A350
TECHNICAL TRAINING MANUAL
MAINTENANCE COURSE - T1+T2 - RR Trent XWB
Oxygen

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OXYGEN

V1813401 - V01T0M0

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

OXYGEN PROPERTIES

The air is made of 21% oxygen, 78% nitrogen and 1% other gases.
The gaseous oxygen is colorless, odorless and tasteless.
The gaseous oxygen is not flammable, but supports combustion.
The gaseous oxygen is heavier than air and can accumulate in low lying areas.
The oxygen reacts to most metals and organic material.
The reactivity varies with the type of material:
- The reaction can be slow and can cause for example steel oxidation commonly called rust,
- The reaction can be fast when the oxygen is in contact with petroleum product, and can cause fire or explosion.

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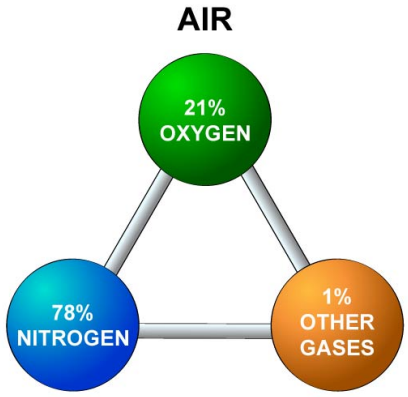


OXYGEN :

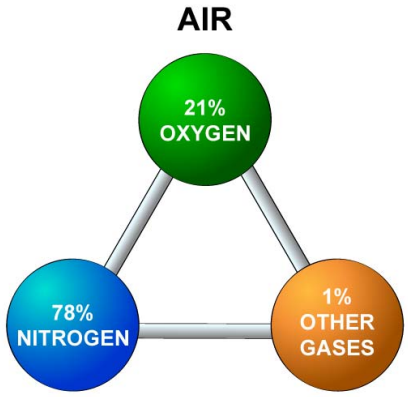
I am invisible ... !

I am silent ... !

I have no smell ... !

I help to burn very quickly ... !

OXYGEN PROPERTIES



OXYGEN :

I am invisible ... !

I am silent ... !

I have no smell ... !

I help to burn very quickly ... !

EXAMPLE OF OXYGEN INCIDENT

OXYGEN PROPERTIES

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OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

AIRCRAFT OXYGEN SYSTEMS

At high altitude, the pressurization (ATA 21) system maintains a sufficient air pressure, thus oxygen partial pressure, in the aircraft.
In case of aircraft depressurization the oxygen systems (ATA35) supply sufficient oxygen partial pressure to the crew and passengers until the aircraft gets at lower altitude (10000ft).
A lot of those systems use bottle of highly pressurized oxygen.

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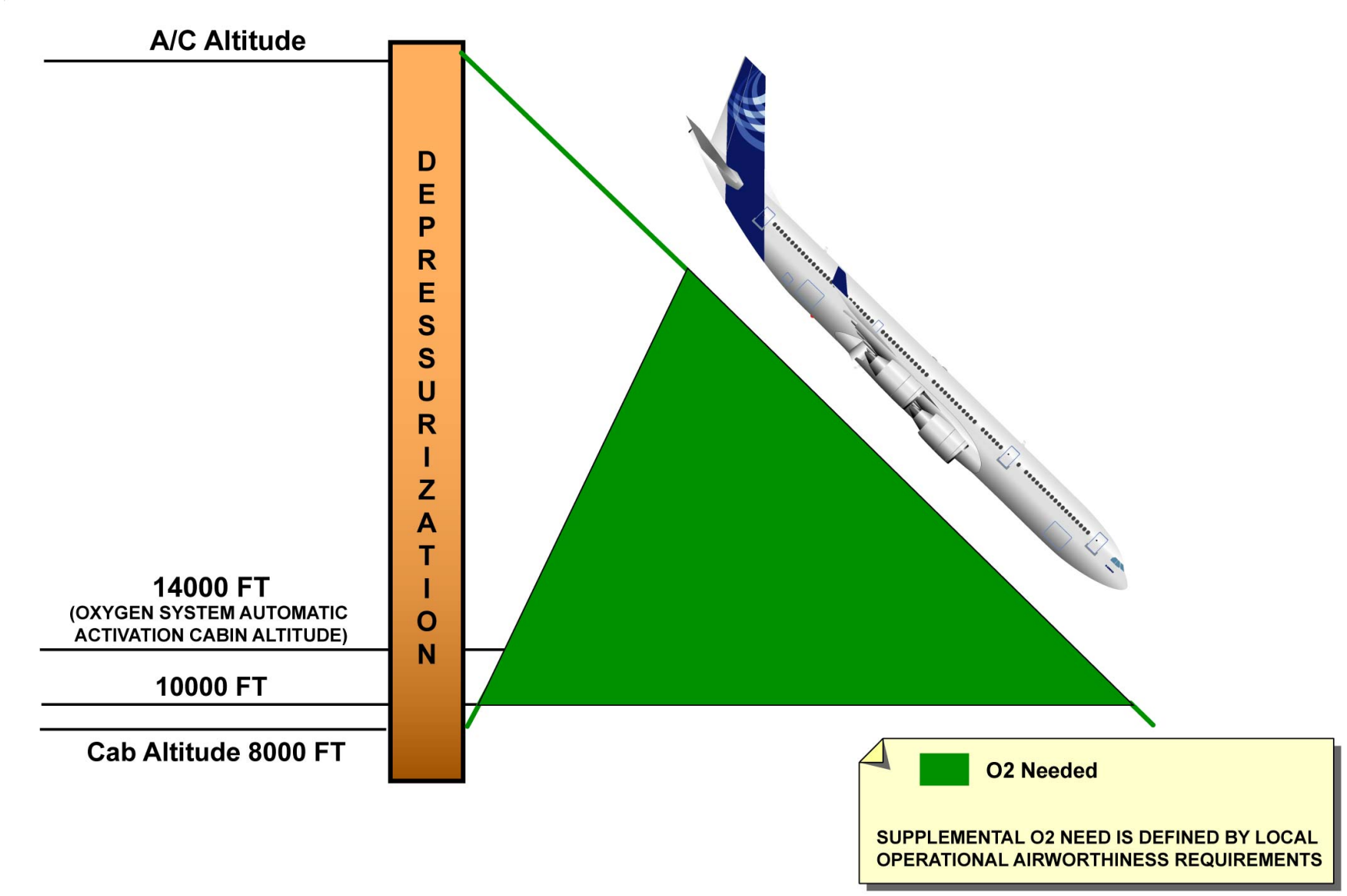

AIRCRAFT OXYGEN SYSTEMS

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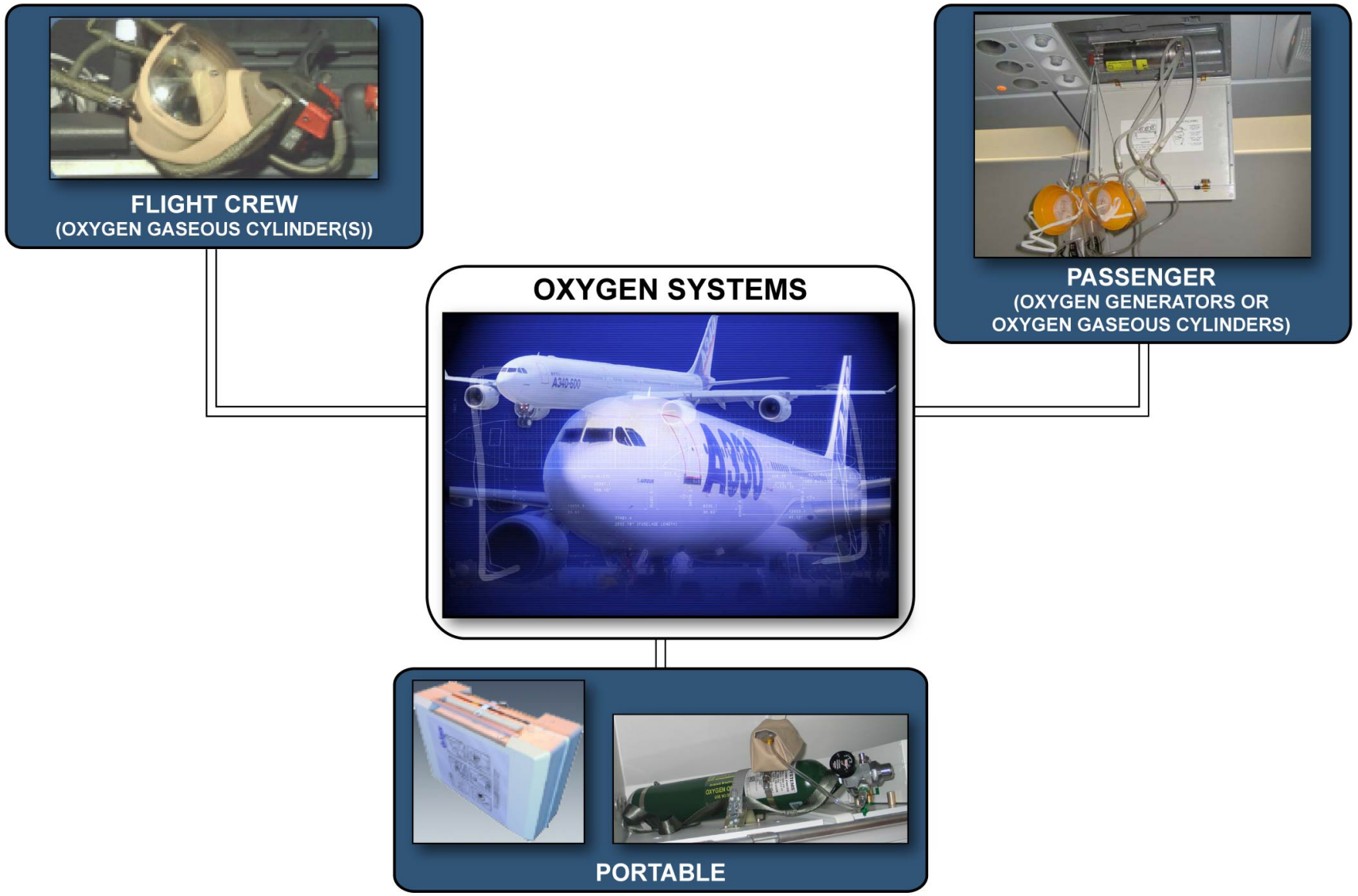

AIRCRAFT OXYGEN SYSTEMS

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OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

THE FIRE TRIANGLE

If one of these elements is missing, no fire / explosion can occur:
- Oxygen,
- Combustible material and,
- An ignition source,

are put together, fire can start and keep on going.

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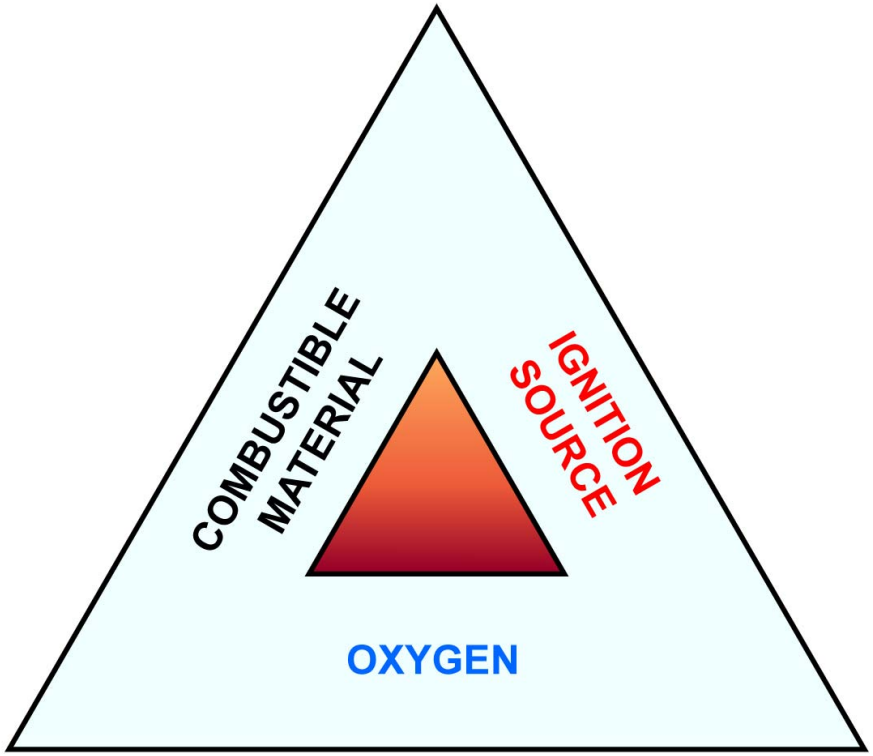

FIRE TRIANGLE

THE FIRE TRIANGLE

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

THE FIRE TRIANGLE (continued)

IGNITION SOURCES

The ignition sources are (examples):
- Raw flame (from cigarettes),
- Incandescent particles (from grinding during structure repairing...),
- Electrical overheating (from electrical engines, bad contact),
- Electrical discharge (static electricity, short circuit, mobile-phone operation, lightning during thunderstorm...),
- Oxygen overheating due to either too high pressure or, quick opening or closure of oxygen valves (sudden pressurization) or impact on the oxygen bottle (molecules agitation),
- Traces of hydrocarbon (petroleum product) mixed with pure oxygen.

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IGNITION SOURCES

RAW FLAME (FROM CIGARETTES)

INCANDESCENT PARTICLES

ELECTRICAL OVERHEATING

ELECTRICAL DISCHARGE

QUICK OPENING = OXYGEN OVERHEATING

TRACES OF HYDROCARBON

THE FIRE TRIANGLE - IGNITION SOURCES

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OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

THE FIRE TRIANGLE (continued)

OXYGEN ENRICHED ATMOSPHERE

An atmosphere is considered as an oxygen-enriched atmosphere when the oxygen percentage is 24% and above.
In comparison to a fire in the air, a fire in an oxygen-enriched atmosphere will be characterized by:
- High in intensity,
- Higher in temperature and,
- Higher in thermal power.

Pure oxygen at high pressure will react violently with materials such as oil, grease, textiles and rubber, and will get powerfully in fire.
In most cases, a fire that occurs in an atmosphere full of oxygen cannot be extinguished as long as the cause of fire has not been isolated.

FIRST AID

Persons getting on fire in an atmosphere full of oxygen cannot get help directly by a person entering the area. The rescuer takes also the risk to get on fire.
The victim must be sprayed of water and carried outside in free air as soon as possible.
The first aid care must be applied immediately and if possible in a specialized care unit for badly burned person.

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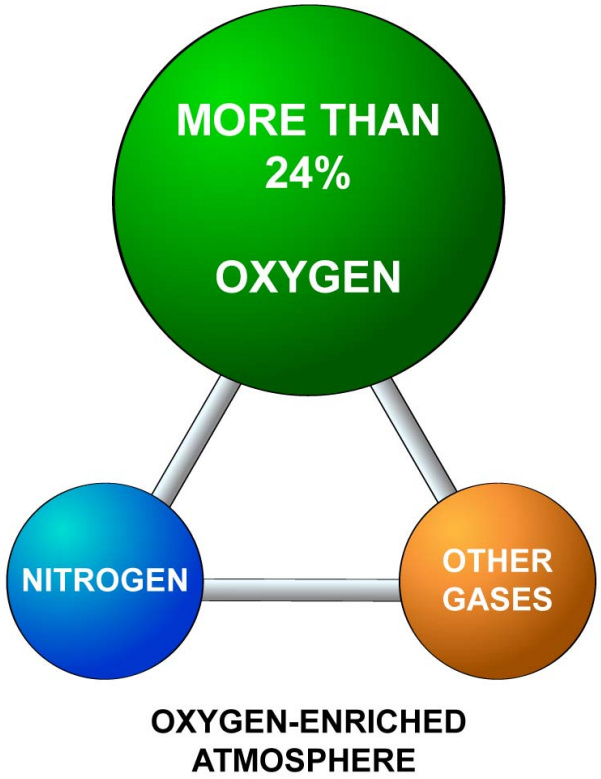

THE FIRE TRIANGLE - OXYGEN ENRICHED ATMOSPHERE & FIRST AID

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

THE FIRE TRIANGLE (continued)

DANGERS LINKED TO PRESSURIZED GAS

The oxygen is stowed in cylinders at very high-pressure: 1850psi at 21°C, 130kg/cm^2. Such a high pressure is potentially dangerous.
Any crack in the pressure wall of pressurized gas system causes a violent eruption of gas through the crack. The result can be a high or even violent explosion.
For example, if a valve brakes off a high-pressure cylinder, the container becomes an unguided missile.
That is the reason why the oxygen cylinders and pressure reducers must be tested at regular intervals (hydrostatic test every 3 - 5 years depending on applicable standard / special permit).

