A350
TECHNICAL TRAINING MANUAL
T1+T2 Mechanical and Avionics A350 RR TRENT XWB
AIRFRAME (LEVEL1)

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HYDRAULIC POWER SYSTEM PRESENTATION

Overview

The function of the hydraulic power system is to supply hydraulic power to the aircraft hydraulic consumers.
General familiarization training for this system focuses on:
- Main hydraulic power
- Auxiliary hydraulic power
- Hydraulic system monitoring.

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MAIN HYDRAULIC POWER

AUXILIARY HYDRAULIC POWER

HYDRAULIC POWER SYSTEM

HYDRAULIC SYSTEM MONITORING

OVERVIEW

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HYDRAULIC POWER SYSTEM PRESENTATION

Main Hydraulic Power - Presentation

Function Description

The main hydraulic-power system includes:
- The Green main hydraulic-power system
- The Yellow main hydraulic-power system
- The reservoir pressurizing system.

The function of the main hydraulic-power system is to supply hydraulic power to the aircraft hydraulic consumers. The Green and Yellow main hydraulic-power systems are fully independent of each other and with no hydraulic fluid transfer between them. The bootstrap-type Green and Yellow hydraulic reservoirs supply hydraulic fluid to engine pumps. Two engine pumps for each system pressurize the hydraulic fluid to 5000psi . Each hydraulic power system has one engine pump on each engine.

Each engine pump has a clutch to mechanically disconnect the pump drive shaft from the engine Accessory Gearbox (AGB). Each engine pump case-drain line has one fuel hydraulic heat-exchanger. The fuel is the cooling agent that decreases the temperature of the hydraulic fluid when it is necessary. Each engine pump suction line has a Fire ShutOff Valve (FSOV) which is installed downstream of the reservoir. The function of the FSOV is to stop the hydraulic fluid supply to the engine pump.

The Green main hydraulic-power system supplies hydraulic power to:
- The brakes and their accumulator
- The Ram Air Turbine (RAT) retraction actuator
- The Main Landing Gear (MLG) extension/retraction
- The flight controls.

The Yellow main hydraulic-power system supplies hydraulic power to:
- The brakes and their accumulator
- The Nose Landing Gear (NLG) extension/retraction
- The nose wheel steering
- The flight controls.

The function of the reservoir pressurizing system is to keep the hydraulic reservoirs pressurized to supply a positive flow of hydraulic fluid to the pumps. The reservoirs of the Green and Yellow hydraulic-power systems are self-pressurized which prevents the cavitation of the hydraulic pumps.

Each system has an accumulator and a pressure maintaining unit. The accumulator absorbs the delivery pulsations and pressure surges of the pumps. With the pressure maintaining unit, the accumulator keeps the reservoir pressurized after a system shutdown.

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MAIN HYDRAULIC POWER - PRESENTATION - FUNCTION DESCRIPTION

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HYDRAULIC POWER SYSTEM PRESENTATION

Main Hydraulic Power - Presentation (continued)

Location

There are two engine pumps on each engine, one for the Green hydraulic-power system and one for the Yellow hydraulic-power system. The engine pumps are installed on the Accessory Gearbox (AGB) on each engine. The Green reservoir is installed on the right side of the rear belly fairing. The Yellow reservoir is installed on the keel beam of the MLG bay. The fuel hydraulic heat-exchangers are installed in the wings (fuel tanks).

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MAIN HYDRAULIC POWER - PRESENTATION - LOCATION

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HYDRAULIC POWER SYSTEM PRESENTATION

Auxiliary Hydraulic Power - Presentation

Function Description

The auxiliary hydraulic-power system includes:
- The Green auxiliary hydraulic-power system
- The Yellow auxiliary hydraulic-power system.

The function of the Green and Yellow auxiliary hydraulic-power systems is to supply hydraulic power to the hydraulic consumers for ground operation and maintenance when no engine is in operation.
Each hydraulic-power system has one electric pump which can pressurize the hydraulic fluid to 5000psi . The electric pumps are used on the ground only. It is also possible to pressurize the hydraulic fluid through a hydraulic ground-power cart connection. The Green and Yellow auxiliary hydraulic-power systems are fully independent of each other and with no hydraulic fluid transfer between them.
The isolation valves (when closed) in the Green and Yellow auxiliary hydraulic-power systems let the hydraulic power to:
- Operate the brakes on the ground
- Pressurize the brake accumulators
- Operate the cargo doors of the Yellow auxiliary hydraulic-power system.

If necessary, for maintenance procedures, it is possible to send hydraulic power to all hydraulic consumers of the Green and Yellow auxiliary hydraulic-power systems with isolation valve open.
The Green auxiliary hydraulic-power system supplies hydraulic power to:
- The brakes and their accumulator
- The RAT retraction actuator
- The MLG extension/retraction
- The flight controls.

The Yellow auxiliary hydraulic-power system supplies hydraulic power to:
- The cargo doors
- The brakes and their accumulator
- The NLG extension/retraction
- The nose wheel steering
- The flight controls.

A hydraulic auxiliary pump in the Yellow auxiliary hydraulic-power system supplies hydraulic power to the brake accumulators and cargo doors for ground operations and maintenance.

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AUXILIARY HYDRAULIC POWER - PRESENTATION - FUNCTION DESCRIPTION

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HYDRAULIC POWER SYSTEM PRESENTATION

Auxiliary Hydraulic Power - Presentation (continued)

Location

There are two electric pumps. The electric pump of the Green hydraulic-power system is installed on the aft keel beam, in the MLG bay. The electric pump of the Yellow hydraulic-power system is installed on the forward keel beam, in the MLG bay. The ground hydraulic-power cart connections are on the Green and Yellow Ground Service Panels (GSPs). The hydraulic auxiliary pump is installed on the Yellow GSP. The Green GSP is installed in the belly fairing, aft of the MLG bay. The Yellow GSP is installed in the belly fairing, in front of the MLG bay.

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AUXILIARY HYDRAULIC POWER - PRESENTATION - LOCATION

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HYDRAULIC POWER SYSTEM PRESENTATION

Hydraulic System Monitoring - Presentation

Function Description

There are two Hydraulic Monitoring and Control Applications (HMCAs), HMCA-G and HMCA-Y. Each one monitors and controls one of the two hydraulic-power systems, Green or Yellow. The function is hosted in Core Processing Input/Output Module (CPIOM). Each HMCA does the control and monitoring function on its related hydraulic power system. Each HMCA collects quantity, pressure and temperature data of the hydraulic-power systems. It has interfaces through the Avionics Full Duplex Switched Ethernet (AFDX) to other aircraft systems to which it transmits this data.
The HMCA controls the pumps and valves. It receives the commands through the AFDX.

Interface

The CPIOM sends the collected hydraulic-power systems data to the CDS HYD page through the AFDX.

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ACCU : Accumulator	HAP : Hydraulic Auxiliary Pump
C : Clutch	HHX : Hydraulic Heat Exchanger
FSOV : Fire ShutOff Valve	HMCA : Hydraulic Monitoring & Control Application
PMV : Pressure Maintaining Valve	RSVR : Reservoir

HYDRAULIC SYSTEM MONITORING - PRESENTATION - FUNCTION DESCRIPTION & INTERFACE

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HYDRAULIC POWER SYSTEM PRESENTATION

Control and Indicating - Presentation

Controls and indications are on the cockpit overhead panel, on:
- The "GND HYD" panel for the control of the electric pumps
- The "HYD" panel for the control of the engine pumps.

Indications are on the cockpit instrument panel, on the ECAM SD "HYD" page.
Controls and indications are also for the maintenance tasks, on:
- The Green GSP, aft of the MLG bay
- The Yellow GSP, forward of the MLG bay.

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CONTROL AND INDICATING - PRESENTATION

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HYDRAULIC POWER SYSTEM PRESENTATION

Maintenance

Tools

An approved 5000psi hydraulic ground-power cart is used to operate the hydraulic-power systems and its hydraulic consumers for maintenance tasks.

Maintenance Practices

An approved repair method is necessary to do repairs on 5000psi pipes of the hydraulic-power systems. The methods are in AirN@v/Line maintenance procedure.
The hydraulic fluid for the Green and Yellow hydraulic-power systems is a low density phosphate-ester hydraulic fluid. Thus it is mandatory that no high-density hydraulic fluid is used in the system. High-density hydraulic fluid can cause damage to the hydraulic-power systems.

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MAINTENANCE - TOOLS & MAINTENANCE PRACTICES

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LANDING GEAR SYSTEM PRESENTATION

Overview

The function of the Landing Gear (L/G) system is to support the aircraft on the ground and transmit taxi, takeoff, landing and braking loads to the structure.
It extends and retracts the L/G.
It decreases the aircraft speed with the braking system and steers the aircraft on the ground.
It also monitors some braking subsystems.
General familiarization training for this system focuses on the:
- Main Landing Gear (MLG) and Doors
- Nose Landing Gear (NLG) and Doors
- Extension and Retraction
- Wheels and Brakes
- Landing Gear Monitoring System (LGMS)
- Nose Wheel Steering and Control.

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OVERVIEW

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LANDING GEAR SYSTEM PRESENTATION

Main Gear and Doors - Presentation

Function/Description

A MLG is installed in each wing. They support the aircraft on the ground and transmit taxi, takeoff, landing and braking loads to the wing. In flight, each MLG retracts inboard into its L/G bay in the fuselage.
The doors cover the L/G bays when the L/Gs are retracted. This gives the aircraft its aerodynamic profile.
A350-900
Each MLG has these parts:
- An Oleo-pneumatic Shock-absorber (Leg) that includes a four-wheel bogie-beam assembly
- Forward and Aft Side Stays and Lock Stays
- Two pairs of Downlock Springs
- A Hydraulic Pitch Trimmer
- A Retraction Actuator
- Two Lock Stay Actuators.

There are three doors for each MLG, the main door, the fixed fairing door and the hinged door.
The main door is operated hydraulically by a door actuator.
The fixed fairing door and the hinged door are mechanically attached to the leg.
A350-1000
Each MLG has these parts:
- An Oleo-pneumatic Shock-absorber (Leg) that includes a six-wheel bogie-beam assembly
- Forward and Aft Side Stays and Lock Stays
- Two pairs of Downlock Springs
- An Independent Pitch Trim Actuator
- A Retraction Actuator
- Two Lock Stay Actuators.

There are three doors for each MLG, the main door, the fixed fairing door and the hinged door.
The main door is operated hydraulically by a door actuator.
The fixed fairing door and the hinged door are mechanically attached to the leg.

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MAIN GEAR AND DOORS - PRESENTATION - FUNCTION/DESCRIPTION

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A350-1000 ONLY

MAIN GEAR AND DOORS - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Nose Gear and Doors - Presentation

Function/Description

The NLG is installed in the forward fuselage. It supports the forward part of the A/C on the ground and transmits taxi, takeoff and landing loads to the airframe. In flight, the NLG retracts forward into its L/G bay in the fuselage.
The doors cover the L/G bay when the L/G is retracted. This gives the aircraft its aerodynamic profile.
The NLG has these parts:
- An Oleo-pneumatic Shock-absorber (Leg) that includes a twin wheel axle
- A Drag Stay and a Lock Stay
- A Retraction Actuator
- A Lock Stay Actuator
- Two Steering Actuators
- Two Downlock Springs.

There are four doors for the NLG, two forward doors and two rear doors.
The two forward doors are operated hydraulically by two door actuators (one actuator per door).
The two rear doors are mechanically attached to the leg.

