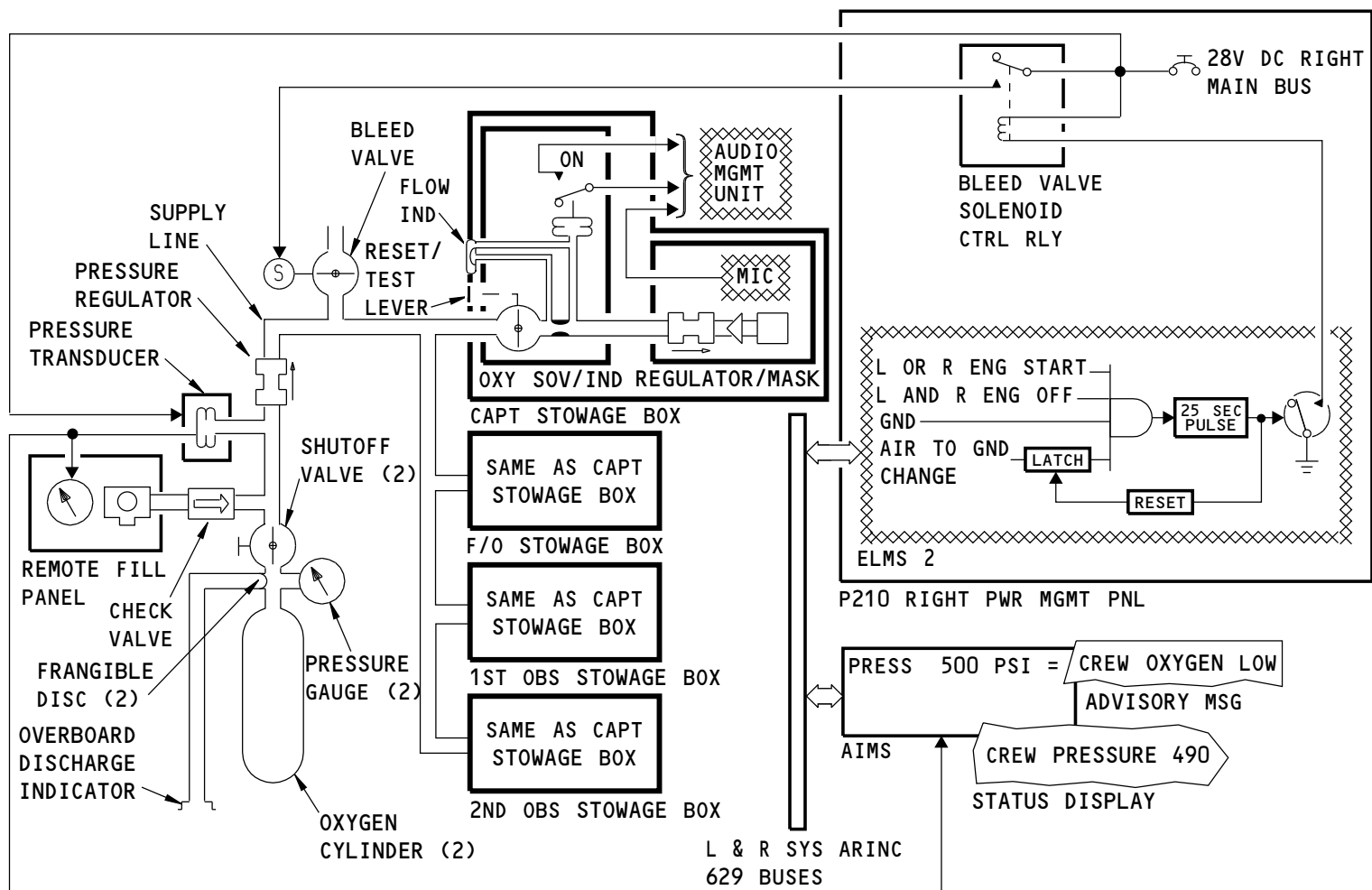
The oxygen shutoff valve/indicator supplies these functions:

- On/off control
- Flow indication
- Starts the oxygen regulator/mask-mounted microphone.

The valve automatically opens when the left door (not shown) on the stowage box is open. The valve stays open until you close the door and push the RESET/TEST LEVER.

The valve supplies flow indication when oxygen flows through the valve.

A switch in the valve supplies an oxygen ON signal to the audio management unit when there is oxygen pressure between the valve the regulator/mask. The audio management unit uses this signal to start the operation of the microphone. See the flight interphone system section for more information about the audio management unit (SECTION 23-51).



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CREW OXYGEN - FUNCTIONAL DESCRIPTION

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PASSENGER OXYGEN - INTRODUCTION

Purpose

The passenger oxygen system supplies oxygen to the passengers and cabin attendants if the airplane loses cabin pressurization.

General Description**ARO 001-010**

The passenger oxygen system uses chemical generators to make the oxygen. The passenger oxygen masks can drop automatically or manually. The masks drop automatically when all these conditions are true:

ARO 011-999

The passenger oxygen system uses chemical generators and oxygen cylinders (CDS) to make the oxygen. The passenger oxygen masks can drop automatically or manually. The masks drop automatically when all these conditions are true:

ARO ALL

- The airplane is in the air with an airspeed of more than 80 knots
- The cabin altitude goes above 13,500 feet (4115 meters).

Push the passenger oxygen switch to drop the masks manually. The oxygen starts when you pull down on the mask.

Location

The oxygen generators and masks are in these locations:

- In passenger service units (PSU) installed over each passenger seat.

ARO 001-010

- In the lavatory PSUs

ARO ALL

- In the flight crew rest (FCR) service units
- In the overdoor panels.

ARO 001-010

The oxygen cylinder (CDS) unit and masks are in these locations:

- In lavatory PSUs

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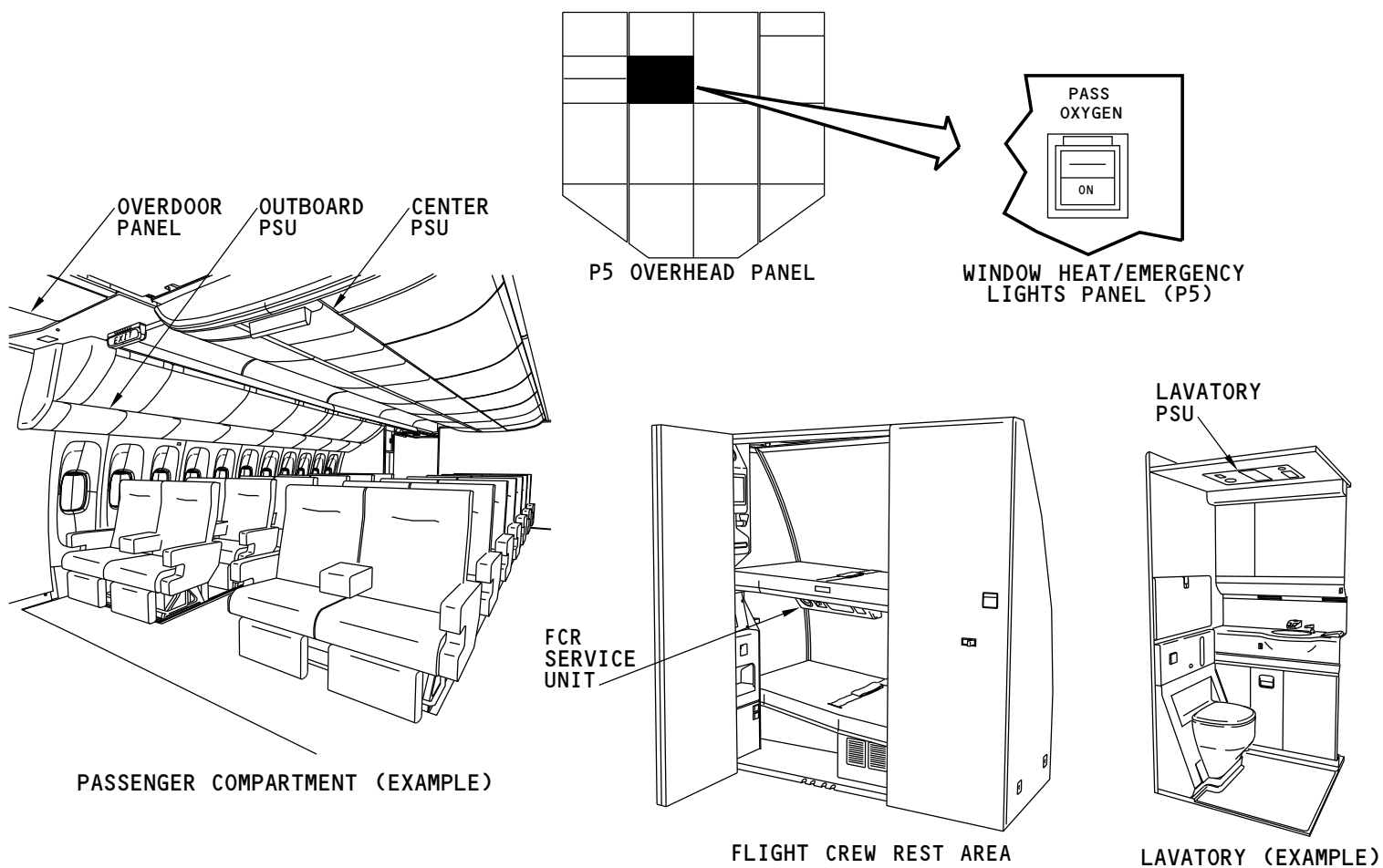
Oxygen generators and masks can also be in lowered ceiling panels in cross aisles and in other areas of the airplane.

The control switch is on the P5 overhead panel in the flight compartment.

35-21-00**ARO ALL** EFFECTIVITY

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PASSENGER OXYGEN - INTRODUCTION

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**PASSENGER OXYGEN - PASSENGER OXYGEN BOX AND PASSENGER OXYGEN MASK****Purpose**

The passenger oxygen boxes contain the oxygen masks for the passengers and flight attendants. The oxygen masks supply oxygen to the passengers and attendants if the cabin pressure decreases too much.

Location

Oxygen mask boxes are in these locations:

- Center passenger service units (PSUs)
- Outboard PSUs
- Lavatory PSUs
- Above the flight crew rest bunks
- On overdoor panels
- On some lowered ceiling panels.

Passenger Oxygen Box

A chemical oxygen generator attaches to each box. The center PSUs have two generators if they supply oxygen to more than three seats. A manifold (not shown) in the box supplies oxygen from the generator to the masks. A door with an electrically operated latch keeps the masks in the box until the oxygen deployment circuit operates.

The total quantity of oxygen masks is more than the quantity of passenger and attendant seats. These are the quantities of masks in each type of oxygen box:

- Outboard PSUs - one more mask than the quantity of related seats and bassinet. Do not put more than four masks in the Outboard PSU.

ARO 001-010

- Center PSUs - one more mask than the quantity of related seats and basinet.

ARO 011-999

- Center PSUs - two more masks than the quantity of related seats

ARO ALL

- Overdoor and lowered ceiling boxes - two masks
- Flight crew rest oxygen boxes - two masks
- Lavatory boxes - two masks.

Latches attach the outboard and center PSUs to the airplane structure. Release the latches and lower the PSU for access to the oxygen generators.

Lower the overdoor panel for access to the oxygen generators above those panels. To get access to the generators in the lavatories or lowered ceiling panels, remove the adjacent lowered ceiling panel.

In the flight crew rest area, access to the oxygen generators is different for the two bunks. Open the PSU for access to the oxygen generator for the lower bunk. Remove the lowered ceiling panel above the aisle for access to the oxygen generator for the top bunk.

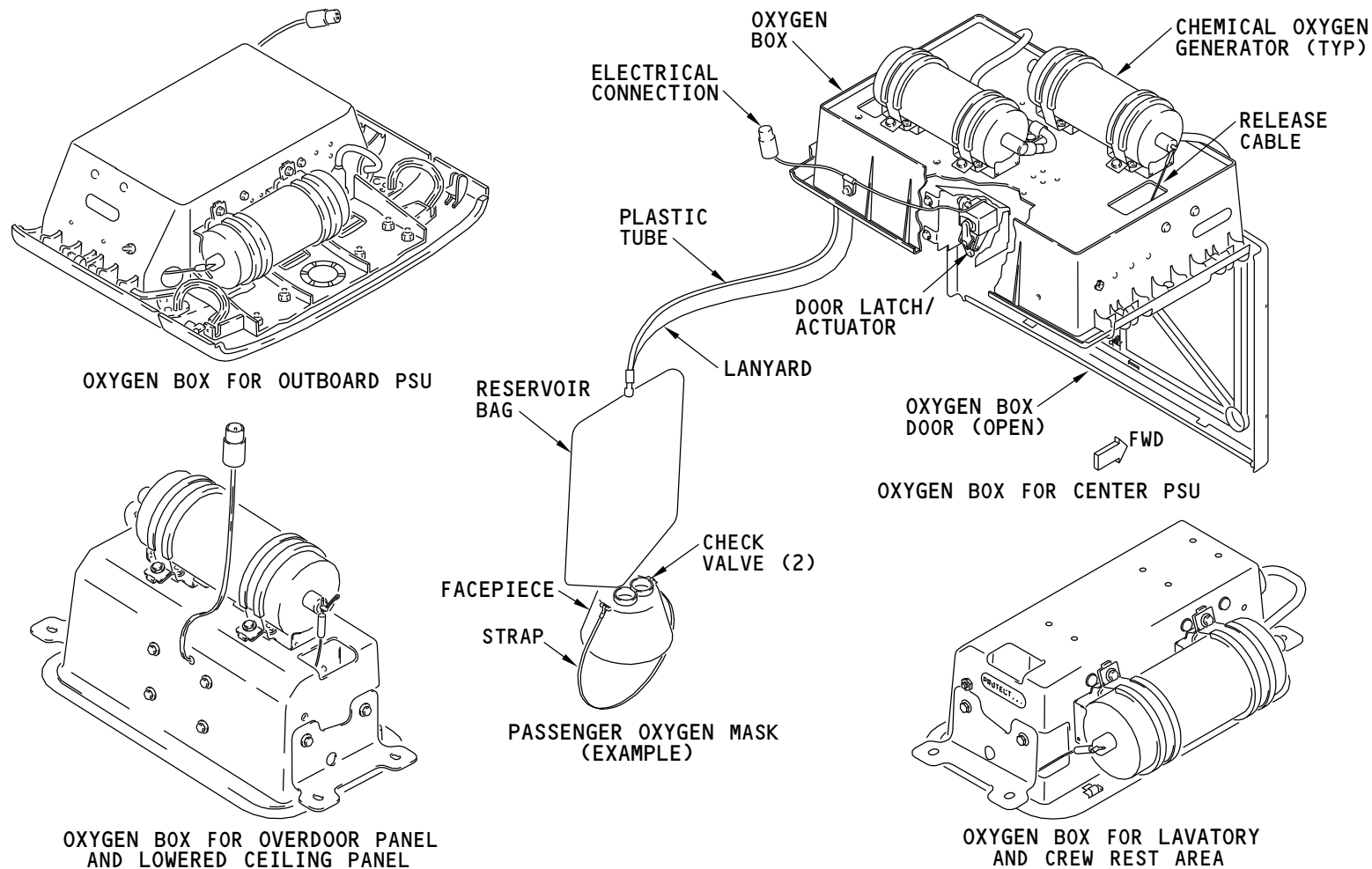
See the equipment and furnishings chapter for more data about the PSUs, overdoor panels, lowered ceiling panels and crew rest areas (CHAPTER 25).