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DANGERS LINKED TO PRESSURIZED GAS

THE FIRE TRIANGLE - DANGERS LINKED TO PRESSURIZED GAS

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

LEAK IN CONFINED AREA

In Flight the stowage compartments of oxygen bottle are naturally ventilated through the cabin ventilation system (air flow from DADO panel to outflow valve).
On the ground, when the aircraft is parked not powered (dead aircraft), these ventilations are not effective any more.
The oxygen bottle and the distribution lines are installed in confined area.
In the case of oxygen leak, the percentage of oxygen in the air will be higher.

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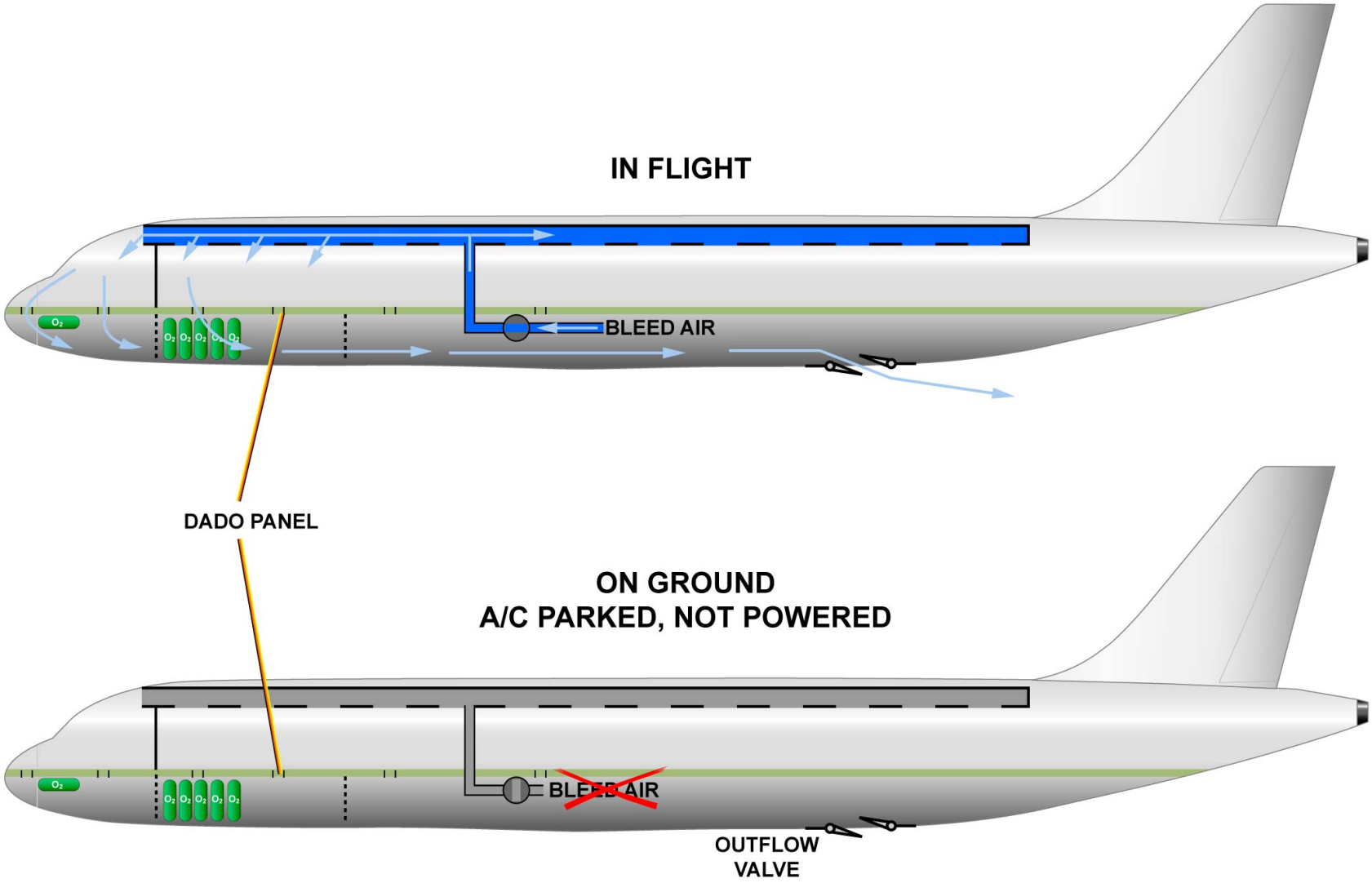

LEAK IN CONFINED AREA

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

LEAK IN CONFINED AREA (continued)

OXYGEN DETECTOR

The oxygen enrichment is not detected by human senses.
An oxygen detector can be used before to get inside an area filled of oxygen.
If there is too high oxygen concentration in this area, do not go into this area and ventilate.

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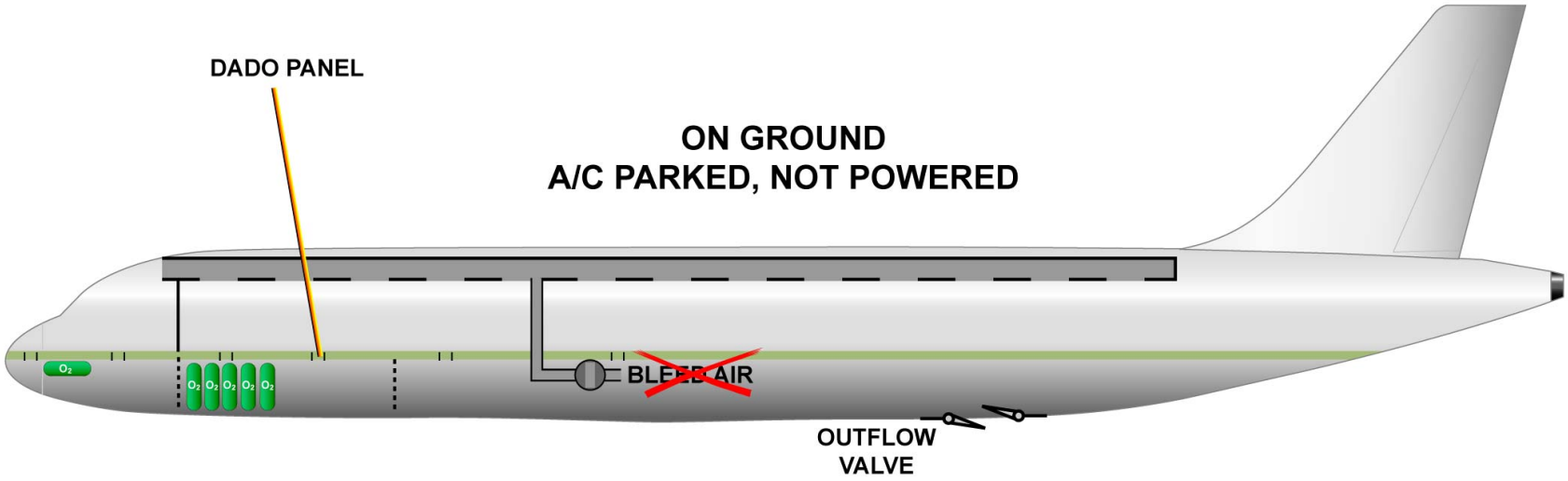
EXAMPLE OF OXYGEN DETECTOR



LEAK IN CONFINED AREA - OXYGEN DETECTOR

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

LEAK IN CONFINED AREA (continued)

CLOTHES, SKIN AND EQUIPMENT

Clothing, skin and equipment must be free of oil or grease.
Clothes and hair tend to absorb oxygen. Consequently, a person in an area where the air is filled with oxygen will keep a high concentration of oxygen. This oxygen stays on for some time. This person must avoid any source of ignition for 15 minutes, smoking for example.

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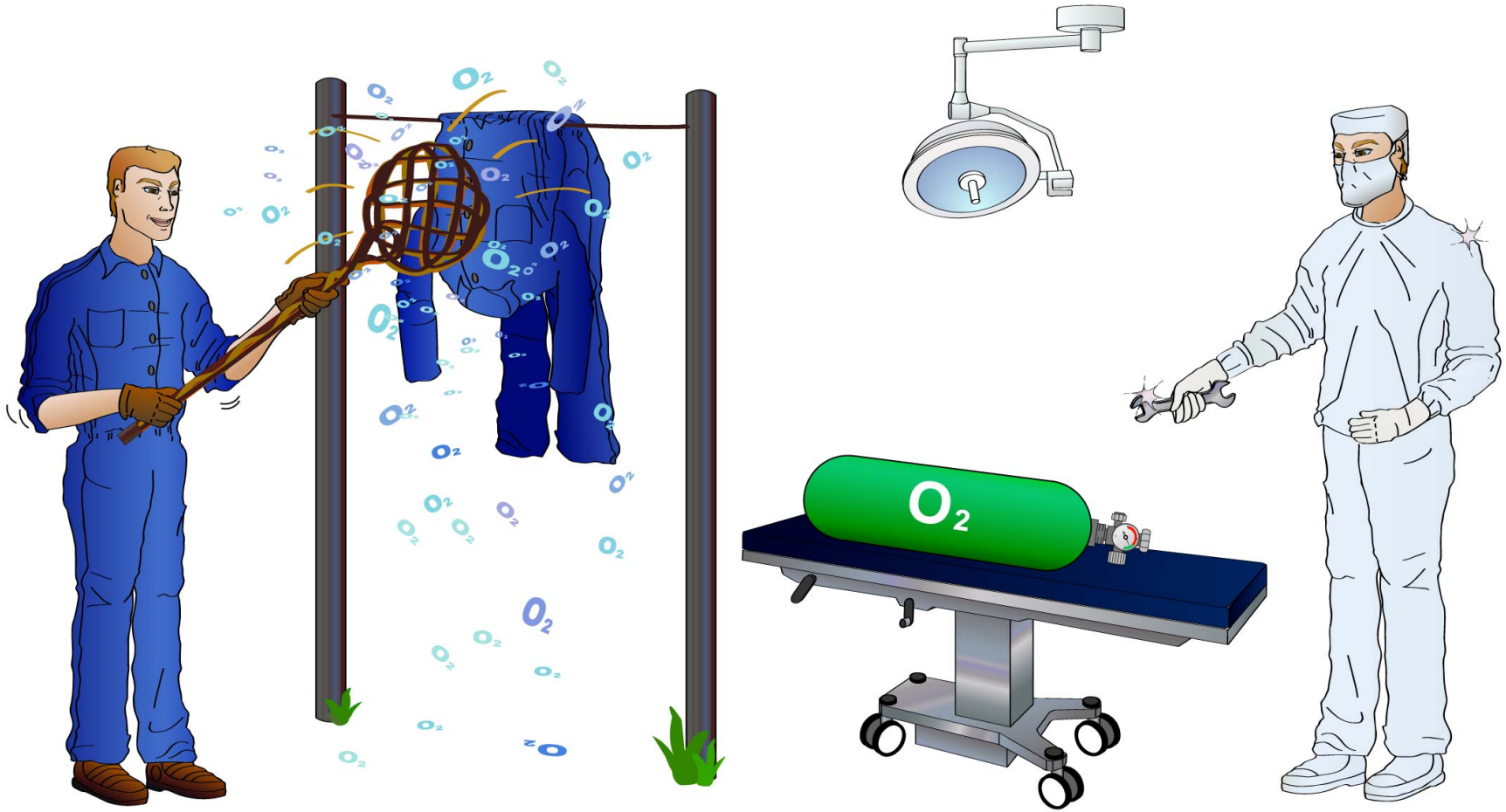

LEAK IN CONFINED AREA - CLOTHES, SKIN AND EQUIPMENT

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

SAFETY PRECAUTIONS

Make sure that you use the correct Airbus documentations corresponding to the aircraft (task in AMM, PN in IPC, SB...). Carefully obey the maintenance procedure instructions. If you do not obey these instructions, you can cause a fire or an explosion.
Prevent all maintenance procedures nearer than 5m (16.4ft) from the working area of the aircraft.
Stop all refueling, and all repairs on fuel and hydraulic systems.
Stop all procedures that use flammable material such as cleaning and de-icing material.
Stop all operations that cause heat and flame (For example: drilling holes...).

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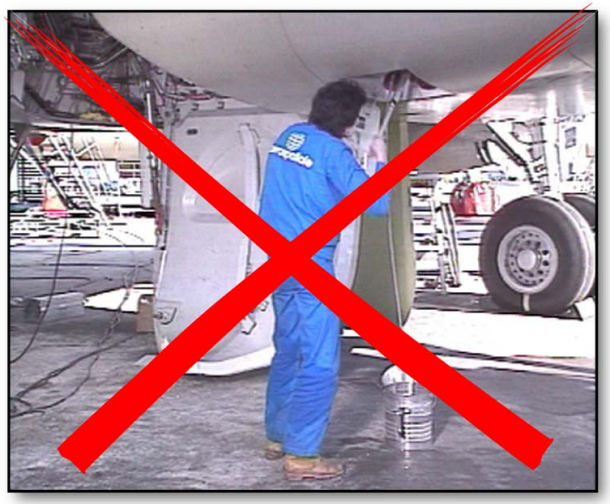
STOP REFUELING

STOP HYDRAULIC SERVICING



STOP DE-ICING

STOP OPERATIONS CAUSING HEAT & FLAME

SAFETY PRECAUTIONS

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

SAFETY PRECAUTIONS (continued)

DURING OXYGEN SERVICING

Put a warning notice in the cockpit, the work area and the cabin to tell persons not to operate electrical switches during the oxygen filling procedure.

Electrostatically ground the aircraft and also electrostatically bond the oxygen charging equipment to the aircraft.

If a thunderstorm can occur, immediately stop all oxygen filling operations.

Stop the filling procedure immediately if the pressures in each oxygen cylinder do not increase smoothly and at the same time. Only use aviator's breathing oxygen as defined by Airbus.

Keep all hydrocarbons (fuels, corrosion protection compounds, lubricants, etc.) away from all sources of oxygen. Oxygen becomes explosive when it touches hydrocarbons.

Open the hand-valves of the oxygen cylinder very slowly and turn them to the fully open position. In the case the hand-valves are not fully open before flight, the data of the oxygen pressure on the corresponding ECAM page will not be correct.

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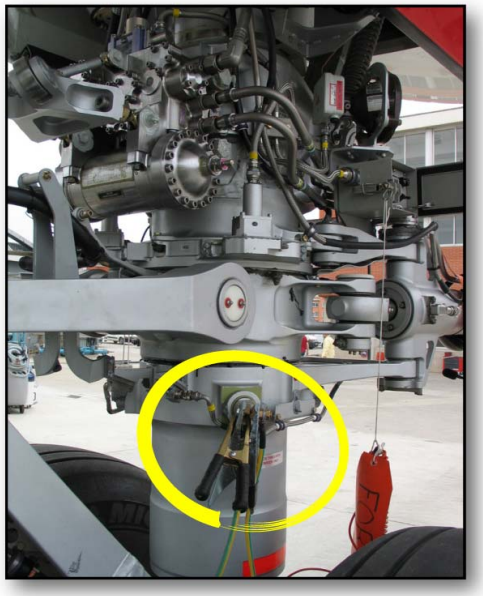
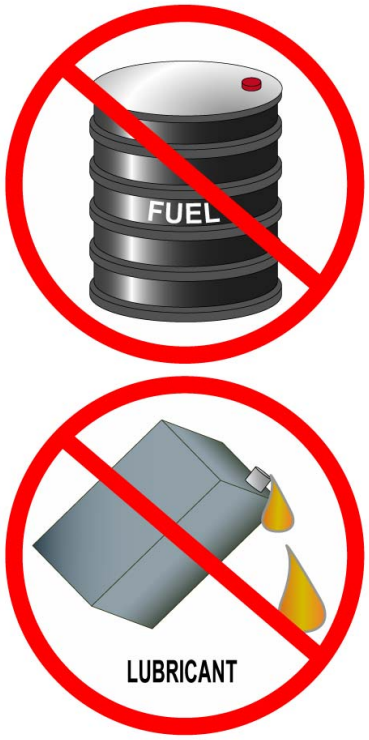
OXYGEN SERVICING EQUIPMENT



ELECTROSTATICALLY GROUND THE AIRCRAFT

STOP OXYGEN SERVICING IF THUNDERSTORM

SAFETY PRECAUTIONS - DURING OXYGEN SERVICING



VERY SLOWLY OPENING

SAFETY PRECAUTIONS - DURING OXYGEN SERVICING

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OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

SAFETY PRECAUTIONS (continued)

OXYGEN COMPONENTS REMOVAL AND INSTALLATION

Make sure that the ground support equipment is approved for the oxygen system. Equipment that is not approved can cause contamination of the system and injury.

