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CHAPTER 13: OXYGEN SYSTEMS

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INTRODUCTION

Oxygen is one of the most abundant elements on earth. As an un-combined gas, it makes up more than one fifth of the air we breathe. Nearly 90% of the weight of water is oxygen, and oxygen is found in most of the soil and rock that makes up the Earth's crust.

As a gas, oxygen is colourless, odourless and tasteless. It is extremely active chemically, and will combine with almost all other compounds. When any fuel burns, it unites with oxygen to produce heat, and in the human body, our tissues are continually being oxidised which causes the heat our bodies produce. This is the reason an ample supply of oxygen must be available at all times to support life.

Oxygen will not burn, but it does support combustion so well, that special care must be taken when handling it and that it is not used in the vicinity of fire, hot material, or any petroleum products. If pure oxygen is allowed to come into contact with oil, grease or any such product, it will combine violently and generate enough heat to ignite the material, and it will burn with a very hot flame.

Aviators breathe oxygen similar to that used for commercial purposes, excepting that it is processed to remove almost all of the water that could freeze and stop the flow of oxygen when it is so vitally needed. This is known as dry breathing oxygen.

For aircraft use, oxygen can be stored/produced and used in four ways;

- stored as a gas under pressure,
- stored as a solid and converted to a gas,
- stored as a liquid and converted to a gas, and
- separated from engine bleed air mechanically.

Gaseous Oxygen

Many commercial aircraft use gaseous oxygen stored in steel cylinders under a pressure of between 1800 - 2400 psi. All oxygen cylinders must be stamped near the filler neck with the approval number, the date of manufacture and the dates of all the hydrostatic checks performed on the cylinder. Cylinders are colour coded for gas identification. Refer to Figure 13-1.

The main reason for using gaseous oxygen is its ease of handling and the fact that it is available at most commercial airports. It does have the disadvantage of all gases stored at high pressure, in that it requires special care when handling the bottles or servicing the system, as well as the weight penalty of heavy storage cylinders. Oxygen quantity is measured by pressure.

Depending on aircraft type it may be used for;

- the fixed oxygen system of the aircraft for the flight crew
- the fixed oxygen system of the aircraft for the cabin crew and passengers,
- portable oxygen bottles used by the cabin crew in emergency
- the operation of some types of smoke hoods, and
- emergency medical equipment carried in the aircraft.

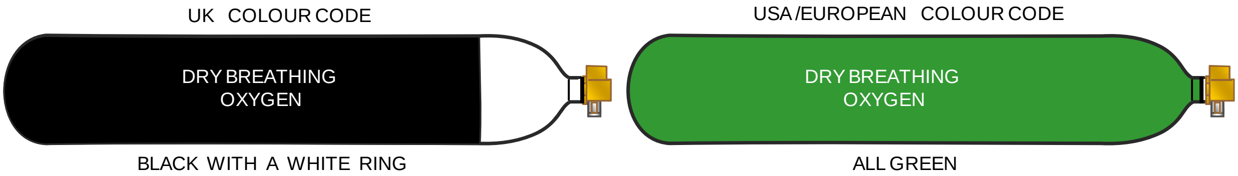


Figure 13-1 Gaseous Oxygen Cylinders

Solid (chemical) Oxygen

This method of storing and producing oxygen has been used for many years in submarines and today it is widely used in commercial aviation. The system consists of a shaped block of a chemical, such as <u>sodium chlorate</u> encased in a protective steel case.

The chemical is ignited either electrically or by a mechanical igniter, and once it starts burning, it cannot be extinguished, and will produce oxygen until the chemical is exhausted, which is <u>typically 20-25 minutes</u>. Because of their time limited generating capacity and the fact that they cannot be tested, these units are not usually employed as the fixed oxygen system for the flight crew.

They have an unlimited shelf life and require no special storage conditions, however they cannot be tested until actually used. <u>Oxygen quantity is not measured as it is assumed that a certain amount will be produced by each generator</u>. Refer to Figure 13-2.

Depending on aircraft type they may be used for;

- the fixed oxygen system of the aircraft for the cabin crew and passengers, and
- the operation of some types of smoke hood.

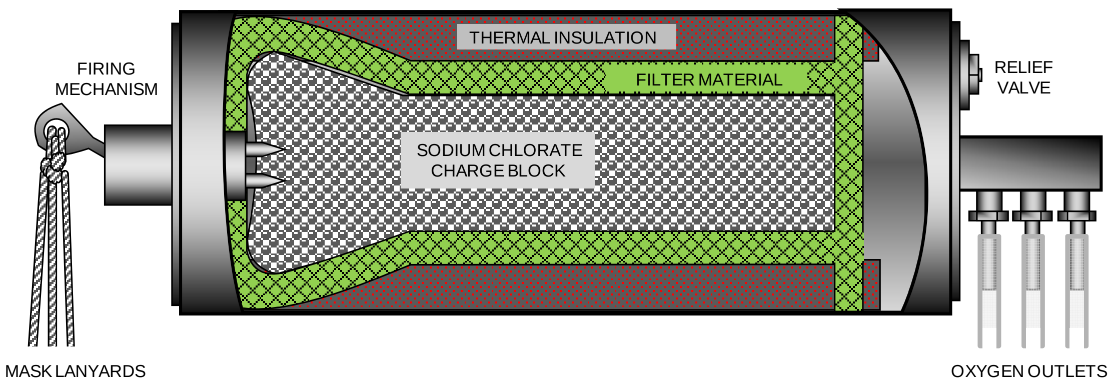


Figure 13-2 Chemical Oxygen Generator

Due to the heat generated by the chemical combustion they must be shielded in such a way as to prevent heat damage to the surrounding aircraft structure. Refer to Figure 13-3.

Figure 13-3 Installation in the Passenger Service Unit (PSU)

Liquid Oxygen

Almost all military aircraft carry their oxygen supply as liquid oxygen. Liquid oxygen is a pale blue, transparent liquid that will remain in its liquid form as long as it is stored at a temperature of below minus 181° F.

This is done in aircraft installations by keeping it in a Dewar bottle which resembles a double-walled sphere having a vacuum between the walls. The vacuum prevents heat transferring into the inner container. The liquid oxygen is heated and evaporated to form gaseous oxygen. Oxygen quantity is measured by the liquid volume.

Liquid oxygen installations are extremely economical in space and weight and there is no high pressure involved in the system. They do have the disadvantage however, of the dangers involved in handling the liquid at its extremely low temperature.

These systems require periodic replenishing because of losses from the venting system. Refer to Figure 13-4.

Typically it is used only as the fixed oxygen system for the crew.

