A330-200
TECHNICAL TRAINING MANUAL

MECHANICS / ELECTRICS & AVIONICS COURSE

21 AIR CONDITIONING

GE Metric

For Training Purposes Only
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This document must be used for training purposes only.

Under no circumstances should this document be used as a reference.

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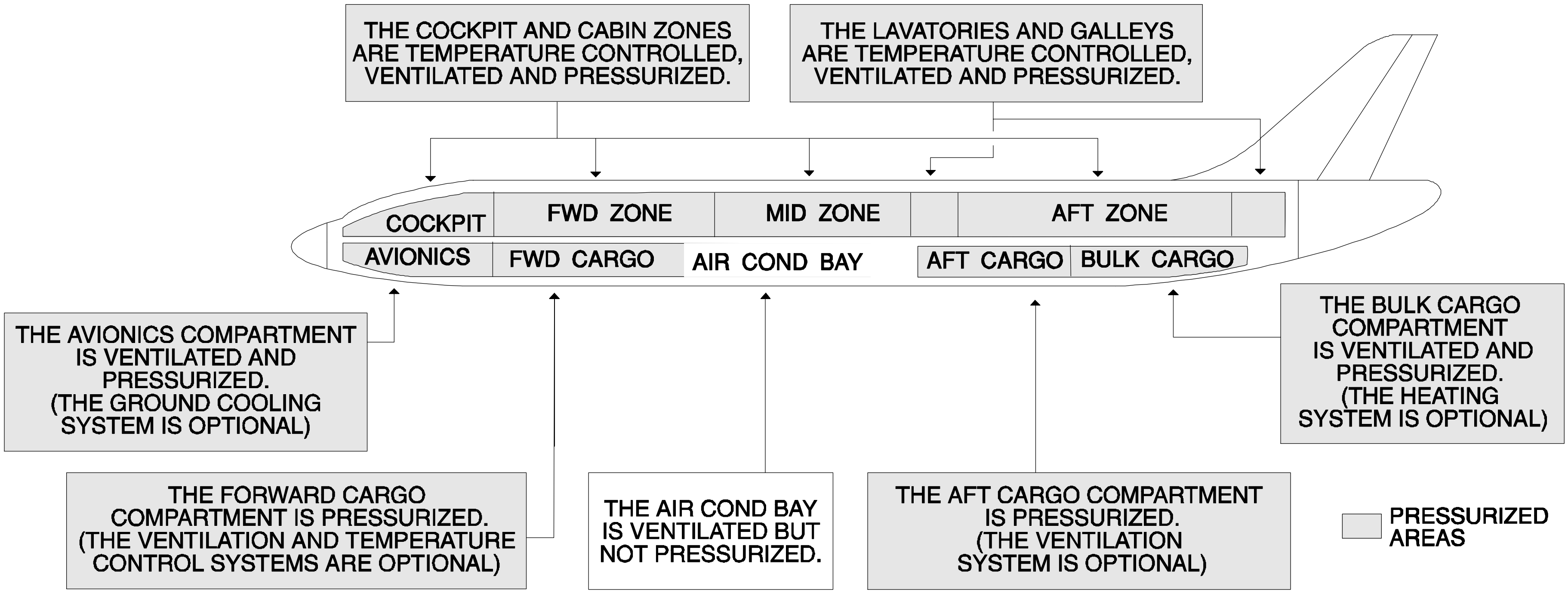
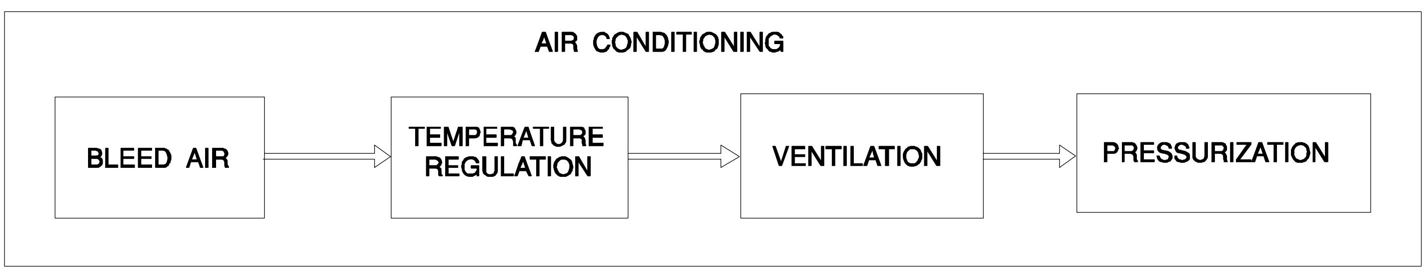
SYSTEM PRESENTATION

The air conditioning system maintains the air in the pressurized fuselage zones at the correct levels of temperature, freshness and pressure.

INTRODUCTION

Air supply comes from the pneumatic system.
Then, air temperature is regulated in temperature by the temperature regulation sub-system.
Correct level of air freshness in the pressurized zones and proper ventilation of the avionics equipment is ensured by the ventilation sub-system.
The pressurization sub-system ensures a cabin altitude compatible with crew and passengers comfort.





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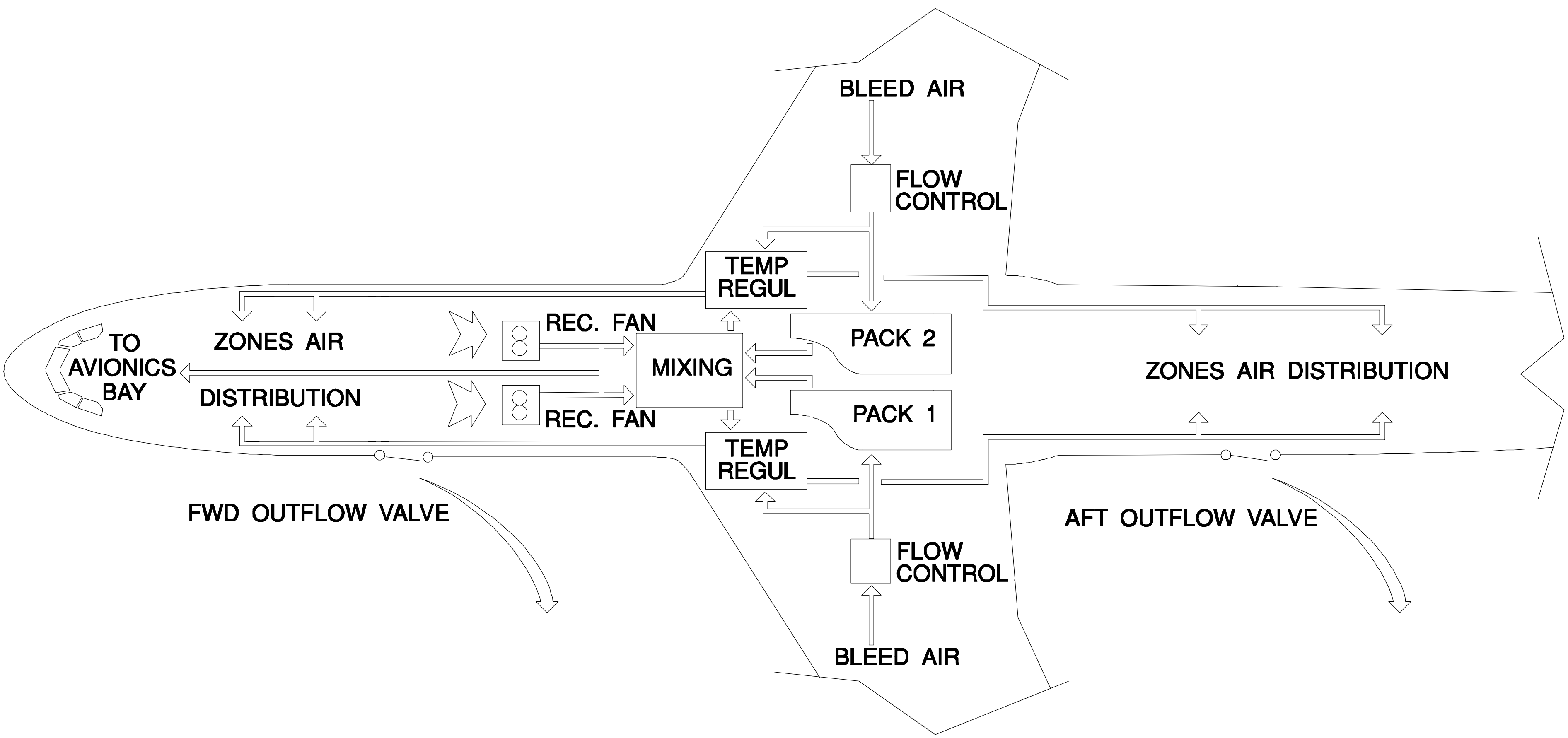
PRESENTATION

Bleed air coming from pneumatic system is controlled in flow before reaching two air conditioning packs which ensure basic temperature regulation.
Air delivered by the packs is mixed with recirculated air from the cabin zones which is also used for avionics ventilation purpose.
Fine temperature adjustment of air distributed in the pressurized zones is obtained by controlling the amount of hot air added to the air coming from the mixer unit.
Correct pressurization is obtained by controlling the conditioned air discharge through two outflow valves.