Always work with clean clothes and tools. Keep your hands clean (possibly, wear gloves in cotton). Do not touch connection ends and interior of oxygen components with bare hands, because skin oil and bacteria are a source of contamination.

The area around the oxygen components must always be cleaned with approved cleaner before and after any work done on the system. Any tool, rag, cloth, or equipment that is not clean and free of oil traces must not be used or stay in the area around the oxygen components.

Make sure that all oxygen cylinder valves are closed. Due to possible residual pressure in the line, disconnect the connectors carefully.

Put dry, clean, metal or plastic plugs on all pipes or units removed temporarily. Put each pipe or unit in a sealed vinyl bag. Unwanted material in the oxygen system could damage the system or cause explosion if oil ingress.

WARNING: NEVER USE STANDARD OIL TO LUBRICATE THE CONNECTOR THREAD (risk of explosion).

ONLY LUBRICANTS and thread compounds SPECIFICALLY APPROVED FOR OXYGEN must be used.

Some unit/assembly are heavy.

Support the unit/assembly carefully to prevent injury to persons and damage.

During disconnection/reconnection of an oxygen line connector use two wrenches: one for the nut and one for the counter nut to avoid force onto the material (risk of rupture and leakage).

Make sure that the flexible hoses are not twisted or pulled tight. If the hoses are twisted or pulled tight the connections will break and cause a leak.

Torque the connection at the right value given by the maintenance manual.

Open and close the spring-loaded clamps carefully to prevent damage to the electrical harness near the oxygen cylinders.

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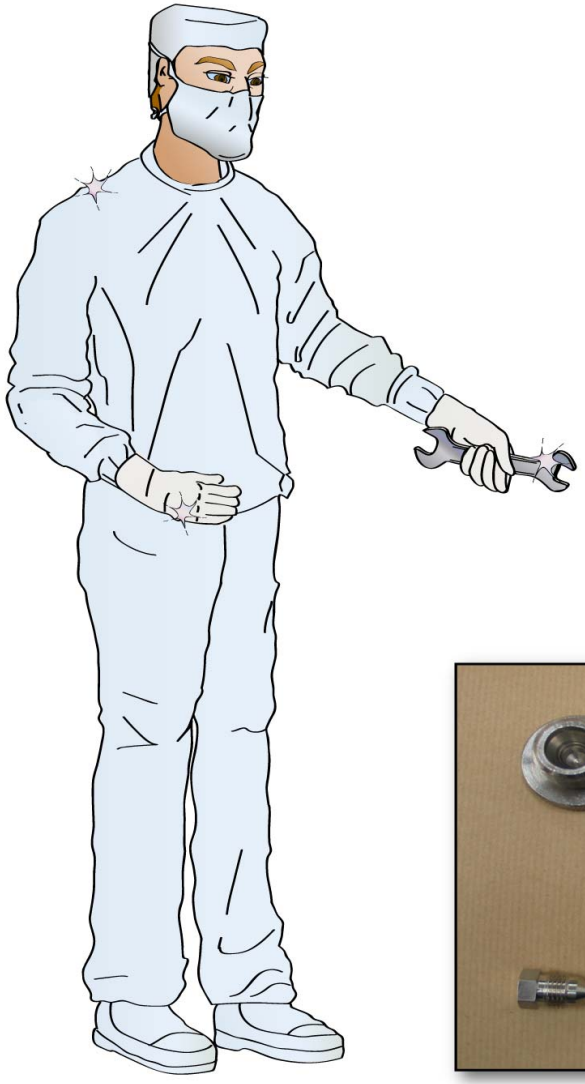


USE CLEAN PLUG

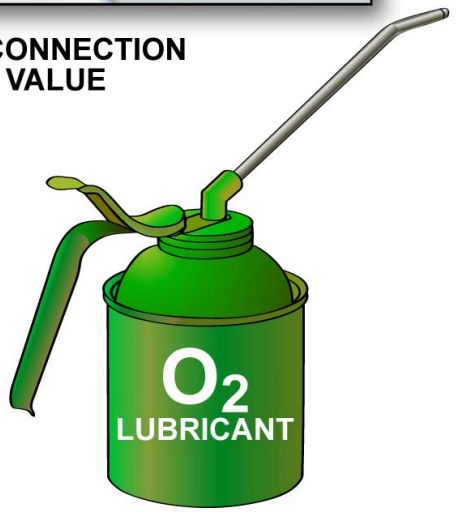
PUT EACH PIPE IN A SEALED VINYL BAG

SAFETY PRECAUTIONS - OXYGEN COMPONENTS REMOVAL AND INSTALLATION

WARNING

NEVER USE STANDARD OIL TO LUBRICATE THE CONNECTOR THREAD (RISK OF EXPLOSION).

TORQUE THE CONNECTION AT RIGHT VALUE



SAFETY PRECAUTIONS - OXYGEN COMPONENTS REMOVAL AND INSTALLATION

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OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

SAFETY PRECAUTIONS (continued)

LEAK DETECTION

Make sure that the leak detector products and test equipment are approved for the oxygen system.
Equipment or products that are not approved can cause contamination of the system and injury to personnel (fire, explosion).
Make sure that the items in the "fixtures, tools, and test and support equipment" paragraph are applicable to your aircraft. Refer to the applicable task and subtasks.

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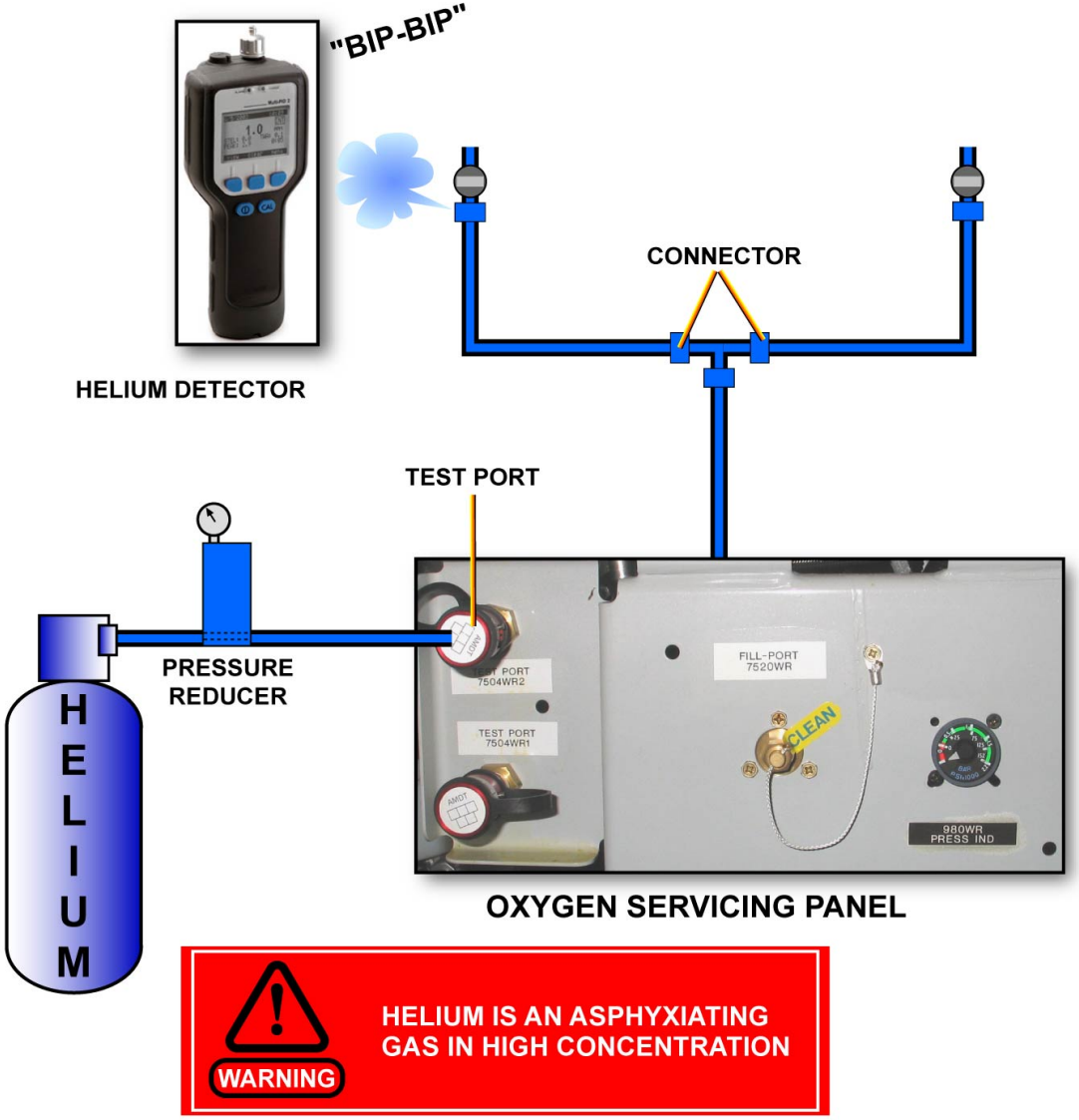

LEAK DETECTION PRODUCTS

SAFETY PRECAUTIONS - LEAK DETECTION

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

SAFETY PRECAUTIONS (continued)

OXYGEN SPECIFIC USE

Oxygen must be used only for oxygen system servicing.
Never use oxygen for other purposes such as tire or accumulator inflation, blowing of dust...

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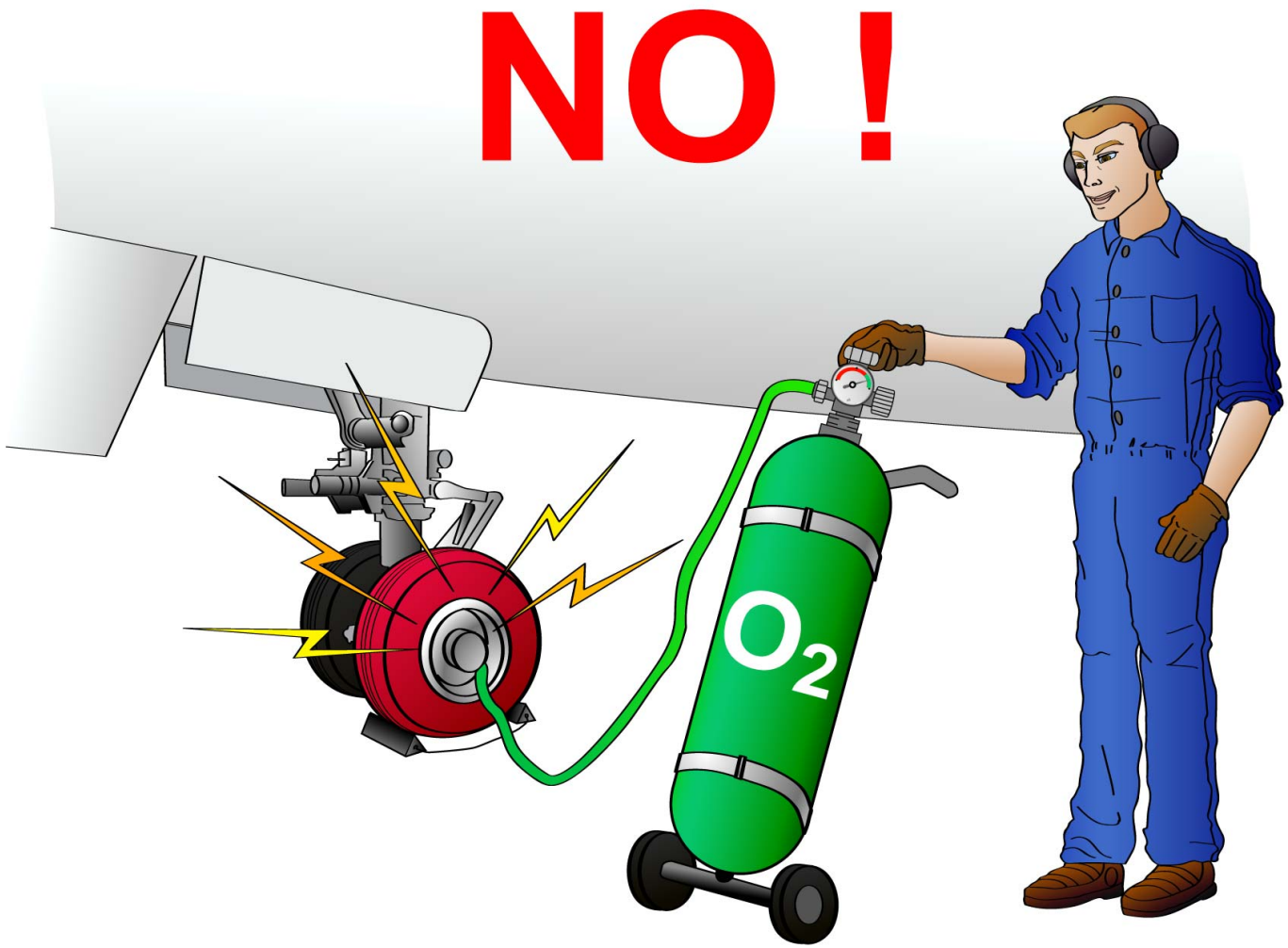

OYXGEN USED ONLY FOR OXYGEN SYSTEM SERVICING

SAFETY PRECAUTIONS - OXYGEN SPECIFIC USE

OXYGEN SAFETY IN AIRCRAFT MAINTENANCE ENVIRONMENT (2)

SAFETY PRECAUTIONS (continued)

OXYGEN TRANSPORTATION

Oxygen cylinders or oxygen chemical generators are classified as dangerous material.
As a result, their transportation by aircraft is restricted and must comply with specific regulations of International Air Transport Association (IATA).

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SAFETY PRECAUTIONS - OXYGEN TRANSPORTATION

CREW OXYGEN SYSTEM DESCRIPTION (2/3)

Crew Oxygen General Architecture

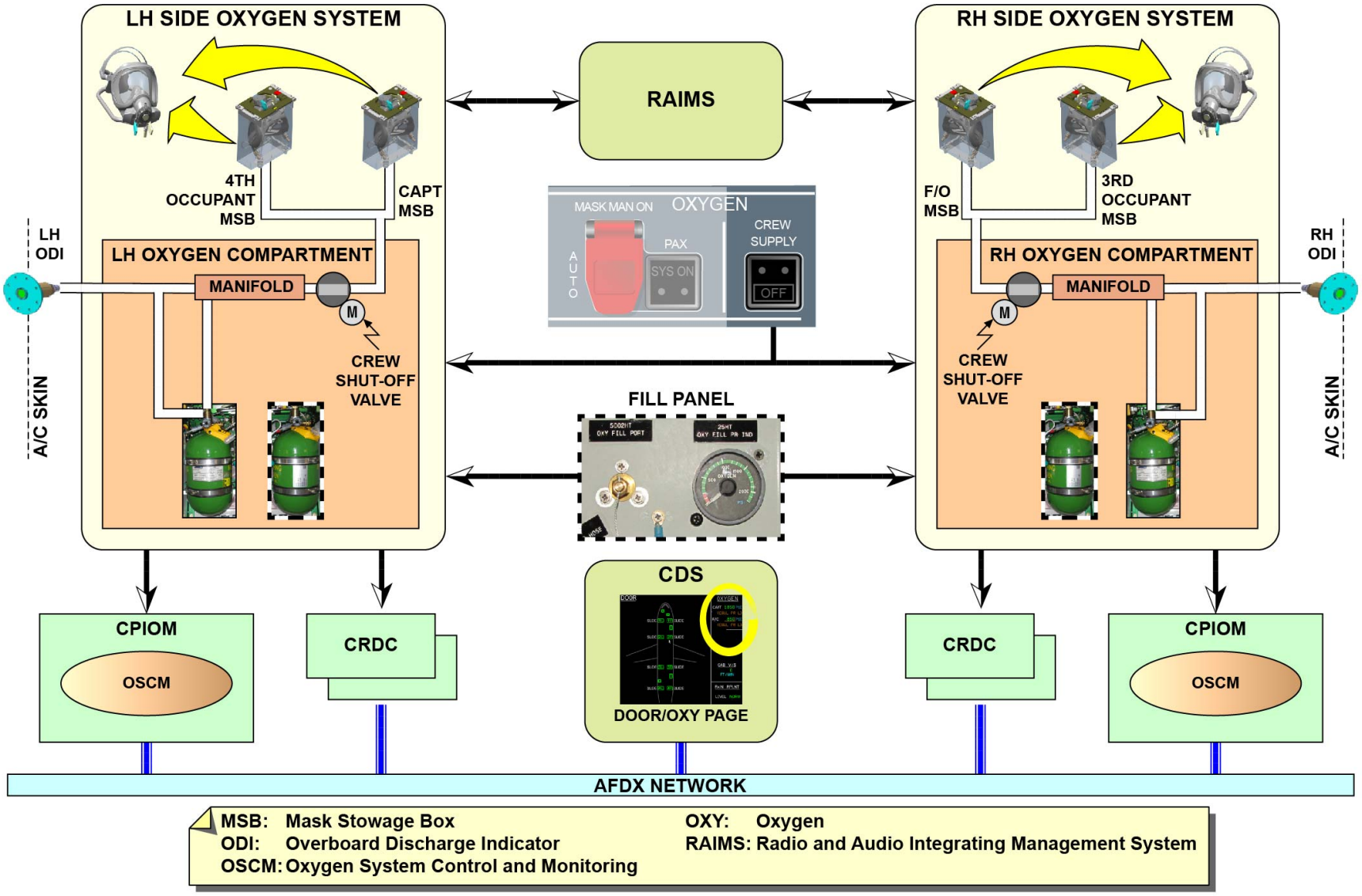
The crew oxygen system gives protection from hypoxia (in case of A/C decompression), smoke and gases for the two flight crew members and the two observers.
The crew oxygen system has three parts:
- The crew oxygen storage
- The crew oxygen distribution
- The crew oxygen control and indicating.