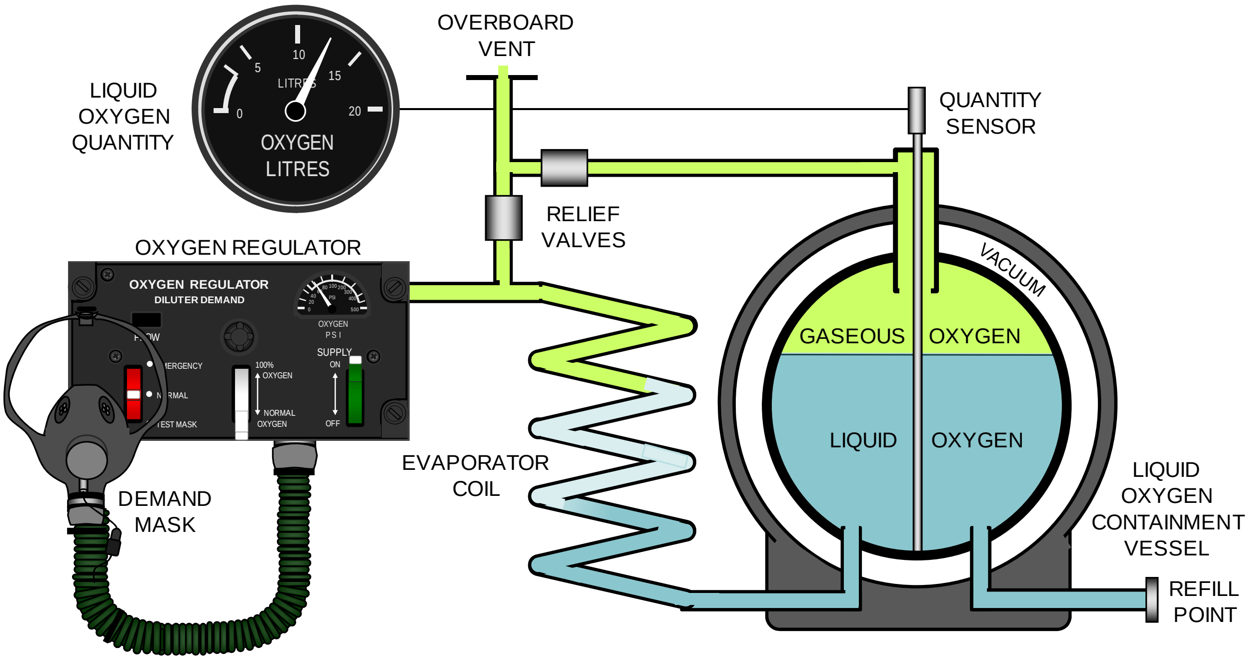


Figure 13-4 Liquid Oxygen System

Separated Oxygen

A modern development is the on board production of oxygen from compressed air, usually bleed air. This system is currently in use in military fighter aircraft such as the F-14, F-16 and FA/18. It is not used on commercial transport aircraft.

For interest, the system consists of a concentrator, a storage plenum, a monitoring unit, a pressure regulator and a small gaseous oxygen bottle for emergencies. The concentrator, which is electrically powered, works on the molecular sieve absorption (surface adhesion) principle, separating a small percentage of oxygen, along with inert gases, primarily argon, from the airflow on each cycle.

The concentrator contains two canisters of zeolite, one canister of which is purged while the other is in the oxygen-generating cycle. The cycle time for operation on each canister is about 5 seconds with inlet bleed air alternately directed to each canister by a motor driven valve. This valve is equipped with a sensor connected to a caution light in the cockpit, which alerts the pilot of any mechanical or electrical failure.

Oxygen-enriched air enters the storage plenum which contains as large a volume as practical, maintained at approximately 80 psi. The storage plenum automatically provides the pilot with up to 16 minutes of oxygen during short term high demands or low output periods, i.e., electrical system failures or engine flameouts.

A low pressure switch, installed immediately before the oxygen regulator, is connected to the caution light which alerts the pilot if oxygen pressure drops to 15 psi. This system produces approximately 94% oxygen.

On ejection from the aircraft the pilot is automatically provided with oxygen from the small gaseous bottle. Refer to Figure 13-5.

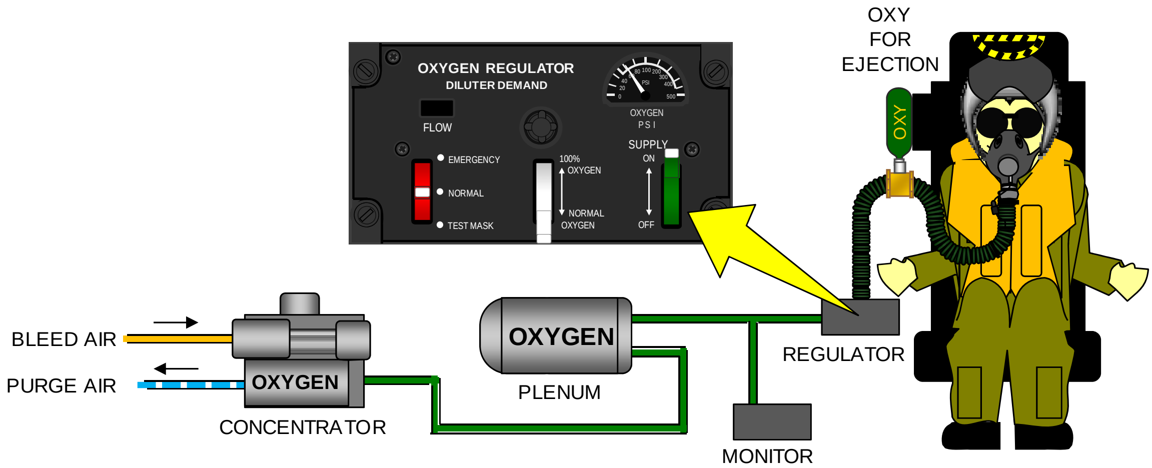


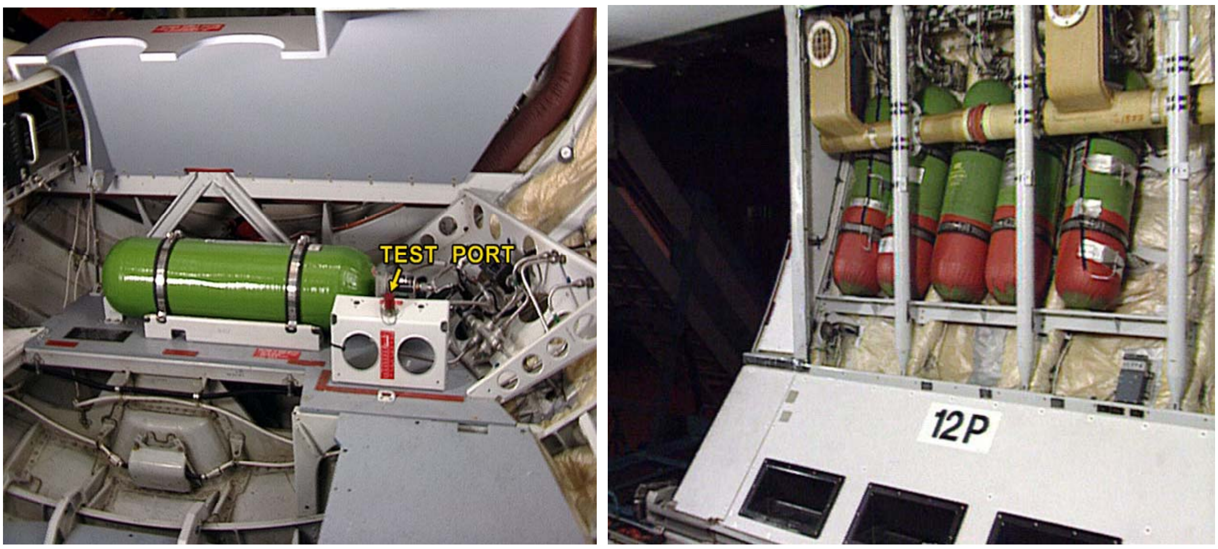
Figure 13-5 Mechanically Separated Oxygen System

GASEOUS OXYGEN SYSTEMS

On commercial airliners, oxygen cylinders are permanently mounted in the aircraft, and are only removed for periodic servicing. They are connected to the systems via check valves that allow one bottle to be removed without the system draining.