Passenger Oxygen Mask

The masks are continuous-flow units. A plastic tube connects the oxygen box manifold to a mask reservoir bag. A flexible face piece with two check valves attaches to the reservoir bag. An elastic strap holds the face piece in its position on the user's nose and mouth. A lanyard connects the mask to the release cable in the oxygen box.

Training Point

The center PSU oxygen box has holes for the installation of the 22 minute and 12 minute oxygen generator release pin cable assemblies. If you put the release cable assembly through the incorrect hole, the cable will bind when the mask is pulled, and the generator will not fire.



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PASSENGER OXYGEN - PASSENGER OXYGEN BOX AND PASSENGER OXYGEN MASK

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**PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - INTRODUCTION****Purpose**

The latch part of the door latch/actuator holds the oxygen door closed. The actuator causes the latch to release the door.

Physical Description

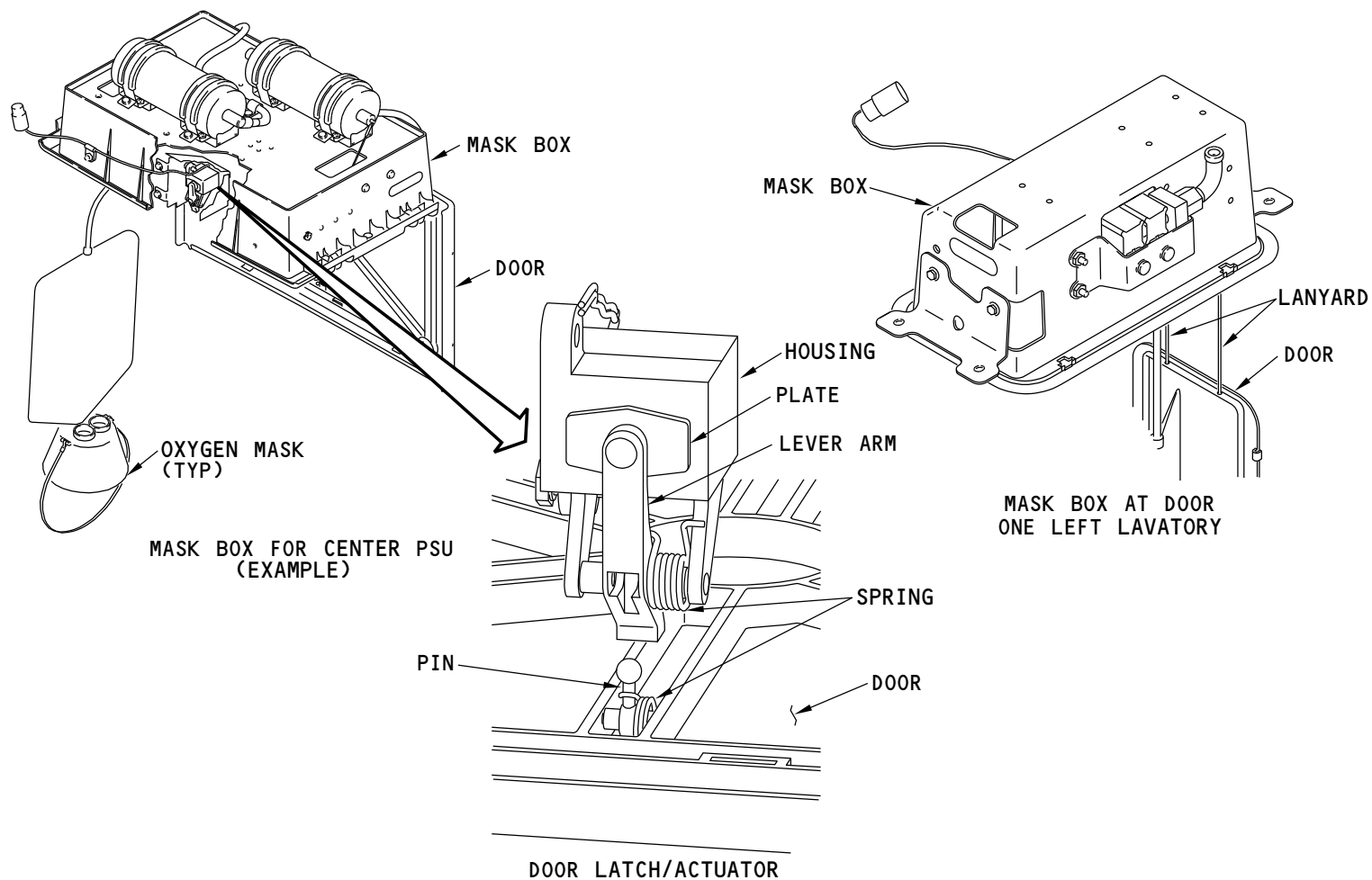
The latch/actuator has these parts:

- Electrical connector
- Housing
- Spring
- Lever arm with metal plate.

The housing contains a permanent magnet with an electric coil around it.

There is a spring-loaded latch pin on the oxygen door. It fits into a notch on the bottom of the lever arm to hold the door closed.

The hinge on the mask box in the lavatory at door one left has a design that is different from the other boxes. When the door is released and moves to open, the hinge separates and lets the door fall. It hangs on lanyards. In this position, the box door will not interfere with the operation of the lavatory bifold door.



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PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - INTRODUCTION

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**PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - FUNCTIONAL DESCRIPTION****General**

Either of these two conditions releases the oxygen masks:

- The passenger oxygen switch on the P5 is set to the ON position
- Two of the three cabin pressure sensors give a signal that the cabin pressure altitude is above 13,500 feet (4115 meters) and the airplane is in the air with an airspeed more than 80 knots.

Functional Description

When you operate the passenger oxygen switch, a signal goes from OPAS to the ELMS. The ELMS latches a ground for the channel A and B oxygen deployment relays for fifteen seconds. (The channel B relay is not shown. It is redundant with the channel A relay.) The relays let 115v ac energize the oxygen module door latch/actuators.