The crew oxygen system has two independent subsystems:
- One for the CAPT and the Fourth Occupant (LH oxygen subsystem)
- One for the F/O and the Third Occupant (RH oxygen subsystem).

Each subsystem has a compartment with a HP gaseous cylinder assembly (one more cylinder assembly for each oxygen compartment is optional).
The LH and RH oxygen compartments are located in the FWD cargo compartment.
An optional fill panel can be also installed for the in-situ refilling of the cylinders.
Each subsystem has a distribution circuit, which includes:
- A valve and a pressure reducer which are integrated in the cylinder assembly
- A distribution manifold, which supplies LP oxygen to the oxygen-mask stowage boxes via a crew shut-off valve
- Two full-face quick-donning oxygen masks which are stowed in the oxygen-mask stowage boxes, in the cockpit. Each mask is equipped with a microphone for the cockpit communication, via the Radio and Audio Integrating Management System (RAIMS).

Each cylinder assembly and its distribution manifold are connected to its related overboard discharge indicator to release the overpressure that comes from the HP or LP part.
The flight crew opens or closes the crew shut-off valves through the CREW SUPPLY P/BSW installed on the overhead panel. Both subsystems indications are shown on the CDS ECAM DOOR/OXY page.

To perform the redundancy function:
- The Oxygen System Control and Monitoring (OSCM) applications are hosted in two CPIOMs
- Both OSCM applications work simultaneously and independently
- The CAPT and F/O CRDCs collect all the monitoring data
- As a back-up, some data are also collected directly by the OSCMs
- The OSCMs and CRDCs are connected via the AFDX network.



CREW OXYGEN GENERAL ARCHITECTURE

CREW OXYGEN SYSTEM DESCRIPTION (2/3)

Crew Oxygen Storage and Distribution System Description

There is an oxygen storage compartment for each crew oxygen subsystem. The compartment is ventilated. The bottom of the compartment is open to give a sufficient turnover of airflow through a venturi port to prevent a high concentration of oxygen (in case of leak).
The cylinder valve and the pressure reducer are integrated together. The valve can be operated by an ON/OFF lever locked in position by a safety pin.
The cylinder assembly is also equipped with:
- A quick disconnect LP outlet
- A HP fill port with an integrated check valve
- A HP transducer equipped with two independent pressure sensors
- A HP gauge
- A HP safety discharge-outlet (with an internal cylinder burst disc, not shown).

The distribution manifold assembly has:
- An inlet connection from the integrated cylinder assembly
- An outlet connection to the crew shut-off valve
- A LP relief valve, which is also connected to the overboard discharge indicator (it opens if there is too much LP)
- A cylinder switch open, which monitors the presence of pressure (LP) in the manifold, to determine if the cylinder is open or closed
- A test port, which is used for oxygen system pressure and leak checks.

The temperature transducer is installed near the oxygen cylinder. It measures the ambient temperature and sends an analog signal through the CRDC, to the OSCMs. The HP transducer sends analog signals to the OSCM applications, through the CRDC. The OSCM applications use the temperature and pressure data to compute the temperature compensated pressure, shown on the CDS ECAM DOOR/OXY page.
The HP safety-relief burst disc of the cylinder assembly and the pressure relief valve on the distribution manifold are connected to an overboard discharge indicator on the fuselage skin. The overboard discharge indicator has a green blow-out disc that can be seen from outside.
The crew shut-off valves are electrically operated and transmit the feedback position signals (fully open/closed) to both CRDC and CPIOM (redundancy). The flight crew opens the valves through the CREW SUPPLY P/BSW from an Integrated Control Panel (ICP) in the cockpit.
Downstream of the crew shut-off valve, the LP switch has the functions that follow:
- To detect a low pressure status in the distribution line
- To sense the LP pressure in the distribution line to confirm the position of the crew shut-off valve (open/closed).

In case of low pressure status, the LP switch transmits this data to both CRDC and CPIOM (redundancy), for the ECAM DOOR/OXY page indication.
If one of the hosted applications fails to perform its intended function, the functional OSCM will take over.

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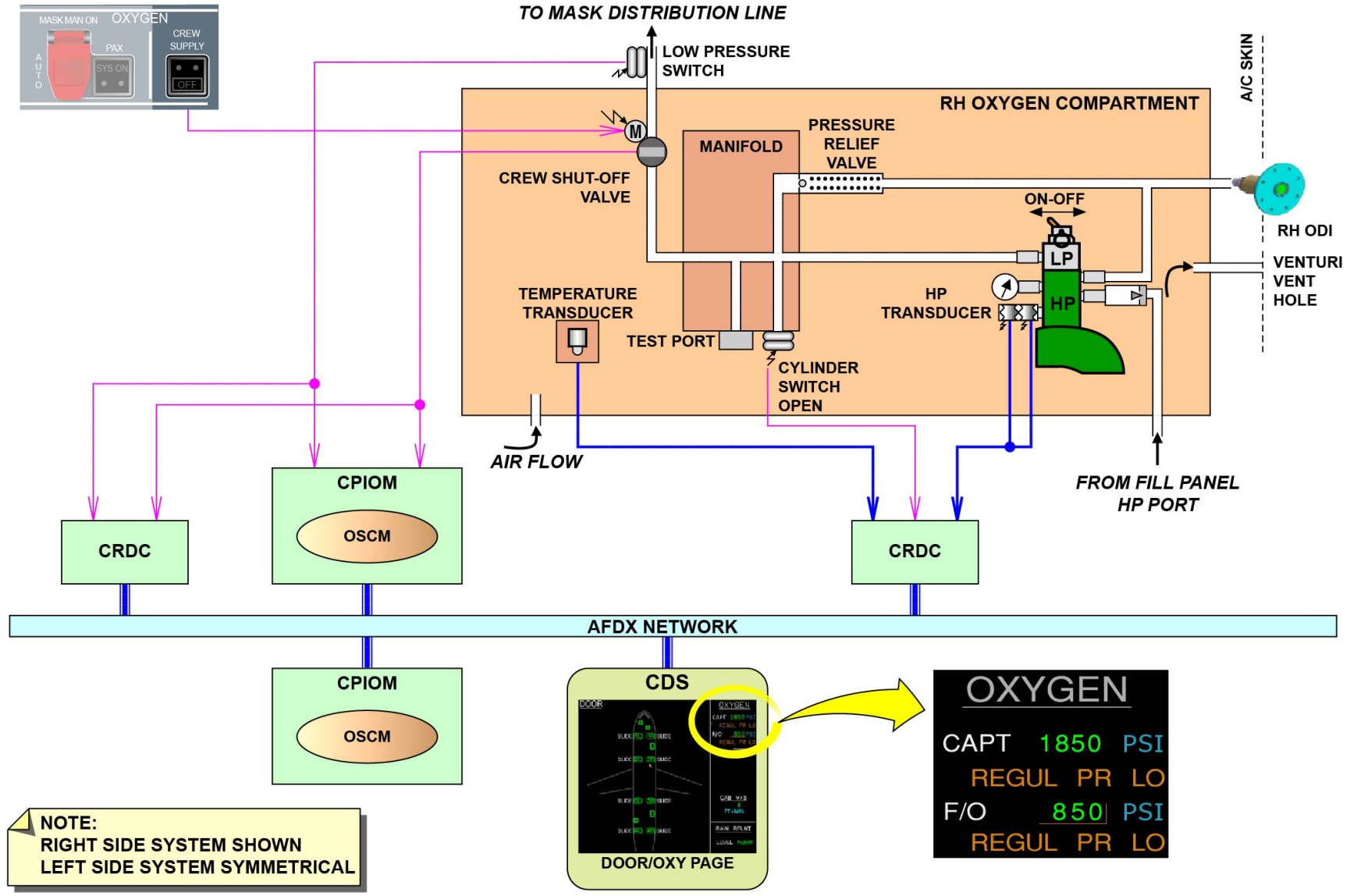
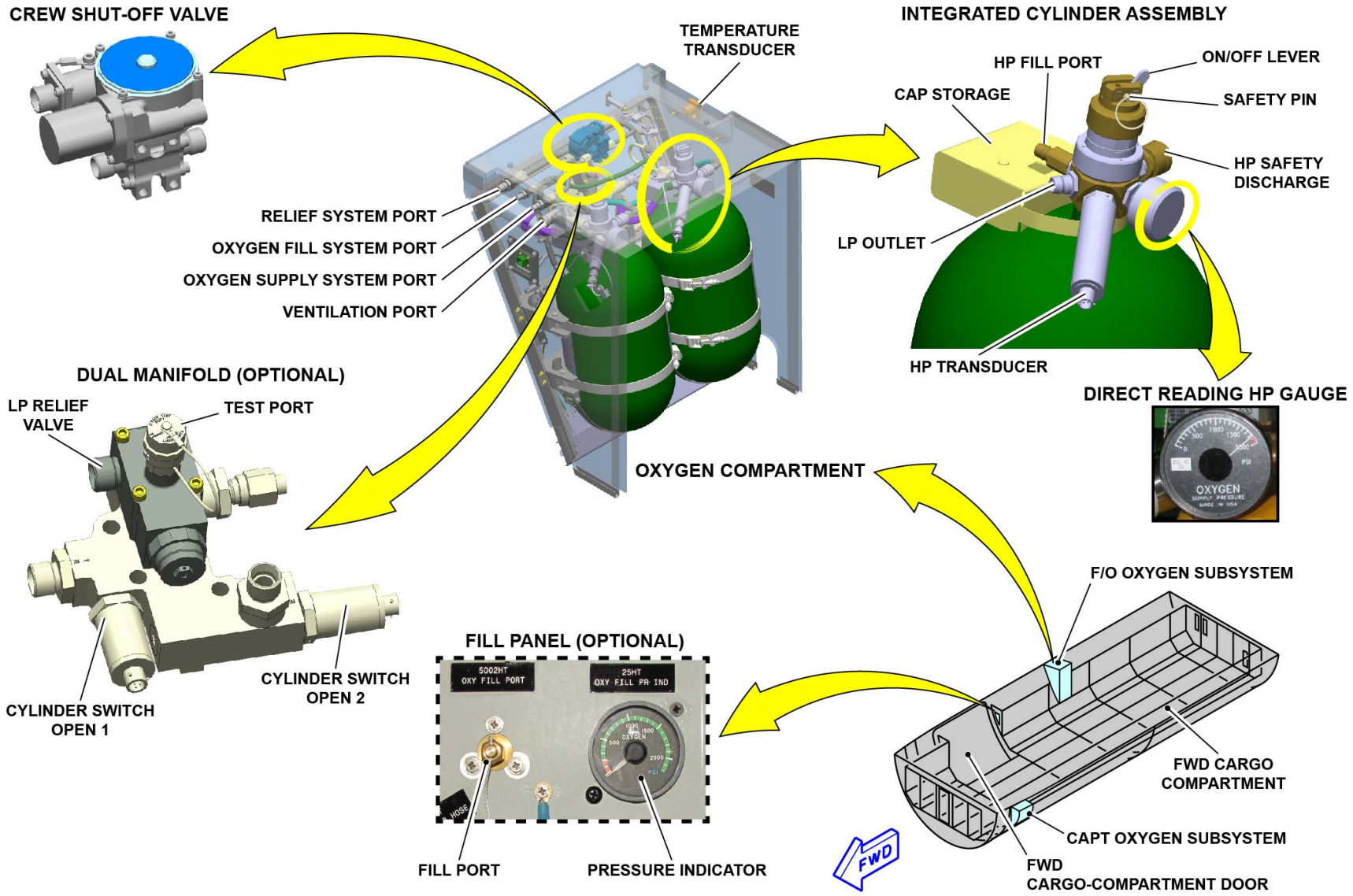


CREW OXYGEN STORAGE AND DISTRIBUTION SYSTEM DESCRIPTION

CREW OXYGEN SYSTEM DESCRIPTION (2/3)

Crew Oxygen Compartment Presentation

The crew oxygen storage-compartments are installed in the LH and RH sides of the FWD cargo compartment.
An optional remote fill panel is installed for in-situ filling of the cylinders.
The fill panel has a filling port and an oxygen filling pressure-indicator.
The compartment is closed with a cargo panel, equipped with a sight glass, to see the cylinder direct reading the pressure gauges without a panel removal.
A safety pin must be used to lock the ON/OFF lever in position, during the removal or after the installation.
The crew oxygen compartment includes:
- One integrated oxygen cylinder assembly (two as an option)
- One single distribution manifold (dual distribution manifold as an option)
- One temperature transducer
- One crew shut-off valve
- A set of ports: pneumatic interfaces to overboard discharge line, crew oxygen distribution-system, fill and venturi.



CREW OXYGEN COMPARTMENT PRESENTATION

CREW OXYGEN SYSTEM DESCRIPTION (2/3)

Crew Oxygen Dispensing

Each oxygen-mask stowage box contains:
- A connector for the LP oxygen supply
- An electrical plug for the radio connection
- Two-flap doors, which keep the mask in the stowage box
- A PRESS TO TEST (and RESET) P/BSW
- A pneumatic LP supply valve, that operates when the flap opens or when you push the PRESS TO TEST P/BSW
- A flow-indication blinker (yellow when the oxygen flows)
- A full-face quick-donning oxygen mask.