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STUDENT NOTES

SYSTEM CONTROLS AND INDICATING - GENERAL

Overhead Panel
Main Instrument Panel
Forward Attendant Panel

OVERHEAD PANEL

The air conditioning system controls are located on the overhead panel.

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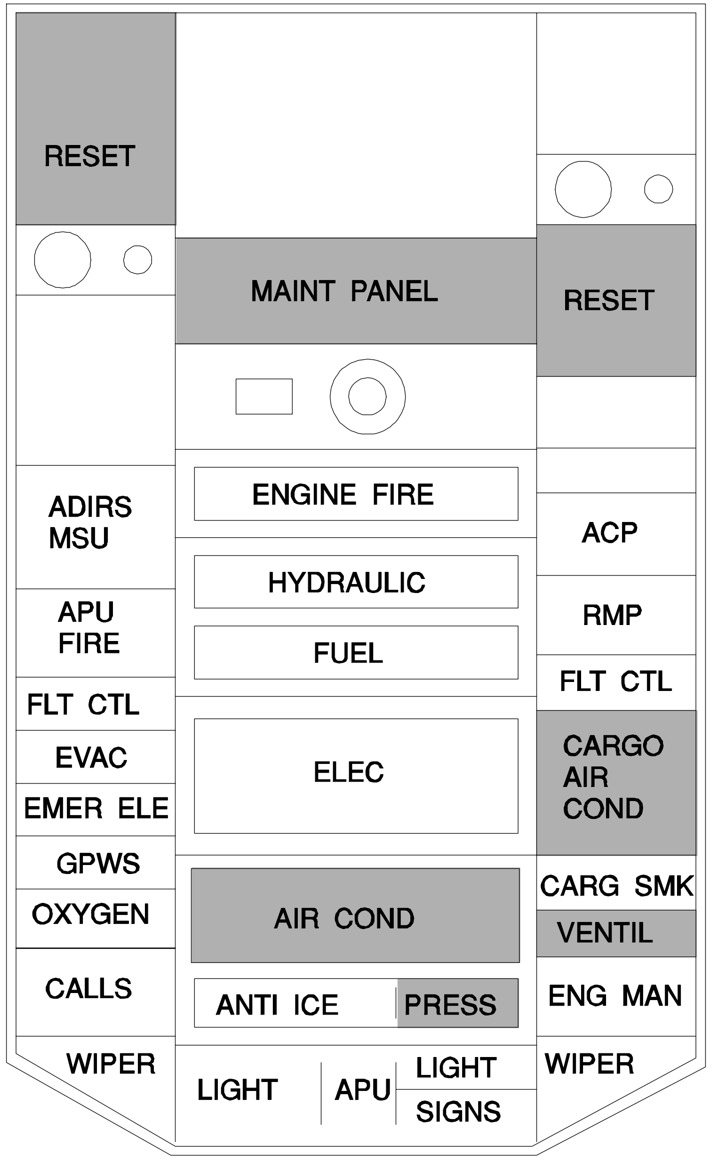

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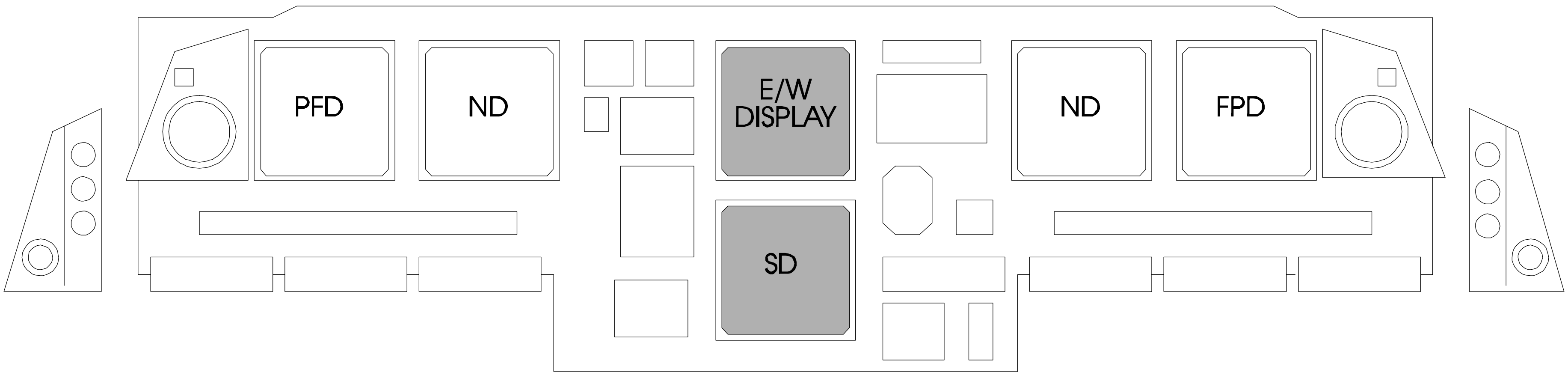
MAIN INSTRUMENT PANEL

The air conditioning system can be monitored on the ECAM system display.
System information is shown on the following pages :

- BLEED page : pack and emergency ram air.
- AIR COND page : temperature control, cabin ventilation, cargo ventilation, cooling and heating (optional).
- PRESS page : pressurization and avionics ventilation.
- CRUISE page : zone temperature and main pressurization system parameters.



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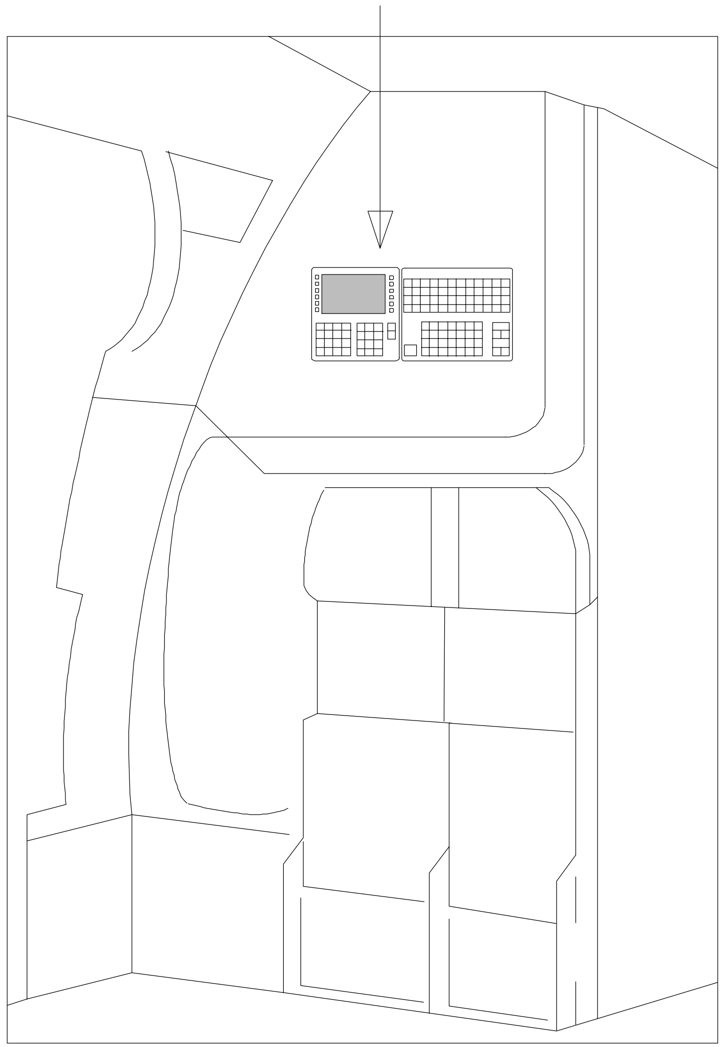
FORWARD ATTENDANT PANEL

At the forward attendant station, the Programming and Indication Module allows cabin crew to slightly adjust the temperature regulation in the three cabin zones.

PROGRAMMING AND
INDICATION MODULE
(P.I.M.)



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STUDENT NOTES

TEMPERATURE CONTROL: SYSTEM DESIGN PHILOSOPHY

Basic Principle
Pack Controllers
Zone Controller

BASIC PRINCIPLE

Air flow is regulated by two flow control valves. Two packs provide air basic temperature regulation.
Both packs provide air at the same temperature.
Trim air pressure regulating valves maintain the downstream pressure above the cabin pressure allowing hot air and cold air to be mixed.
Trim air valves optimize the temperature by adding hot air to pack air supply, when necessary.
A part of cabin air is recirculated to decrease air supply demand.