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NOSE GEAR AND DOORS - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Extension and Retraction - Presentation

Function/Description

The Landing Gear Extension and Retraction System (LGERS) controls and monitors the extension and retraction of the L/G.
The system is divided into three subsystems, the:
- Normal extension and retraction system
- Emergency (alternate) extension system
- Ground Door Opening (GDO) system.

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EXTENSION AND RETRACTION - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Normal Extension and Retraction - Presentation

Function/Description

The normal extension and retraction system extends and retracts the L/G and opens/closes the L/G doors in normal operation.
It uses Core Processing Input/Output Modules (CPIOM) (LGERS application) to control the operational sequence of the L/G and to monitor the L/G positions.
The system is electrically controlled and hydraulically operated by:
- Gear and door selector valves
- Gear and door uplock control-valves
- Gear and door actuators
- Gear and door uplocks.

The L/G lever in the cockpit is used to extend or retract the L/G. The L/G lever signals are sent to the CPIOMs (LGERS application) via the Avionics Full Duplex Switched Ethernet (AFDX) network.
The normal extension and retraction system monitors the position of the gears and doors. The position data is sent to the CPIOMs via the AFDX network for system monitoring and the Control and Display System (CDS).
The normal extension and retraction system controls and monitors the isolation, selector and uplock valves, the actuators and the uplocks. Data is sent to the CPIOMs via the AFDX network.
Hydraulic power is supplied through the isolation valve to the gear and door selector valves and the gear and door uplock valves. The hydraulic power then goes from the:
- Gear selector valves to the gear actuators
- Door selector valves to the door actuators
- Gear uplock control-valves to the gear uplocks
- Door uplock control-valves to the door uplocks.

Interface

Two independent hydraulic power supplies are used to operate the L/G in normal operation.
The green hydraulic system supplies the hydraulic power to operate the MLG and the MLG doors.
The yellow hydraulic system supplies the hydraulic power to operate the NLG and the NLG doors.

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NORMAL EXTENSION AND RETRACTION - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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NORMAL EXTENSION AND RETRACTION - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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LANDING GEAR SYSTEM PRESENTATION

Alternate Extension - Presentation

Function/Description

The alternate extension system is used when the normal extension system is not available because of failure.
The system releases the L/G and doors from their uplocks, the doors open and the L/G extends under gravity (Free Fall).
"L/G GRVTY EXTN" switches in the cockpit control the operation of the alternate extension system.
The system is an electrically controlled hydro-mechanical system. It uses two Alternate Power Packs, one for the MLG and one for the NLG.
When the "L/G GRVTY EXTN" switches are set to the down position:
- Signals go to the Alternate Extension Control Modules (AECM)
- The isolation valves are de-energized.

Hydraulic power is supplied:
1 To the vent valve which connects all actuators to return.
2 To the door-uplock actuators, to release the uplock, to open the doors under gravity.
3 To the gear-uplock actuators, to release the uplock, to extend the gear under gravity.

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ALTERNATE EXTENSION - PRESENTATION - FUNCTION/DESCRIPTION

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ALTERNATE EXTENSION - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Ground Door Opening System - Presentation (A350-900 ONLY)

Function/Description

The Ground Door Opening (GDO) system is used to open the L/G doors to give access to the L/G bays for maintenance.
Mechanical control via handles, cables and linkages is used to open the L/G doors. Hydraulic power is used to close the L/G doors.
The GDO handles are installed on panels adjacent to each L/G bay.
When the GDO handle is moved to the OPEN position the system releases the doors from their uplocks and the doors open under gravity.
A bypass valve is also actuated by the GDO handle. It isolates the door actuator from the hydraulic supply.
The doors close when the GDO handle is moved to the CLOSE position and its hydraulic system is pressurized.

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GROUND DOOR OPENING SYSTEM - PRESENTATION (A350-900 ONLY) - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Ground Door Opening System - Presentation (A350-1000 ONLY)

Function/Description

The Ground Door Opening (GDO) system is used to open the L/G doors to give access to the L/G bays for maintenance.
Electrical control and power supply from Ground Door Opening Panels (GDOP) to the Bypass valves and Uplocks is used to open the L/G doors. Hydraulic power is used to close the L/G doors.
The GDOP are installed on panels adjacent to each L/G bay. When the GDOP rotary handle is moved to the OPEN position the system releases the associated door(s) from their uplock(s) and the door(s) open under gravity.
A bypass valve is also actuated by the GDOP rotary handle. It isolates the door actuator from the hydraulic supply.
The doors close when the GDOP rotary handle is moved to the CLOSE position and its hydraulic system is pressurized.

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GROUND DOOR OPENING SYSTEM - PRESENTATION (A350-1000 ONLY) - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Extension and Retraction - Presentation

Control and Indicating

A L/G control lever located on the main instrument panel in the cockpit is used to extend or retract the L/G.
Alternate extension switches located on the center pedestal in the cockpit can be used to extend the L/G with the alternate extension system.
Indication of the L/G position is shown on the "WHEEL" page of the System Display (SD) on the CDS in the cockpit.
Independent downlock indication is shown on the Primary Flight Displays (PFD) in the cockpit.

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EXTENSION AND RETRACTION - PRESENTATION - CONTROL AND INDICATING

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LANDING GEAR SYSTEM PRESENTATION

Wheels and Brakes - Presentation

Function/Description

The wheels and brakes system lets the crew control the speed of the aircraft on the ground. The system is divided into four subsystems:
- Normal braking
- Alternate braking
- Emergency braking
- Parking braking.

The normal, alternate and emergency braking systems decrease the aircraft speed on the ground.
The parking braking system prevents movement of the aircraft when it is parked.
Each brake is a single cavity brake.
A350-900
The Yellow main hydraulic power system supplies the hydraulic power for the brake units at wheels 1 to 4. The Green main hydraulic power system supplies the hydraulic power for the brake units at wheels 5 to 8.
A350-1000
The Yellow main hydraulic power system supplies the hydraulic power for the brake units at wheels 1 to 4, 6 and 8. The Green main hydraulic power system supplies the hydraulic power for the brake units at wheels 5, 7 and 9 to 12.

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WHEELS AND BRAKES - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Normal Braking - Presentation

Function/Description

The normal braking system decreases the aircraft speed on the ground (landing, taxi and in case of a rejected take off). It also stops the rotation of the MLG wheels before the L/G is retracted (MLG retraction braking).
The system is fully "Brake by Wire" and controlled by signals from:
- The Captain's or the First Officer's (F/O) brake pedals
- The brake control panel
- The L/G control lever.

Control and monitoring of the normal braking system is done by the CPIOMs (Braking Control System (BCS) application) via two Remote Braking Control Units (RBCU).
Protection against tire skidding is given by the anti-skid function.
The hydraulic power for the normal braking system is supplied by the aircraft hydraulic power supply. A Pressure Limiting Valve (PLV) reduces the hydraulic pressure from 5000psi to 3000psi.
Control signals from the pedals, the brake control panel and the L/G control lever are sent to the CPIOMs (BCS application). Signals between the CPIOMs (BCS application) and the normal braking system are sent via two Remote Braking Control Units (RBCU).
Hydraulic power is supplied through the (ON/OFF) normal selector valve to the (regulating) servo valve, then to the brake units via the shuttle valve.
Tachometers installed in the axle of each wheel measure the wheel's speed for anti-skid protection.

Interface

Two independent hydraulic power supplies are used to operate the brake units.

The aircraft speed data is sent by the Air Data and Inertial Reference System (ADIRS) to the RBCUs and BCS applications. This data is used by the anti-skid function to prevent the tires from skidding.

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NORMAL BRAKING - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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NORMAL BRAKING - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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LANDING GEAR SYSTEM PRESENTATION

Normal Braking - Presentation (continued)

Location

The two RBCUs are installed in the avionics bay.

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NORMAL BRAKING - PRESENTATION - LOCATION

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LANDING GEAR SYSTEM PRESENTATION

Alternate Braking - Presentation

Function/Description

The alternate braking system decreases the aircraft speed on the ground (landing, taxi and in case of a rejected take off). It operates when the normal braking system is not available.
The system is fully "Brake by Wire" and controlled by signals from the:
- Captain's or the First Officer's (F/O) brake pedals
- Brake control panel.

Control and monitoring of the alternate braking system is done by the CPIOMs (BCS application), via two Remote Braking Control Units (RBCU).
Protection against tire skidding is given by the anti-skid function.
The hydraulic power for the alternate braking system is supplied by two accumulators.
A350-900
One accumulator supplies the hydraulic power for the brake units at wheels 1 to 4. The other accumulator supplies the hydraulic power for the brake units at wheels 5 to 8.
A350-1000
One accumulator supplies the hydraulic power for the brake units at wheels 1 to 4, 6 and 8. The other accumulator supplies the hydraulic power for the brake units at wheels 5, 7 and 9 to 12.
Control signals from the pedals and the brake control panel are sent to the CPIOMs (BCS application). Signals between the CPIOMs (BCS application) and the alternate braking system are sent via the two RBCUs.
Tachometers installed in the axle of each wheel measure the wheel's speed.
Hydraulic power from the accumulators is supplied through the (ON/OFF) alternate selector valve to the (regulating) alternate servo valve, then to the brake units via the shuttle valve.
In alternate braking, there is only one servo valve in operation for each pair of wheels on the same axle.

Interface

The yellow hydraulic system refills the accumulator through an Alternate Refill Valve (ARV). The accumulator supplies the hydraulic power to operate the brake units:
A350-900
At wheels 1 to 4.
A350-1000
At wheels 1 to 4, 6 and 8.
The green hydraulic system refills the accumulator through an ARV. The accumulator supplies the hydraulic power to operate the brake units:
A350-900
At wheels 5 to 8.
A350-1000
At wheels 5, 7 and 9 to 12.
The aircraft speed data is sent by the ADIRS to the RBCUs and BCS applications. This data is used by the anti-skid function to prevent the aircraft from skidding.

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ALTERNATE BRAKING - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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ALTERNATE BRAKING - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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LANDING GEAR SYSTEM PRESENTATION

Emergency Braking - Presentation

Function/Description

The emergency braking system decreases the aircraft speed on the ground (landing, taxi and in case of a rejected take off). It operates when the normal braking and the alternate braking systems are not available.
The system is fully "Brake by Wire" and controlled by signals from the Captain's or the First Officer's (F/O) brake pedals.
Control and monitoring of the emergency braking system is done by the RBCUs.
When the emergency braking system is active, there is limited braking pressure and no anti-skid protection.
The hydraulic power for the emergency braking system is supplied by two accumulators.
A350-900
One accumulator supplies the hydraulic power for the brake units at wheels 1 to 4. The other accumulator supplies the hydraulic power for the brake units at wheels 5 to 8.
A350-1000
One accumulator supplies the hydraulic power for the brake units at wheels 1 to 4, 6 and 8. The other accumulator supplies the hydraulic power for the brake units at wheels 5, 7 and 9 to 12.
Control signals from the pedals are sent to the RBCUs. Signals are sent between the RBCUs and the emergency braking system.
Hydraulic power from the accumulators is supplied through the alternate selector valve to the alternate servo valve, then to the brake units via the shuttle valve.