When the deployment relays energize, the ELMS sends a signal to these systems:

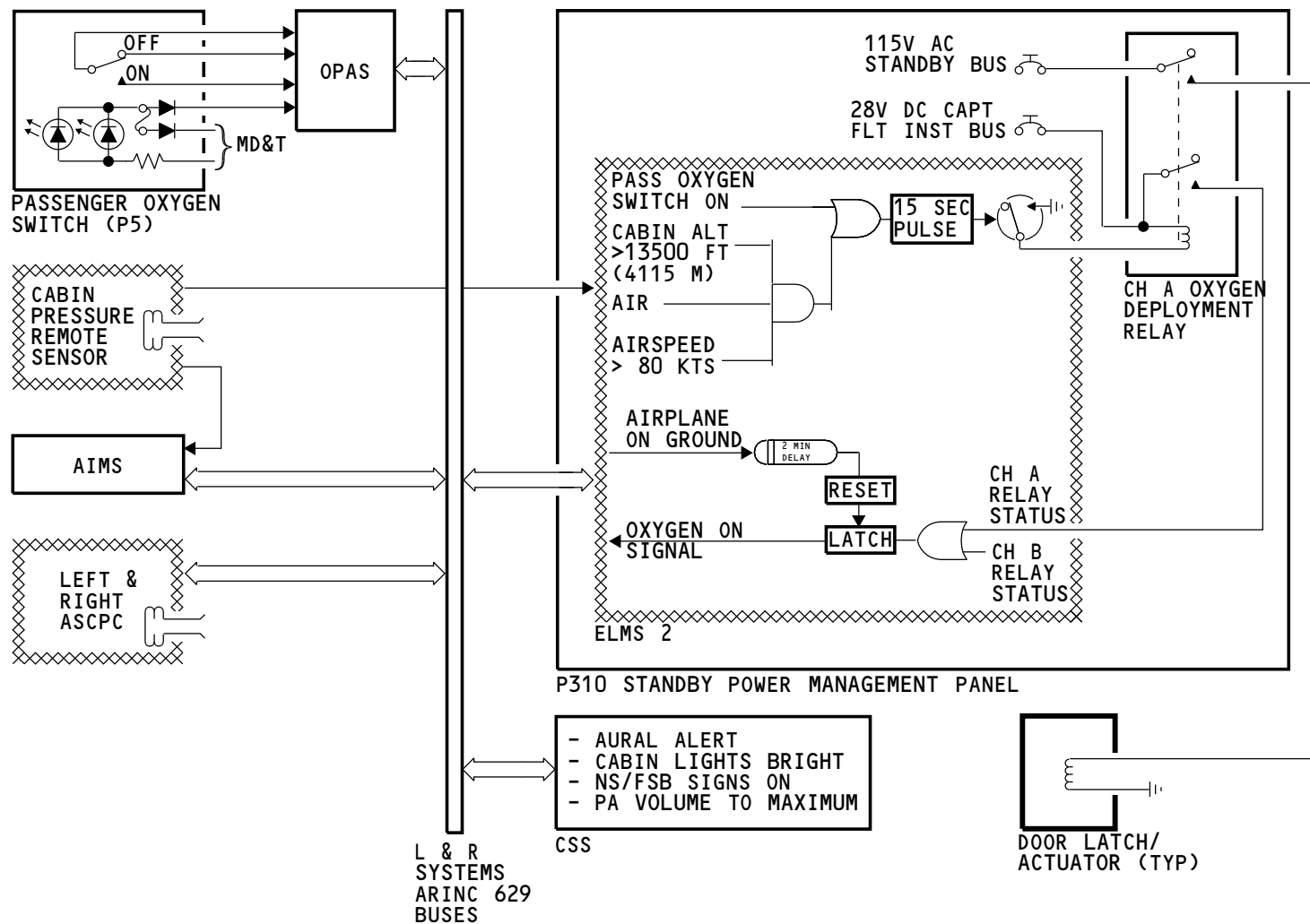
- AIMS
- Cabin services system (CSS)
- OPAS.

The OPAS turns on the light in the passenger oxygen switch. The AIMS shows an advisory message.

The CSS causes these events in the passenger compartment:

- Aural alert
- The passenger compartment lights come on bright
- The fasten seat belt signs come on
- Passenger address volume increases to maximum.

The ELMS cancels the oxygen on signal two minutes after the airplane lands.



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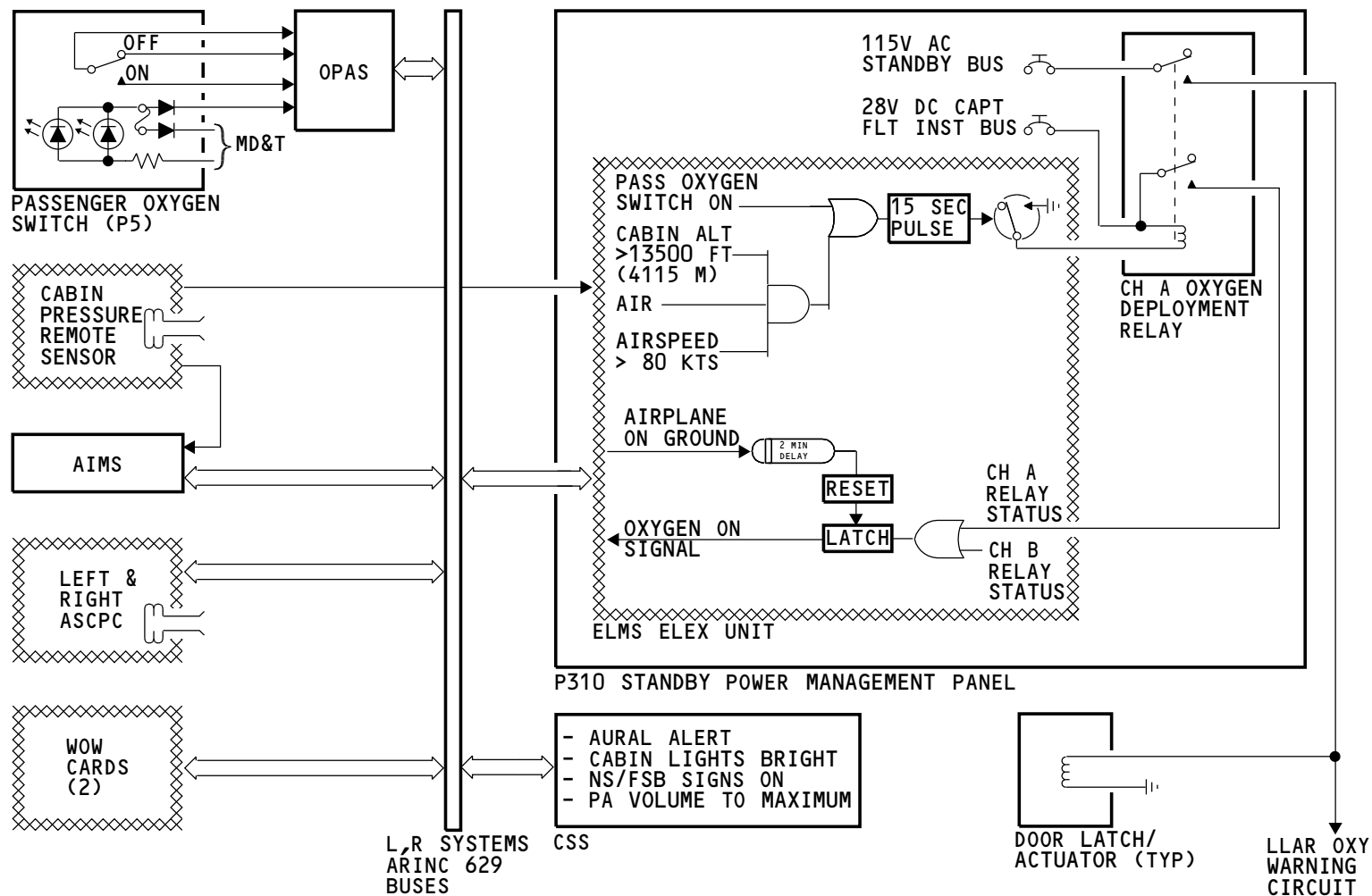
PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - FUNCTIONAL DESCRIPTION