PACK CONTROLLERS

Each Pack Controller provides:

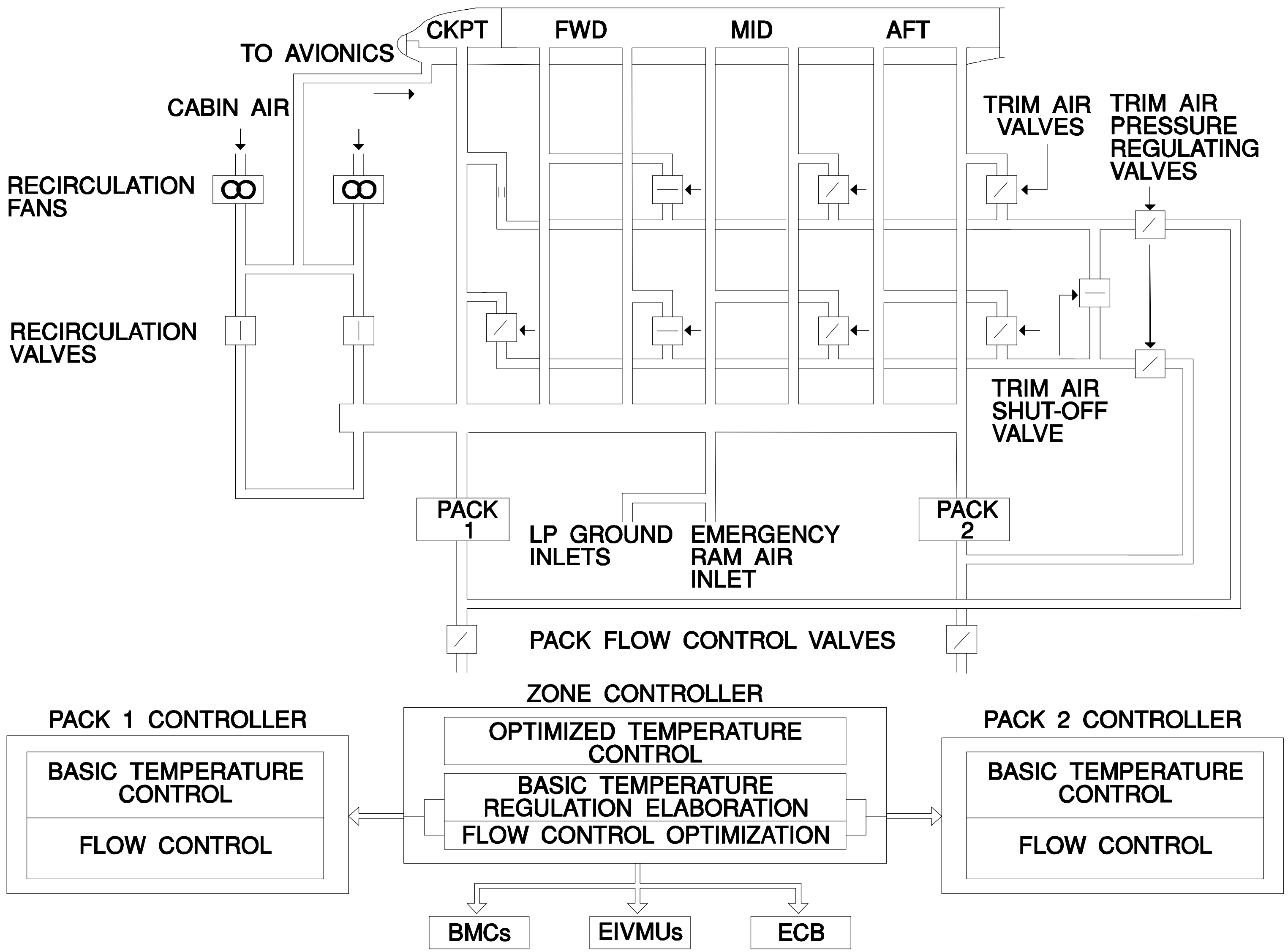
- basic temperature regulation of its associated pack in accordance with the demand from the zone controller.
- and flow control setting and monitoring.

ZONE CONTROLLER

The Zone Controller provides:

- A basic temperature regulation signal elaboration which is the lowest demanded zone temperature.
- An optimized temperature control which is the demanded temperature on the control panel.
- An optimized flow control demand.

Optimized temperature is provided by control of the trim air valves.
In case of cooling demand not satisfied due to low air flow, the zone controller sends a signal to the EIVMU or ECB in order to provide necessary flow to the packs.
EIVMU : Engine Interface Vibration and Monitoring Unit.
ECB : Electronic Control Box (APU).
If the selected temperature cannot be maintained, the bleed monitoring computer receives a signal in order to control the bleed air delivered temperature, at a decreased level.
The bleed air temperature is reduced from 200°C to 150°C. This mode is inhibited if the wing anti-ice system is in operation.



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STUDENT NOTES:

TEMPERATURE CONTROL: SYSTEM PRESENTATION

Ozone Converter (Optional)
Flow Control Valves
Pack Units
Mixer Unit
Emergency Ram Air Flap
LP Ground Inlets
Filters
Recirculation Fans
Recirculation Valves
Trim Air Pressure Regulating Valves (TAPRV)
Trim Air Shut Off Valve (TASOV)
Trim Air Valves
Controllers
Sensors and Pressure Switches
Check Valves

OZONE CONVERTER (OPTIONAL)

An optional ozone converter removes ozone from the hot bleed air.
Ozone removal is performed by catalytic effect.

FLOW CONTROL VALVES

Each valve is pneumatically operated and electrically controlled. The flow regulation is achieved by a torque motor under Pack Controller control.
Three basic flow settings can be selected by means of a PACK FLOW selector. A back up function is provided in case of automatic flow regulation failure. A shut off function is achieved by a solenoid controlled by an ON/OFF pushbutton switch or by the Pack Controller, according to system logic.

PACK UNITS

Two independent packs provide basic temperature regulation.
Each pack mainly consists of a heat exchanger assembly using ram air and an air cycle machine. The pack components are controlled by their associated pack controller.

MIXER UNIT

The mixer unit mixes temperature regulated air from packs with part of the cabin air supplied by recirculation fans.

EMERGENCY RAM AIR FLAP

In the event of both packs being inoperative or in case of smoke removal, an emergency ram air inlet flap will allow the aircraft to be ventilated .
The flap electrical actuator is controlled by the RAM AIR pushbutton switch.

LP GROUND INLETS

The mixer unit may also receive conditioned air through two low pressure ground connections.

FILTERS

Filtering is performed for cabin air recirculation.

RECIRCULATION FANS

Two recirculation fans feed the mixer unit with air from the cabin. In addition, they are used as blowers for the avionics equipment ventilation.
The fans are controlled from the VENTILATION panel through the Ventilation Controller.

RECIRCULATION VALVES

In the event of both packs being off, two recirculation valves close to keep the avionics equipment sufficiently ventilated.
The valves are controlled by the Ventilation Controller.

TRIM AIR PRESSURE REGULATION VALVES (TAPRV)

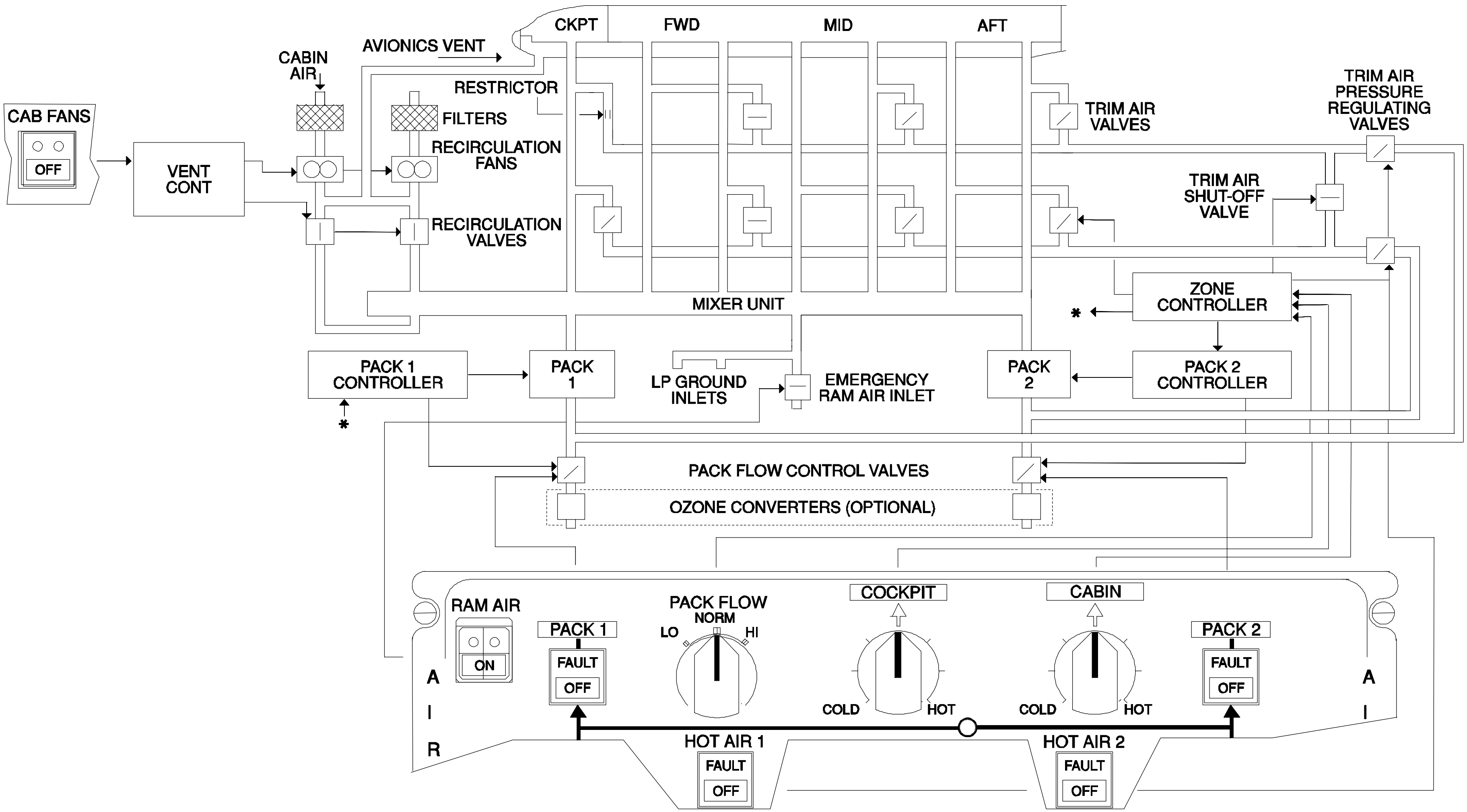
Hot air, tapped upstream of the packs, supplies the trim air valves through two Trim Air Pressure Regulating Valves. These valves pneumatically regulate the downstream pressure above cabin pressure.
The shut-off function of each TAPRV is achieved by means of a solenoid. It is controlled from the Zone Controller (in case of related zone distribution duct overheat) or from the AIR panel.