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YELLOW HYDRAULIC FOR BRAKES 1 TO 4
GREEN HYDRAULIC FOR BRAKES 5 TO 8

ARV:	Accumulator Refill Valve
ASV:	Alternate Selector Valve
NSV:	Normal Selector Valve
PBSV:	Park Brake Selector Valve
PLV:	Pressure Limiting Valve

EMERGENCY BRAKING - PRESENTATION - FUNCTION/DESCRIPTION

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ARV: Accumulator Refill Valve
ASV: Alternate Selector Valve
NSV: Normal Selector Valve
PBSV: Park Brake Selector Valve
PLV: Pressure Limiting Valve

EMERGENCY BRAKING - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Parking Braking - Presentation

Function/Description

The parking braking system prevents the movement of the aircraft when it is stopped on the ground. It can also be used to decrease the aircraft speed on the ground (landing, taxi and in case of a rejected take off) as the ultimate braking function.
The system is controlled by the parking brake handle in the cockpit.
When the parking braking system is active, there is full braking pressure (3000psi) and no anti-skid protection.
The hydraulic power for the parking braking system is supplied by two accumulators.
A350-900
One accumulator supplies the hydraulic power for the brake units at wheels 1 to 4. The other accumulator supplies the hydraulic power for the brake units at wheels 5 to 8.
A350-1000
One accumulator supplies the hydraulic power for the brake units at wheels 1 to 4, 6 and 8. The other accumulator supplies the hydraulic power for the brake units at wheels 5, 7 and 9 to 12.
Signals from the parking brake handle control the (ON/OFF) parking brake selector valve.
Hydraulic power from the accumulators is supplied through the parking brake selector valve to the alternate servo valve, then to the brake units via the shuttle valve.
The parking braking system is monitored by the CPIOMs (BCS application) via the RBCUs.

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PARKING BRAKING - PRESENTATION - FUNCTION/DESCRIPTION

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PARKING BRAKING - PRESENTATION - FUNCTION/DESCRIPTION

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LANDING GEAR SYSTEM PRESENTATION

Wheels and Brakes - Presentation

Control and Indicating

The main controls and indicating for the wheels and brakes systems are in the cockpit.
Brake pedals are installed at each pilot's position.
The brake control panel is located on the main instrument panel. The indications for the systems are displayed on the "WHEEL" page of the SD on the CDS.
The parking brake control panel is installed on the center pedestal. The panel includes the park brake handle and pressure indicators.
A steering disconnect panel is installed on the NLG. A "PARK BRAKE ON" light (on the steering disconnect panel) is illuminated when the parking braking system is in operation.

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A350-900 ONLY

PARKING BRAKE CONTROL PANEL 115VM

BRAKE 312VM

BRAKE PEDAL

ELECTRONIC CENTRALIZED AIRCRAFT MONITORING SYSTEM DISPLAY WHEEL PAGE

WHEELS AND BRAKES - PRESENTATION - CONTROL AND INDICATING

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WHEELS AND BRAKES - PRESENTATION - CONTROL AND INDICATING

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WHEELS AND BRAKES - PRESENTATION - CONTROL AND INDICATING

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LANDING GEAR SYSTEM PRESENTATION

Landing Gear Management System - Presentation

Function/Description

The Landing Gear Management System:
- Measures the temperature of each brake unit and gives indication of the temperatures in the cockpit (Brake System Temperature)
- Decreases the temperature of the brake units (Brake Cooling (optional))
- Measures the pressure of each tire and gives indication of the pressures in the cockpit (Tire Pressure Indicating System (TPIS)).

Brake System Temperature:
Brake Temperature Sensors (BTS) are installed in each brake unit. Temperature information from the BTS is sent to the cockpit via the AFDX network and CPIOMs (LGMS application). The temperature of each brake unit is displayed on the "WHEEL" page of the SD on the CDS.
Brake Cooling (optional):
The brake cooling system uses Brake Cooling Fans (BCF) to decrease the temperature of each brake unit.
The system is controlled by a "BRK FAN" P/BSW in the cockpit. The control signals are sent to each BCF via the AFDX network and the CPIOMs (LGMS application).
TPIS:
Pressure sensors are installed on each wheel. Pressure information is sent to the cockpit via the AFDX network and CPIOMs (LGMS application). The pressure of each tire is displayed on the "WHEEL" page of the SD on the CDS.

Control and Indicating

The BCFs are controlled by a "BRK FAN" P/BSW on the brake control panel in the cockpit.

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LANDING GEAR MANAGEMENT SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & CONTROL AND INDICATING

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LANDING GEAR MANAGEMENT SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & CONTROL AND INDICATING

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LANDING GEAR SYSTEM PRESENTATION

Nose Wheel Steering Control System - Presentation

Function/Description

The Nose Wheel Steering (NWS) Control System controls and changes the direction of the aircraft when it moves on the ground with engine power.
The system is "Steer by Wire" and controlled by signals from the:
- Captain's or the F/Os handwheels
- Captain's or the F/Os rudder pedals
- Autopilot.

Control and monitoring of the NWS system is done by the CPIOMs (Wheel Steering Control System (WSCS) application).
The NWS system is powered hydraulically.
An alternate steering mode can be used if the normal steering mode is not available or not serviceable. The alternate steering mode uses differential braking on the aft MLG wheels to steer the aircraft.
Control signals from the rudder pedals, the handwheels and the autopilot (in PRIMs) are sent to the CPIOMs (WSCS application).
Signals are sent between the CPIOMs (WSCS application) and the steering system.
Control signals from the handwheels are sent to the CPIOMs (BCS application) when the alternate steering (differential braking) mode is engaged.
The Yellow main hydraulic power is supplied through the (ON/OFF) steering selector valve to the (regulating) servo valve, then to the steering actuators.

Interface

The Yellow hydraulic system supplies the hydraulic power to operate the NWS system.

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NOSE WHEEL STEERING CONTROL SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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LANDING GEAR SYSTEM PRESENTATION

Nose Wheel Steering Control System - Presentation (continued)

Control and Indicating

The indications for the NWS system are displayed on the "WHEEL" page of the SD on the CDS.
The NWS handwheels and the rudder pedals that control the NWS system are installed at each pilot's position.

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NOSE WHEEL STEERING CONTROL SYSTEM - PRESENTATION - CONTROL AND INDICATING

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STRUCTURE SYSTEM PRESENTATION

Overview

General familiarization training for this chapter focuses on:
- The aircraft structure
- The materials
- The structure layout
- The window layout.

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OVERVIEW

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STRUCTURE SYSTEM PRESENTATION

Aircraft structure - Presentation

Function/Description

The aircraft structure is divided into these chapters:
- 52 for the doors
- 53 for the fuselage
- 54 for the nacelles and pylons
- 55 for the stabilizers
- 56 for the windows
- 57 for the wings.

Doors:
The aircraft has eight passenger doors, four on the right side and four on the left side.
Two cargo compartment doors at the lower right side of the fuselage give access to the main cargo compartments.
The bulk cargo access door is on the left side of the fuselage in the lower rear area.
The doors include the nose and the Main Landing Gear (MLG) doors.
There is a cockpit escape hatch on the right side upper shell of the cockpit. The primary function of the cockpit escape facilities is to let the flight crew evacuate the cockpit, when it is not possible to evacuate through the cabin.
Pylons and Nacelles:
The pylons include the pylon box and the pylon fairings. The pylon box is a primary structure and the pylon fairings are the secondary structure.
The nacelles include the air inlet, the fan cowls, the Thrust Reverser (T/R) cowls and the exhaust.
Stabilizers:
The stabilizers include:
- The Trimmable Horizontal Stabilizer (THS) with two lateral boxes and a center joint to make one unit and one elevator on each side.
- The vertical stabilizer with the vertical stabilizer box and a rudder.

Wings:
The wings include the center wing box and the outer wing boxes with the movable surfaces, the flaps, the ailerons, the spoilers, the droop panels and the slats. Each wing has a winglet at the tip of the wing.
The center wing box is a fuel tank.

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AIRCRAFT STRUCTURE - PRESENTATION - FUNCTION/DESCRIPTION

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AIRCRAFT STRUCTURE - PRESENTATION - FUNCTION/DESCRIPTION

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AIRCRAFT STRUCTURE - PRESENTATION - FUNCTION/DESCRIPTION

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AIRCRAFT STRUCTURE - PRESENTATION - FUNCTION/DESCRIPTION

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AIRCRAFT STRUCTURE - PRESENTATION - FUNCTION/DESCRIPTION

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STRUCTURE SYSTEM PRESENTATION

Materials - Presentation

Function/Description

There are two different types of composite material structures:
- The sandwich structure
The sandwich structure has a honeycomb core and skins, which are made of layers of fabric or tape. The fabric and tape are made of carbon, aramid or glass.
- The monolithic structure
The monolithic structure is made of layers of fabric or tape. The fabric and tapes are made of carbon, aramid or glass.
These are the most frequently used materials for the aircraft structure:
- Carbon Fiber Reinforced Plastic (CFRP)
- Glass Fiber Reinforced Plastic (GFRP)
- Quartz Fiber Reinforced Plastic (QFRP)
- Aluminum alloy
- Titanium alloy
- Steel.

Location

The composite materials weight is more than half of the total structural weight (with gears).
CFRP is the primary material used for these components:
- The doors
- The fuselage panels
- The nacelles
- The stabilizers
- The wing skins (the 2 last outboard slats are made of hybrid CFRP/Metallic and remaining all slats are fully metallic parts).
The primary structural components of the pylons are made of titanium alloys.
The nose fuselage is made of aluminum alloy, except the lower shell Nose Landing Gear (NLG) bay which is made of CFRP.
In cabin and cargo areas, the passenger and cargo floor crossbeams, the rails, the roller tracks and the struts are metallic (usually aluminum).
The exhausts of the nacelles and the nose lips of the external structure are metallic.
The pylon box is made of titanium.
Most of the frames are CFRP, in some lower shell areas frames are made of titanium.
The radome of the aircraft is made of QFRP and the leading edge of the vertical stabilizer is made of GFRP.

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COMPOSITE PRINCIPLE

SANDWICH PART STRUCTURE

TYPICAL

MONOLITHIC PART STRUCTURE

TYPICAL

CFRP: Carbon Fiber Reinforced Plastic
NLG: Nose Landing Gear

MATERIALS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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MATERIALS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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STRUCTURE SYSTEM PRESENTATION

Fuselage Layout - Presentation

Function/Description

The new fuselage layout is made of:
- Four circular joints
- Four panels for each section made of CFRP
- CFRP stringers bonded to the skin

Most of these stringers are omega shaped.
The frame design includes frames with four sections each. Some sections are made of CFRP and/or others are made of titanium alloy.
The A350-1000 has 6 additional frames forward of the wings and 5 additional frames aft of the wings.

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FUSELAGE LAYOUT - PRESENTATION - FUNCTION/DESCRIPTION

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FUSELAGE LAYOUT - PRESENTATION - FUNCTION/DESCRIPTION

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A350-900 FUSELAGE STRUCTURE

A350-1000 FUSELAGE STRUCTURE

FUSELAGE LAYOUT - PRESENTATION - FUNCTION/DESCRIPTION

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STRUCTURE SYSTEM PRESENTATION

Window Layout - Presentation

Function/Description

The cockpit has six symmetrically installed fixed windows.
There are:
- Two front windows
- Two forward lateral windows
- Two aft lateral windows.

The cabin windows are installed on the left and right sides of the fuselage.
Compared with other Airbus aircraft, the cabin windows are larger.
The passenger door windows are installed on each passenger door.

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WINDOW LAYOUT - PRESENTATION - FUNCTION/DESCRIPTION

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STRUCTURE SYSTEM PRESENTATION

Maintenance

Tools

For composite structure inspection, you must use Non Destructive Testing (NDT) methods. Usually, ultrasonic for monolithic structure and tap test for sandwich structure.