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PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - FUNCTIONAL DESCRIPTION

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PASSENGER OXYGEN - CHEMICAL OXYGEN GENERATOR

Purpose

The chemical oxygen generators supply oxygen for the passengers and flight attendants.

Physical Description

The size of the generator has a relation to the number of oxygen masks that connect to it. The masks connect to a manifold at one end of the generator.

A firing pin is at the other end. A release pin holds the firing pin against the spring force. A release cable connects to a lanyard that goes to the mask. A safety pin holds the firing pin when the release pin is not installed.

The generator contains iron and sodium chlorate.

An expended indicator is around the middle of the generator. It goes to a dark color to show that the generator has been used.

Functional Description

When a passenger or attendant pulls on an oxygen mask, the lanyard and release cable pull the release pin out of the firing pin. The spring moves the firing pin into the primer. This causes the iron and sodium chlorate to react to release oxygen.

You cannot stop the reaction after it starts. There is full oxygen flow 10 seconds after the reaction starts. The oxygen flows at least 22 minutes.

Training Information Point

The expended indicator turns a dark color because of the heat of the reaction. This shows you that you must replace the generator.

There are pliers you use to pull out on the firing pin so you can put in a safety pin.



WARNING

MAKE SURE TO REMOVE THE SAFETY PIN FROM THE GENERATOR. THE GENERATOR WILL NOT FIRE IN AN EMERGENCY IF THE SAFETY PIN IS IN THE GENERATOR.

NOTE: If the firing pin is in the fired position (you cannot install the release pin), the generator has fired.



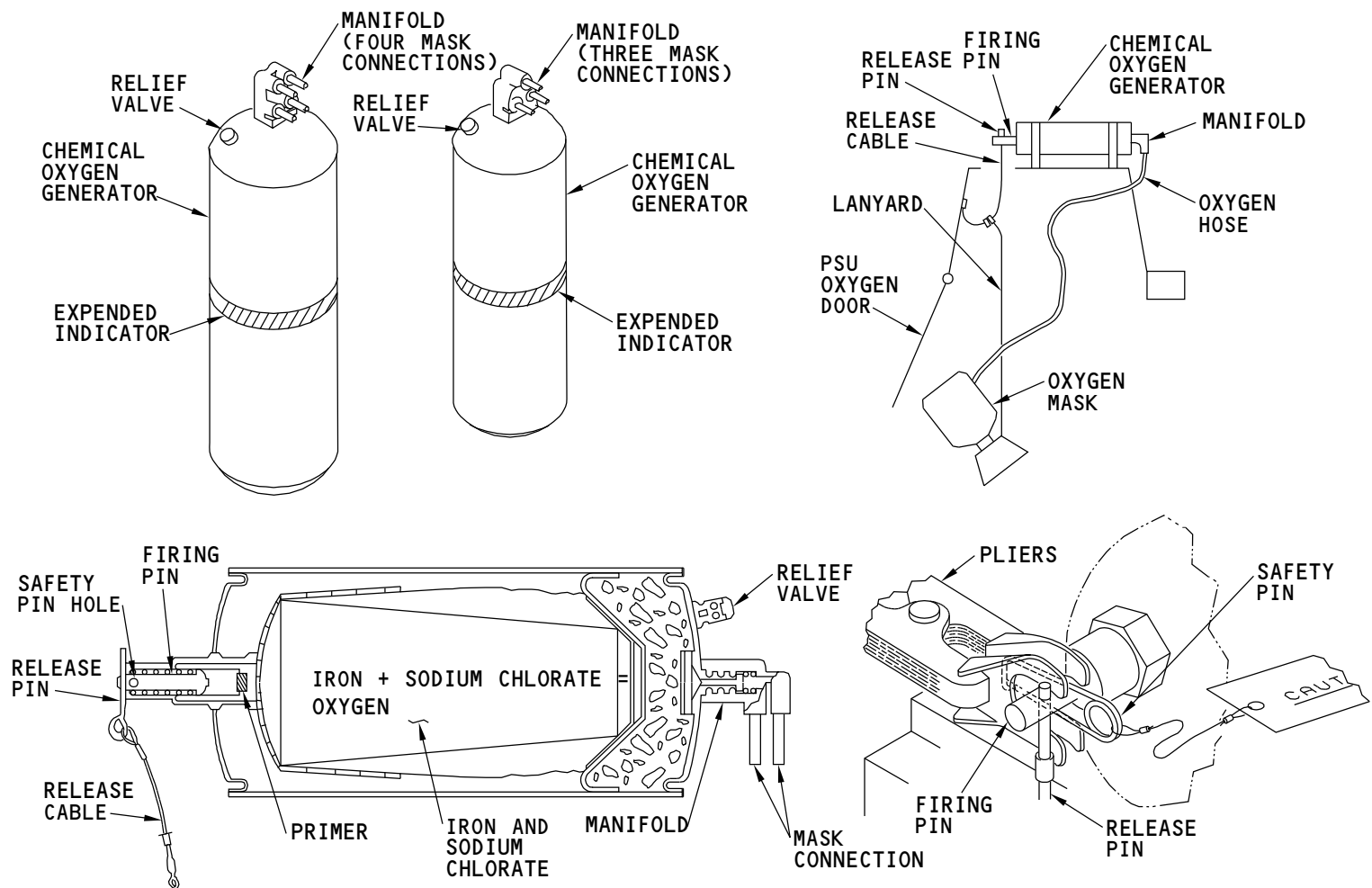
WARNING

MAKE SURE THE SAFETY PIN IS INSTALLED. THE GENERATOR IS A PYROTECHNIC ARMED DEVICE. IF THE GENERATOR FIRES, IT WILL GET VERY HOT (450 F OR MORE), WHICH CAN CAUSE INJURY TO PERSONS OR CAN CAUSE DAMAGE TO EQUIPMENT.

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PASSENGER OXYGEN - CHEMICAL OXYGEN GENERATOR

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**PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - TRAINING INFORMATION POINT****Door Latch/Actuator Test**

There is a restraint tool you use when you test the door latch/actuator. The tool goes through a slot in the PSU oxygen door. Push up on the tool until it locks in position.