A large commercial aircraft will usually have one or two oxygen cylinders for the flight crew system and up to six bottles for the passenger system. The systems are separate and oxygen cannot be transferred from one system to another.

Each system's cylinders are connected to a common manifold. The manifold contains a fill valve that allows the cylinders to be filled without removing them, and a supply valve that is used to isolate the cylinders from the aircraft system. Refer to Figure 13-6.



FLIGHT CREW SYSTEM CYLINDER - A340

PASSENGER SYSTEM CYLINDERS - A340

Figure 13-6 Airbus Oxygen Cylinder Installations

All fixed aircraft installations have an overpressure safety relief system which vents oxygen overboard in the event of excessive pressure build-up. The discharge point is visible on the fuselage of the aircraft and contains a GREEN disc which will blowout if overpressure occurs.

If the green disc is missing the oxygen system is unserviceable. Refer to Figure 13-7.

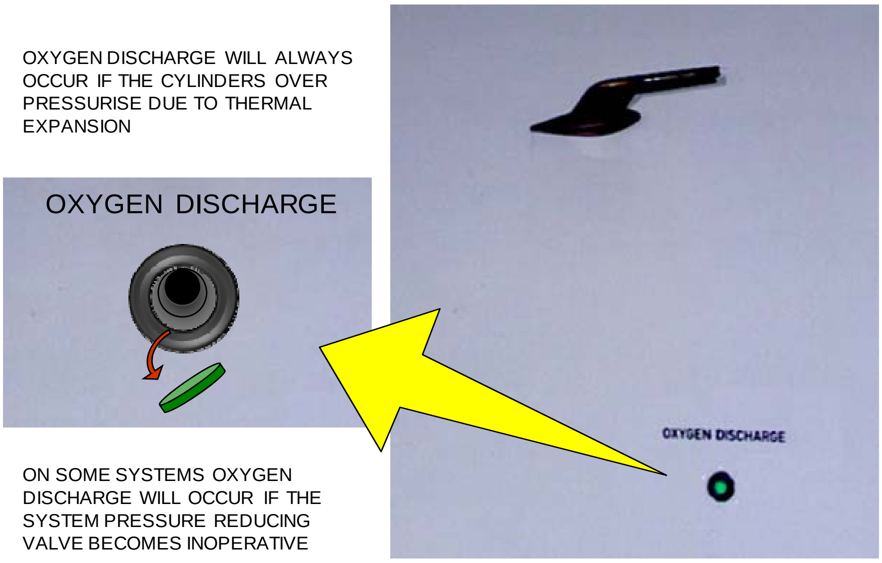


Figure 13-7 Oxygen Overboard Discharge Indicator

Oxygen System Replenishment

Oxygen is a dangerous gas, and it is at its most lethal state during servicing of the system. It is imperative that during servicing of the fixed and portable cylinders all safety precautions are rigorously followed. All portable oxygen cylinders should be removed from the aircraft when due for replenishment.

When servicing fixed systems the following precautions should be observed;

- all electrical work should cease on the aircraft,
- only personnel involved with the servicing of the oxygen system are allowed at the aircraft,
- both the aircraft and oxygen cart grounded, and the oxygen cart bonded to the aircraft, and
- no smoking within 50 feet of the aircraft, and personnel involved in the process, should not smoke for 10 minutes afterwards.

The most important aspect of replenishing the system is cleanliness. There should be no grease or oil anywhere near the aircraft. All tools required should be approved for use with oxygen replenishment and be spotlessly clean.

Oxygen replenishment trolleys consist of several oxygen cylinders grouped together and connected to a common manifold. Before commencing replenishment, all cylinders should be checked for compliance with the required test criteria. Each cylinder is connected to the manifold by a shut-off valve. The trolley manifold is connected to the aircraft by a hose and a specific replenishment procedure is used.

The replenishment procedure consists of opening the valve of the cylinder with the lowest pressure first, and when the pressures have equalized shut-off that cylinder. Open the valve of the next cylinder with the lowest pressure and repeat the procedure until the aircraft is fully charged. No cylinder should be allowed to become empty, as moisture may form due to condensation or from air which may enter the bottle.

Temperature compensation charts should be used to accurately work out the correct refill pressure, as a temperature increase will cause a pressure increase in the bottles.

Replenishment should be carried out slowly and within ambient temperature conditions that are within the range of the compensation chart for accurate pressure readings.

Fixed Flight Crew System

The fixed flight crew oxygen system, also referred to as a pressure demand system is provided for flight crew members, because under certain operating conditions, one or more of the crew are required to wear oxygen masks.

With a pressure demand type system, each crew member on the flight deck is able to select a different mode of oxygen supply using their individual oxygen regulators. The oxygen regulators and masks vary with aircraft type and will be discussed later in this Chapter. Refer to Figure 13-8.

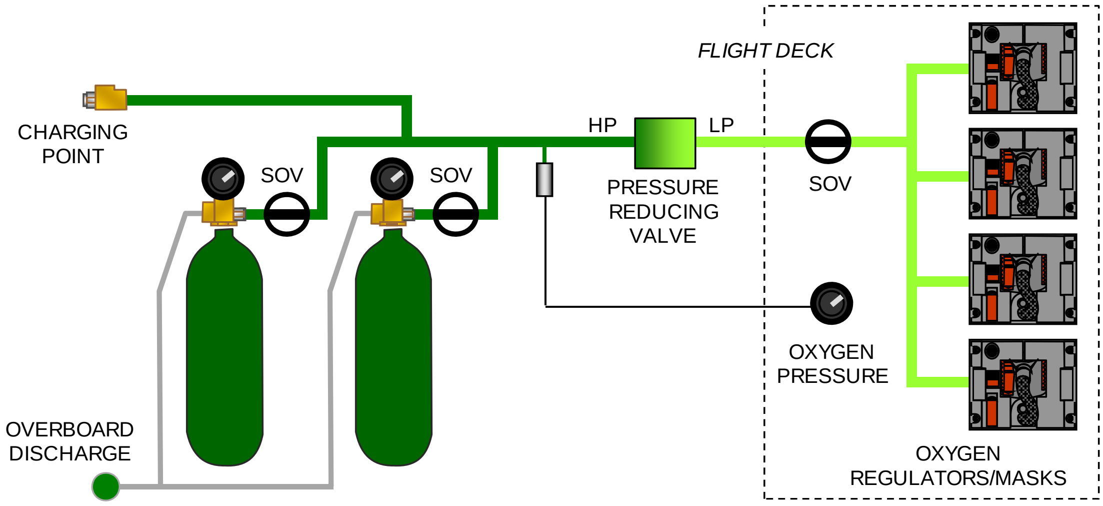


Figure 13-8 Flight Crew Gaseous Oxygen System (Typical)

The flight crew oxygen system pressure and regulators/masks should be checked during pre-flight for serviceability.

<u>A minimum amount of system pressure is required for every flight</u> and may vary depending on the route and destination involved. Refer to Figure 13-9 as an example.

35-10 CREW OXYGEN

13-01 Control and Indicating

A) Indications on DOOR/OXY ECAM Page

The table provided below must be used to determine the minimum oxygen bottle pressure required for dispatch.