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DELAMINATION AND DISBOND DETECTION

FOR SANDWICH STRUCTURES

MANUAL TAP TEST
OR AUTOMATIC TAP TEST

FOR MONOLITHIC STRUCTURES

LINE TOOL

SINGLE TRANSDUCER (TRADITIONAL)

ARRAY TRANSDUCER

ULTRASONIC INSPECTION

CAUTION

REFER TO THE NONDESTRUCTIVE TESTING MANUAL FOR INSPECTION PROCEDURE MAINTENANCE PRACTICES AND LIMITATIONS

MAINTENANCE - TOOLS

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DOORS SYSTEM PRESENTATION

Overview

The doors give access to different compartments or areas for passengers, crew or maintenance personnel.
General familiarization training for this system focuses on:
- Passenger/Crew doors
- Emergency exit doors
- Cargo doors
- Cargo Door Actuation System (CDAS)
- Passenger compartments fixed partitions interior doors
- Service and miscellaneous doors
- Doors and Slides Management System (DSMS).

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PASSENGER/CREW

EMERGENCY EXIT

CARGO

DOORS

CARGO DOOR ACTUATION SYSTEM

DOORS AND SLIDES MANAGEMENT SYSTEM

PASSENGER COMPARTMENT FIXED PARTITIONS INTERIOR DOORS

SERVICE AND MISCELLANEOUS

OVERVIEW

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DOORS SYSTEM PRESENTATION

Passenger/Crew Doors - Presentation

Function/Description

The passengers and crew can use the doors for access or to go out of the cabin. There are eight doors installed on the aircraft, four on each side of the cabin. The doors 1L/1R, 2L/2R, 3L/3R and 4L/4R have a door-mounted slide/raft system. The doors can have a single-lane slide/raft (type C door) or a dual-lane slide/raft (type A door). The doors 1L/1R and 3L/3R can have one of the two types, type A or type C door. But the doors 2L/2R and 4L/4R can have only type A door.
All the doors are plug-type doors. These plug-type doors have the door-stop fittings on each side of the door and the door-stop fittings on each side of the door frame (fuselage). In flight, the fuselage stop fittings and the door-stop fittings are in touch to let the door transmit the loads (caused by cabin pressurization) to the fuselage.
All the doors open outboard/forward parallel to the fuselage.
A manual overridable door stay mechanism installed on the doors holds the doors in the open position. A door damper and emergency-opening actuator is installed on the doors. During emergency operation, the door damper and emergency-opening actuator operates as an actuator and this causes a faster movement of the door. In normal operation, the door damper and emergency-opening actuator operates as a damper. This makes sure that the door does not open too quickly, which can cause damage to the fuselage.

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PASSENGER/CREW DOORS - PRESENTATION - FUNCTION/DESCRIPTION

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PASSENGER/CREW DOORS - PRESENTATION - FUNCTION/DESCRIPTION

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DOORS SYSTEM PRESENTATION

Passenger/Crew Doors - Presentation (continued)

Control and Indicating

These controls and indications are installed on the inner side of the passenger/crew door:
- The residual cabin-pressure warning-light
- The slide armed warning-light
- The slide armed warning buzzer
- The mechanical door-locking indicators
- The inner handle
- The door stay pushbutton
- The slide arming lever with safety pin.

An outer handle is installed on the outer side of the door to control the operation of the door.
With the inner and outer handles you can lock or unlock, latch or unlatch and lift or lower the door manually. The slide arming lever puts the slide/raft in the armed or disarmed condition. The door indication panel shows the residual cabin pressure and the "slide armed" status. It also supplies an aural warning to tell maintenance personnel that it is dangerous to operate the door at this time.

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PASSENGER/CREW DOORS - PRESENTATION - CONTROL AND INDICATING

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DOORS SYSTEM PRESENTATION

Emergency Exit Doors - Presentation

Function/Description

The emergency exit doors include:
- The cockpit escape hatch
- The passenger/crew doors.

In an emergency, the passengers and crew use the emergency exits to go out of the aircraft quickly.
The manually operated cockpit escape hatch is of a plug type.

Location

The cockpit escape hatch is installed in the cockpit ceiling.
In an emergency, the passengers and crew can use passenger/crew doors 1L/1R, 2L/2R, 3L/3R and 4L/4R to go out of the cabin.

Control and Indicating

The cockpit escape hatch has outer and inner handles.
The passenger/crew doors have outer and inner handles.

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EMERGENCY EXIT DOORS - PRESENTATION - FUNCTION/DESCRIPTION ... CONTROL AND INDICATING

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DOORS SYSTEM PRESENTATION

Cargo Doors - Presentation

Function/Description

The cargo doors include:
- The forward cargo-compartment door
- The aft cargo-compartment door
- The bulk cargo-compartment door.

The functions of the cargo doors are to:
- Give access to the cargo compartments
- Keep the aircraft pressurized.

The forward and aft cargo doors are of a hook type. They open outboard and up. From the outer side you can manually lock/unlock and latch/unlatch the forward and aft cargo doors and operate them hydraulically from an cargo-door operation panel.
The bulk cargo door is of a plug type and opens inboard and up. You can operate the bulk cargo door manually from the inside or the outside of the aircraft.

Location

The forward and aft cargo doors are installed on the lower right side of the fuselage.
The bulk cargo door is installed aft on the lower left side of the fuselage.

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AFT CARGO DOOR

FORWARD CARGO DOOR

BULK CARGO DOOR

CARGO DOORS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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DOORS SYSTEM PRESENTATION

Cargo Doors - Presentation (continued)

Control and Indicating

The cargo door controls that are installed on or adjacent to each of the forward and aft cargo doors are:
- One latching handle, to manually latch/unlatch the cargo door
- One locking handle, to manually lock/unlock the cargo door
- An cargo-door operational panel to operate the cargo door.

These give indications for each forward and aft cargo doors:
- A residual pressure light on each forward and aft cargo doors comes on when residual cabin pressure is sensed.
- The indicator flag and windows on the outer side of each forward and aft cargo doors show that the cargo doors are correctly closed, latched and locked.

With the outer door handle you can manually open/close and latch/unlatch the bulk cargo door. On the inner side of the bulk cargo door, a quad fitting let the maintenance crew operate the door.

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CARGO DOORS - PRESENTATION - CONTROL AND INDICATING

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DOORS SYSTEM PRESENTATION

Cargo Door Actuation System - Presentation

Function/Description

The function of the CDAS is to control the hydraulic operation of each forward and aft cargo door. The Door and Slide Control System (DSCS) controls and monitors the CDAS. The Yellow main hydraulic-power system supplies hydraulic power to the CDAS through the electric pump or the hydraulic auxiliary pump (with a powered hand tool).
The cargo-door operation panel adjacent to each forward and aft cargo door has a toggle switch and a manual override switch to control the door movement.
There are two operation modes:
In normal operation, a toggle switch on the cargo-door operation panel controls the operation of the cargo doors. The input from the toggle switch goes through the Avionics Full Duplex Switched Ethernet (AFDX) to the DSCS. Then the DSCS electrically operates the cargo-door control valve to extend or retract the cargo door actuator of the applicable cargo door.
In auxiliary operation, the manual override switch operates the cargo-door control valve.

Interface

In normal operation, the CDAS has interfaces with:
- The DSCS, to start the Hydraulic Monitoring and Control Application (HMCA) function through the AFDX.
- The HMCA, to start the electric pump through the AFDX.
- The Yellow main hydraulic-power system, to supply hydraulic power from the electric pump to the cargo-door control valve.

In auxiliary operation, the CDAS has interfaces with:
- The Yellow main hydraulic-power system, to supply hydraulic power from the hydraulic auxiliary pump to the cargo-door control valve.

Control and Indicating

The controls and indications available on the cargo-door operation panel of each forward and aft cargo doors are:
- A toggle switch for normal operation
- A manual override switch for auxiliary operation
- A green indicator light which comes on when the cargo door actuator is in "fully extended and locked" status.

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CARGO DOOR ACTUATION SYSTEM

CARGO DOOR ACTUATION SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION ... CONTROL AND INDICATING

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DOORS SYSTEM PRESENTATION

Passenger Compartment Fixed Partitions and Interior Doors - Presentation

Function/Description

The passenger compartment fixed partitions and interior doors include the cockpit door and its Cockpit Door Locking System (CDLS). The CDLS isolates the cabin area from the cockpit area and it makes the cockpit access safe. The cockpit door is electrically controlled and is thicker and stronger than the other doors.
The CDLS controls and monitors the electrical release strikes to lock or to open the cockpit door through the control unit and the control panel. In an emergency, the flight crew can open the cockpit-door decompression and evacuation panel and then use it to go out of the cockpit.

Location

The cockpit door is installed on the fixed partition located between the cockpit and the cabin.

Control and Indicating

The controls for the cockpit door and CDLS are:
- The door handles installed on the cabin and cockpit side of the cockpit door
- The keypad installed on the cabin side
- The toggle switch installed on the cockpit door panel on the center pedestal, to control the cockpit door
- The maintenance switch installed on the overhead panel, to inhibit the CDLS during maintenance work.

The indications for the cockpit door and CDLS are available on:
- The keypad
- The cockpit door panel on the center pedestal.

A buzzer installed on the overhead panel in the cockpit gives an aural warning to the flight crew.

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PASSENGER COMPARTMENT FIXED PARTITIONS AND INTERIOR DOORS - PRESENTATION - FUNCTION/DESCRIPTION ... CONTROL AND INDICATING

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DOORS SYSTEM PRESENTATION

Service and Miscellaneous Doors - Presentation

Function/Description

The service and miscellaneous doors include:
- Access doors
- Service doors
- Overpressure doors
- Ram Air Turbine (RAT) doors.

The access and service doors give access for maintenance to:
- Systems and equipment
- Avionics compartment
- Cargo loading system
- Trimmable Horizontal Stabilizer (THS)
- Auxiliary Power Unit (APU) compartment.

The access and service doors are manually operated and latched doors.
The overpressure doors prevent overpressure in an area where pneumatic-system components are installed. The overpressure doors are blowout panels. After they disengage, it is possible to install them again.
The function of the RAT doors is to keep the RAT and its components safe when they are in the retracted position. The RAT doors open in-flight in an emergency condition.

Location

The service and miscellaneous doors are installed in these locations:
- The avionics access door is installed below the cockpit.
- The cargo loading control panel is installed in the forward area of each cargo door.
- The THS compartment access-door is installed below the THS.
- The Auxiliary Power Unit (APU) access door is installed at the rear of the aircraft.
- The ground power-unit door is installed aft of the Nose Landing Gear (NLG).
- The air-ground connection doors are installed forward of the Main Landing Gear (MLG).
- The hydraulic service doors are installed in the lower mid area of the aircraft.
- The refuel door is installed in the lower mid area of the aircraft.
- The water and waste service doors are installed aft of the aft cargo door.
- The overpressure doors are installed in the lower fuselage.
- The RAT doors are located in the lower center area of the fuselage.