TRIM AIR SHUT OFF VALVE (TASOV)

In the event of a Trim Air Pressure Regulating Valve failed closed, the trim air shut-off valve opens to restore trim air supply in the failed side.
The valve is electrically operated and controlled from the Zone Controller.

TRIM AIR VALVES

If necessary, trim air valves, associated to each zone, optimize the temperature by adding hot air to the air coming from the mixer unit.
The Trim Air Valves are controlled from the Zone Controller by a stepper motor. A restrictor ensures a minimum cockpit air supply in case the cockpit trim air valve is jammed closed.



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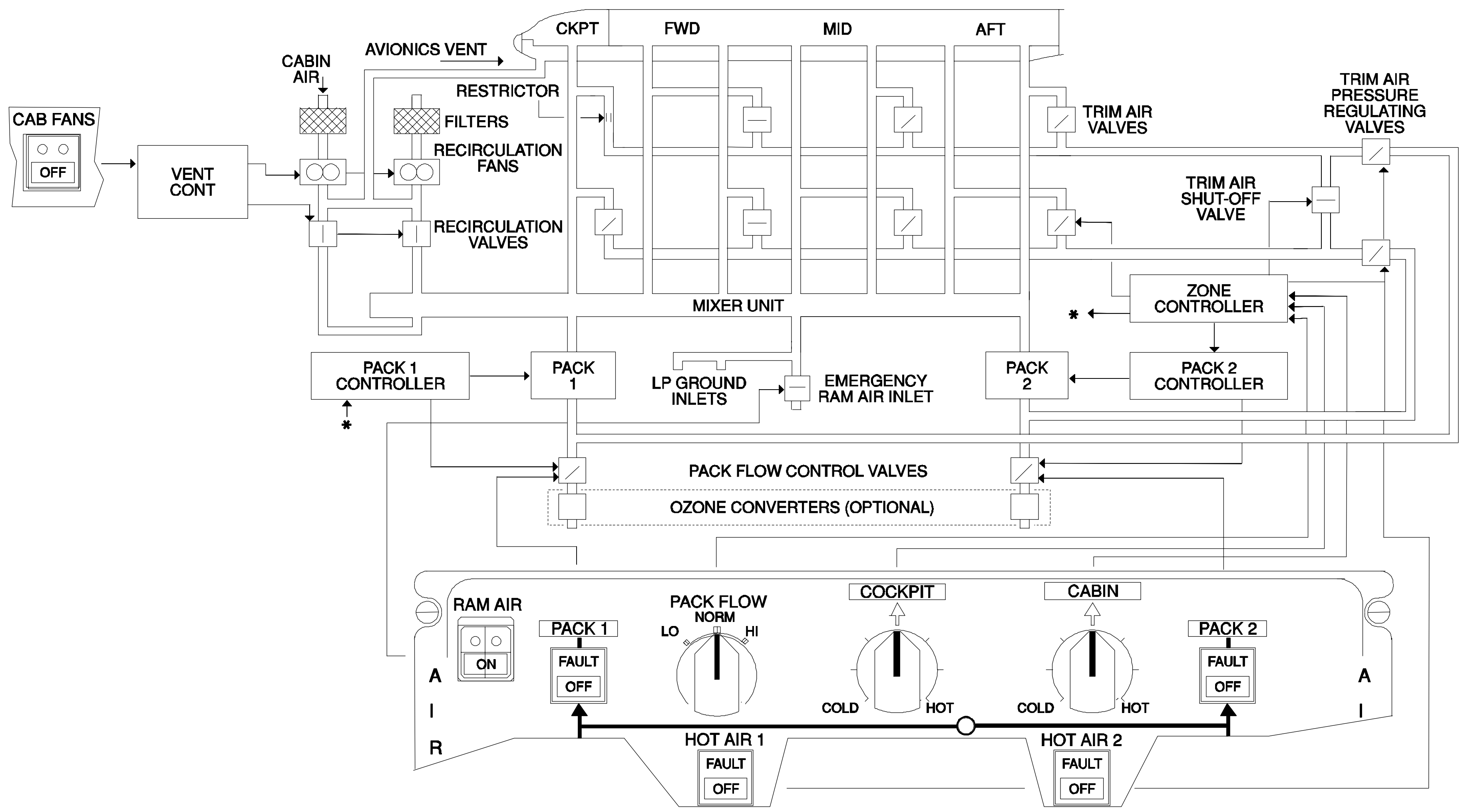
CONTROLLERS

Each Pack Controller provides basic temperature and flow regulation of its associated pack.
Each Pack Controller consists of two identical lane 1 and lane 2 computers. In normal operation, one lane is active and the other lane is in hot-standby mode. The lane changes over at the end of each flight. If there is a failure in the active lane, the other becomes active. If there is a failure in both lanes, the lane with the least significant failure becomes active.

The Zone Controller controls the Trim Air Valves for optimized temperature regulation and also informs the Pack Controllers of the desired basic temperature and flow.
The Zone Controller consists of two identical lane 1 and lane 2 computers. In normal operation, one lane is active and the other lane is in hot-standby mode. The lane changes over at the end of each flight. If there is a failure in the active lane, the other becomes active. If there is a failure in both lanes, the lane with the least significant failure becomes active.



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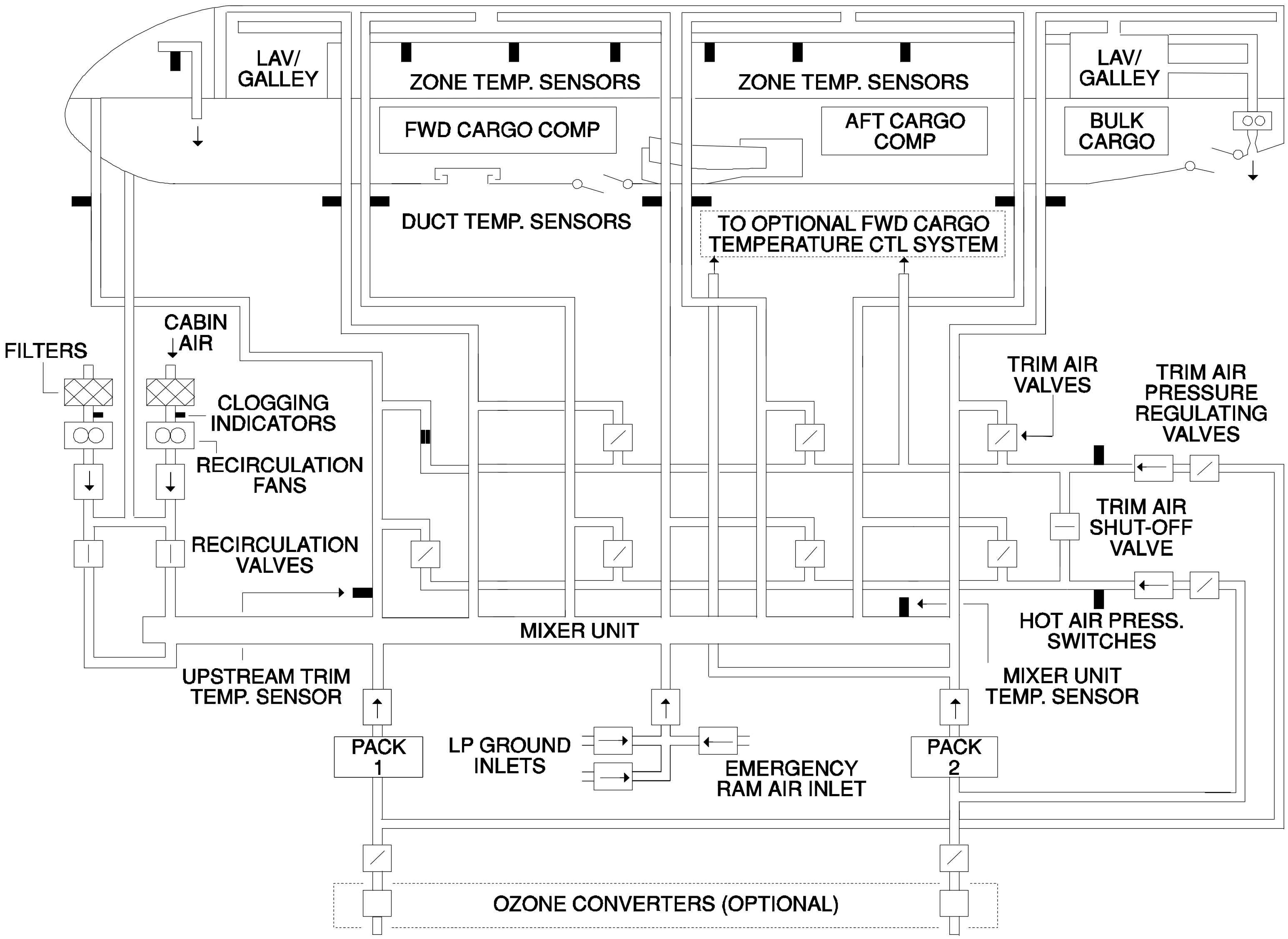
SENSORS AND PRESSURE SWITCHES