When you push the passenger oxygen switch on the P5 overhead panel, you release the oxygen doors on the PSUs so they can open. The restraint tool will let the door open sufficiently so you can see that the latch/actuator operates correctly. The door cannot open sufficiently to let the masks drop.

Door Latch/Actuator Reset

The electric circuit that causes the latch/actuator to open will reset automatically after two minutes.

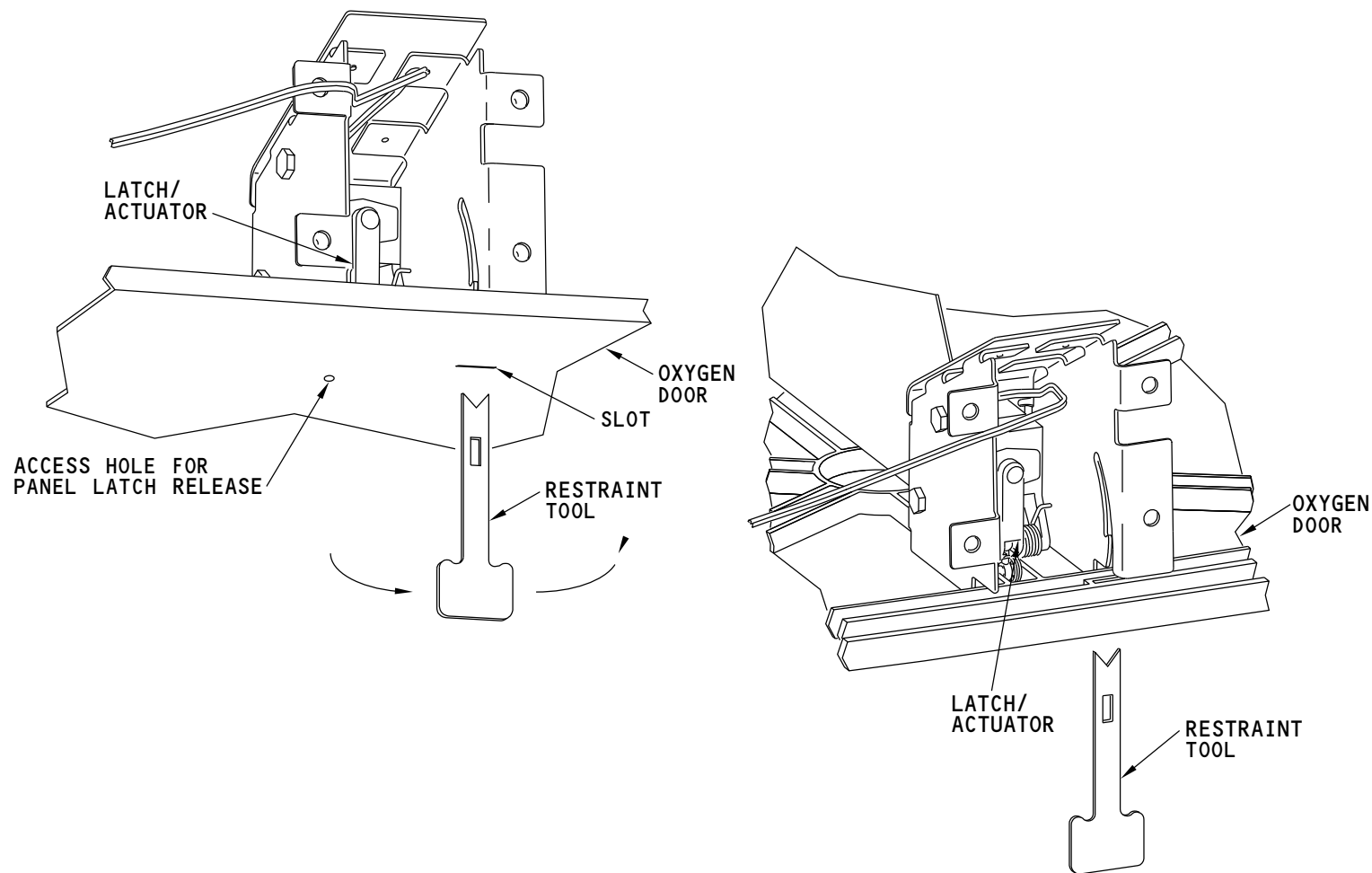
After the test you must reset the latch/actuators and close the doors. The open space between the door and the PSU is sufficient to let you touch the latch/actuator. Push the lever arm of the latch/actuator against the force of its spring so the lever goes against the housing. The magnet in the housing will hold the lever arm in this position.

Close the door. To remove the restraint tool, push up on the tool, pull it to the side, and then pull it down.

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PASSENGER OXYGEN - DOOR LATCH/ACTUATOR - TRAINING INFORMATION POINT

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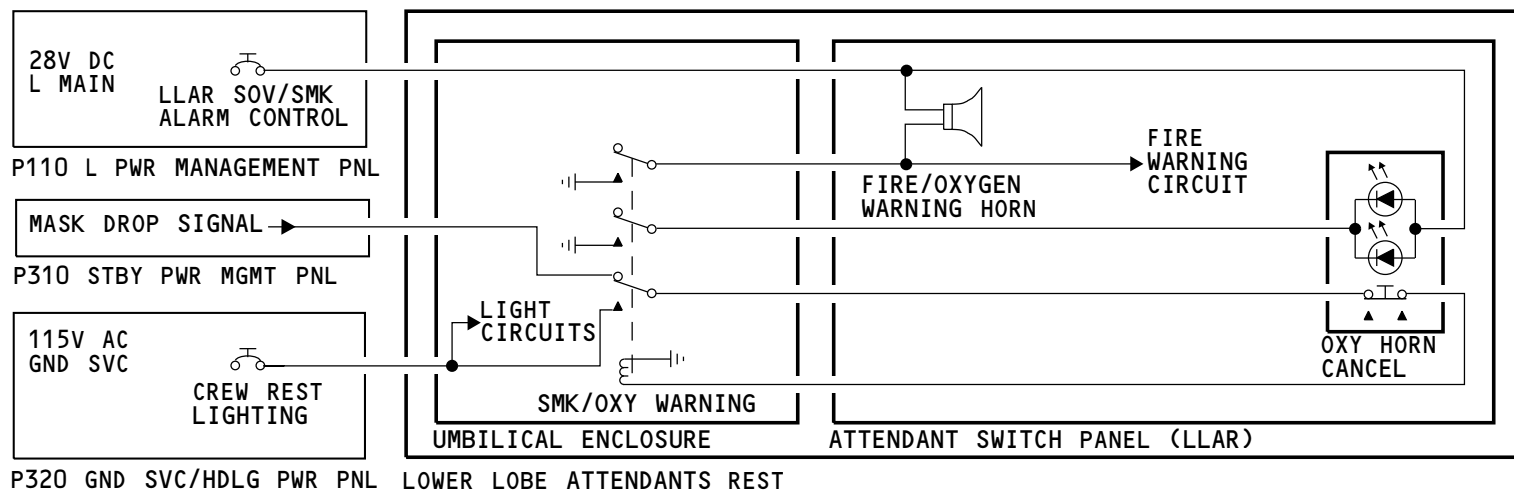
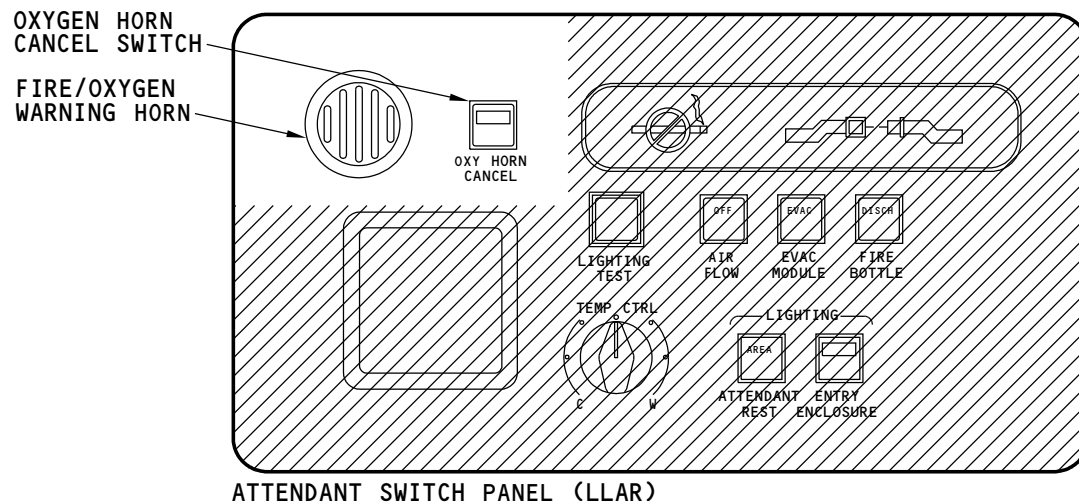
**PASSENGER OXYGEN - CREW REST AREA OXYGEN WARNING - FUNCTIONAL DESCRIPTION****General**