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SERVICE AND MISCELLANEOUS DOORS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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DOORS SYSTEM PRESENTATION

Doors and Slides Management System - Presentation

Function/Description

The functions of the DSCS are:
- To give indications related to the status of the doors and slides.
- To control the operation of the CDAS to open or close the forward and the aft cargo doors.
- To supply the visual residual pressure indication for all passenger/crew doors and for the forward and aft cargo doors. It also supplies an aural warning if the door handle is lifted more than specified angle when residual pressure is there in the aircraft.
- To monitor the position of all doors and to generate the ALL DOOR status when all doors are in the closed position. It supplies this ALL DOOR status to the Cabin Pressure Control System (CPCS) which pressurizes the aircraft. The CPCS prevents cabin pressurization if one of the monitored doors is in a condition that is not safe.
- To supply a visual indication on the passenger/crew doors, when the slide is armed. It also supplies an aural warning if the door handle is lifted more than a specified angle when the slide is armed.

The DSCS receives the doors and slides position data from proximity sensors through the AFDX. The DSCS sends the slide "armed/disarmed" status to the Control and Display System (CDS) and the Flight Attendant Panel (FAP) for indication and warning. The differential pressure switches send the data about the residual pressure to the Autonomous Standby Power Supply Unit (ASPSU). The ASPSU supplies the residual pressure indicators on the passenger/crew doors and the forward and aft cargo doors.
The DSCS sends data to the CDAS through the AFDX.

Interface

The AFDX sends the indication supplied from the DSCS to the CDS and to the FAP.

The DSCS delivers ALL DOOR status to the CPCS through the AFDX.

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DOORS AND SLIDES MANAGEMENT SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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DOORS SYSTEM PRESENTATION

Doors and Slides Management System - Presentation (continued)

Control and Indicating

The doors and slides status indications are available on the DOOR/OXY page on the System Display (SD), on the CDS and also on the FAP.
Residual pressure indicators are installed on the passenger/crew doors and the forward and aft cargo doors. A buzzer that gives an aural warning is installed on the passenger/crew doors only.
The slide armed warning-light and buzzer are installed on the passenger/crew doors.

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ECAM DOOR/OXY PAGE

FAP DOOR PAGE

ECAM : ELECTRONIC CENTRALIZED AIRCRAFT MONITORING
FAP : FLIGHT ATTENDANT PANEL

DOORS AND SLIDES MANAGEMENT SYSTEM - PRESENTATION - CONTROL AND INDICATING

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DOORS SYSTEM PRESENTATION

Maintenance

Safety Precautions

WARNING: DO NOT OPEN THE PASSENGER/CREW DOORS WHILE THE RED WARNING LIGHT FLASHES. IF THE RED WARNING LIGHT FLASHES, REMAINING PRESSURE IN THE CABIN CAN CAUSE THE DOOR TO OPEN SUDDENLY AND CAN:
- KILL OR CAUSE INJURY TO PERSONS
- CAUSE DAMAGE TO THE AIRCRAFT.

DO NOT OPEN THE CARGO-COMPARTMENT DOORS WHILE THE RED WARNING LIGHT FLASHES. IF THE RED WARNING LIGHT FLASHES, REMAINING PRESSURE CAN CAUSE THE DOOR TO OPEN SUDDENLY AND KILL OR CAUSE INJURY TO PERSONS OR CAUSE DAMAGE TO THE AIRCRAFT.

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MAINTENANCE - SAFETY PRECAUTIONS

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Overview

The equipment and furnishings are, for example, seats, stowages and emergency equipment which are installed for the comfort and safety of the passengers and crew.
General familiarization training for this chapter focuses on:
- The cockpit
- The passenger compartment
- The galleys
- The lavatories
- The additional compartments
- The emergency equipment
- The rapid-decompression safety system.

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EQUIPMENT / FURNISHINGS

COCKPIT

PASSENGER COMPARTMENT

RAPID DECOMPRESSION SAFETY SYSTEM

GALLEYS

EMERGENCY

ADDITIONAL COMPARTMENTS

LAVATORIES

OVERVIEW

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Cockpit - Presentation

Function/Description

The cockpit is the compartment where the captain and the First Officer (F/O) sit.
It contains equipment and furnishings that the crew use to fly the aircraft.
The cockpit compartment includes:
- The cockpit seats
- The cockpit equipment racks
- The ancillary equipment
- The main avionics compartment (below the cockpit).

Cockpit seats
The cockpit contains four seats.
The seats for the captain and the F/O are symmetrical and each has electrical and mechanical control for seat position adjustment.
The seat for the third occupant only has a mechanical control.
The folding seat for the fourth occupant has no adjustment function.
Cockpit equipment racks
The cockpit equipment racks usually contain equipment such as:
Consoles for the pilots and the other two occupants.
The consoles have different stowages and contain emergency equipment.
It is possible to remove them for maintenance.
Ancillary equipment
The ancillary equipment is special equipment such as:
Two sliding tables with integrated keyboard, two Electronic Flight Bag (EFB) docking stations and the Onboard Maintenance Terminal (OMT).
It is possible to remove it for maintenance.
Main avionics compartment
The main avionics compartment is a pressurized compartment that contains most of the avionics equipment on racks.

Location

Cockpit seats
The seats for the captain and the F/O are classically installed on each side of the center pedestal.
The seats for the other two occupants are in the aft area of the cockpit.
Cockpit equipment racks
The consoles are installed on each side of the center pedestal and in the aft area of the cockpit.
Ancillary equipment
The ancillary equipment is installed on each side of the center pedestal and in the aft area of the cockpit.
Main avionics compartment
The main avionics compartment is below the cockpit.

Control and Indicating

Cockpit seats
The electrical controls for the captain's seat and the F/O's seat are installed on the seat pan.
The mechanical controls for the captain's seat and the F/O's seat are installed on the seat pan and on the backrest.
The third occupant seat is the same as the pilots' seats but the seat controls are only mechanical.

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COCKPIT - PRESENTATION - FUNCTION/DESCRIPTION ... CONTROL AND INDICATING

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Passenger Compartment - Presentation

Function/Description

The passenger compartment includes:
- The passenger compartment seats
- The cabin attendant seats
- The linings and furnishings
- The Overhead Stowage Compartments (OHSCs)
- The Passenger Service Units (PSUs).

Passenger compartment seats
These seats are installed in rows on the cabin floor structure as single seats or in groups of two or three seats. The basic seat configuration is 2-2-2 for the business class and 3-3-3 for the economy class.
It is possible to remove them for maintenance or to quickly change the configuration of the cabin.
Cabin attendant seats
These seats retract automatically and are attached to the seat tracks, to the cabin floor structure or to the lavatory, galley or stowage walls.
Linings and furnishings
The linings and furnishings are panels that keep the fuselage structure, the insulation and electrical or air conditioning components out of view.
The linings and furnishings (ceiling, sidewall and dado panels, lighting covers, linings) are all made of composite material and/or plastic.
It is possible to remove them for maintenance.
OHSCs
The OHSCs are used for the stowage of passenger hand luggage and emergency equipment.
The OHSCs are retractable; it is possible to remove them for maintenance or to quickly change the configuration of the cabin.
PSUs
The PSUs supply services and safety-related data such as oxygen, attendant call to the passengers and the cabin crew.
They are part of the passenger supply channels.
It is possible to remove them for maintenance or to quickly change the configuration of the cabin.

Location

The passenger compartment is the part of the aircraft where the passengers sit.
Passenger compartment seats
The passenger compartment seats are installed all along the cabin.
Cabin attendant seats
The cabin attendant seats are installed in the cabin at door areas.
Linings and furnishings
The linings and furnishings are installed on the ceiling and on the side of the cabin.
OHSCs
The OHSCs are installed on the side and center areas of the cabin ceiling.
PSUs
The PSUs are installed above passenger and cabin crew seats.

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PASSENGER COMPARTMENT - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Galleys - Presentation

Function/Description

The galley is a module where the cabin crew usually keeps food, drinks, trolleys, containers and unwanted or used materials.
It is also the work area where the cabin crew can prepare meals and drinks.
There are two types of galleys:
- A wet galley is connected to other aircraft systems (potable water and waste system, electrical system and supplemental cooling system) and is used to prepare and store food and drinks and to store trolleys and containers.
- A dry galley is used only for storage of food, drinks, trolleys and containers.

It is possible to remove the galley modules for maintenance or to change the configuration of the cabin for some of them.

Location

The galley modules are installed in different areas of the cabin.
There are two types of galley location, fixed and flexible.
The galleys in fixed locations are installed in the forward and aft areas of the cabin.
The galleys in flexible locations are installed in the forward/mid forward and aft/mid aft areas of the cabin.

Interface

The electrical GAlley INsert equipment (GAIN) system of the wet galleys has an interface through the Cabin Intercommunication Data System (CIDS) to the Onboard Maintenance System (OMS). This makes it possible to do the troubleshooting of the GAIN equipment.

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WET GALLEY (PREPARATION AND STORAGE)

DRY GALLEY (STORAGE)

CIDS: Cabin Intercommunication Data System
GAIN: Electrical GAlley INsert equipment
OMS: Onboard Maintenance System

GALLEYS - PRESENTATION - FUNCTION/DESCRIPTION ... INTERFACE

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Lavatories - Presentation

Function/Description

The lavatory assembly is made of an integrated floor pan, sidewalls and a ceiling.
It is possible to remove the lavatory modules for maintenance or to change the configuration of the cabin.
The equipment is, for example, a toilet bowl and shroud with seat and cover, a mirror, a washbasin and a baby nursing table.

Location

The lavatory modules are installed in different areas of the cabin.
There are two types of lavatory location, fixed and flexible.
The lavatories in fixed locations are installed in the forward and aft areas of the cabin.
The lavatories in flexible locations are installed in the forward/mid forward and aft/mid aft areas of the cabin.
The lavatory equipment is installed in the lavatory.

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LAVATORY

LAVATORIES - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Additional Compartments - Presentation

Function/Description

The additional compartments are installed for the flight and cabin crew as an option.
These compartments are the Flight Crew Rest Compartment (FCRC) and the Cabin Crew Rest Compartment (CCRC).
The crew members use these compartments for rest during long flights.
The compartments may have seats, bunks and a coat stowage.

Location

The additional compartments are installed in the cabin.
The FCRC is installed in the forward top area of the cabin.
The CCRC is installed in the aft top area of the cabin.

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ADDITIONAL COMPARTMENTS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Emergency - Presentation

Function/Description

The emergency equipment is installed for the safety of the passengers and the crew if an emergency occurs during the flight.
The emergency equipment includes:
- The cockpit escape facilities
- The cabin escape facilities
- The first aid equipment
- The miscellaneous emergency equipment
- The floatation and survival equipment
- The supplementary medical equipment.

Cockpit escape facilities
The cockpit escape facilities include an evacuation hatch and an escape rope, which is always attached to the aircraft structure.
If it is not possible to use the cockpit door in an emergency, the flight crew can use the rope to evacuate the cockpit after opening of the emergency escape hatch.
Cabin escape facilities
The cabin escape facilities are evacuation systems that let the passengers and crew members go out of the aircraft quickly in an emergency.
The cabin escape facilities have dual-lane or single-lane inflatable escape-slides that are also used as rafts after an evacuation, when the aircraft is in a ditching condition.
First aid equipment
The crew can use the first aid equipment to give medical aid to passengers or crew members who become ill or have small injuries during flight.
The first aid equipment is usually a self-contained first-aid kit.
Miscellaneous emergency equipment
The miscellaneous emergency equipment helps the crew to give aid to the passengers if an emergency occurs.
The miscellaneous emergency equipment is equipment such as a megaphone, crash axe or flashlight, which the crew can use in an emergency.
Floatation and survival equipment
The floatation and survival equipment help the passengers and crew members to stay on the water surface during an emergency over water.
The floatation and survival equipment are the escape-slides/rafts and other survival equipment such as life vests.
Supplementary medical equipment
The supplementary medical equipment is additional equipment, which the crew can use in a medical emergency.
The supplementary medical equipment is usually an emergency medical kit, for example defibrillator, doctor kit, etc.
Emergency Locator Transmitter (ELT)
The function of the ELT system is to transmit distress and location signals in an emergency situation. This helps search and rescue personnel to identify the aircraft and to find its location.
Two systems are installed in the aircraft:
- An automatic fixed ELT connected to a dedicated transmission antenna
- One or more portable ELTs fitted with their own antenna.