CKPT OXYGEN MINIMUM DISPATCH PRESSURE

Departing Port/Region	Minimum Dispatch Pressure (PSI)
Hong Kong	[1500]
Northern Asia	1000
Southern Asia	1000
Australia, New Zealand	1100
India, Middle East via Bangkok	1000
India, Middle East via Kunming	1500
South Africa	1300
Europe and North America	1500

1) The minimum dispatch pressure may be reduced according to the number of cockpit seats to be occupied as follows:
- If three seats are occupied, the pressure may be reduced by up to 15%.
- If two seats are occupied, the pressure may be reduced by up to 35%.

Figure 13-9 Flight Crew Minimum Dispatch Pressure

Fixed Passenger System (Gaseous)

The fixed passenger oxygen system, also referred to as a continuous flow or supernumerary oxygen system, is provided for passenger use during a depressurisation emergency. This system allows oxygen to flow from the cylinders regardless of whether or not the user is inhaling.

The system consists of multiple oxygen cylinders connected to a common manifold through a shut-off valve and a pressure reducer/regulator. Refer to Figure 13-10.

The shut-off valve is opened either by an automatic cabin altitude barometric switch or electrically by the pilot.

A pressure gauge is fitted to the system between the cylinders and the regulator, and is used to determine the amount of oxygen in the system. A fill valve is fitted to the system to allow external filling.

Individual masks are supplied above each seat, inside a Passenger Service Unit (PSU). They deploy automatically if cabin altitude becomes excessively high (14,000 ft), or they can be deployed by the pilot at any time.

When deployed (pneumatically) and presented to the passenger oxygen does not flow until the user pulls the mask down to open the individual mask shut-off valves.

With a continuous flow system, oxygen is provided to the mask at all times and consumption is high, however, when no longer required, mask flow can be shut-off by closing the individual valves for each mask. There is only one type of mask used and it will be described later in this Chapter.

The passenger oxygen system pressure should be checked during pre-flight for serviceability. A minimum amount of system pressure is required for every flight and may vary depending on the route and destination involved.

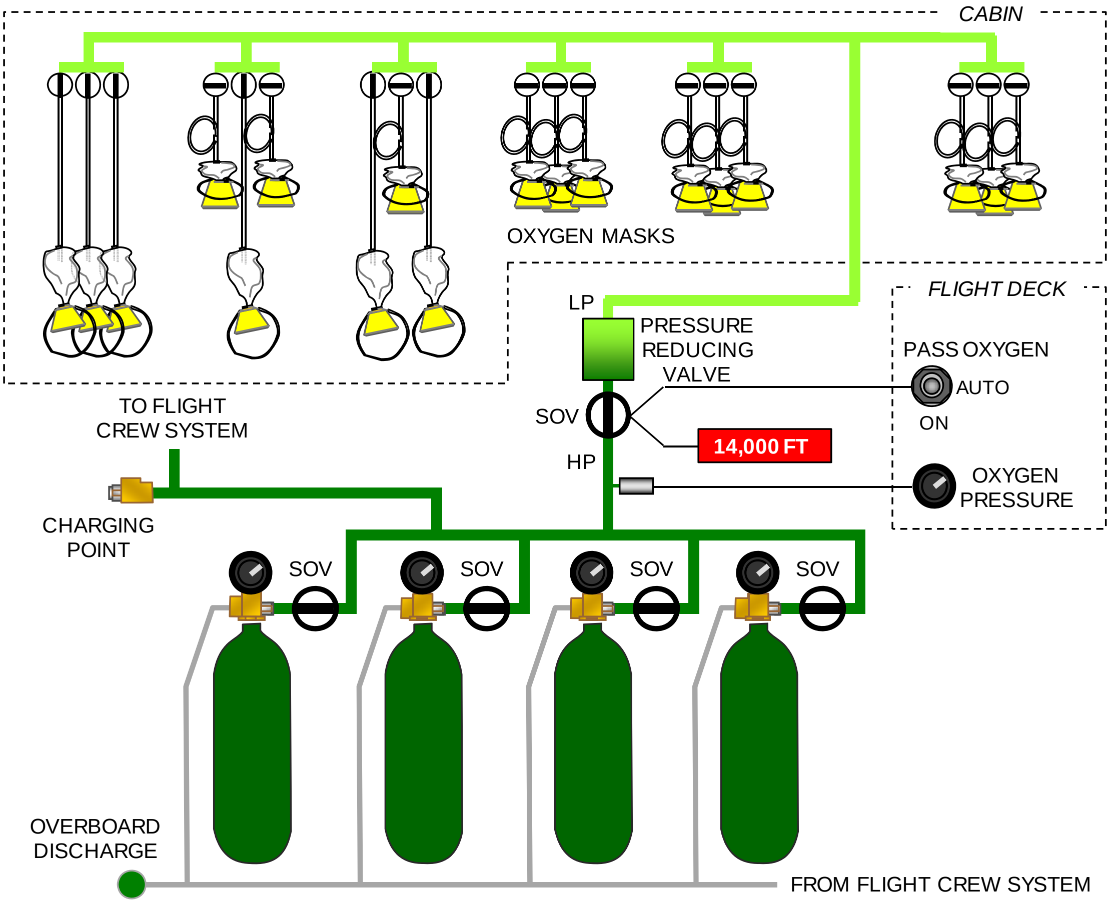


Figure 13-10 Passenger Gaseous Oxygen System (Typical)

Portable Oxygen System

Portable walk-around oxygen cylinders are located in various positions throughout the aircraft for use by cabin crew in emergencies. They are normally 120 litre wire wound cylinders and together with an attached mask form a portable oxygen set.

The normal cabin crew seating positions are fitted with the same drop-down type masks like the passengers and when required, cabin crew can use the portable oxygen sets to move around the cabin.

The portable cylinders may be fitted with a normal mask or a smoke mask and may also be used as medical oxygen. The normal minimum pressure is 1800 psi.

Demand type regulators are normally used with portable, walk-around, type oxygen cylinders. Refer to Figure 13-11.

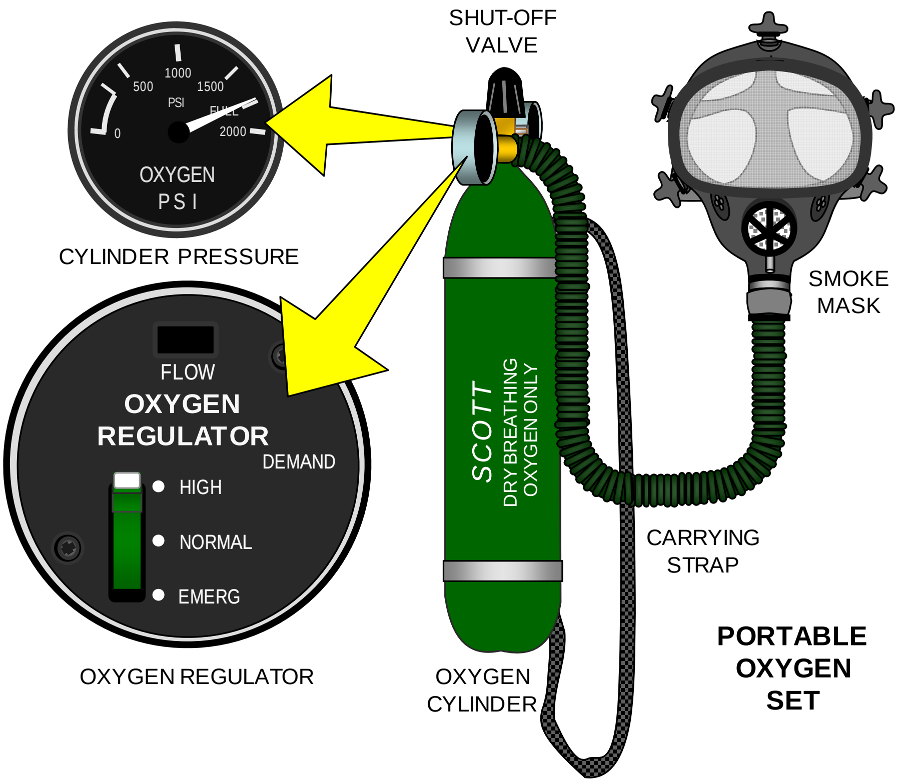


Figure 13-11 Portable Oxygen Cylinder

The regulator will usually have three flow rate settings which allow the system to be used under differing operational conditions. It should be noted that the times given are for a crew member operating under normal working conditions, and those times can be expected to be shorter under high stress conditions. Refer to Figure 13-12.