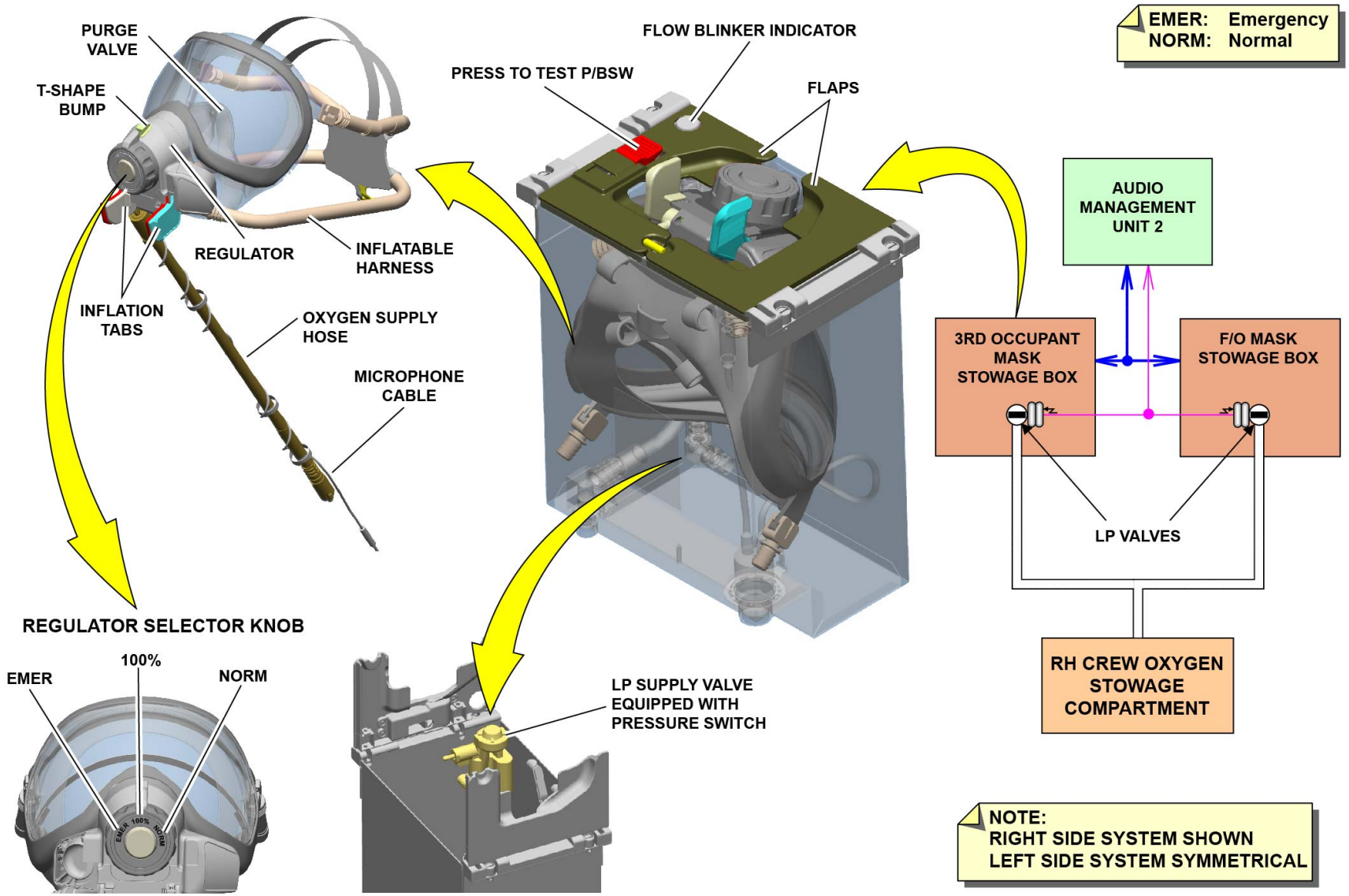
The two-flap doors open with the extraction of the mask, then the LP supply valve opens and the oxygen flows to the mask regulator.
Each LP supply valve has a pressure switch that gives a signal to its related Audio Management Unit (AMU 1 for CAPT, AMU 2 for F/O). The AMUs stop the cockpit boom microphones and start automatically the microphone of the mask.
The PRESS TO TEST P/BSW can be used to perform an in-situ test of the mask.
It can be used also to reset the LP valve to the closed position, after the closure of the flap doors.
The box has a stowage guide to keep the mask in position and to make sure that the mask is stowed with its selector knob at the 100% position (it is necessary to align the T-shape bump and the selector knob finger).
The full-face quick-donning oxygen mask gives respiratory and eye protection to the flight crew from cockpit depressurization or presence of smoke or toxic gas.
The mask assembly has:
- A lens protected by a plastic layer, when you remove the mask from its box. The layer also prevents the ice formation on the lens during the depressurization
- An inflatable harness inflated when the inflation tabs are pushed manually (to ease the positioning on the user's face). It maintains the mask tight against the user's face, when deflated
- A microphone, with its cable and connector
- A regulator and its selector knob, with flexible hose and quick connector.

The selector knob controls the distribution of the oxygen in the mask.
It has different modes of operation:
- 100% mode (used to stow the mask)

The 100% mode supplies 100% of oxygen to the user, regardless of the altitude, on demand.
- Diluted mode (normal (NORM))

The user breathes a mixture made of ambient air and oxygen on demand. The regulator comprises one aneroid capsule which regulates ambient air and oxygen mixture up to (34000 ft). Above this altitude, it is oxygen only. If there is an emergency (EMER) decompression, the regulator gives automatically 100% of oxygen when the cockpit altitude is above high altitude (34000 ft).
- EMER mode

The EMER mode supplies a continuous flow of 100% of oxygen, under overpressure, regardless of the altitude, to prevent the entrance of smoke or contaminants. The oxygen flows also through a purge valve into the lens area, to purge any smoke, fumes or irritants. This mode can be used also to defog the lens.



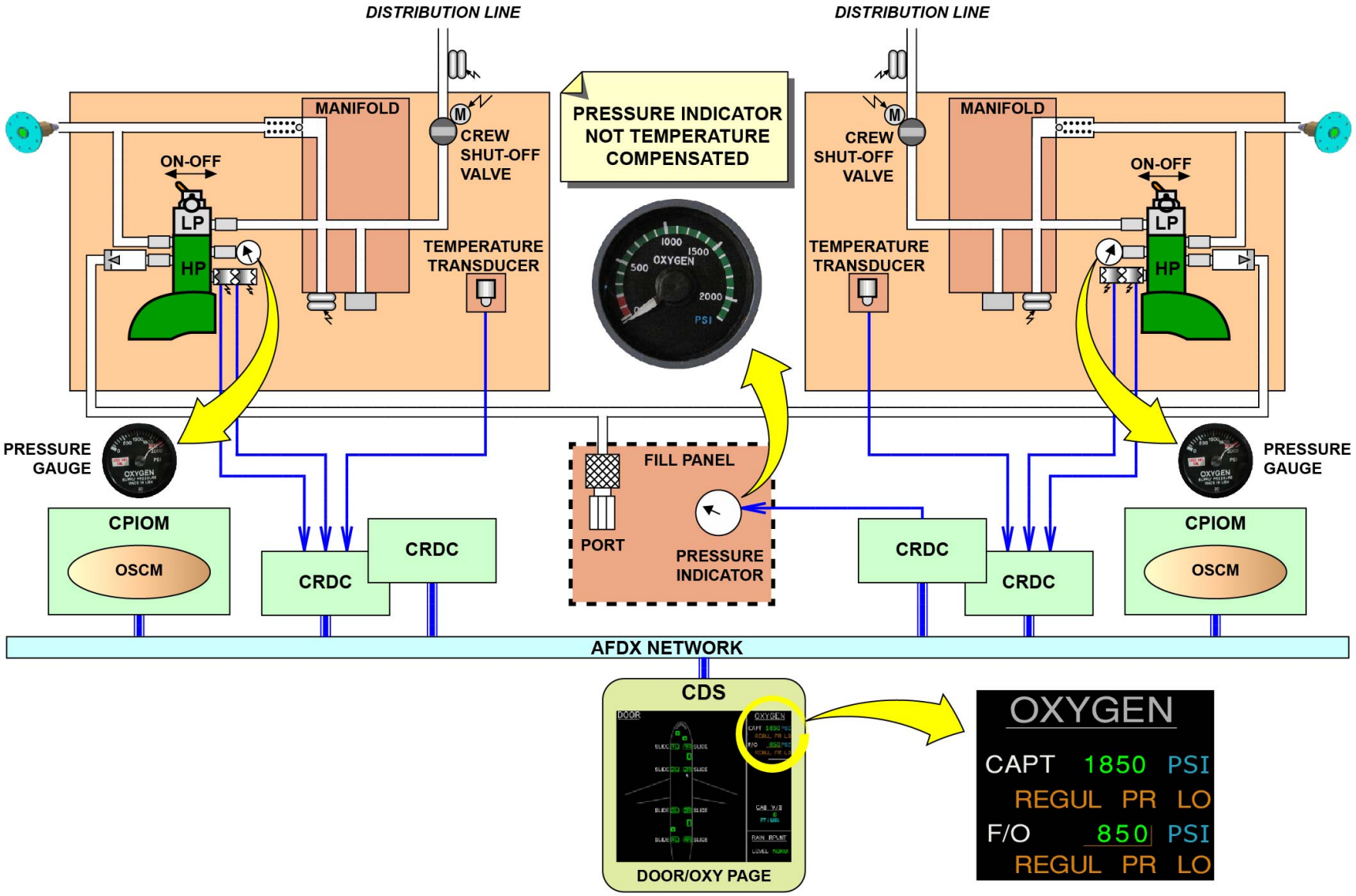
CREW OXYGEN DISPENSING

CREW OXYGEN SYSTEM DESCRIPTION (2/3)

Crew Oxygen System Pressure Monitoring

It is possible to fill the cylinders from the optional fill panel with its fill port and fill pressure indicator. If the filling on the A/C is not permitted, the cylinder assembly must be removed and filled in the shop.
For cockpit indications, the both OSCMs compute the pressure values, warning and memos. The CDS chooses always the lowest value (for pressure values, warning activation signals). If one of the applications fails, the other OSCM will take over.
The ECAM DOOR/OXY page shows the CAPT and F/O temperature compensated pressures.
A fill pressure indicator shows the average pressure of the cylinders, but not the temperature compensated. The OSCM applications compute this value and the lowest result is sent to the fill pressure indicator, through a dedicated CRDC.
The HP gauge on the cylinder assembly shows the cylinder HP to the maintenance personnel (not temperature compensated). The HP gauge indication can be read through the panel-compartment sight glass.

V1813401 - V01T0M0 - VM35D1FCREW3001



CREW OXYGEN SYSTEM PRESSURE MONITORING

PASSENGER OXYGEN SYSTEM DESCRIPTION (2/3)

Passenger Oxygen System Architecture

The passenger oxygen system is a system which gives hypoxia protection to the cabin occupants if there is a cabin decompression.
The passenger oxygen system is a decentralized system. The basic passenger oxygen system is a chemical oxygen system with 15 minutes of autonomy or 22 minutes (optional).
As an option, a decentralized gaseous oxygen system can be used for high terrain profiles operation (up to 47 min).
The system interfaces, architecture and wiring are the same in both installations (chemical or gaseous).
The oxygen source and the dispensing masks are integrated in the oxygen containers, which are available in the cabin where it is necessary to supply supplemental oxygen to the passengers or to the cabin attendants.

System activations

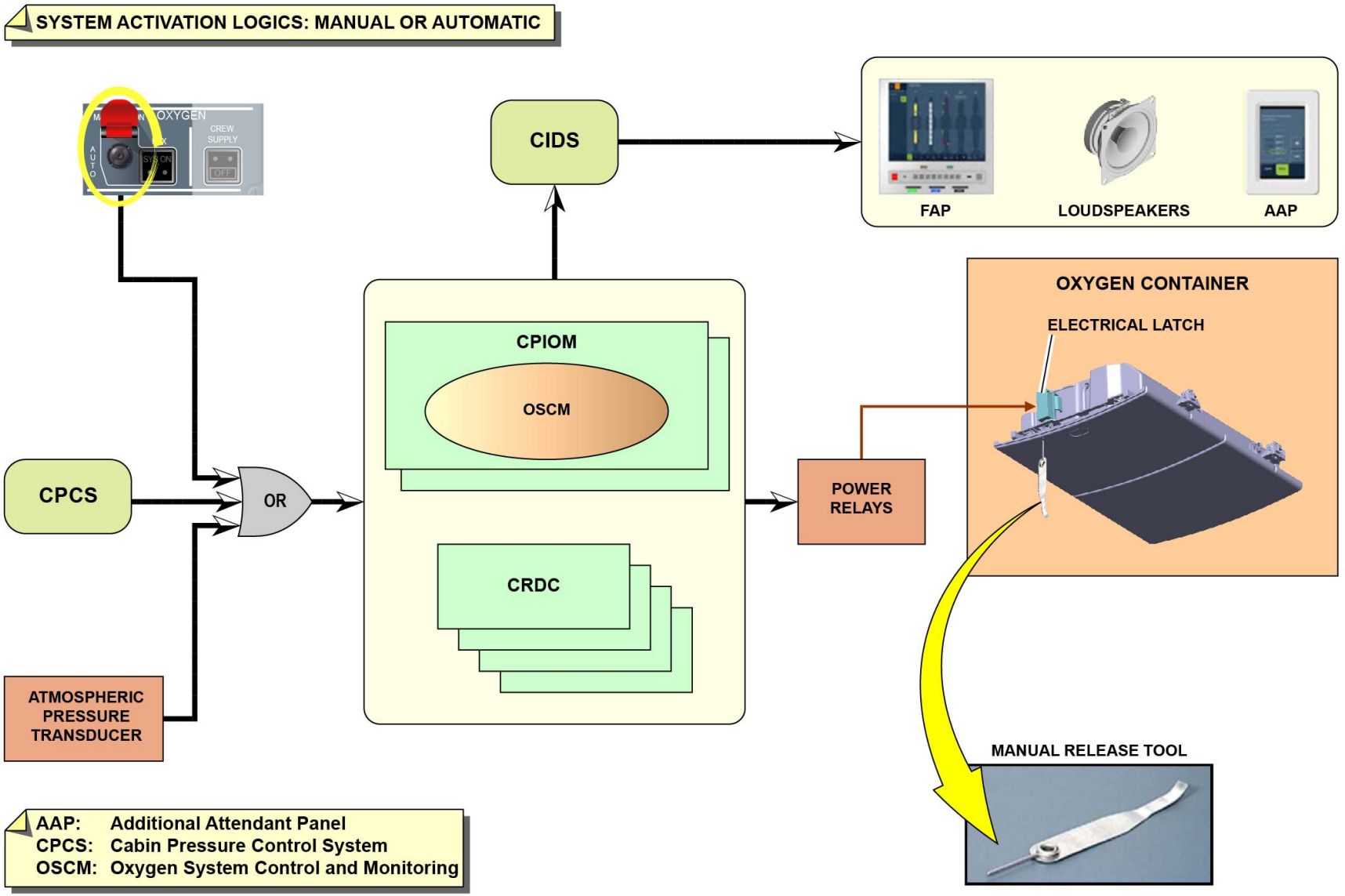
There are three possibilities to start the passenger oxygen system:
- Automatically, through the cabin pressure signal from the Cabin Pressure Control System (CPCS) (ATA 21)
- Automatically, through the atmospheric pressure transducer
- Manually, through the MASK MAN ON P/BSW.

The CPCS and the atmospheric pressure transducer send the cabin altitude data to the CPIOMs and CRDCs. The Oxygen System Control and Monitoring (OSCM) applications start automatically the system if the cabin altitude is more than (13800 - 14000 ft).
The OSCMs send activation signals to the power relays, which close to energize the electrical latches of the oxygen containers. The containers open and the oxygen masks fall down. The oxygen flow starts when the passenger pulls the lanyard of the mask.
If there is a failure of the automatic activation, the flight crew can start the passenger oxygen system when they operate the MASK MAN ON P/BSW on the overhead panel.
The cabin crew can use a manual release tool to open the door lid of the container if it does not open automatically or manually.

Cabin indications

During a decompression event, the OSCM (or CRDC as a back-up) transmits the decompression signal to the CIDS directors. A passenger announcement warning is automatically broadcasted through the CIDS active director, with decompression chimes and indication lights.
The decompression chime can be reset by FAP and AAP.

V1813401 - V01T0M0 - VM35D2CABIN3001



PASSENGER OXYGEN SYSTEM ARCHITECTURE - SYSTEM ACTIVATIONS & CABIN INDICATIONS

V1813401 - V01T0M0 - VM35D2CABIN3001

PASSENGER OXYGEN SYSTEM DESCRIPTION (2/3)

Passenger Oxygen Description/Operation

Normal operation condition

The CPCS sends the cabin altitude data to the OSCM applications continuously through the AFDX network. There is a cabin decompression event if the cabin altitude is higher than (13800 ft). After a decompression event, the system energizes (115 Voltage Alternating Current (VAC) Emergency (EMER)) all the latches, to open all the containers door lids.
To perform this function:
- The OSCMs send activation discrete signals to their dedicated sets of power relays
- The OSCMs transmit activation signals to the FWD CRDCs (for activation redundancy purpose)
- The FWD CRDCs send also activation discrete signals to others dedicated sets of power relays (redundancy).

This design permits to energize all the latches by several ways of activation.
As soon as the passenger oxygen system becomes available:
- The SYS ON indicator light on the overhead panel comes on
- The OXY PAX SYS ON (memo message) is automatically shown on the ECAM display page in the cockpit.