Automatic fixed ELT
The fixed ELT can be activated:
- either manually by the crew through dedicated switches either in the cockpit or on the ELT
- or automatically in case of important deceleration event (crash, big impact, etc.).

Portable ELT
The portable ELT can only be activated manually by the crew in case of emergency. Activation is made by a dedicated switch on the ELT.

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FIRST AID KIT

MEGAPHONE

AUTOMATIC FIXED ELT

ELT

ELT TRANSMISSION ANTENNA

FLASH LIGHT

EMERGENCY MEDICAL KIT

ELT: Emergency Locator Transmitter

CRASH AXE

PORTABLE ELT (SEVERAL MODELS POSSIBLE)

EMERGENCY - PRESENTATION - FUNCTION/DESCRIPTION

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Emergency - Presentation (continued)

Location

The emergency equipment is usually installed in standard locations on the aircraft but other locations are also possible.
Cockpit escape facilities
The cockpit escape hatch is an emergency exit located on the cockpit ceiling.
The escape rope is kept in a dedicated stowage compartment adjacent to the escape hatch.
Cabin escape facilities
The cabin escape facilities are installed on each passenger door of the aircraft.
Passenger doors that are type A emergency exits have dual-lane slide/rafts.
Type C emergency exits have single-lane slide/rafts.
Passenger doors 2 and 4 are always type A emergency exits, but passenger doors 1 and 3 can be a type A or a type C emergency exit.
In the standard configuration, passenger door 1 has a single-lane slide/raft and doors 2, 3 and 4 have dual-lane slide/rafts.
Floatation and survival equipment
The floatation and survival equipment is installed at each door and in different locations on the aircraft.
The life vests are below or near the passenger compartment seats, the cabin attendant seats and the cockpit seats.
Emergency Locator Transmitter (ELT)
The automatic fixed ELT is located in the aft top section of the aircraft fuselage.
Portable ELTs can be installed at several aircraft locations (example: overhead compartments, doghouse, etc.)

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EMERGENCY - PRESENTATION - LOCATION

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Emergency - Presentation (continued)

Control and Indicating

The automatic fixed ELT can be manually activated through the:
- ELT remote control panel on the overhead panel
- ELT control panel on the ELT.

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ELT REMOTE CONTROL PANEL

ELT CONTROL PANEL

ELT: Emergency Locator Transmitter

EMERGENCY - PRESENTATION - CONTROL AND INDICATING

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EQUIPMENT/FURNISHINGS SYSTEM PRESENTATION

Rapid Decompression Safety System - Presentation

Function/Description

The rapid-decompression safety system balances the pressure between the cockpit, the cabin and the cargo compartments if a decompression occurs.
The rapid-decompression safety system includes blow-in and blow-out rapid-decompression panels, flaps and the cockpit door.

Location

The rapid-decompression safety system includes:
- A decompression panel in the lower part of the cockpit door
- Decompression panels in the lower sidewall/dado panels of the passenger compartment
- Decompression panels in the sidewall and ceiling panels of the cargo compartment.

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RAPID DECOMPRESSION SAFETY SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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CABIN PRESENTATION

Cabin Presentation

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CABIN PRESENTATION

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CARGO & ACCESSORY COMPARTMENTS SYSTEM PRESENTATION

Overview

The cargo compartments contain the Unit Load Devices (ULDs) and the equipment and hold them in a safe position during the flight.
The Cargo Loading Systems (CLSs) move the ULDs into and out of the cargo compartments.
General familiarization training for this system focuses on:
- The cargo compartments
- The lower-deck cargo-loading systems
- The accessory compartments.

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OVERVIEW

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CARGO & ACCESSORY COMPARTMENTS SYSTEM PRESENTATION

Cargo Compartments - Presentation

Function/Description

The cargo compartments include:
- The lower-deck cargo compartments
- The lower-deck cargo-compartment drainage-system.

The cargo compartments hold the ULDs in the forward, aft and bulk areas of the aircraft. All cargo compartments have fireproof walls, floors, ceilings, sidewall panels and decompression panels to retard fire and smoke propagation. If there is smoke, each compartment is fully sealed when the doors are closed. This makes sure that the fire or smoke in one compartment cannot go to another compartment.
The drainage system collects unwanted fluids from the cargo compartment floors and drains them through a network of pipes into the bottom of the fuselage. The fluids then go to the bilge drain valves.

Location

The cargo compartments are installed in the lower-deck forward, aft and bulk areas of the aircraft.

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CARGO COMPARTMENTS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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CARGO & ACCESSORY COMPARTMENTS SYSTEM PRESENTATION

Lower-Deck Cargo-Loading Systems - Presentation

Function/Description

The lower-deck CLSs move and latch the ULDs in the forward and aft cargo-compartments. The lower-deck CLSs have mechanical and electrical components that move, align and control the ULDs.
The electrical CLSs include the Power Drive Units (PDUs). The inside control panels and the outside control panels are connected to the control boxes to control the PDUs. The control boxes also monitor the PDUs.
The mechanical CLSs include the guides, the tracks, the ballmats and the latches. There are different latches that safety the ULDs and hold them in position. You can engage and disengage the latches manually.

Interface

Each control box has an interface with the Onboard Maintenance System (OMS) for trouble shooting.

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LOWER-DECK CARGO-LOADING SYSTEMS - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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CARGO & ACCESSORY COMPARTMENTS SYSTEM PRESENTATION

Lower-Deck Cargo-Loading Systems - Presentation (continued)

Location

There is an inside control panel in the forward cargo compartment and also in the aft cargo compartment. An outside control panel is on the external skin of the aircraft adjacent to the cargo compartment doors for each of these compartments.
There are two control boxes. One is installed in the forward cargo compartment and one in the aft cargo compartment.

Control and Indicating

These controls are installed:
- Two control panels adjacent to the door of the forward cargo compartment
- Two control panels adjacent to the door of the aft cargo compartment.

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LOWER-DECK CARGO-LOADING SYSTEMS - PRESENTATION - LOCATION & CONTROL AND INDICATING

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CARGO & ACCESSORY COMPARTMENTS SYSTEM PRESENTATION

Accessory Compartments - Presentation

Function/Description

The accessory compartments include:
- The wheel wells
- The additional avionics compartment
- The miscellaneous compartments (air conditioning compartment, hydraulic compartment, waste tank area).

The accessory compartments can contain the equipment for the In-Flight Entertainment System (IFE), the retracted landing gears, the packs, the hydraulics and other equipment.

Location

The wheel wells are installed in the nose landing-gear and in the main landing-gear areas.
The air conditioning compartment is installed forward of the main landing-gear.
The hydraulic compartment is installed between the main landing-gears.
The waste tank area is aft of the bulk cargo compartment.
The additional avionics compartment is installed between the bulk cargo compartment and the waste tank area.

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ACCESSORY COMPARTMENTS - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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FLIGHT CONTROLS SYSTEM PRESENTATION

Overview

General familiarization training for this system focuses on:
- PFCS
- Aileron
- Spoiler
- Elevator
- THS
- Rudder
- Lift augmenting
- Flaps.

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OVERVIEW

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FLIGHT CONTROLS SYSTEM PRESENTATION

Primary Flight Control System (PFCS) - Presentation

Function/Description

The function of the PFCS is:
- To compute the flight control laws and their related functions.
- To give the surface deflection orders and do the servoing and monitoring of the flight control surfaces in normal, abnormal and emergency conditions. The flight control surfaces are:
- Two pairs of ailerons used for roll control
- Seven pairs of spoilers used for speedbrake function and lift damping on ground (ground spoilers), including five pairs used for roll control
- One rudder used for yaw control
- One pair of elevator used for pitch control
- One THS used for pitch-trim control
- Two pairs of flaps for high-lift control
- Lift augmenting (one pair of droop-nose device and six pairs of slats) for high-lift control.

General architecture
The general architecture has three main parts:
- Control
- Computation
- Actuation.

The control part includes:
- Side Stick Units (SSUs)
- Rudder pedals
- Automatic Flight System (AFS)
- Speedbrake control lever
- PITCH TRIM control switches
- RUDDER TRIM control switch.

The control part sends signals to the computation part to generate command orders.
The computation part includes:
- Three PRIMary Computers (PRIMs)
- Three SECondary Computers (SECs)
- One Backup Control Module (BCM)
- Two Flight Control Data Concentrators (FCDCs) which are a Core Processor Input/Output Module (CPIOM) application for indicating/interface functions
- Local computation (for servoloop function) ensured by Flight Control Remote Module (FCRM) or electronic module installed on actuators.

The computation part sends data to:
- The Control and Display System (CDS) for system indicating through the FCDCs
- The Flight Warning System (FWS) for crew alerts through the FCDCs
- The Onboard Maintenance System (OMS) through the FCDCs, for subsequent maintenance.

The actuation part
The actuation part moves the control surfaces. It receives command orders from the PRIMs and SECs.
If the PRIMs and SECs are not serviceable or if the main electrical power supply is not available, the actuation part receives command orders from the BCM.
Laws and Related Functions
The PRIMs and SECs have two functions:
- Computation of the flight control laws (including protections) and
- Execution (servoing and monitoring of the related control surfaces).

There are three control law levels:
- Normal (all the protections are available)
- Alternate (some protections are decreased or not available)
- Direct (no protections available).

The flight control laws are automatically switched from normal to alternate and then to direct in relation to the type and number of failures.
The PRIMs and SECs receive orders from the cockpit controls or the AFS. With reference to the current aircraft attitude, the computation

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function changes these orders to an aircraft objective and generates the surface deflection orders necessary to go to the computed aircraft objective. The computation function compares the reached aircraft attitude with the computed aircraft objective.
In normal operation, one PRIM only (called "MASTER") does the computation function.
The master PRIM generates the surface deflection orders and sends them:
- To its dedicated actuators and
- To the two other PRIMs and to the three SECs to move their dedicated actuators.

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PRIMARY FLIGHT CONTROL SYSTEM

PRIMARY FLIGHT CONTROL SYSTEM (PFCS) - PRESENTATION - FUNCTION/DESCRIPTION

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PRIMARY FLIGHT CONTROL SYSTEM (PFCS) - PRESENTATION - FUNCTION/DESCRIPTION

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PRIMARY FLIGHT CONTROL SYSTEM (PFCS) - PRESENTATION - FUNCTION/DESCRIPTION

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FLIGHT CONTROLS SYSTEM PRESENTATION

Actuators - Presentation

Function/Description

C
onventional servocontrols
The conventional servocontrols have:
- A hydraulic block connected to one aircraft hydraulic system
- A FCRM that controls a servo module to extend or retract the actuator and performs the actuator servoloop function (control and feedback).
- A hydraulic jack
- A mode selector valve.

Electro-Hydrostatic Actuators (EHAs)
The EHAs generate their hydraulic pressure and are used when there is loss of the normal aircraft hydraulic pressure.
The EHAs have:
- A hydraulic block
- An Electronic Module (EM) that controls the electric motor pump and performs the servoloop function (control and feedback)
- An electric motor pump, to extend or retract the actuator piston rod
- A hydraulic jack
- An accumulator
- A mode selector valve.