REGULATOR SETTING	TIME
NORMAL	60 MINS
HIGH	30 MINS
EMERGENCY	12 MINS

Figure 13-12 Portable Oxygen Cylinder Flow Rates

Smoke Hood Oxygen System

Some types of smoke hoods use gaseous oxygen stored in a circular cylinder at the neck of the hood. The operation of smoke hoods will be discussed later in this Chapter.

CHEMICAL OXYGEN SYSTEMS

Solid or chemical oxygen systems are not used for the flight crew as they have a limited capacity and cannot be pre-flight tested.

They may be used for the fixed passenger system and are also often fitted in the various crew rest areas on modern aircraft.

Chemical oxygen generation is also not used for portable oxygen sets used by cabin crews.

Fixed Passenger System (Chemical)

The fixed passenger oxygen system, also referred to as a continuous flow or supernumerary oxygen system, is provided for passenger use during a depressurisation emergency. This system allows oxygen to flow from the chemical oxygen generators regardless of whether or not the user is inhaling.

The system consists of multiple oxygen generators located in the Passenger Service Units (PSU's) above each seat group. Each generator typically produces oxygen for 2, 3 or 4 passengers. Refer to Figure 13-13.

Individual masks are supplied and they deploy automatically if cabin altitude becomes excessively high (14,000 ft), or they can be deployed by the pilot at any time.

When deployed (electrically) and presented to the passengers oxygen does not flow until the first user pulls a mask down to operate the igniter and start the chemical reaction.

Once started the chemical reaction cannot be stopped and oxygen will flow to the individual masks continuously until it is exhausted. A burning smell, smoke and an increase in cabin temperature may be associated with the normal operation of the oxygen generators.

Oxygen generators usually produce oxygen for 20 – 25 minutes.

The same type of mask is used as the gaseous system and it will be described later in this Chapter.

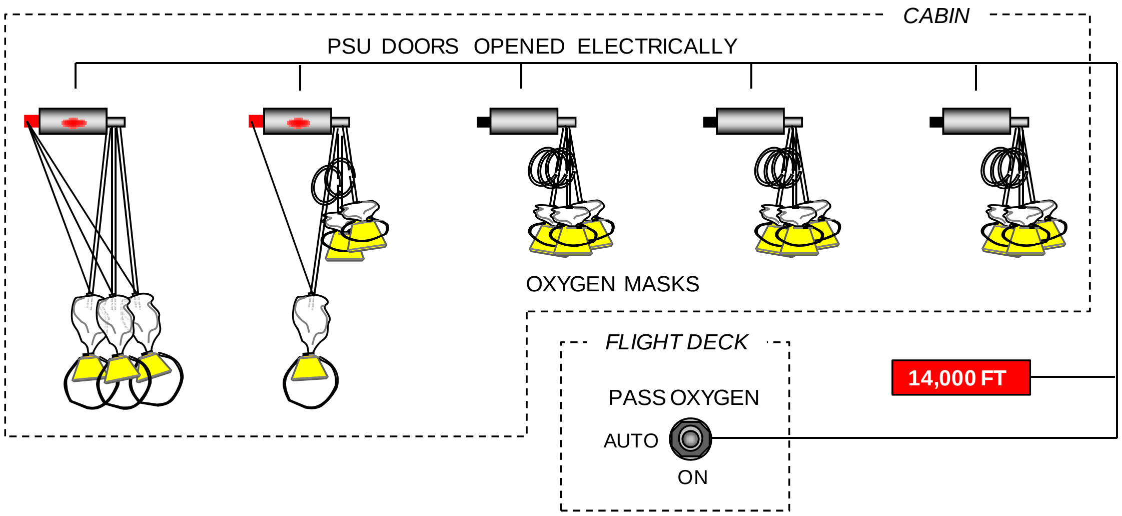


Figure 13-13 Passenger Chemical Oxygen System (Typical)

Smoke Hood Oxygen System

Some types of smoke hoods use small chemical oxygen generators located within in the hood. The operation of smoke hoods will be discussed later in this Chapter.

LIQUID OXYGEN SYSTEMS

Liquid oxygen systems are not used on commercial transport aircraft and therefore no example system is shown. Refer to Page 3 of this Chapter for a brief description.

SEPARATED OXYGEN SYSTEMS

These oxygen systems are not used on commercial transport aircraft and therefore no example system is shown. Refer to Page 4 of this Chapter for a brief description.

OXYGEN REGULATORS AND MASKS

Oxygen regulators are the interface between the oxygen cylinder or system and the user. They provide oxygen flow at a low regulated pressure via an oxygen mask. The pressure is defined as DEMAND pressure, that is, as the user inhales, oxygen will flow at a rate demanded by the user.

Some are simple regulators that only provide three fixed demand flow options while more complex regulators have infinite flow rates, dilution of the oxygen with ambient air and forced or POSITIVE pressure options and therefore regulators are either;

- demand regulators (simple), or
- diluter demand regulators (complex).

This allows various combinations of regulators and masks for aircraft use such as;

- a demand regulator connected by a hose to a separate mask for portable use, and
- a diluter demand regulator connected by a hose to a separate mask or integrated as part of the mask for fixed system use.

Demand Regulator connected to a Separate mask (portable)

This combination has been discussed previously. Refer to Page 9 of this Chapter.

Diluter Demand Regulator connected to a Separate mask (older fixed system type)

These regulators, located within easy reach next to each crewmember position, supply oxygen to the user in response to the suction of the user's breath.

They are designed to provide the most economical use of the oxygen under normal conditions. The user initially breathes ambient cabin air but as altitude increases, a greater concentration of oxygen is added until, at <u>approximately 34,000 feet, 100% oxygen is supplied</u>.

The face of the regulator has three coloured manual control levers, a pressure gauge and a flow indicator. Refer to Figure 13-14.