Temperature sensors and pressure switches are installed for control, monitoring and indicating.

CHECK VALVES

Check valves are installed to prevent reverse flow.



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STUDENT NOTES:

TEMPERATURE CONTROL: SYSTEM CONTROLS AND INDICATING

AIR Panel

Ram Air Pushbutton Switch
Pack 1(2) Pushbutton Switches
Pack Flow Selector
Zone Temp Selectors
Hot Air 1(2) Pushbutton Switches

P.I.M.

Cabin Temp Hardkey
Temperature Preselection Softkeys
Reset Softkey

Reset Panel

AIR PANEL

RAM AIR PUSHBUTTON SWITCH

When the RAM AIR pushbutton is set to ON, on the AIR COND panel, the emergency ram air flaps open provided the ditching pushbutton switch is in normal position on the PRESS panel.
When it is released out, the emergency ram air inlet flap closes.

ON : ON light comes on white. Provided the DITCHING pushbutton switch is in normal position:
- The ram air inlet flap opens
- Both outflow valves open at 50% when ΔP is lower than 1 psi.

OFF : The ram air inlet flap closes and the outflow valves return to their normal position.

PACK 1(2) PUSHBUTTON SWITCHES

When pack 1 (or pack 2) pushbutton is pressed in, the pack flow control valve operates if pneumatic pressure is available. When set to OFF, the pack flow control valve is maintained closed electrically.

ON : The flow control valve opens provided there is no pack overheat, no engine starting sequence, no upstream pressure below minimum, no corresponding fire pushbutton released out, no passenger/crew door open nor ditching selected.
OFF : The flow control valve closes.
FAULT : comes on amber when the flow control valve position disagrees with the selected position or in case of pack overheat.

PACK FLOW SELECTOR

The PACK FLOW selector serves to select the pack flow.
The PACK FLOW selector enables the pack flow setting to be selected in accordance with the number of passengers and the ambient conditions.

LO : 80% of normal flow
NORM : 100%
HI : 125% of normal flow.

ZONE TEMPERATURE SELECTORS

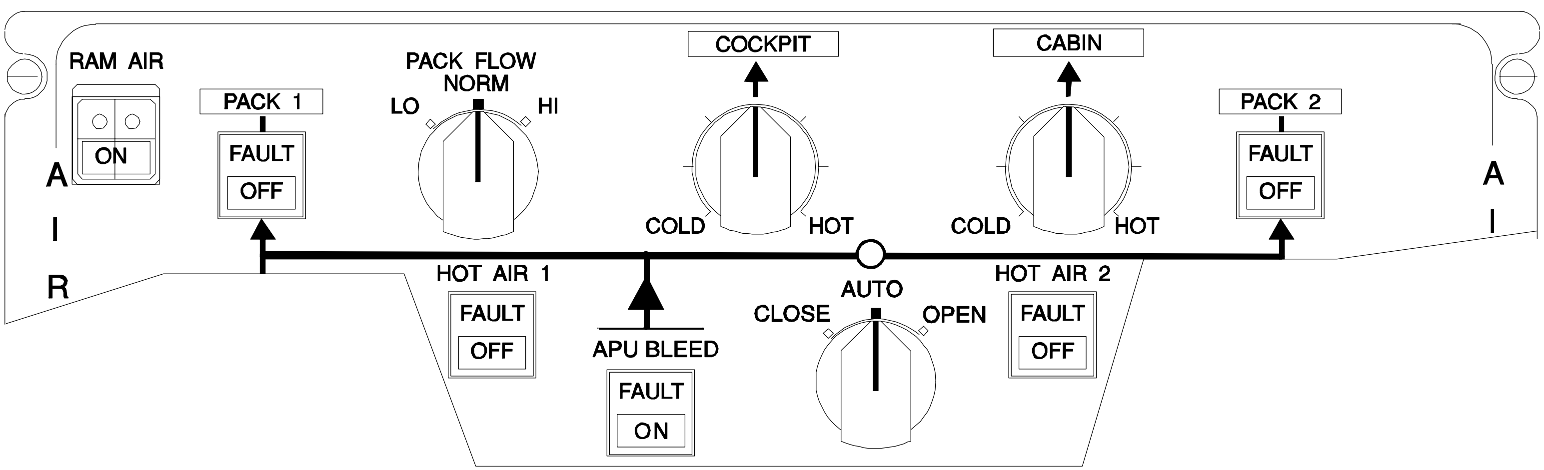
The COCKPIT and CABIN temperature selectors enable the selection of the desired ambient temperature in the corresponding zone.

12 o'clock position: 24°C
COLD position: 18(C
HOT position: 30°C

HOT AIR 1(2) PUSHBUTTON SWITCHES

When the HOT AIR pushbutton is pressed in, the trim air pressure regulating valve opens and pneumatically regulates hot air pressure above the cabin pressure. When set to OFF, the valve is electrically closed.

ON : The valve regulates hot air pressure.
OFF : The valve closes, the trim air valves close and the FAULT circuit is reset.
FAULT : Comes on amber when a duct overheat temperature is detected (88°C). FAULT light goes off when the duct temperature drops below 70°C or OFF is selected .



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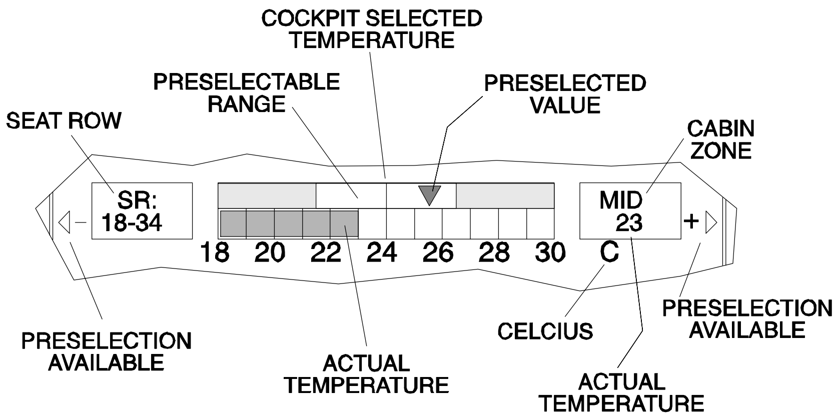
P.I.M.

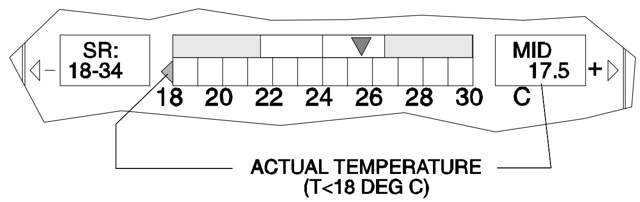
CABIN TEMP HARDKEY

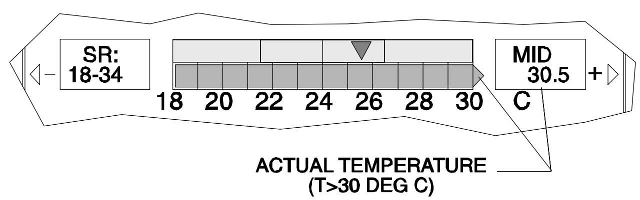
When the CABIN TEMP hardkey is pressed on the Programming and Indicating Module (P.I.M.), the cabin temperature page is displayed. It provides the menu for cabin temperature and remote control of the three cabin zones.