The electric motor and the hydraulic pump receive orders from the EM/flight control computers (PRIMs and SECs) to extend or retract the actuator.
Electrical Backup Hydraulic Actuators (EBHAs)
The EBHAs have a conventional servocontrol part and an EHA part that control a same hydraulic actuator.
In normal operation mode, the EBHA operates as a conventional servocontrol that uses aircraft hydraulic pressure to move the actuator rod. If there is loss of aircraft hydraulic pressure, the EBHA operates as an EHA, that generates its hydraulic pressure to move the actuator rod.

The EBHA EM has the same function as the EHA.

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	CONVENTIONAL SERVOCONTROL	EHA	EBHA
AILERONS	X	X	
SPOILERS	X		X
ELEVATORS	X	X	
RUDDER	X	X	

ACCU: Accumulator
EM: Electronic Module
FCRM: Flight Control Remote Module
HYD: Hydraulic

CONVENTIONAL SERVO CONTROL

Electro-Hydrostatic Actuator (EHA)

Electrical Back-Up
Hydraulic Actuator (EBHA)

ACTUATORS - PRESENTATION - FUNCTION/DESCRIPTION

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FLIGHT CONTROLS SYSTEM PRESENTATION

Aileron - Presentation

Function/Description

The ailerons have these functions:
- Roll control
- Lift control (aileron droop)
- Lift dumping on ground (ground spoilers).

Ailerons - Architecture
There are two ailerons on each wing, operated by actuators. The aileron actuators are electrically controlled and monitored by the PRIMs and SECs from:
- The speedbrake control lever
- The SSUs
- The AFS or
- The Slat Flap Control Computers (SFCCs).

There are two types of ailerons:
- The outboard ailerons are operated by two conventional servocontrols.
- The inboard ailerons are operated by a conventional servocontrol or by an EHA.

In normal conditions, each servocontrol and each EHA are controlled and monitored through the PRIMs and SECs.
Actuator position feedback is sent to the FCRM or electronic module for servoloop computation.
Surface and actuator position feedback is sent to the PRIMs and SECs for monitoring.
In emergency conditions, the inboard aileron servocontrols are controlled through a BCM, from the SSUs.

Interface

The ailerons have interfaces with the Yellow and Green hydraulic systems to supply hydraulic power to the aileron servocontrols and with electrical system to supply electrical power to EHA.

Through the Avionics Full Duplex Switched Ethernet (AFDX) network the PRIMs and SECs send data related to the aileron actuators to the CPIOMs (FCDC application) and then to the CDS.

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AILERON - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Spoiler - Presentation

Function/Description

The spoilers have these functions:
- Roll assistance
- Speedbrake
- Lift dumping on ground (ground spoilers)
- Adaptive Droop Hinge Flap (ADHF) through interface with SFCCs in order to control the gap between spoilers and flaps when flaps are extended.

Spoiler - Architecture
There are seven spoilers on each wing operated by actuators. Each spoiler actuator is electrically controlled and monitored by the PRIMs and SECs from:
- The speedbrake control lever
- The SSUs or
- The AFS
- The SFCCs (for ADHF).

All spoilers are hydraulically operated by conventional servocontrols but not spoiler 5 which is operated by an EBHA. Each servocontrol/EBHA is controlled and monitored by the PRIMs and SECs.

Interface

The spoilers have interfaces with the Yellow and Green hydraulic systems to supply hydraulic power to the spoiler actuators and with electrical system to supply electrical power to EBHA.
Through the AFDX network, the PRIMs and SECs send data related to the spoiler actuators to the CPIOMs (FCDC application) and then to the CDS.

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SPOILER - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Elevator - Presentation

Function/Description

The elevators give pitch control of the aircraft.
There are two elevators, one on each side, operated by actuators. The elevator actuators are electrically controlled and monitored by the PRIMs and SECs from the SSUs or the AFS. Each surface is operated by one conventional servocontrol and one EHA.
In normal conditions, each actuator is controlled and monitored by the PRIMs and SECs.
Actuator position feedback is sent to the FCRM or electronic module for servoloop computation.
Surface and actuator position feedback is sent to the PRIMs and SECs for monitoring.
In emergency conditions, the conventional servocontrols are controlled and monitored by a BCM from the SSUs or the PITCH TRIM control switches.

Interface

The elevator has interfaces with the Yellow and Green hydraulic systems to supply hydraulic power to the elevator conventional servocontrols and with electrical system to supply electrical power to EHA.
Through the AFDX network, the PRIMs and SECs send data related to the elevators/actuators to the CPIOMs (FCDC application) and then to the CDS.

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ELEVATOR - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Trimmable Horizontal Stabilizer (THS) - Presentation

Function/Description

The THS gives pitch control and pitch trim control of the aircraft. There is one surface operated by actuator. The THS actuator is electrically controlled and monitored by the PRIMs and SECs pitch trim function.
The THS actuator has two electric motors, a screwjack and a ball nut. The two independent electric motors are controlled and monitored by the PRIMs and SECs. Each computer receives command signals from the SSUs or the AFS for the autotrim function or from the PITCH TRIM control switches for the manual trim function via Electric Motor Control Unit (EMCU).
Surface and actuator position feedback is sent to the PRIMs and SECs for servoloop computation.

Interface

Through the AFDX network, the PRIMs and SECs send data related to the THS actuator to the CPIOMs (FCDC application) and then to the CDS.

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TRIMMABLE HORIZONTAL STABILIZER (THS) - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Rudder - Presentation

Function/Description - A350-900 Only

The rudder controls the aircraft in the yaw axis.
The rudder gives:
- Yaw control
- Turn coordination
- Dutch roll damping
- Rudder trim
- Aircraft guidance on the ground (during takeoff and rollout).

There is one rudder operated by actuators. The rudder actuators are electrically controlled and monitored by the PRIMs and SECs from the rudder pedals, the SSUs (for turn coordination), the AFS or the rudder trim.
The rudder is operated by two conventional servocontrols and one EHA.
In normal conditions, each servocontrol/EHA is controlled and monitored by the PRIMs and SECs.
The pilot commands the rudder trim with the RUDDER TRIM control switch through the PRIMs and SECs. Then, the PRIMs and SECs give orders through the Pedal Feel and Trim Unit (PFTU) to move the rudder pedals. The rudder is then moved to a new neutral position.
Actuator position feedback is sent to the FCRM or electronic module for servoloop computation.
Surface and actuator position feedback is sent to the PRIMs and SECs for monitoring.
In emergency conditions, the top servocontrol actuator is controlled and monitored by a BCM from the rudder pedals through the PFTU.

Function/Description - A350-1000 Only

The rudder controls the aircraft in the yaw axis.
The rudder gives:
- Yaw control
- Turn coordination
- Dutch roll damping
- Rudder trim
- Aircraft guidance on the ground (during takeoff and rollout).

There is one rudder operated by actuators. The rudder actuators are electrically controlled and monitored by the PRIMs and SECs from the rudder pedals, the SSUs (for turn coordination), the AFS or the rudder trim.
The rudder is operated by two conventional servocontrols and one EHA.
In normal conditions, each servocontrol/EHA is controlled and monitored by the PRIMs and SECs.
The pilot commands the rudder trim with the RUDDER TRIM control switch through the PRIMs and SECs. Then, the PRIMs and SECs give orders through the Rudder and Brake Pedal Unit (RBPU) to move the rudder pedals. The rudder is then moved to a new neutral position.
Actuator position feedback is sent to the FCRM or electronic module for servoloop computation.
Surface and actuator position feedback is sent to the PRIMs and SECs for monitoring.
In emergency conditions, the top servocontrol actuator is controlled and monitored by a BCM from the rudder pedals through the RBPU.

Interface

The rudder has interfaces with the Yellow and Green hydraulic systems to supply hydraulic power to the rudder servocontrols and with electrical system to supply electrical power to EHA.
Through the AFDX network, the PRIMs and SECs send data related to the rudder actuators to the CPIOMs (FCDC application) and then to the CDS.

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RUDDER - PRESENTATION - FUNCTION/DESCRIPTION - A350-900 ONLY ... INTERFACE

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RUDDER - PRESENTATION - FUNCTION/DESCRIPTION - A350-900 ONLY ... INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Lift Augmenting - Presentation

Function/Description

The slat system operates together with the flap system to give high-lift control of the aircraft.
Each wing has one droop-nose device and six slats to give more lift to the aircraft.
The slats and droop-nose actuation and power-transmission system controls the movement of the droop-nose devices and slats during:
- Takeoff
- Approach
- Landing.

The lift augmenting operation is electrically controlled and monitored by two SFCCs. This operation is also hydro-mechanically and electro-mechanically controlled through a Power Control Unit (PCU), actuators and transmission shafts.
The slat/flap control lever gives commands to the SFCCs which transmit orders to the PCU to move the surfaces. The PCU moves each slat section through two rotary actuators and transmission shafts.
The slat PCU has:
- One hydraulic motor (Yellow system)
- One electric motor
- One differential gearbox.

The differential gearbox changes hydraulic and electrical energy into mechanical energy to drive the slat transmission system.
Wing Tip Brakes (WTBs) can lock the system if there is mechanical failure/rupture. Monitoring is provided by sensors.
The SFCCs monitor (through sensors) and control the PCU and the WTBs.

Interface

The lift augmenting function has interfaces with the Yellow hydraulic system and electrical system to supply the PCU motors.

Through the AFDX network, the SFCCs send data related to the lift augmenting actuators to the CDS.

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ROTARY ACTUATORS
SENSORS

AFDX: Avionics Full Duplex Switched Ethernet
CDS: Control and Display System
DIFF: Differential
PCU: Power Control Unit
SFCC: Slat Flap Control Computer
WTB: Wing Tip Brake

LIFT AUGMENTING - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Flaps - Presentation

Function/Description

The flaps give lift augmenting, variable camber and differential flap setting.
Flaps - Architecture
Each wing includes one inboard and one outboard flap section. The flap operation is controlled and monitored by the two SFCCs. This operation is actuated through a PCU, transmission shafts, actuators and two ADGBs.
The flap/slat control lever gives commands to the SFCCs which transmit orders to the PCU and ADGBs to move the surfaces. The PCU and ADGBs move each flap surface through transmission shafts and two rotary actuators.
The flap PCU has:
- Two hydraulic motors (Green and Yellow hydraulic systems)
- One differential gearbox.

The differential gearbox changes hydraulic and electrical energy into mechanical energy to drive the flap transmission system.
Each transmission shaft end has a WTB which can lock the system if there is mechanical failure/rupture. Monitoring is provided by sensors.
Two Active Differential Gearboxes (ADGBs) between the inboard and outboard flap transmissions give the differential flap setting. With the ADGBs, the outboard flaps can move independently from the inboard flaps.
The PCU, WTBs and ADGBs are controlled and monitored by the SFCCs.
Flaps - Principle
The variable camber function is a small extension of the two inboard and outboard flaps in cruise that reduce aircraft drag.
The differential flap setting function is a differential extension between the inboard and outboard flaps that decreases wing loads and alleviates wing bending.

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FLAPS - PRESENTATION - FUNCTION/DESCRIPTION

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FLAPS - PRESENTATION - FUNCTION/DESCRIPTION

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FLIGHT CONTROLS SYSTEM PRESENTATION

Flaps - Presentation (continued)

Interface

The flaps have interfaces with the Yellow and Green hydraulic systems to supply the flap PCU motors and with electrical system to supply electrical power to ADGB.
Through the AFDX network, the SFCCs send data related to the flaps to the CDS.