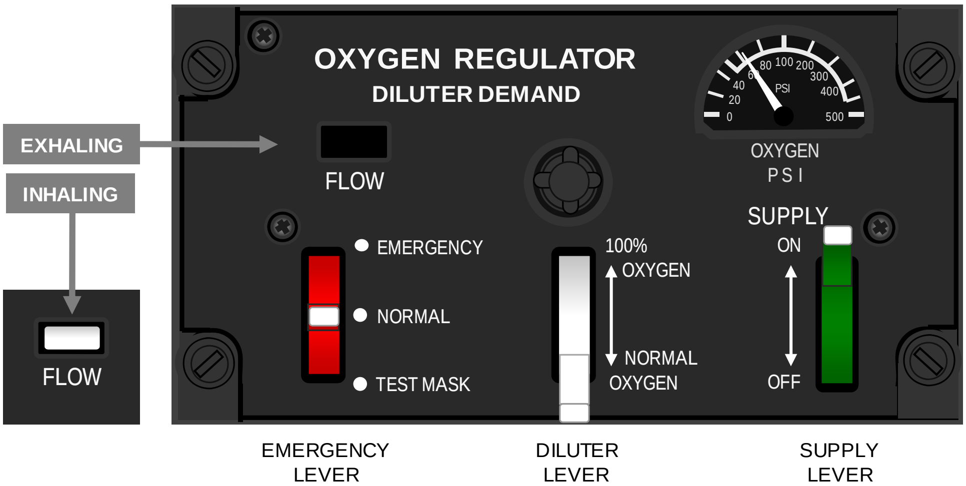


Figure 13-14 Diluter Demand Oxygen Regulator (older type)

The **SUPPLY** lever is used to turn the regulator ON or OFF.

The **DILUTER** lever is used to select NORMAL DEMAND supply (air/oxygen mixture) or 100% DEMAND supply (pure oxygen). <u>The selection of 100% is used when the ambient cabin air is contaminated with smoke or fumes</u>.

The **EMERGENCY** lever, when selected to EMERGENCY provides <u>100% oxygen under POSITIVE pressure</u>. The TEST MASK position is used to test the sealing of the mask around the face, using an increased POSITIVE pressure.

The pressure gauge indicates the oxygen pressure in the regulator when the supply lever is ON and a flow indicator or "blinker" shows white when the user inhales and flow occurs.

This regulator uses a separate oxygen mask normally located on a hook close to the crewmember position. Oxygen masks are fitted with an integral microphone which must be switched to replace the normal headset boom mike. Refer to Figure 13-15.

Figure 13-15 Regulator / Mask Combination (older type)

Diluter Demand Regulator integrated with the Mask (modern fixed system type)

Designed to save stowage space and provide a faster donning procedure the modern mask/regulator is stowed in a container with quick release doors. The modern regulators have exactly the same functions as older types but are integrated into the front of the oxygen mask. Refer to Figure 13-16.

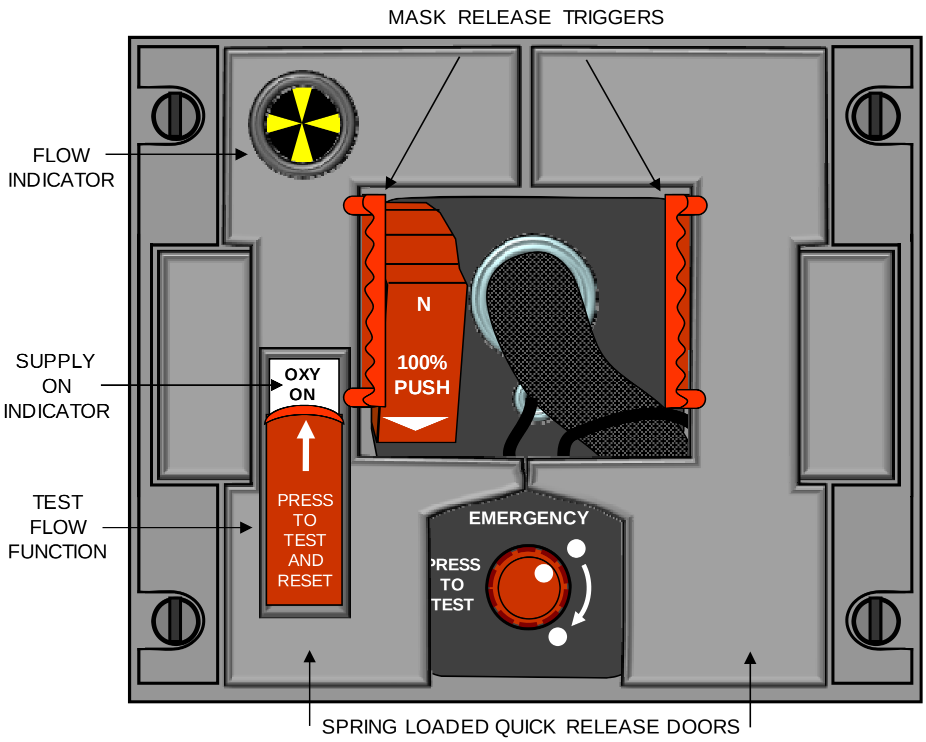


Figure 13-16 Regulator / Mask Combination (modern type)

A test switch on the LH door allows pre-flight checking of the mask function without removing the mask from the container. A flow indicator on the LH door operates in the same manner as the older type and a supply ON indicator shows when the mask is removed.

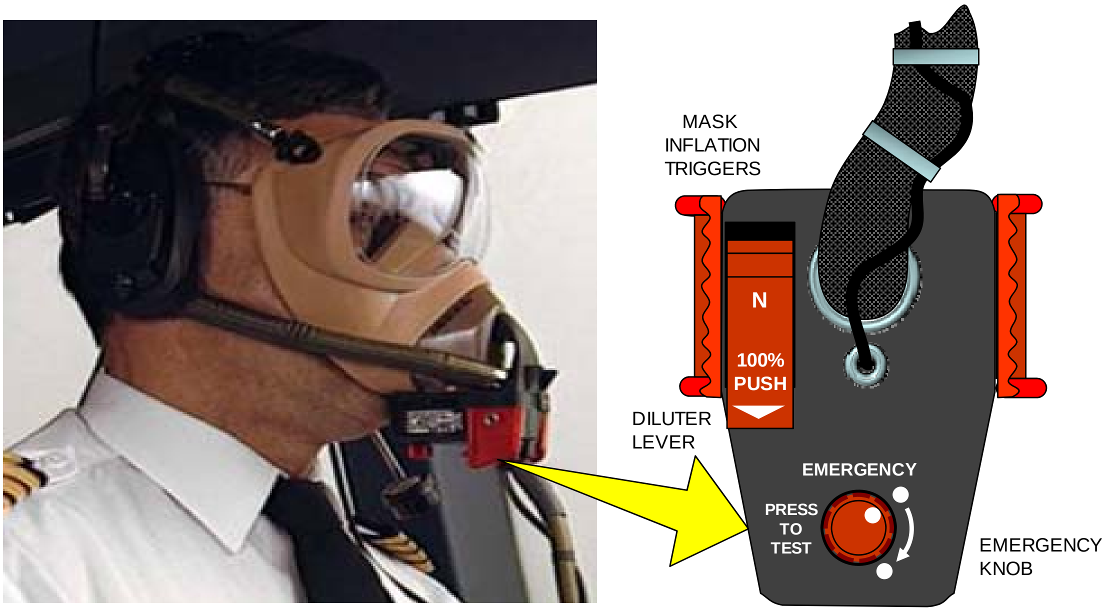


Figure 13-17 Mask donned and Regulator Controls

To don the mask, the inflation triggers are squeezed together which begins inflating the mask harness forcing the mask out of the container and opening the doors. Opening the doors starts oxygen flow and switches the mask microphone on.

The user maintains pressure on the triggers, pulls the mask from the container and dons the mask with the harness inflated.

When in position over the head and against the face the user releases the triggers which deflates the harness and tightens the mask.

The DILUTER and EMERGENCY functions can be selected on the mask. Refer to Figure 13-17.

Oxygen use can be terminated by closing the RH door and selecting RESET. This also reverts communication from the mask microphone to the normal headset microphone. If required, reopening the doors will restore mask flow and communication.