The actual temperature is simultaneously represented by a figure and a bargraph. The preselected range is centered on the cockpit selected temperature and covers 5 degrees celcius (+/-2.5 DEG C).
The three arrows initially indicate the cockpit selected temperature.
The seat row values for each zone depend on the cabin layout selected on the Cabin Attendant Module (C.A.M.).
As an option, all temperatures can be indicated in degrees fahrenheit (64-86 DEG F).

If the actual temperature is lower than 18 DEG C or greater than 30 DEG C, a green arrow is respectively displayed on the left or the right of the bargraph.





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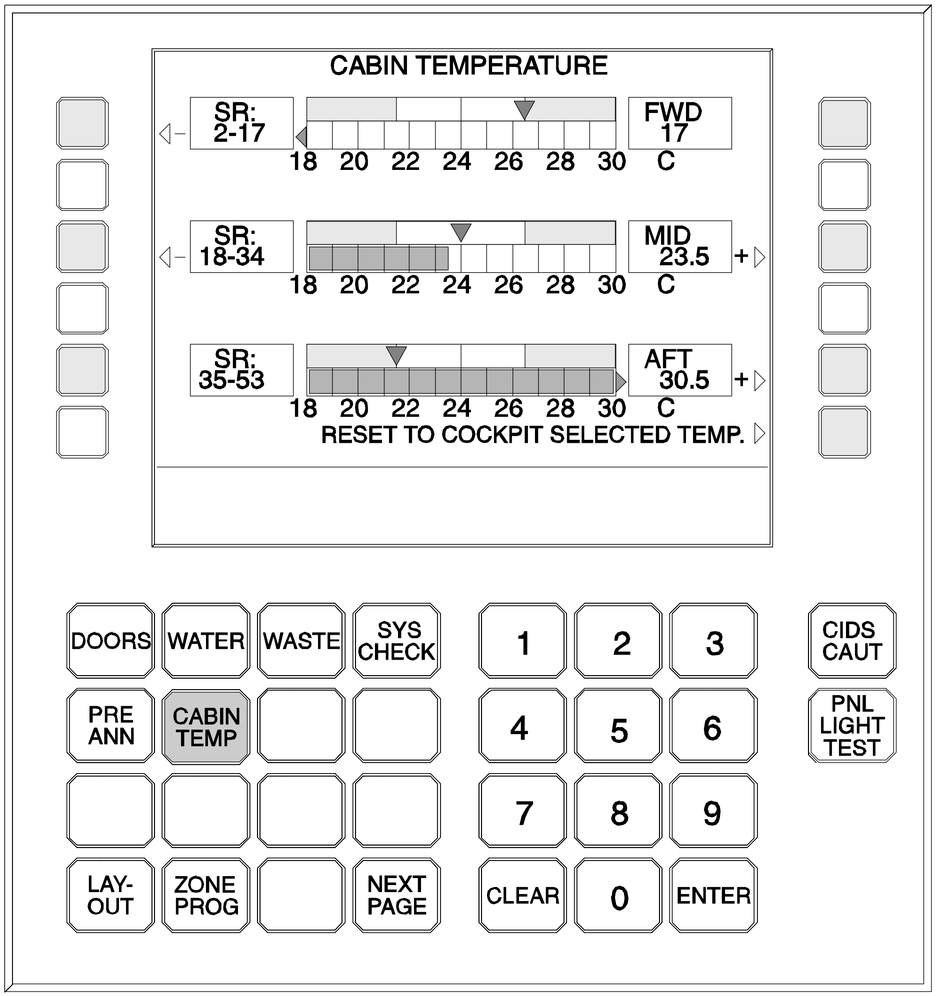
PROGRAMMING AND INDICATION MODULE(PIM)



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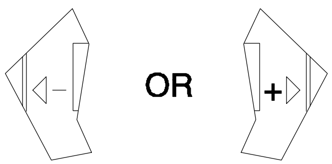
P.I.M.

TEMPERATURE PRESELECTION SOFTKEYS

There are two softkeys per zone wich enable the cabin crew to add or substract by increments of 0.5 degrees celcius up to a 2.5 degrees celcius range around the cockpit selected temperature.

The arrow indicating this preselected value moves accordingly on the temperature bargraph.



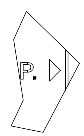
respectively disappear if the upper or lower limit is reached.

RESET SOFTKEY

If any preselection has been applied, the reset command is available and the reset indication displayed in white.

When the reset softkey is pressed in, the three arrows indicating the three preselected values move back to the cockpit selected temperature.

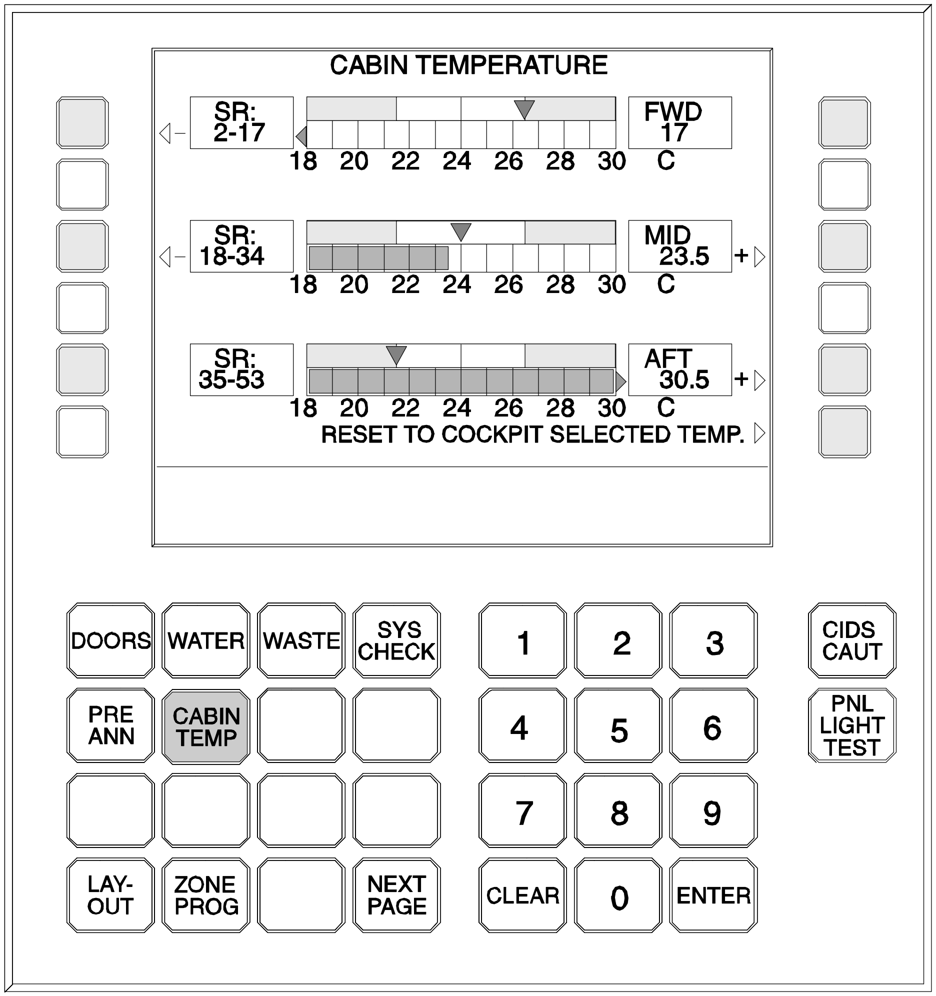
The reset indication becomes green and



disappears.

If the cockpit selected temperature is changed, then the three preselectable ranges are repositioned on the bargraphs and the preselected values reset.

PROGRAMMING AND INDICATION MODULE(PIM)



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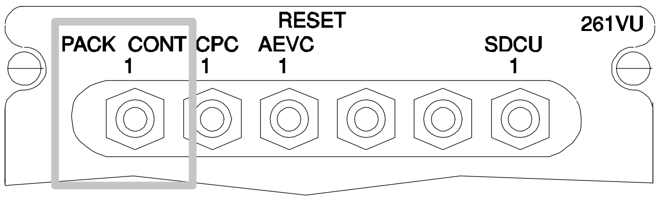
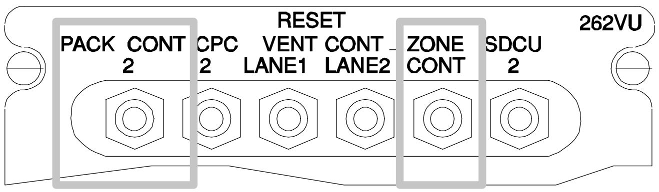
RESET PANEL

A reset control is provided for each controller.
Reset is performed by pulling and pushing the corresponding circuit breaker.