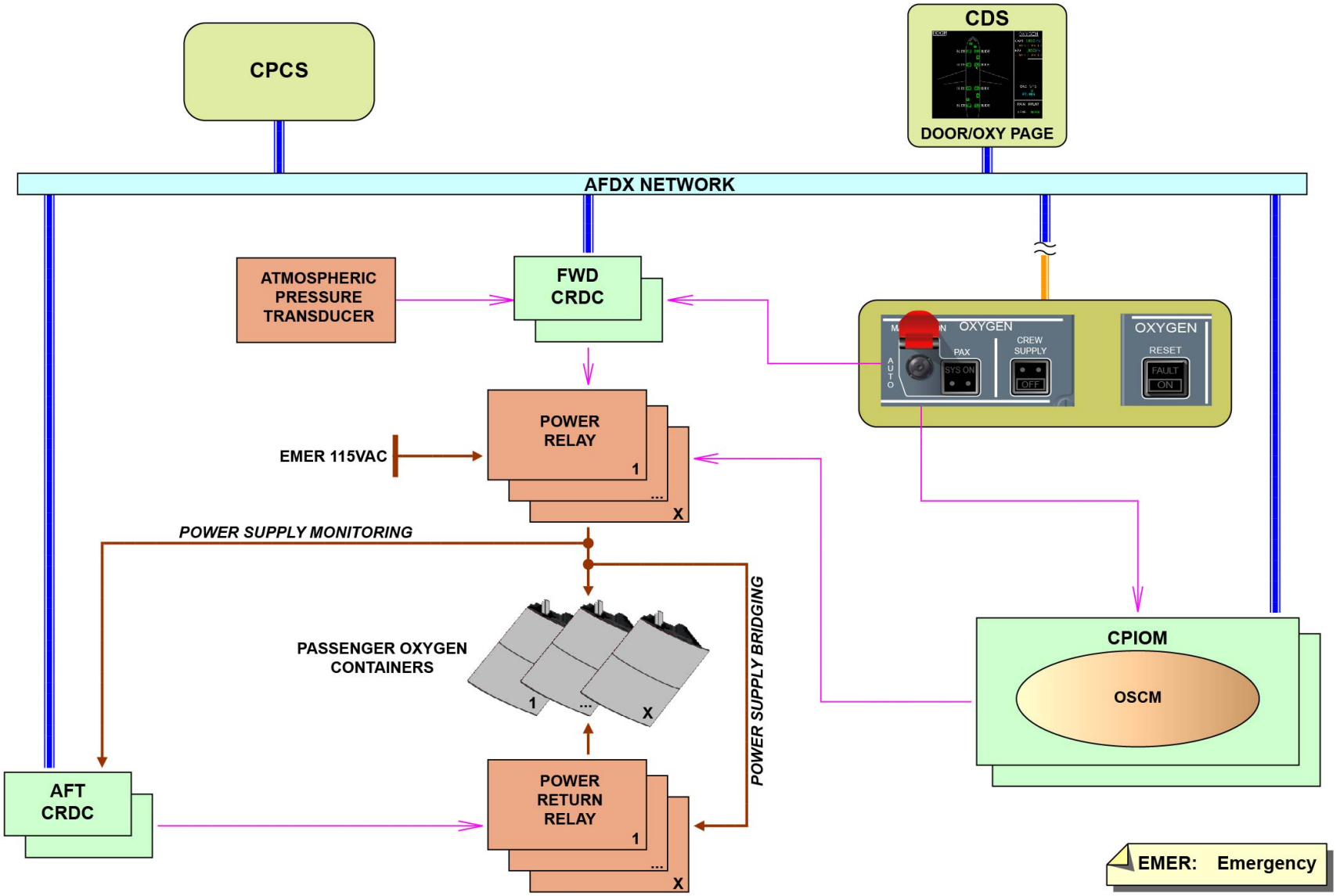
System activation redundancies

As automatic back-up activation, the OSCM applications monitor the cabin decompression event from the atmospheric pressure transducer (14000 ft) through a dedicated CRDC.
If there is a failure of both automatic logics, the cockpit crew activates the system manually with the MASK MAN ON P/BSW. For redundancy purpose, the discrete signal is sent to both OSCMs and to both FWD CRDCs.
If some latches are not electrically supplied, it is detected by the aft CRDCs (done by power supply monitoring).
The aft CRDCs send activation discrete signals to their dedicated power return relays. The power return relays energize the latches by (115 VAC EMER) obtained by power supply bridging.
Both OSCMs work at the same time and independently. The AFDX network connects them to each other. If one OSCM is unserviceable, the serviceable one sends discrete activation signals:
- To its related power relays
- To both FWD CRDCs through the AFDX network.

System reset

The system is reset by the manual OXYGEN RESET P/BSW, on the overhead maintenance panel. A reset of the passenger oxygen system can only be possible if the cabin altitude is below a specified cabin altitude threshold (12000 ft). The reset signal is distributed to OSCMs and all CRDCs, through AFDX network.

V1813401 - V01T0M0 - VM35D2CABIN3001



PASSENGER OXYGEN DESCRIPTION/OPERATION - NORMAL OPERATION CONDITION ... SYSTEM RESET

PASSENGER OXYGEN SYSTEM DESCRIPTION (2/3)

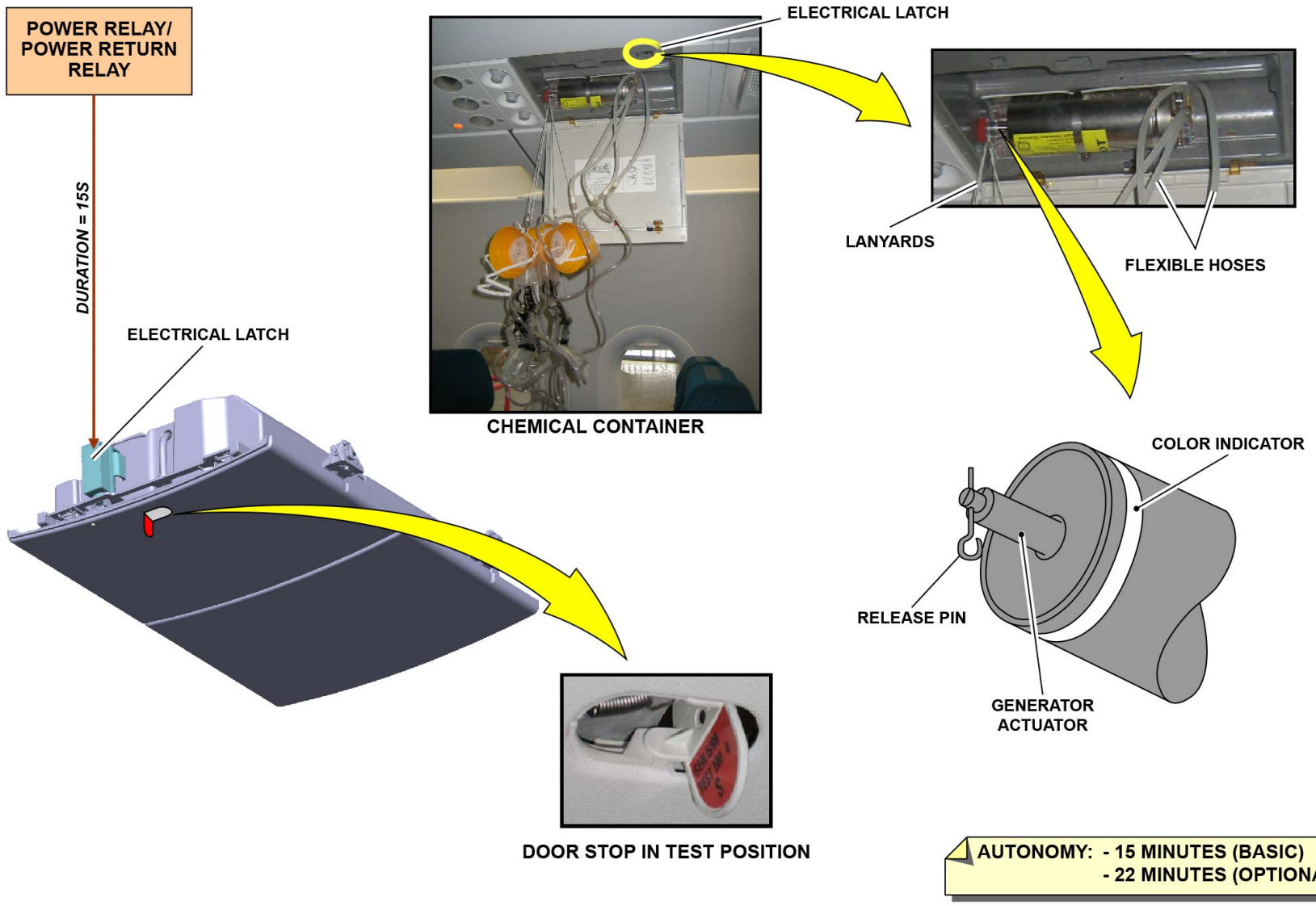
Passenger Oxygen System Generation/Distribution

Whatever the passenger oxygen system is (chemical or gaseous), the architecture, activation, operation and redundancies are the same. For chemical system, electrical latches are energized only for 15 seconds (software programming).
For the decentralized gaseous system, relays continuously energize oxygen containers (software programming) for its oxygen control board operation.

Chemical system generation

The passenger oxygen container has:
- A container door lid and an electrical latch (energized for 15 seconds)
- Passenger oxygen masks, to distribute the required oxygen flow to the occupants after the actuation by the lanyard
- A chemical oxygen generator assembly
- A test button (DOOR STOP), which is installed on the door lid:
It is used to perform the functional check of the passenger system without a complete opening of the container.
The number and types of the oxygen containers depend on each cabin layout.
All the chemical oxygen generator assemblies have the arrangement that follows:
- A starter assembly (with spring, firing pin, housing and a percussion cap: not shown), that has a release pin.
- A lanyard, which is connected to the release pin.
- A chlorate core, which supplies the oxygen by exothermal reaction.
The chemical oxygen generator has a color indicator which changes its color after the exothermal reaction (white to black). It can be used to confirm that the generator has been used.

V1813401 - V01T0M0 - VM35D2CABIN3001



PASSENGER OXYGEN SYSTEM GENERATION/DISTRIBUTION - CHEMICAL SYSTEM GENERATION

PASSENGER OXYGEN SYSTEM DESCRIPTION (2/3)

Passenger Oxygen System Generation/Distribution (continued)

Gaseous system generation (optional)

The gaseous oxygen container includes:
- 1 or 2 single-use (3000 psig) sealed gaseous oxygen cylinders (with a internal cylinder burst disc)
- An electrical latch
- A door lid equipped with a test button (DOOR STOP)
- An oxygen control board assembly
- An activation mechanism assembly.

The oxygen control board assembly has:
- An electronic control board, for the control/monitoring and flow regulation
- An oxygen temperature and pressure sensors
- Cabin temperature and altitude pressure sensors
- Regulation valves.

The activation mechanism assembly is equipped with:
- An activation pin which operates the percussion mechanism, to burst the internal cylinder burst disc
- An overpressure outlet and its cylinder loss pressure indicator
- A pressure reducer.

When the gaseous system is activated, a continuous (115 VAC EMER) power supply is necessary to energize the oxygen control board. First, the oxygen control board and the door latch are both energized, and then the oxygen control board switches off the power of the latch, after 2 seconds.

When a passenger pulls the mask lanyard:
- The actuation pin is removed. The percussion mechanism bursts the cylinder burst disc to open the cylinder
- The pressure is reduced by the pressure reducer (from 3000 psig to a nominal working pressure of 15 - 40 psig) and goes to the regulation valves.

After the oxygen control board receives:
- The oxygen pressure and temperature sensor data
- The cabin ambient temperature and the altitude pressure.

These data are used by the oxygen control board to regulate the necessary quantity of oxygen, through the valves pulse regulation.

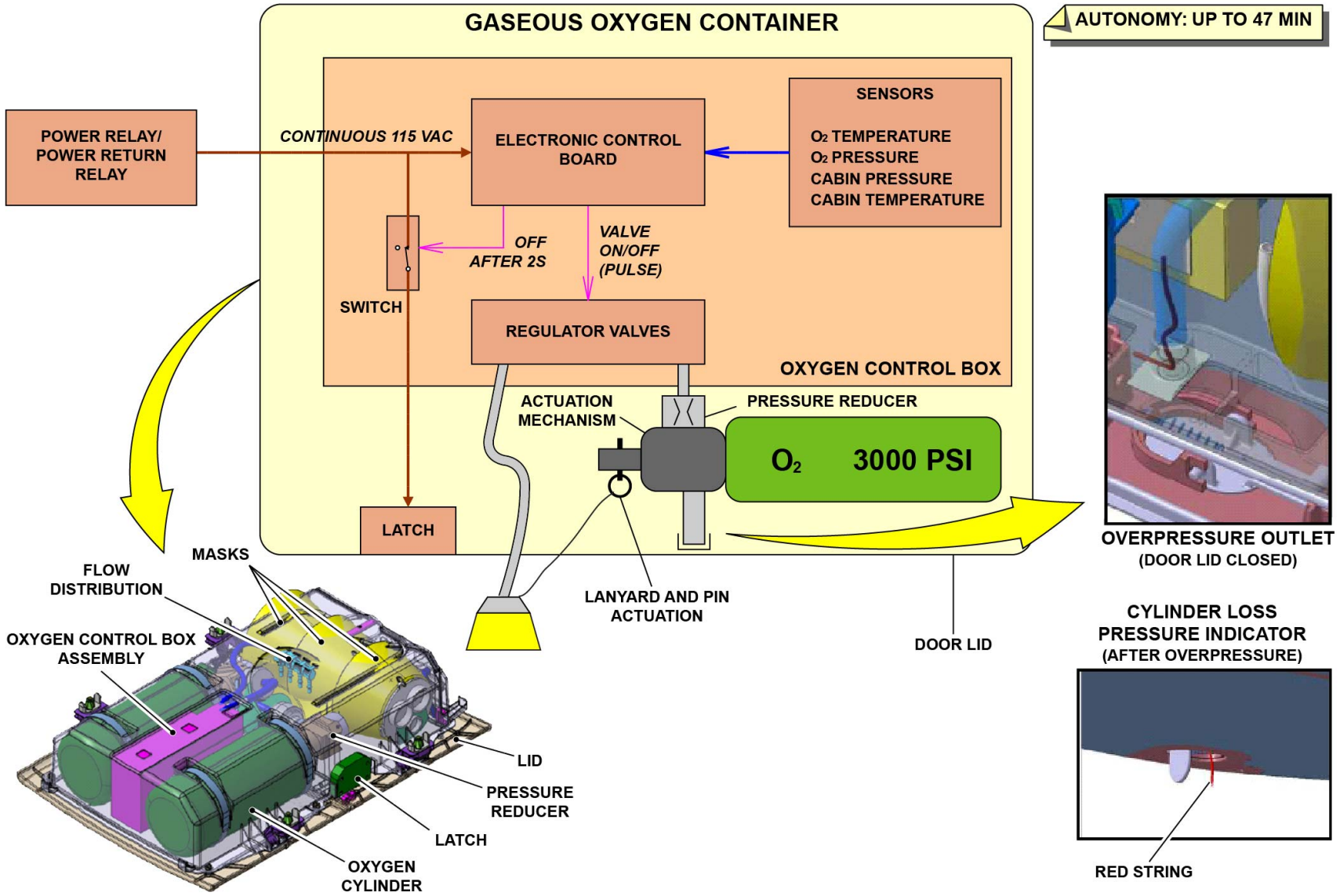
If there is an overpressure inside the cylinder, the cylinder burst disc operates as an overpressure relief device.

When an overpressure occurs:
- The disc bursts
- The overpressure is vented into the cabin area, via a tube and through the overpressure outlet and its pressure loss indicator
- The cylinder pressure-loss indicator is ejected and shows a red string through the test button (DOOR STOP), opened by the overpressure flow.

When the oxygen control board is energized (operational mode or maintenance test), the monitoring cycle and self-test are done at every specified period to operate the functions that follow:
- The power supply voltage, pressure and temperature sensors in range
- The regulation-valves functional test
- The self-test of the oxygen control board.

If an error is found, the latch is energized periodically (the container door opens or re-opens).