Passenger Masks

Supernumerary or passenger oxygen is supplied using a simple continuous flow re-breather mask.

Masks are stowed above the passenger seat groups and in the toilets in a container called the Passenger Service Unit (PSU). The door of the PSU opens and masks are deployed automatically when the cabin altitude reaches approximately 14,000 feet. If the door fails to open, cabin crew can manually open the PSU doors.

When the mask is pulled down, oxygen starts to flow and fills the bag. Oxygen is drawn into the lungs and is replaced in the bag by more oxygen. As the user breathes out, most of the used oxygen escapes around the side of the mask leaving a mix of breath and oxygen to be inhaled.

There are no controls or options with this type of mask, however with a gaseous system, when oxygen is no longer required, cabin crew can terminate flow by closing the small individual mask shut-off valves located inside the PSU.

Some re-breather systems use cup type masks which fit over the nose and mouth and have a check valve that allows the user to exhale.

The passenger may check oxygen flow by observing the flow indicator. Refer to Figure 13 18.

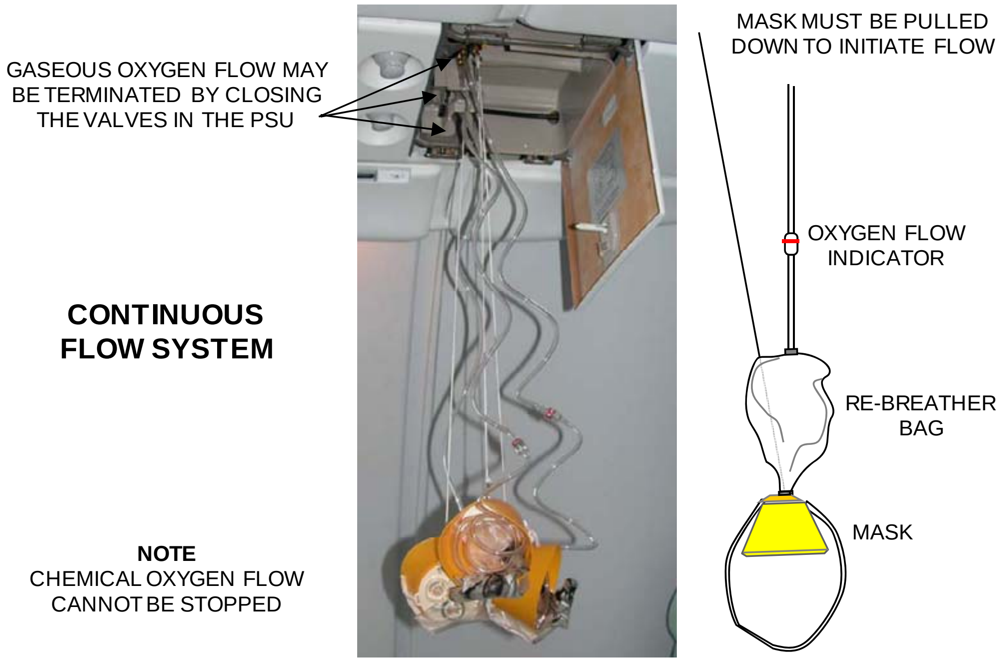


Figure 13-18 Continuous Flow Mask

SMOKE HOODS

Smoke hoods are located at various points throughout the aircraft and are intended for use by the crew to direct the ground (or sea) evacuation of passengers from a smoke filled cabin.

Smoke hoods are only intended to be used for this purpose and typically have a usage time of only 15 minutes, at which time they should be removed to prevent possible suffocation.

There are two common types in use. They are;

- gaseous types, and
- chemical types.

Both types are stowed in containers and must be unwrapped for use. Pre-flight serviceability is usually confirmed by inspecting the expiry date or a coloured disc on the container.

Gaseous Types are pulled over the head which forces the start lever upwards initiating oxygen flow. The rubber neck seal stops the oxygen escaping and the user breathes oxygen and exhausted air. An absorption system removes as much CO_2 as possible for the 15 minute duration.

Chemical Types are placed over the head and the user should ensure the internal face mask is secure. To operate, the user waits momentarily until water vapour and CO_2 starts the generator or they may pull the ignition cord for immediate oxygen flow. This is also a re-breather system removing CO_2 by absorption. Refer to Figure 13-19.

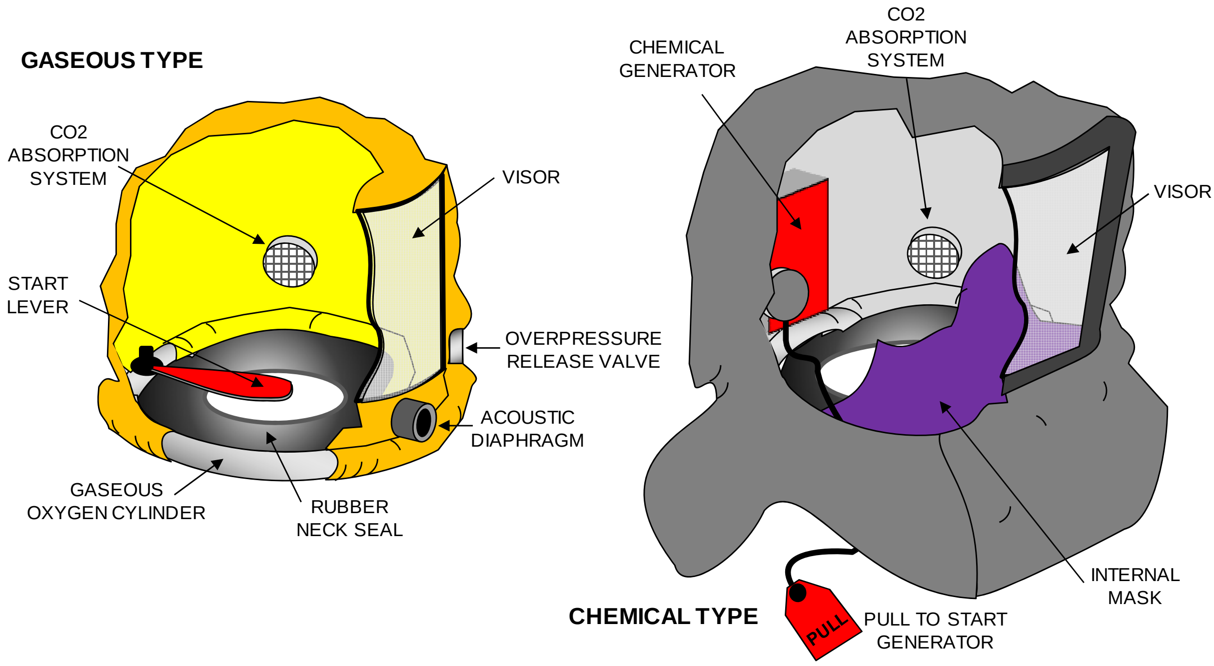


Figure 13-19 Gaseous and Chemical Smoke Hoods

The following table summarises the oxygen systems used in aircraft. Refer to Figure 13-20.