When the passenger oxygen system operates, a warning horn operates in the lower lobe attendants rest (LLAR). If flight attendants are sleeping, the warning horn wakes them so they can put on their oxygen masks.

Functional Description

The mask drop signal energizes the smoke/oxygen warning relay through the oxygen horn cancel switch. Power from the ground service bus latches the relay. The energized relay gives a ground for the warning horn and the LEDs in the horn cancel switch.

When you push the horn cancel switch, it removes electrical power from the relay. The warning horn stops and the switch LEDs go out.



PASSENGER OXYGEN - CREW REST AREA OXYGEN WARNING - FUNCTIONAL DESCRIPTION

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PASSENGER OXYGEN - OXYGEN CYLINDER (CDS)**Purpose**

The oxygen cylinders (CDS) supply emergency oxygen to the lavatory service units.

Physical Description

The oxygen cylinder is a stainless steel bottle with an actuator assembly, release lanyard and oxygen manifold attached to one end of the bottle.

Location

The oxygen cylinders are in the lavatory service units.

Functional Description

The oxygen cylinder is non-refillable, one use device. Oxygen is released when the release lanyard pin is pulled from the actuator assembly. Oxygen then flows from the cylinder through the oxygen manifold which has a flow control orifice. The orifice will cause constant oxygen pressure and flow during the oxygen release.

If the cylinder pressure becomes too high, the rupture disc will release the oxygen from the relief port near the oxygen manifold. The discharge indicator tape at the relief port will show that a high pressure oxygen release occurred.

Operational Controls

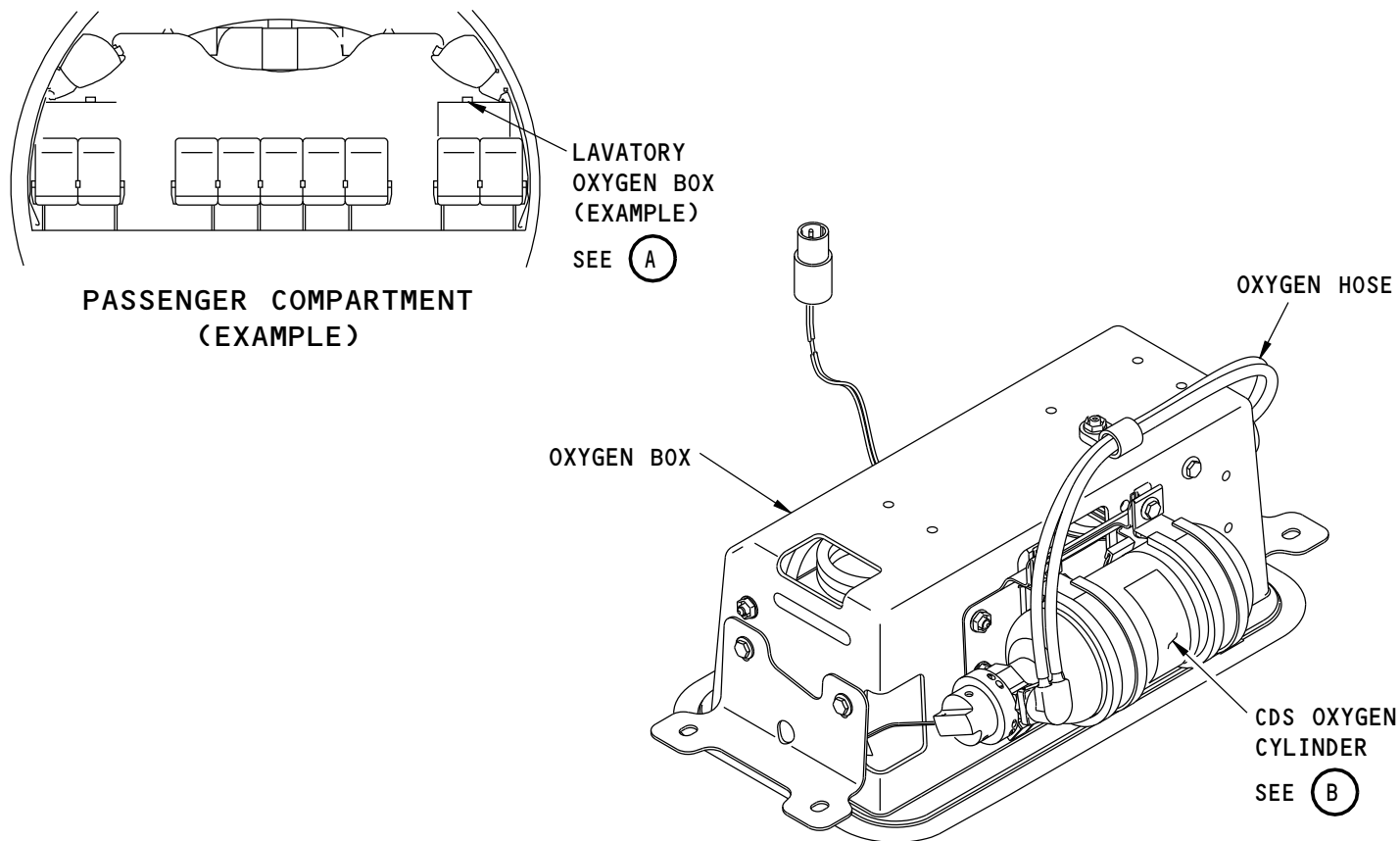
The oxygen cylinder operates mechanically. When a passenger pulls on an oxygen mask, a mask lanyard pulls on the release lanyard. The release lanyard pulls the release lanyard pin from the actuator assembly and releases a spring-loaded pin. The pin puts a hole in the rupture disc which starts the oxygen flow.