V1813401 - V01T0M0 - VM35D2CABIN3001



PASSENGER OXYGEN SYSTEM GENERATION/DISTRIBUTION - GASEOUS SYSTEM GENERATION (OPTIONAL)

V1813401 - V01T0M0 - VM35D2CABIN3001

PASSENGER OXYGEN SYSTEM DESCRIPTION (2/3)

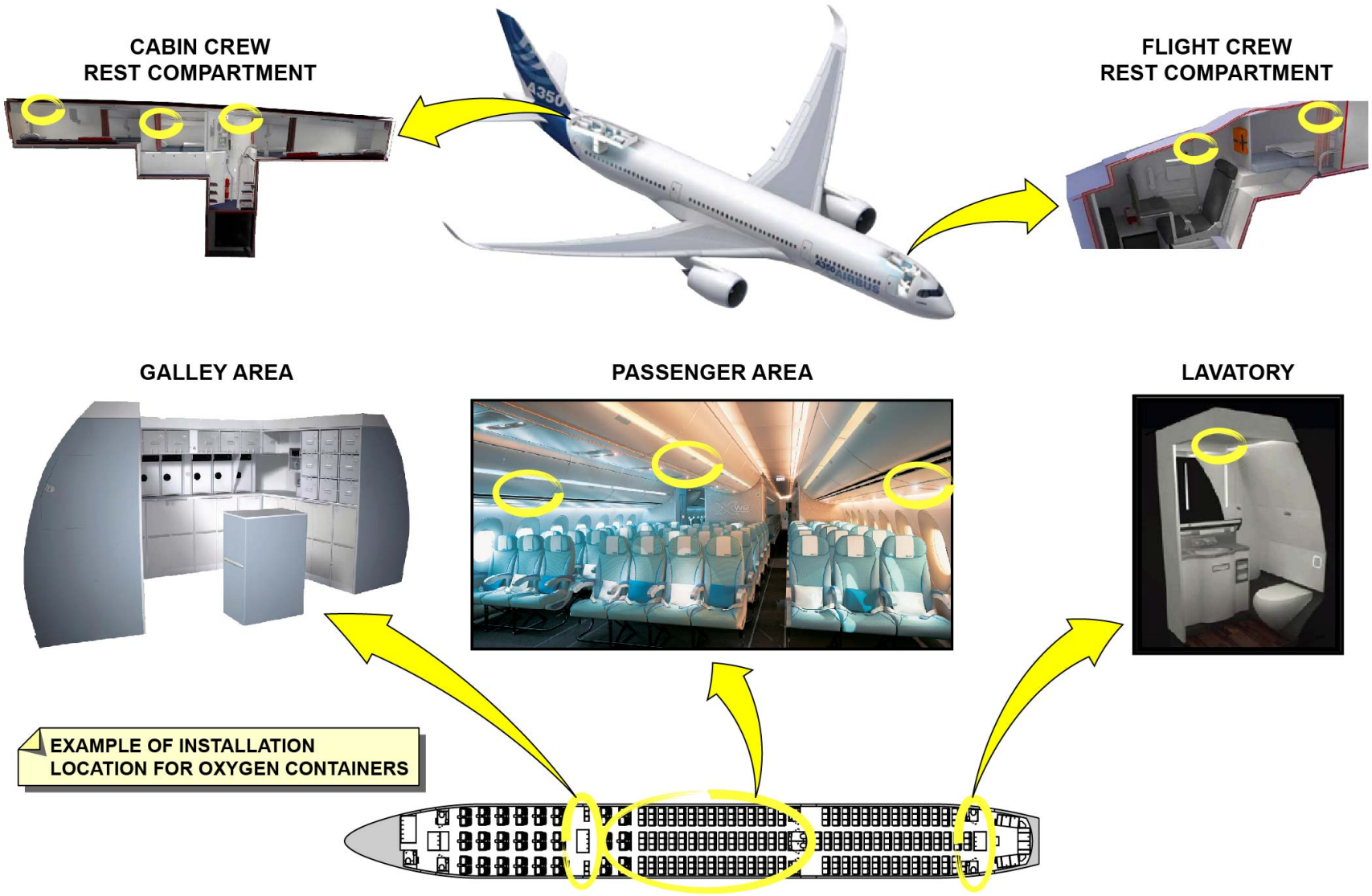
Passenger Oxygen System Generation/Distribution (continued)

Passenger oxygen system location

The passenger oxygen containers are installed throughout the cabin:
- Above the passenger seats
- Near the cabin attendant seats
- In the lavatories
- In the galley working areas
- In the crew rest compartments and in other isolated areas
- In the door entrance areas.

Different types of containers with a different number of masks are used for the different locations of the container (e.g.: lateral and center passenger service channel, cabin attendant station, galley working areas, lavatories, flight-crew and cabin-crew rest compartments, etc.).

V1813401 - V01T0M0 - VM35D2CABIN3001



PASSENGER OXYGEN SYSTEM GENERATION/DISTRIBUTION - PASSENGER OXYGEN SYSTEM LOCATION

PORTABLE OXYGEN SYSTEM DESCRIPTION (2/3)

Portable Oxygen System Description

The portable oxygen equipment is used for:
- The first aid after decompression or for the medical first aid, made by portable oxygen cylinder assemblies
- The protection for the flight and cabin crew for the firefighting and decompression, made by Protective Breathing Equipment (PBE) (1 in the cockpit)
- The back-up solution to open the oxygen container, made by manual release tools.

The portable oxygen system is integrated into the cockpit console, cabin hat-racks, doghouses and attendant seats.
The cabin attendants can use the portable oxygen cylinder assemblies during decompression to move freely through the cabin or if there are therapeutic needs.
The cabin and cockpit crews can use the PBE to move freely in case of smoke, for firefighting procedure and decompression. The PBE in the cabin will only be installed in the headrest of the cabin attendant seat. In the cockpit, the PBE is installed above the Third Occupant seat. It gives autonomy for a minimum of 15 minutes. It is kept in a low moisture vacuum sealed bag inside a protective casing.
This protective casing has:
- A serviceability indicator (green when the PBE is in good condition/red if there is a loss of vacuum)
- A tamper seal (stick of inviolability).

The manual release tool enables the opening of the passenger oxygen container in case of no automatic activation. The manual release tools are installed into the lower compartment of the cabin attendant seat.

V1813401 - V01T0M0 - VM35D3PORTA3001

PORTABLE OXYGEN CYLINDER ASSEMBLY

CABIN ATTENDANT SEAT
- CABIN PBE -

TAMPER SEAL

SERVICEABILITY INDICATOR

COCKPIT PBE

CABIN ATTENDANT SEAT STOWAGE

MANUAL RELEASE TOOL

PBE: Protective Breathing Equipment

PORTABLE OXYGEN SYSTEM DESCRIPTION

V1813401 - V01T0M0 - VM35D3PORTA3001

OXYGEN SYSTEM CONTROL AND INDICATING (2/3)

Flight Crew Oxygen ICP and FFQDM (2/3)

The A350 oxygen system is controlled by two redundant Oxygen System Control & Monitoring (OSCM) applications.
These two applications perform the following functions:
- Monitoring of crew and passenger oxygen systems.
- Automatic passenger system activation.
- Communication with other aircraft systems.
- Indications and alerts.
- BITE and interactive mode tests.

The main indications are displayed at the DOOR/OXY SD page, eventually associated with alerts and messages on WD page. Each mask stowage box assembly provides a stowage location and connections for the Full Face Quick Donning Mask (FFQDM).
The activation of the Crew Oxygen System will be done via a "CREW SUPPLY" P/B switch available on oxygen ICP in cockpit. "CREW SUPPLY" P/B switch activates both Crew Shut-Off Valves (CSOV) in the LH and RH crew oxygen compartments.
When the "CREW SUPPLY" P/B is released (A/C on ground):
- White OFF light illuminates(position of switch),
- DOOR/OXY SD page, an amber legend REGUL PR LO appears, for CAPT and F/O subsystems,
- CAPT and F/O Titles are indicated in amber.

When the "CREW SUPPLY" P/B is on (A/C on ground):
- CAPT and F/O Titles are indicated in white.

The Stowage Box has a Press to Test/Reset button and a flow indication blinker in the left door.
The "Press to Test/Reset" P/B can be used to:
- Perform "in situ" test of the mask(LP valve opens when P/B is pressed),
- Reset the LP supply valve to the closed position, after use of the mask and stowage operation.

After stowage operation of the mask and closure of stowage box, "OXY ON "white flag is in view on the left door, to remain you that the LP valve is still open. This flag disappears during reset operation.
The flow blinker indicator responds to oxygen flow when the Press to Test/Reset button is pressed or during oxygen inhalation. When oxygen flows, the indicator shows a "bright yellow" color. During "in situ" test, in case of leak, this indicator is continuously shown.
During "in situ" test, if no leak, indicator disappears after 2 or 3 seconds.
The Stowage Box LP valve is equipped with a pressure switch that provides a signal used by the AMUs (Audio Management Unit) to automatically deactivate the boom microphones and activate the mask microphone. This eliminates the need for the pilot to perform this operation manually.
So when the Stowage Box is open or the Press to Test/Reset P/B is pressed, the mask regulator is pressurized and the microphone is activated (LP supply valve determined open by the pressure switch). Both regulator and microphone remain functional after the doors are closed and until the Press to Test/Reset P/B is pressed (to close LP supply valve).
The mask is equipped with an inflatable harness, a face piece with visor, a microphone (MIC), a regulator with a selector knob and harness inflation levers.
The following mode settings can be selected by using the selector knob:
- Emergency MODE (EMER)
- Oxygen MODE (100%)
- Diluted MODE (NORM).

To secure the right selection (EMER, 100%, NORM), a tab locking clip is installed inside the regulator. The mask can be stowed in the box and extracted for donning in the 100% regulator mode only.
An indicator ring pops out of the front face of the control knob in NORM mode to provide tactile mode indication.

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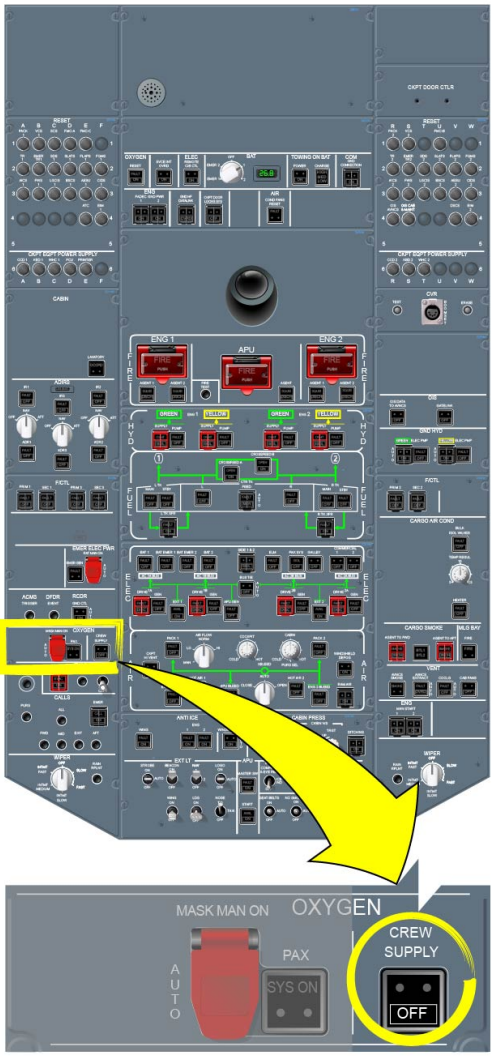
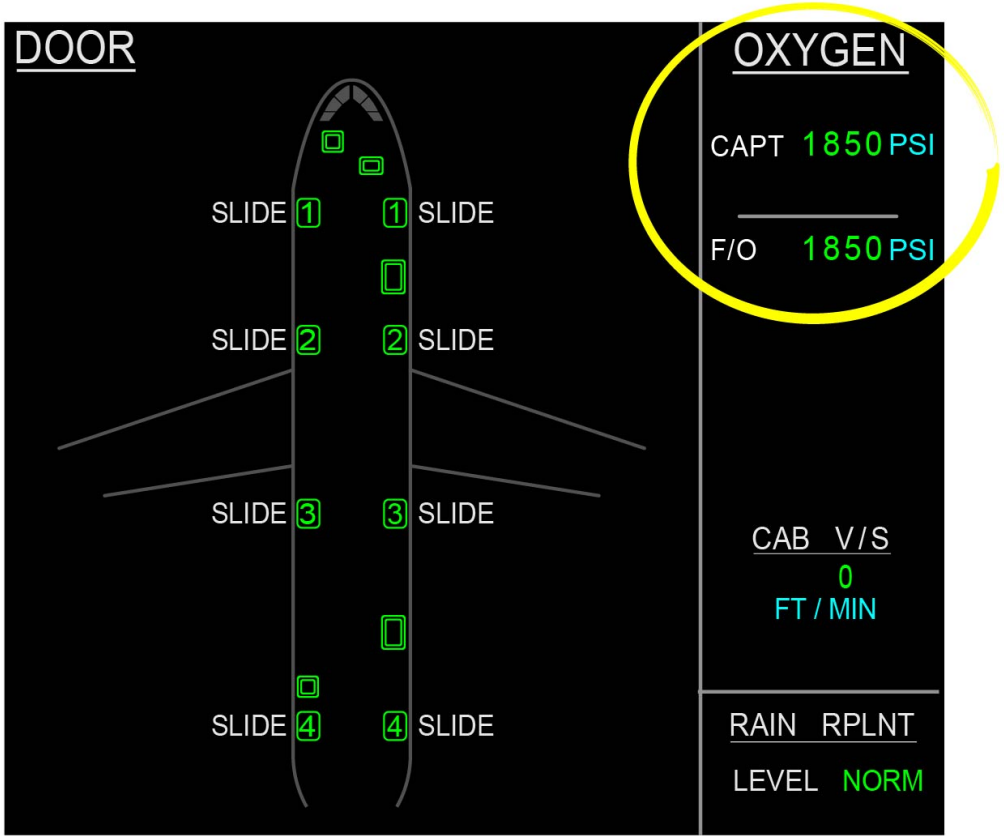
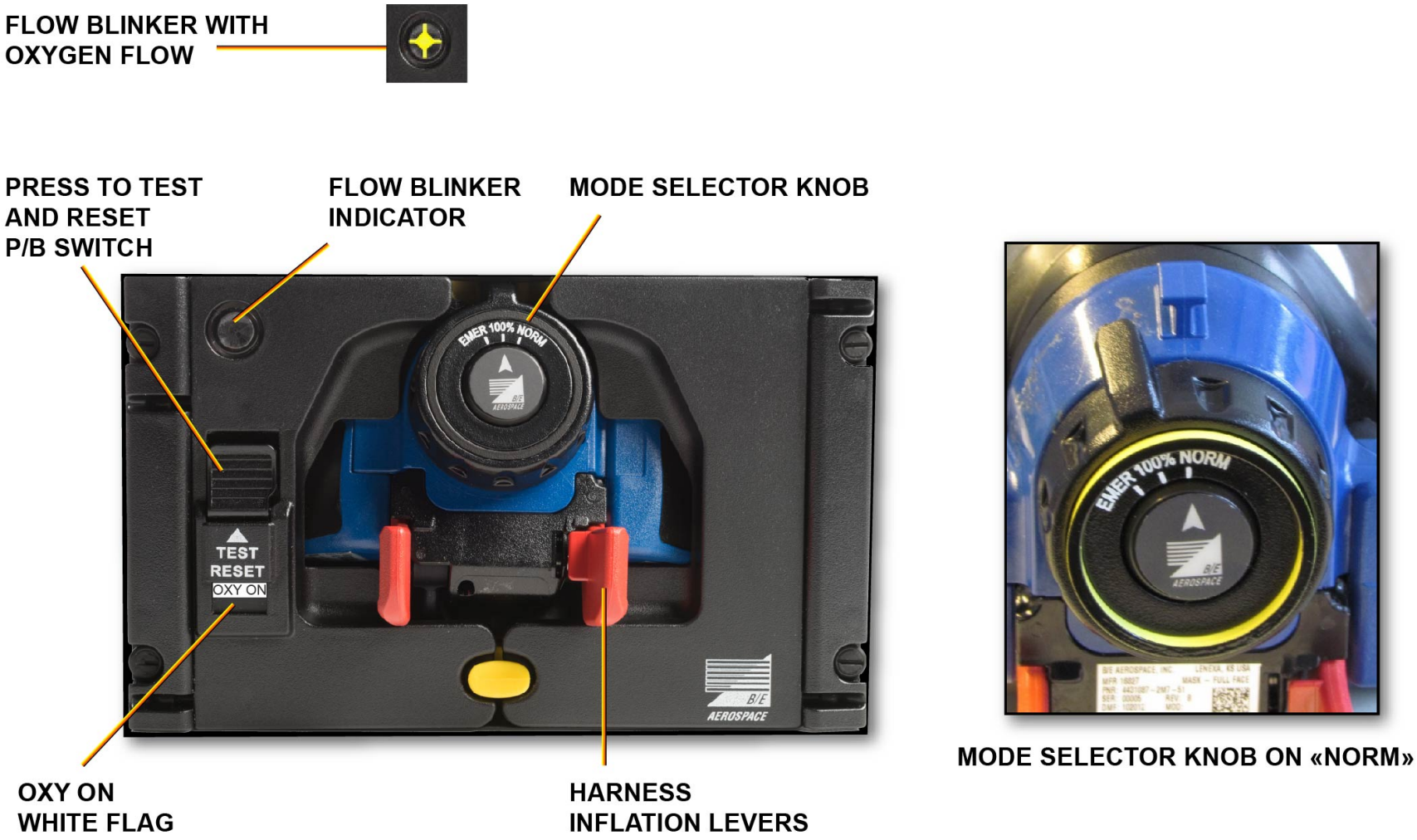