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FLAPS - PRESENTATION - INTERFACE

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FLIGHT CONTROLS SYSTEM PRESENTATION

Location - Presentation

The three PRIMs and the three SECs are installed in the avionics compartment.
The BCM is located in the lower deck forward cargo compartment.
The two SFCCs are located in the avionics compartment.

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LOCATION - PRESENTATION

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FLIGHT CONTROLS SYSTEM PRESENTATION

Control and Indicating - Presentation

Controls
- PRIM and SEC pushbutton switches
The PRIM and SEC pushbutton switches are on the overhead panel.
- SSU and rudder pedals
One SSU is on the CAPT console, the other one is on the F/O console.
The rudder is controlled through the CAPT and F/O rudder pedals.
- Speedbrake control lever
The speedbrake control lever is on the center pedestal.
- RUDDER TRIM control switch
The RUDDER TRIM control switch is on the center pedestal.
- PITCH TRIM control switches
The PITCH TRIM control switches are on the center pedestal.
- Slat/flap control lever
The slat/flap control lever is on the center pedestal.
Indicating
The flight control data is shown on these display units:
- The System Display (SD)
- The lower part of the CAPT and F/O Primary Flight Displays (PFDs).

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CONTROL AND INDICATING - PRESENTATION

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OXYGEN SYSTEM PRESENTATION

Overview

The oxygen system has these subsystems:
- Crew oxygen
- Passenger oxygen
- Portable oxygen.

The function of the crew oxygen is:
- To supply oxygen to two flight crews and two observers during decompression
- To give protection against the smoke and/or toxic gas in the cockpit.

The function of the passenger oxygen is to supply oxygen to passengers and cabin occupants during cabin decompression.
The function of the portable oxygen system is:
- To give more oxygen to the passengers after cabin decompression, if more oxygen is necessary
- To give protection to the flight crew and cabin crew during fire fighting.

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OXYGEN SYSTEMS

CREW OXYGEN

PASSENGER OXYGEN

PORTABLE OXYGEN

OVERVIEW

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OXYGEN SYSTEM PRESENTATION

Crew Oxygen - Presentation

Function/Description

The crew oxygen has two equivalent subsystems:
- The LH subsystem supplies oxygen to the CAPT and one observer (4th occupant)
- The RH subsystem supplies oxygen to the F/O and one observer (3rd occupant).

When the crew oxygen is in operation, each subsystem operates at the same time.
Crew Oxygen Storage
The crew oxygen storage in each subsystem includes:
- An oxygen cylinder-reducer assembly that keeps the high-pressurized oxygen and lets the oxygen flow to the crew oxygen distribution, when the system operates
- A ventilated oxygen compartment that keeps the oxygen cylinder-reducer assembly in position and discharges overboard any leak inside the compartment.

If a leak occurs in the oxygen compartment, a venturi lets the high concentration of oxygen in the oxygen compartment flow overboard.
For the crew oxygen storage, it is optional to install:
- A second oxygen-reducer assembly in the same oxygen compartment
- An in-situ refilling with a fill panel and a fill port.

Crew Oxygen Distribution
The crew oxygen distribution in each subsystem includes:
- Two full-face quick-donning oxygen-masks (referred to as "the mask") that supplies oxygen and also give protection to the flight crew
- Two oxygen mask stowage-boxes (referred to as "stowage box") to keep the masks
- A single oxygen manifold to supply oxygen from the oxygen cylinder-reducer assembly to the related user
- An overboard discharge indicator to release the pressure, if overpressure occurs.

If two oxygen cylinders are installed in one oxygen compartment, a dual distribution manifold is necessary.

Interface

The crew oxygen control and indicating for the two subsystems has two Oxygen System Control and Monitoring (OSCM) software which monitor and supply data to other system.
The crew oxygen control and indicating in each subsystem includes:
- A crew shut-off valve to start the crew oxygen system
- The pressure and temperature sensors that are used by the OSCM for cockpit indication.

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CREW OXYGEN - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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OXYGEN SYSTEM PRESENTATION

Crew Oxygen - Presentation (continued)

Location

The two oxygen compartments are located in the FWD cargo compartment:

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CREW OXYGEN - PRESENTATION - LOCATION

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OXYGEN SYSTEM PRESENTATION

Passenger Oxygen - Presentation

Function/Description

The passenger oxygen system is a decentralized system with either a chemical or a gaseous oxygen source. The interfaces to the aircraft and the aircraft wiring are identical for both cases.
The basic passenger oxygen system is the chemical oxygen system.
It is also possible to have a passenger oxygen system with:
- A higher amount of chemical oxygen in the storage
- A decentralized passenger oxygen system with a gaseous oxygen source able to cover all high terrain profiles.

For manual opening of oxygen container, the cabin crew can open the oxygen container with a manual release tool.

Interface

The passenger oxygen system operates automatically if it receives signals from the Cabin Pressure Control System (CPCS) and from the atmospheric pressure transducer.
The flight crew can also start the passenger oxygen system manually with the MASK MAN ON push button on the ICP panel.

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PASSENGER OXYGEN - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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OXYGEN SYSTEM PRESENTATION

Passenger Oxygen - Presentation (continued)

Location

The passenger oxygen containers are installed at these locations in 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 separated areas.

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PASSENGER OXYGEN - PRESENTATION - LOCATION

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OXYGEN SYSTEM PRESENTATION

Portable Oxygen - Presentation

Function/Description

The portable oxygen system includes:
- Portable oxygen cylinder assemblies
- Portable Breathing Equipment (PBE) in the cabin and cockpit.

The function of the portable oxygen cylinder assemblies is:
- To supply more oxygen to the passengers for first aid function
- To supply oxygen to the cabin crew when the cabin crew moves in the cabin during a cabin decompression.

The function of the PBE is to give protection to the flight crew and the cabin crew for fire fighting.

Location

The equipment for the portable oxygen is single equipment that is installed in different locations in the cabin and in the cockpit.

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PORTABLE OXYGEN - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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OXYGEN SYSTEM PRESENTATION

Control and Indicating - Presentation

The OXYGEN control panel for the crew and passenger systems is on the cockpit overhead panel. The CREW SUPPLY pushbutton switch in ON position lets the oxygen flow from the oxygen cylinders to the crew masks. The MASK MAN ON pushbutton electrically controls the opening of the oxygen container doors, by manual operation.
Passenger "SYS ON" light illuminates, when the passenger oxygen system is in operation.
The crew oxygen system status is then shown on the upper right corner of the DOOR/ OXY ECAM Page. For the LH side of the crew oxygen system, the status is shown in the "CAPT" side. For the RH side of the crew oxygen system, the status is shown in the "F/O" side.
Each overboard discharge line has an overboard discharge indicator which gives an indication if the oxygen is released overboard. These indicators are located at LH side and RH side, on FWD section of the aircraft.

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211VM

DOOR /OXY ECAM PAGE

OVERBOARD DISCHARGE INDICATOR

ECAM: Electronic Centralized Aircraft Monitoring
OXY: Oxygen

CONTROL AND INDICATING - PRESENTATION

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WATER/WASTE SYSTEM PRESENTATION

Overview

The water and waste system supplies potable water, removes the waste and discards the waste water.
General familiarization training for this system focuses on:
- Potable water
- Toilet system
- Waste water drain.

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WATER AND WASTE

POTABLE WATER

TOILET SYSTEM

WASTE WATER DRAIN

OVERVIEW

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WATER/WASTE SYSTEM PRESENTATION

Potable Water - Presentation

Function/Description

The potable water system supplies pressurized potable water from two potable water tanks to the lavatories and to the galleys. The pneumatic system supplies bleed air through the air supply system to pressurize the potable water tanks. Also, an electrical water boost pump increases this pressure to the necessary supply pressure in the water line. On the ground, through a ground air connection, it is also possible to pressurize the potable water tanks.
A potable-water treatment module keeps the risk of microbiological contamination of the potable water to the minimum.
The primary control of the filling and draining procedures is from the Potable Water Indication Panel (PWIP) of the Potable Water Service Panel (PWSP).
System servicing (filling and draining) is only possible when electrical power is available. But if electrical power is not available, it is possible to do servicing manually. Then only maintenance personnel can do this servicing.
The PWIP controls and monitors the potable water system.
The Flight Attendant Panel (FAP) shows the level of potable water in the potable water tanks. It also makes it possible to pre-select the fill level.
The potable-water system function hosted in the Cabin Intercommunication Data System (CIDS) directors is the interface between the FAP and the system.

Interface

The potable water system has an interface with the CIDS through the FAP and the CIDS directors.
The potable water system has also an interface with the pneumatic system.

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CIDS:	Cabin Intercommunication Data System
FAP:	Flight Attendant Panel
PWIP:	Potable Water Indication Panel
PWSP:	Potable Water Service Panel

POTABLE WATER - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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WATER/WASTE SYSTEM PRESENTATION

Potable Water - Presentation (continued)

Location

The two potable water tanks are in the aft-cabin underfloor area.

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POTABLE WATER - PRESENTATION - LOCATION

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WATER/WASTE SYSTEM PRESENTATION

Toilet System - Presentation

Function/Description

The toilet system moves waste from the toilets and the Galley Waste Disposal Units (GWDUs) to the waste tanks.
The toilet system has two separate subsystems, the left and the right toilet subsystems. Each subsystem has one waste tank.
A vacuum transport system uses differential pressure to move the toilet and GWDU waste through the flush valves to the waste tanks. When this differential pressure is not sufficient, vacuum generators supply the necessary negative pressure (vacuum).
The draining and flushing procedures of the waste tanks are possible from the waste service panel.
The waste drain lines connect the waste tanks through the waste drain valves to the waste service panel.
The vacuum generators are between the waste tanks and the outer lower fuselage.
The Vacuum Toilet System (VTS) function hosted in the Cabin Intercommunication Data System (CIDS) directors is the interface between the FAP and the system.
The FAP shows the level of waste in the waste tanks.

Interface

The toilet system has an interface with the CIDS, through the FAP and the CIDS directors.

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TOILET SYSTEM - PRESENTATION - FUNCTION/DESCRIPTION & INTERFACE

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WATER/WASTE SYSTEM PRESENTATION

Toilet System - Presentation (continued)

Location

The two waste tanks are in the aft-cabin underfloor compartment.

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TOILET SYSTEM - PRESENTATION - LOCATION

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WATER/WASTE SYSTEM PRESENTATION

Waste Water Drain - Presentation

Function/Description

The waste-water drain system removes waste water from the galley sinks and lavatory washbasins. The waste water flows through the drain valves and the drain lines to the heated drain masts.
The drain lines are between the galley sinks, the lavatory washbasins and the drain masts.

Location

The drain valves are in the related galleys and lavatories (in the cabin).
The drain lines are between the cabin and the lower fuselage.

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WASTE WATER DRAIN - PRESENTATION - FUNCTION/DESCRIPTION & LOCATION

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WATER/WASTE SYSTEM PRESENTATION

Control and Indicating - Presentation

These panels control the system:
- The FAP in the cabin
- The waste service panel and PWIP of the PWSP on the outer surface of the aft lower fuselage.

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FAP: Flight Attendant Panel
PWIP: Potable Water Indication Panel
PWSP: Potable Water Service Panel

CONTROL AND INDICATING - PRESENTATION

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