BASIC SYSTEMS	REGULATORS	MASK USED	TYPICAL USE	OPERATION
PRESSURE DEMAND GASEOUS	DILUTER DEMAND	DEMAND	FIXED FLIGHT CREW SYSTEM	DILUTES WITH AIR ONLY FLOWS WHEN USER INHALES POSITIVE PRESSURE OPTION
	DILUTER DEMAND REGULATOR INTEGRAL WITH DEMAND MASK		FIXED FLIGHT CREW SYSTEM	DILUTES WITH AIR ONLY FLOWS WHEN USER INHALES POSITIVE PRESSURE OPTION
	DEMAND	DEMAND	PORTABLE SYSTEM	ONLY FLOWS WHEN USER INHALES THREE FLOW RATES
CONTINUOUS FLOW GASEOUS	NONE	RE-BREATHER	FIXED PASSENGER SYSTEM	CONTINUOUS FLOW, USER RE-BREATHES OXYGEN FROM BAG ONE FLOW RATE
CONTINUOUS FLOW CHEMICAL	NONE	RE-BREATHER	FIXED PASSENGER SYSTEM	CONTINUOUS FLOW, USER RE-BREATHES OXYGEN FROM BAG ONE FLOW RATE
SMOKE HOOD GASEOUS	NONE	RE-BREATHER HOOD WITH CO_2 ABSORPTION	SMOKE HOOD GND EVACUATION	CONTINUOUS FLOW, USER RE-BREATHES OXYGEN FROM HOOD ONE FLOW RATE
SMOKE HOOD CHEMICAL	NONE	RE-BREATHER HOOD WITH CO_2 ABSORPTION	SMOKE HOOD GND EVACUATION	CONTINUOUS FLOW, USER RE-BREATHES OXYGEN FROM HOOD ONE FLOW RATE
PRESSURE DEMAND LIQUID	DILUTER DEMAND	DEMAND	FIXED FLIGHT CREW SYSTEM	DILUTES WITH AIR ONLY FLOWS WHEN USER INHALES POSITIVE PRESSURE OPTION
PRESSURE DEMAND SEPARATED	DILUTER DEMAND	DEMAND	FIXED FLIGHT CREW SYSTEM	DILUTES WITH AIR ONLY FLOWS WHEN USER INHALES POSITIVE PRESSURE OPTION

Figure 13-20 Summary of Oxygen Systems

OXYGEN SYSTEM INDICATIONS AND WARNINGS

For FIXED systems the normal and abnormal indications associated with oxygen systems are;

- the current HP cylinder pressure for the flight crew and passenger systems, shown on a gauge in the cockpit or on the EICAS/ECAM in modern aircraft.
- a present green disc on the fuselage of the aircraft,
- a supply pressure gauge or oxygen ON tag on diluter demand regulators, and
- an amber caution light or EICAS/ECAM message indicating oxygen masks have been deployed in the cabin.

For PORTABLE systems the indications are;

- the current cylinder pressure shown on an attached gauge.

General Safety Precautions

When operating an aircraft with an oxygen system, pilots and cabin crew should be aware of the possibility of spontaneous ignition occurring from contact with any products containing grease or oil. Examples of substances that may ignite are lipsticks, hair cream or oils, sunburn creams, Vaseline etc.

OXYGEN TERMINOLOGIES AND DEFINITIONS

The following table defines old and/or common terms that you may encounter with reference to oxygen systems. Refer to Figure 13-21.

TERM REFERRED	DEFINITION
LOX	The common acronym for Liquid Oxygen
OBOGS	On-Board Oxygen Generating System (OBOGS). An acronym used to describe a system that mechanically separates oxygen from engine bleed air.
Blinker	Is the common term used to describe the indicator located on a diluter demand regulator to indicate when the user inhales oxygen. Either shows white or yellow when flow is occurring.
PBE	Protective Breathing Equipment (PBE) is another common name of a smoke hood
EROS Mask	Emergency Respiratory Oxygen System (EROS). One of the common names used to describe the modern mask fitted to the fixed system for the flight crew.
CPR	Cardio Pulmonary Resuscitation (CPR)
PSU	Passenger Service Unit (PSU). The container located above the passenger seat group that houses the oxygen masks. It normally opens automatically but can be opened manually by cabin crew

Figure 13-21 Oxygen System Terms and Definitions

OXYGEN SYSTEMS QUESTIONS

The following questions will examine your understanding of oxygen systems. The answers may be found in the text or diagrams of this Handbook.

1. Gaseous oxygen used for aircraft is called;

a. Aircraft Certified Oxygen (ACO).
b. Aircraft Standard Oxygen (ASO).
c. dry breathing oxygen.

2. Passenger oxygen masks are automatically deployed;

a. when cabin altitude exceeds 10,000 ft.
b. to the half hang position when cabin altitude exceeds about 14,000 ft.
c. to the half hang position when cabin rate of descent exceeds 1,500 fpm.

3. A chemical oxygen generator comprises;

a. a filter, a sodium chlorate charge, iron powder and a firing mechanism.
b. a filter, a nitrous oxygen and iron powder charge and a firing mechanism.
c. a filter, a potassium hydroxide charge and an iron firing mechanism.

4. Portable oxygen sets are provided;

a. for passengers wishing to use the toilet in unpressurised aircraft.
b. for use by cabin crew.
c. for use by flight crew in a smoke filled cabin.

5. On large commercial transport aircraft the flight crew oxygen source is usually;

a. gaseous or liquid.
b. gaseous or chemical.
c. gaseous.

6. HP oxygen cylinders identified under UK standards are;

a. coloured black with a white ring on the bottom.
b. coloured black with a white ring on the top.
c. coloured black with a green ring on the top.

7. The white coloured lever on a diluter demand regulator is called the;

- **a.** normal supply lever.
- **b.** normal lever.
- **c.** diluter lever.

8. An oxygen “blinker” is;

- **a.** used to indicate quantity.
- **b.** used to indicate flow.
- **c.** used to indicate pressure.

9. HP cylinder overpressure due to thermal expansion is indicated by;

- **a.** a missing disc.
- **b.** a present green disc.
- **c.** a warning on the ECAM or EICAS.

10. In a supernumerary oxygen system the oxygen will flow when;

- **a.** the cabin altitude increases to approximately 14,000 ft.
- **b.** the pilot selects it to ON.
- **c.** the passenger pulls the mask down.

11. If a PSU door for a fixed gaseous system fails to open the cabin crew should;

- **a.** immediately direct the passengers to another seat group.
- **b.** open the PSU door using the electric override.
- **c.** open the PSU door manually.

12. In a LOX system the amount of oxygen available for all crew members is displayed on a gauge or readout measuring the;

- **a.** liquid weight in the Dewar container.
- **b.** gas pressure in the Dewar container.
- **c.** liquid volume in the Dewar container.

13. In aircraft fitted with modern EROS type oxygen masks the emergency oxygen control is located;

- **a.** on the LH door.
- **b.** adjacent to the LH door.
- **c.** on the mask.

14. A continuous flow mask is used;

- **a.** for gaseous oxygen systems only.
- **b.** for both gaseous and chemical oxygen systems.
- **c.** for chemical oxygen systems only.

15. A demand oxygen regulator;

- **a.** has three flow settings.
- **b.** has two flow settings.
- **c.** is a forced breathing type.

16. Gaseous oxygen replenishment is normally conducted with;

- **a.** a ground unit that generates oxygen from chemical action.
- **b.** reference to a temperature chart.
- **c.** a ground unit that stores oxygen in black bottles.

17. To conduct a pre-flight inspection of a smoke hood you would;

- **a.** no pre-flight is required as the smoke hood is sealed.
- **b.** inspect the smoke hood container.
- **c.** open the container and inspect the smoke hood.

18. A diluter demand oxygen regulator;

- **a.** dilutes the oxygen output all of the time.
- **b.** is normally used on portable oxygen bottles.
- **c.** has a red coloured emergency control.