OXYGEN INTERGATED CONTROL PANEL



DOOR /OXY SD NORMAL PAGE

FLIGHT CREW OXYGEN ICP AND FFQDM (2/3)



FLIGHT CREW OXYGEN ICP AND FFQDM (2/3)

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V1813401 - V01T0M0 - VM35I1000003001

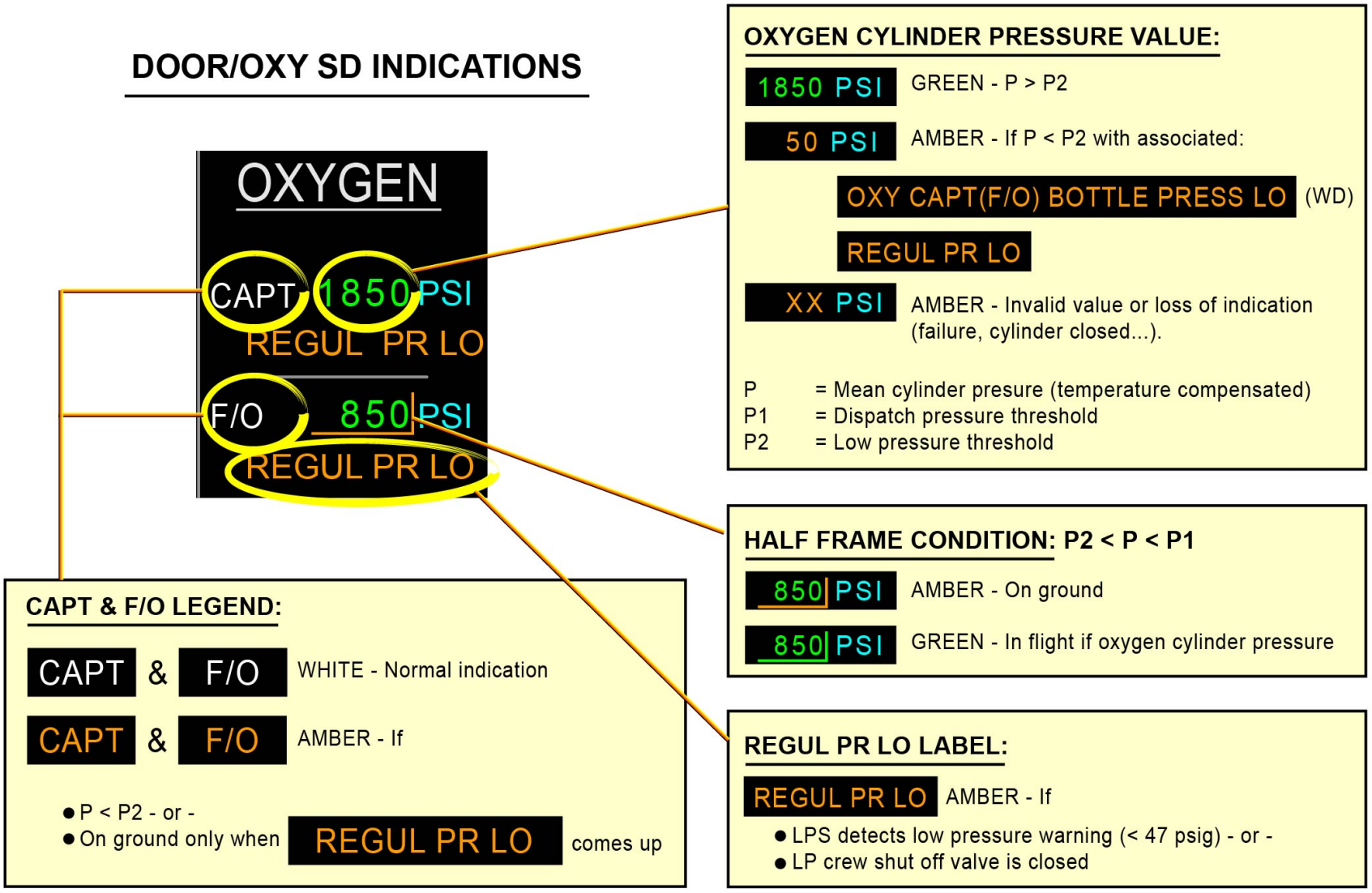
OXYGEN SYSTEM CONTROL AND INDICATING (2/3)

Flight Crew Oxygen System Indications (2/3)

The flight crew oxygen system is monitored through:
Indications on the DOOR/OXY SD page,
Alerts on the WD.
DOOR/OXY SD PAGE INDICATIONS, A/C ON GROUND:
REGUL PR LO is only displayed in A/C ON GROUND condition and when:
low pressure is detected by the low pressure sensor(LPS) in the distribution line(47PSI), or
When the associated CSOV is in the closed position.
PRESSURE VALUE (temperature-compensated, lowest value provided OSCM applications) is displayed:
In green. When two bottles are installed, the average pressure is displayed when both values are valid. Half of the value of the remaining bottle is displayed if one bottle value is not valid or one bottle is closed.
In green and amber half framed when the oxygen pressure is below the dispatch pressure threshold (P1). (In green and green half framed when the aircraft is in flight).
XX in amber, when the pressure(s) signal(s) is (are) invalid.(cylinder closed as example)
In amber when the oxygen content is below the low pressure threshold (P2).
CAPT (F/O) is normally displayed in white. It is displayed amber when:
The REGUL PR LO indication comes up(on ground only) or
The oxygen pressure indication is below the low pressure threshold (P2).
UNITS (PSI) appears in blue.
THE ALERTS DISPLAYED ON THE WD ARE:
OXY CAPT BOTTLE PRESS LO when the captain oxygen pressure is below P2.
OXY F/O BOTTLE PRESS LO when the first officer oxygen pressure is below P2.

There are two oxygen thresholds for the pressure indication:
P1: Oxygen cylinder pressure to protect 4 cockpit occupants covering depressurization and toxic gases/smoke emissions. (P1 is a Software Pin Programming parameter). However the pressure may be sufficient to dispatch the A/C with less than four flight crew members.
P2: Oxygen cylinder pressure to protect 2 cockpit occupants covering emergency descent only.

V1813401 - V01T0M0 - VM35I1000003001



FLIGHT CREW OXYGEN SYSTEM INDICATIONS (2/3)

OXYGEN SYSTEM CONTROL AND INDICATING (2/3)

Flight Crew Oxygen Leak / Cylinder Closed (2/3)

Oxygen pressure indication will always be displayed as temperature compensated (for two cylinder configuration: averaged) (least value of both CPIOMs).
In case of subsystem leak, DOOR/OXY page indications (pressure, subsystem status), will change following P1 and P2 threshold. It will be also associated with WD message. At the end, an oxygen low pressure condition is detected by the low pressure switch (LPS) installed on the distribution line, downstream the CSOV. It sends a signal to both OSCM applications.
Standard steps are, during constant leak (or use of pressure):
Pressure in green, becomes amber half framed at P1 threshold.
Pressure becomes amber, at P2 threshold. Amber pressure indication is associated with WD (level 2) OXY F/O BOTTLE PRESS LO (+ automatic DOOR/OXY page called). F/O title becomes amber.
Low Pressure switch confirms a distribution system pressure lower than (47) psi, REGUL PR LO indication comes up.
IN ONE CYLINDER CONFIGURATION:
"XX" will be displayed if no or an invalid value is determined. An invalid value is given when cylinder pressure signal is determined as out of range, not valid (oxygen system internal failure) or cylinder switch open (CSO) signal is closed.
IN TWO CYLINDERS CONFIGURATION:
"XX" will be displayed if no or an invalid value is determined. An invalid value is given when cylinders pressures signals are determined as out of range, not valid (oxygen system internal failure) or both cylinder switch open (CSO) signals are closed. One closed signal will lead to display of half value of other cylinder content.

Flight Crew Oxygen Refill Panel (Optional) and Overpressure Discharge Indicator (2/3)

In case of low pressure at the oxygen bottles, they can either be changed or refilled according to airline policy and local regulations.
The refilling is done by connecting the oxygen ground filling equipment at the oxygen refilling panel located at the frame of the forward cargo door. At this panel appears a Fill Port to refill the both subsystems.
A Fill Pressure Indicator, located near the Fill Port, displays the average pressure of oxygen cylinders (open cylinders), supplied by the OSCMs software. The displayed pressure is not temperature compensated, shows the arithmetic mean of the oxygen pressure in the healthy and open bottles. This computation is done by OSCMs applications (A/C need to be energized).
At any time, the cylinder pressure can be checked directly on the direct reading pressure gauge. It can be done through sight glass, without removal of panel compartment.
The high-pressure safety relief burst disc (burst pressure: 2700 to 3000 Psig) on the oxygen cylinder head and the low-pressure relief valve (relief pressure: 110 - 115 Psig) on the distribution manifold are connected to a common discharge indicator on the fuselage skin.
The overboard discharge indicator provides an indication, visible from outside of the A/C. It must be checked during the walk around. Each subsystem is equipped by overboard discharge indicator (L/H side and R/H on the fuselage skin).
There is a green blowout disc that can be seen from outside. In case of overpressure, this disc will blow out (51 Psig) to show a yellow indicator.
DOOR/OXY SD page, direct reading pressure gauges, Oxygen Refilling panel indicator can be used to determine the source of overpressure.

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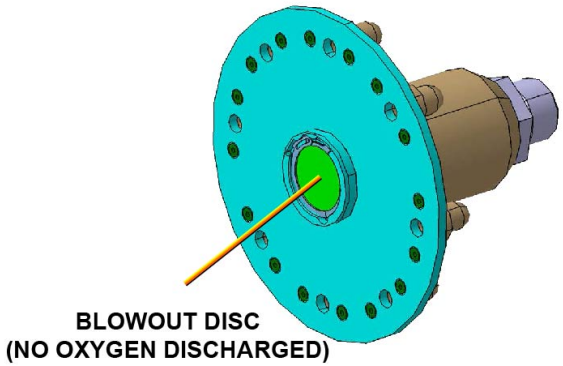
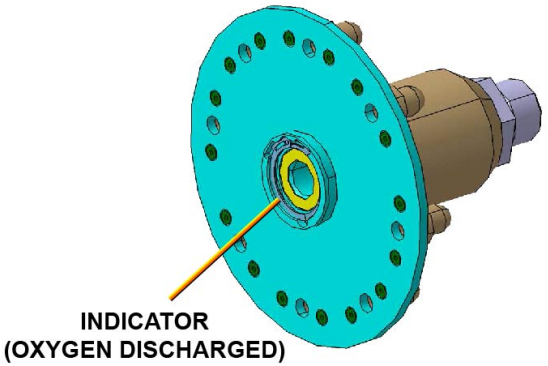
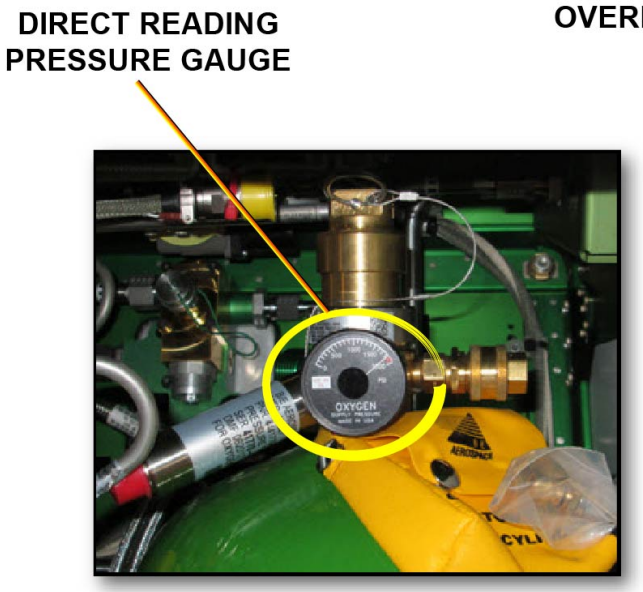




OVERBOARD DISCHARGE INDICATOR



OXYGEN CYLINDER

OPTIONAL FILL PANEL

FLIGHT CREW OXYGEN LEAK / CYLINDER CLOSED (2/3) & FLIGHT CREW OXYGEN REFILL PANEL (OPTIONAL) AND OVERPRESSURE DISCHARGE INDICATOR (2/3)

OXYGEN SYSTEM CONTROL AND INDICATING (2/3)

Cabin Oxygen System (2/3)

The cabin oxygen system is activated electrically in the event of a cabin decompression:
AUTOMATICALLY by any OSCM application using:
The cabin altitude signals sent by the CPCS (13 800 ft).
The atmospheric pressure transducer (TPA) as back-up (14 000 ft).
AT ANY TIME, MANUALLY, by "Mask Man On" P/B Switch on the cockpit overhead oxygen panel.
After use, the system must be reset, to come back to its initial configuration. All containers are equipped with a test button (DOOR STOP).
With the system activation:
PAX "SYS ON" light illuminates on the Overhead Panel.
MEMO appears automatically on the WD page.
Flight Attendant Panel (FAP) in the cabin area provides aural and visual indication of cabin decompression event.
When the system is activated, 115VAC is supplied to the container electrical latch:
Only for 15 seconds, for the chemical oxygen containers.
Continuously, for the gaseous oxygen containers.
For the gaseous oxygen system, power will be provided to the Oxygen Control Board (OCB), in charge of the oxygen flow regulation. The OCB also cuts the power to the latch, after 2 seconds.
PAX "SYS ON" light on the OXYGEN overhead panel:
"SYS ON" light comes on when an activation signals and activation power lines are supplied. The light remains on until the RESET P/B switch is pressed.
Memos displayed on the WD are:
OXY PAX SYS ON (green) when the cabin oxygen is activated by the CPCS cabin low pressure data.
OXY PAX SYS ON (amber) when the cabin oxygen is activated by the atmospheric pressure transducer (TPA) or the "Mask Man On" P/B Switch (CPCS data not available).
RESET PB/switch on the maintenance OXYGEN panel:
ON light comes on when the RESET P/B switch is pressed. When the reset is completed, the ON light goes off and the OXY PAX SYS ON memo is no more displayed on the WD.
FAULT (amber) light comes on when the RESET PB/switch is pressed but some activation lines are still supplied.
A reset of the passenger oxygen system can only be done on ground (or if the cabin altitude is below 12000ft).
Container test button (DOOR STOP):
To perform maintenance tasks, don't forget to put the Test Button on test position. It will avoid a complete opening of container and a complete masks deployment (by consequence, a stowage operation of the entire cabin).

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WD MEMO PAGE

MEMOS DISPLAYED ON THE WD ARE:

- OXY PAX SYS ON (green) when the cabin oxygen is activated by the CPCS cabin low pressure data.

- OXY PAX SYS ON (amber) when the cabin oxygen is activated by the atmospheric pressure transducer (TPA), or the «MASK MAN ON» P/B Switch (CPCS data not available).

CONTROL

1. Push the RESET «ON» P/B

INDICATION

- RESET «ON» illuminates
- «SYS ON» illuminates
- If RESET «FAULT» illuminates - System encounters failure
- «SYS ON» will switch off when system is reset and ready if cabin decompression occurs

CONTROL

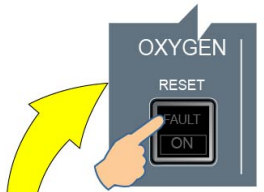
1. Lift off the red plastic flap
2. Push the «**MASK MAN ON**» P/B behind the red plastic

INDICATION

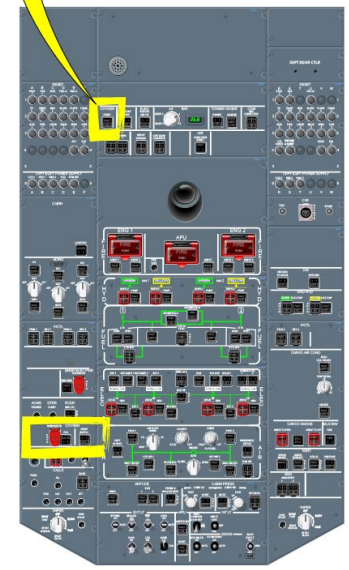
- «**SYS ON**» **illuminates** - System **operative**
  If cabin decompression occurs, the system is activated associated with memo WD page.
- «**SYS ON**» not illuminates - System is not operative.

REMARKS

- For manual activation in case of CPCS and TPA defective, maintenance test.
- By pushing this P/B, the mask will automatically drop down
- «**MASK MAN ON**» P/B is covered by a red plastic flap to avoid any inadvertent activation, which could accidently activate the system unnecessarily.



OXYGEN RESET P/B



OXYGEN INTERGATED CONTROL PANEL

CABIN OXYGEN SYSTEM (2/3)

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