RESET
261VU
PACK CONT
1
CPC
1
AEVC
1
SDCU
1


RESET
262VU
PACK CONT
2
CPC
2
VENT CONT
LANE1
LANE2
ZONE CONT
SDCU
2

STUDENT NOTES

TEMPERATURE CONTROL: PACK PRESENTATION

INTRODUCTION

The air conditioning packs decrease the temperature of hot air to a level compatible with cabin air conditioning. They also remove humidity contained in the air bleed supply.
This is performed by passing bleed air through heat exchangers and an air cycle machine.
The pack outlet air temperature control is automatically achieved by controlling together the amount of ram air through the heat exchangers and the amount of hot air supply through the temperature control valve.
The high pressure water separation loop system, allows water to be condensed and removed to protect the air cycle machine against corrosion.
In case of air cycle machine failure, the system operates in pure heat exchanger cooling mode.
A pack by-pass valve serves to by-pass the air cycle machine.

EXCHANGERS / COMPRESSOR

The primary heat exchanger cools the hot air before it enters the compressor.
The compressor brings the air to a higher pressure and temperature.
Pressurized air is then cooled in the main heat exchanger.

PLENUM CHAMBER

The plenum chamber collects ram air from the main and primary heat exchangers.

CHECK VALVE

A check valve enables the compressor to be bypassed for easier starting and for pure heat exchanger cooling mode.

HIGH PRESSURE WATER SEPARATION LOOP

The air is sent through the high pressure water separation loop to remove water particles in order to allow very low turbine oulet temperatures with reduced changer of ice build-up downstream of the turbine oulet.
The condenser uses cold air from the turbine to condense the humidity of air into water particles.
The water extractor removes water particles. Extracted water is injected into the ram air inlet to improve the cooling efficiency of the heat exchangers.
The reheater revaporises the remaining water particles not extracted by the water extractor to protect the turbine against freezing.

TURBINE / FAN

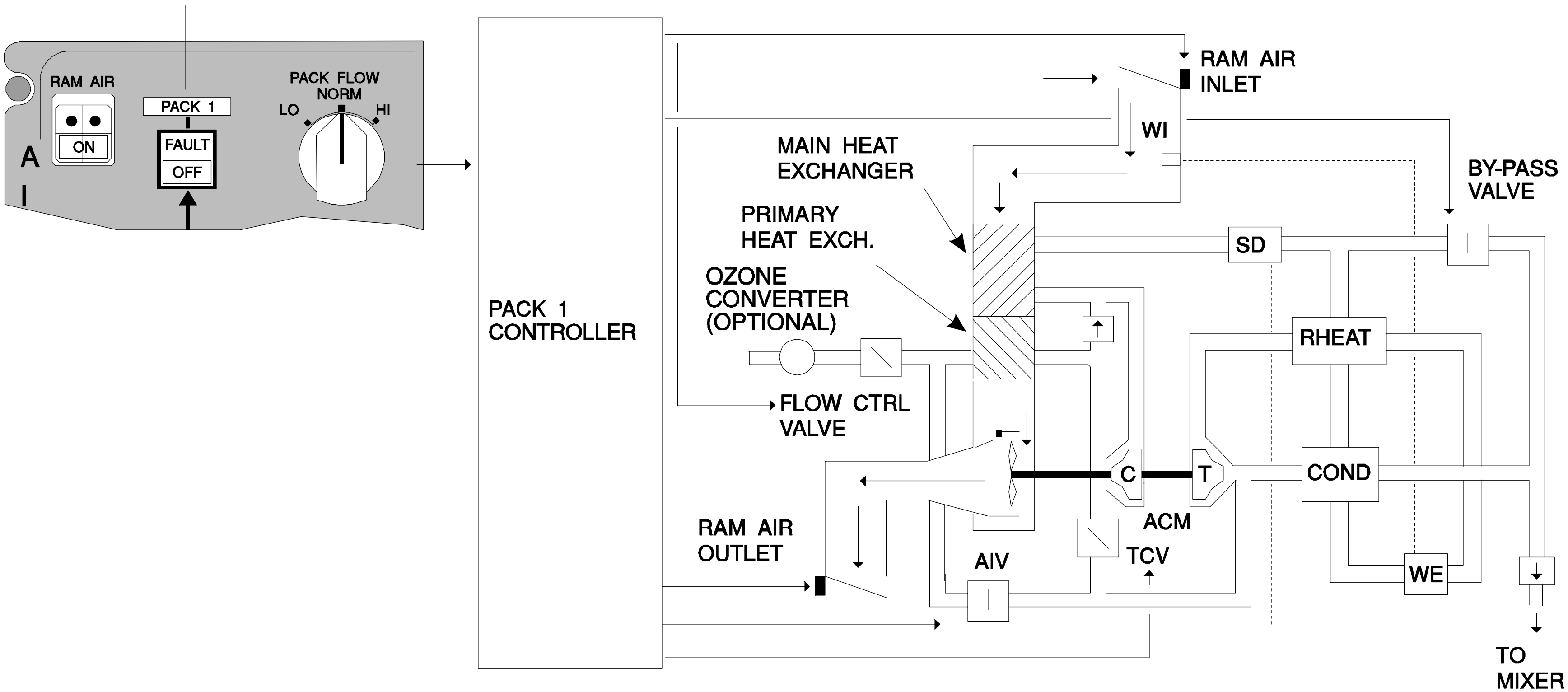
The dry air expands in the turbine section, this results in very low turbine discharge air temperature.
The turbine generates power to drive the compressor and the fan.
The fan impeller compensates any insufficient ram air flow on ground.
The check valve in the plenum chamber permits the fan to be bypassed when ram air flow is sufficient.

TEMPERATURE CONTROL VALVE, RAM AIR INLET AND RAM AIR OUTLET FLAPS

The temperature control valve, the ram air inlet and outlet flaps are simultaneously controlled by the pack controller.
The temperature control valve modulates the pack discharge temperature by adding hot air.
The temperature control valve is electrically controlled and operated by a stepper motor. The ram air flaps are actuated by means of a linear actuator.
The ram air inlet and the ram air outlet flaps modulate the air flow through the exchangers.
To increase cooling, the ram air flaps open more and the temperature control valve closes more. To increase heating, the ram air flaps close more and the temperature control valve opens more. During take-off and landing, the ram air inlet flap fully closes to prevent ingestion of foreign matter.

BY PASS VALVE

In the event of air cycle machine failure, the by-pass valve opens. Cooling is performed by the heat exchangers and pack temperature control is achieved by means of ram air modulation and the TCV regulation.
A split duct extracts water accumulated during bypass valve operation.
Extracted water is then sent to the water extractor and the water injector.



LEGEND: C:COMPRESSOR T:TURBINE ACM:AIR CYCLE MACHINE
COND: CONDENSER RHEAT:REHEATER WI:WATER INJECTOR
WE:WATER EXTRACTOR AIV:ANTI ICE VALVE
TCV:TEMPERATURE CONTROL VALVE SD:SPLIT DUCT

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ANTI ICING VALVE

An anti-icing valve prevents ice formation across the condenser by supplying hot air at the turbine outlet.
The anti-ice valve operates according to delta pressures sensed across the condenser in order to prevent ice build-up at any time.
In case of pack controller failure, the anti-icing valve is used also as a temperature control valve back-up.
Its solenoid is then de-energized and the anti-icing valve pneumatically operates under the control of the Pneumatic Temperature Sensor to maintain a pack discharge temperature of approximately 11°C (52°F).

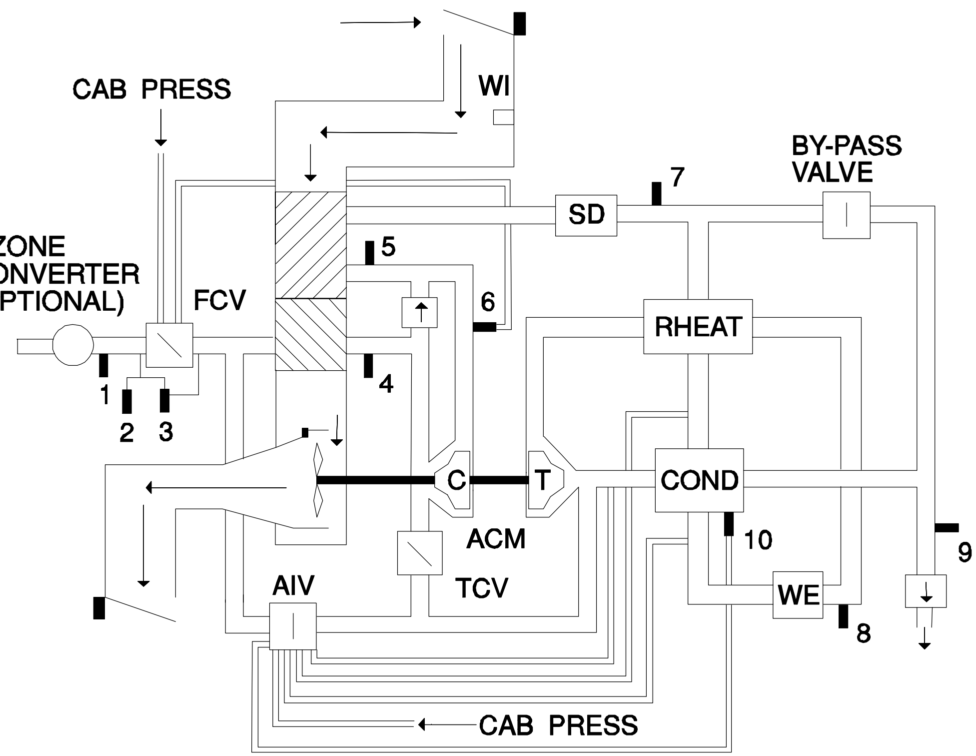
SENSORS

Pack sensors are used for pack temperature control, monitoring and indicating.