Operational Displays

The release lanyard and discharge indicator tape show the cylinder condition. If the release lanyard is removed from the actuator or the discharge indicator tape is damaged, then the oxygen cylinder must be replaced.

Training Information Point

A safety pin in the oxygen cylinder prevents accidental release of oxygen during maintenance activities. The safety pin must have a warning flag to prevent a safety-pinned cylinder from service. The safety pin must be removed for return to service.



**LAVATORY OXYGEN BOX
(EXAMPLE)**

(A)

PASSENGER OXYGEN - OXYGEN CYLINDER (CDS)

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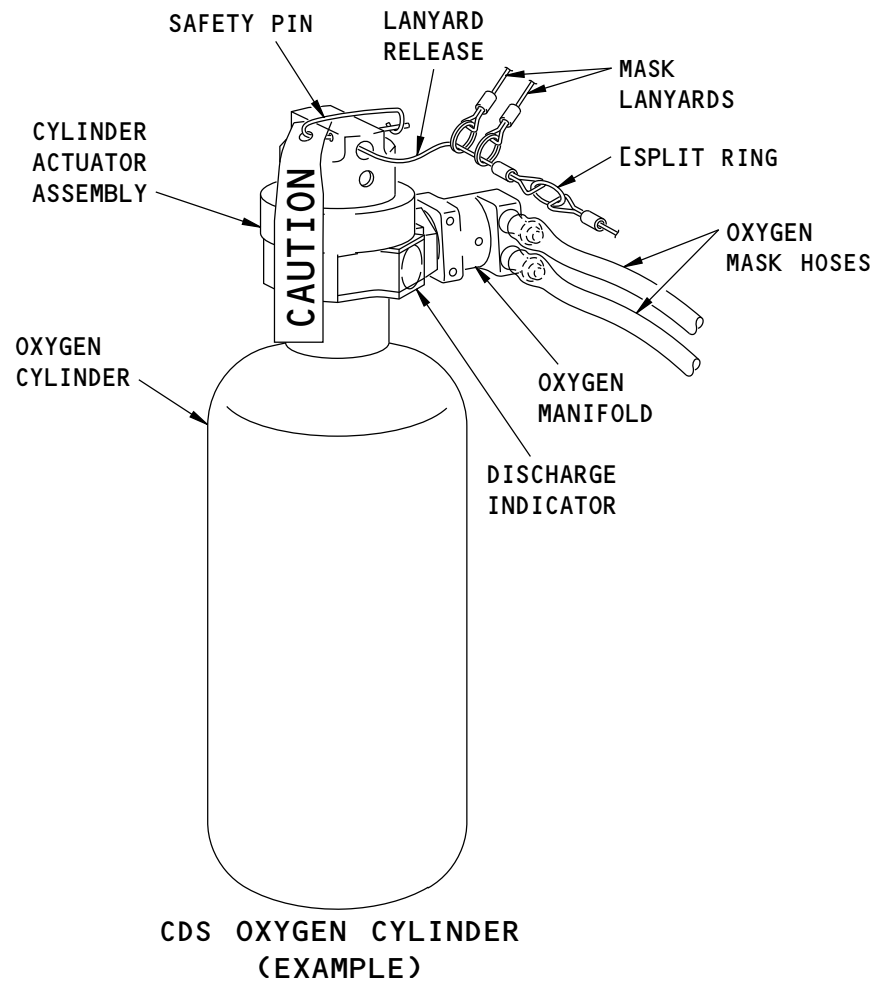
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(B)

PASSENGER OXYGEN - OXYGEN CYLINDER (CDS)

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PORTABLE OXYGEN - GENERAL DESCRIPTION

Purpose

Portable oxygen equipment lets the flight attendants move in the airplane when oxygen is in use. It is also a gaseous oxygen supply for medical emergencies.

Portable oxygen equipment lets the crew move in the airplane when oxygen is in use. The portable oxygen equipment lets crew persons go into compartments that have smoke and fumes if it is necessary. It is also a gaseous oxygen supply for medical emergencies.

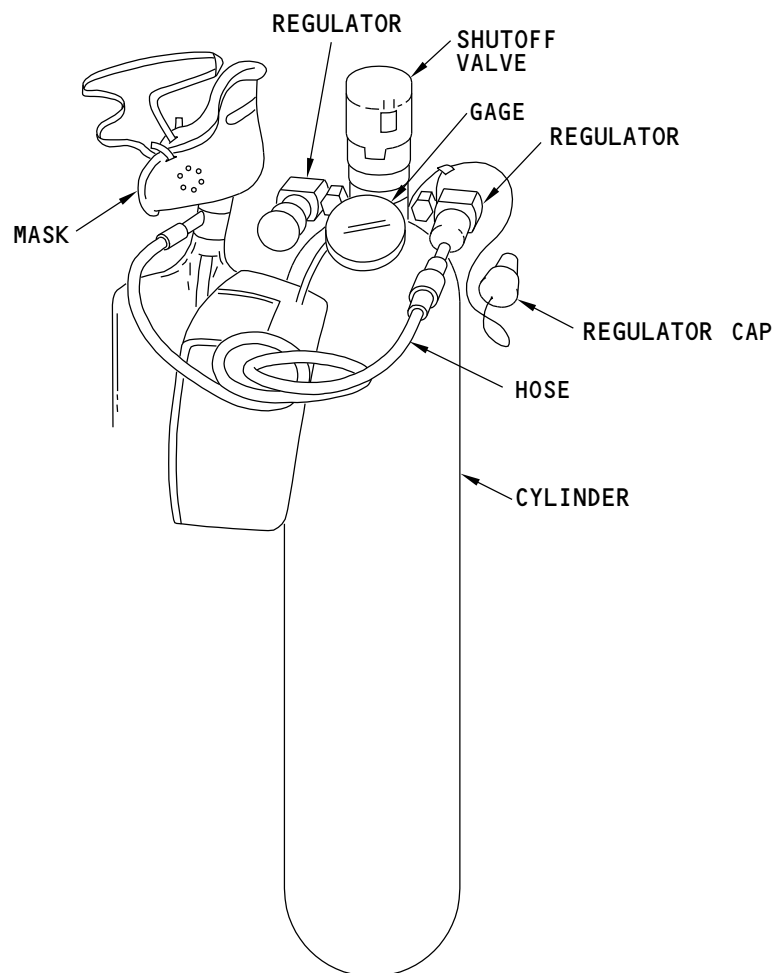
Physical Description

The portable oxygen equipment has these components:

- Regulator (2)
- Shutoff valve
- Gage
- Hose
- Cylinder
- Mask.

Operation

You connect the mask hose to the regulator that gives the oxygen flow that you want. One regulator supplies four liters per minute. The other supplies two liters per minute. Oxygen will flow through the regulator when you connect the mask and open the shutoff valve.



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PORTABLE OXYGEN - GENERAL DESCRIPTION

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