DOWNSTREAM CHECK VALVE

A downstream check valve prevents reverse flow back to the pack.

1: BTS: BLEED TEMPERATURE SENSOR
2: PIPS: PACK INLET PRESSURE SENSOR
3: FS: FLOW SENSOR
4: CIS: COMPRESSOR INLET SENSOR
5: CDS: COMPRESSOR DISCHARGE SENSOR
6: CPNOH: COMP PNEU OVERHEAT SENSOR
7: HOS: HEAT EXCHANGER OUTLET SENSOR
8: PTS: PACK TEMPERATURE SENSOR
9: PDS: PACK DISCHARGE SENSOR
10: PNTS: PNEUMATIC TEMPERATURE SENSOR



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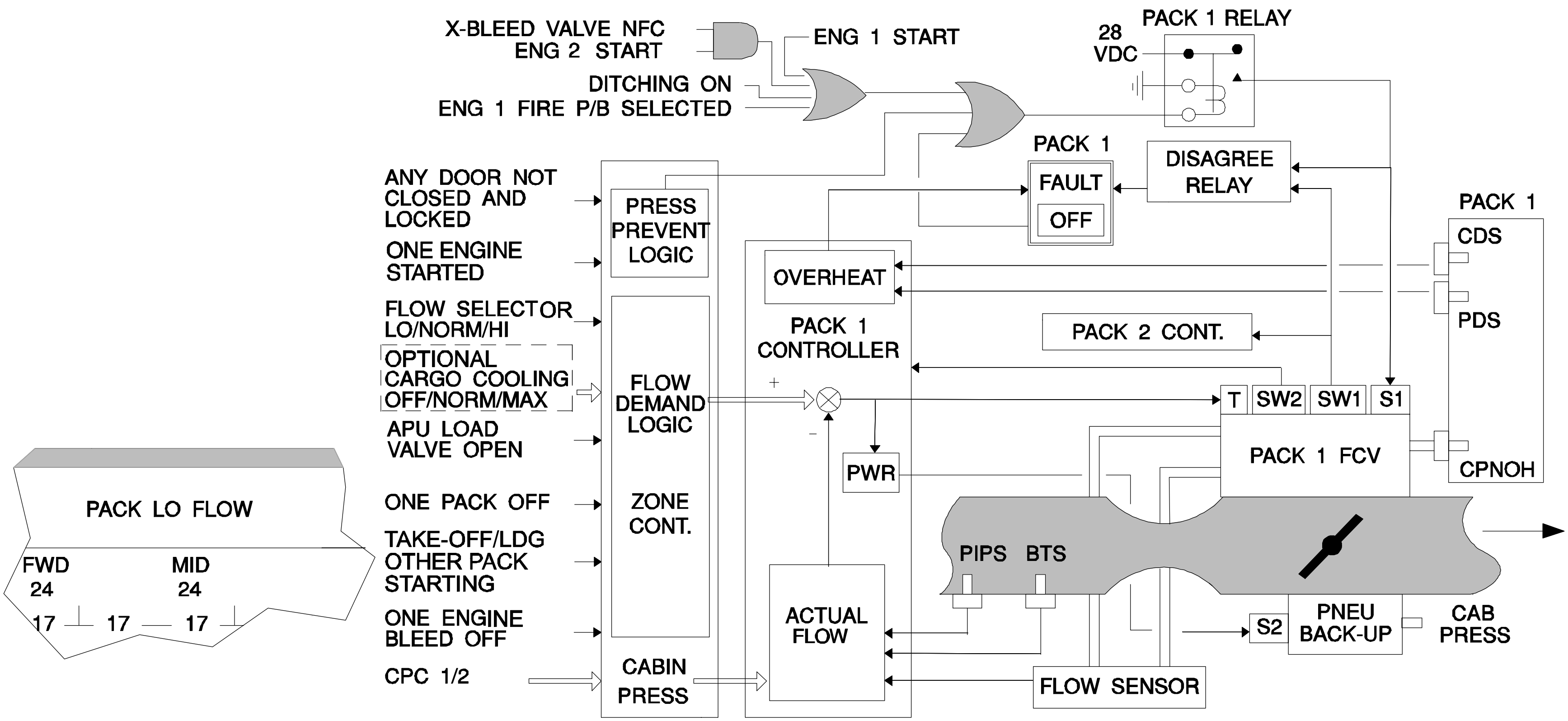
STUDENT NOTES:

FLOW CONTROL D/O

GENERAL

According to specific flow demand inputs, the zone controller processes a flow demand logic and sends it to both pack controllers. Consequently, the pack controller controls its dedicated Flow Control Valve to provide a stable mass flow supply.



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ASSOCIATED COMPONENTS

FLOW CONTROL VALVE

The Flow Control Valve is pneumatically operated and electrically controlled by means of a torque motor. The Flow Control Valve is equipped with two solenoids. One solenoid (S1) is used for the shut-off function:

- S1 energized, FCV closure
- S1 de-energized, flow regulation.

The other solenoid (S2) is used for pneumatic back up flow regulation in case of automatic regulation failure:

- S2 energized, auto flow regulation
- S2 de-energized, pneumatic flow regulation.

BLEED TEMPERATURE SENSOR

The Bleed Temperature Sensor sends bleed temperature signals to the pack controller for pack actual flow calculation.

PACK INLET PRESS SENSOR

The Pack Inlet Pressure Sensor is used for pack actual flow calculation.

FLOW SENSOR

The flow sensor senses differential pressure through the Flow Control Valve for pack actual flow calculation.

COMP. PNEU. OVHT SENSOR

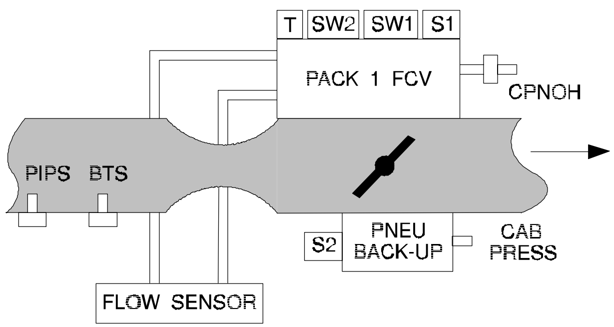
The Compressor Pneumatic Overheat Sensor is used to protect the pack by pneumatically actuating the Flow Control Valve according to the compressor outlet temperature.

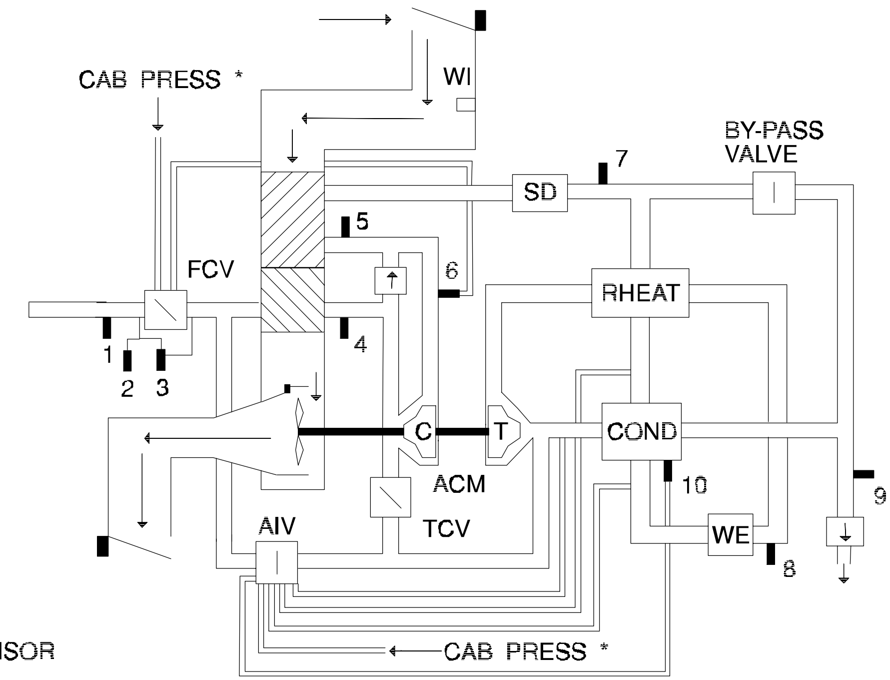
COMP. DISCHARGE SENSOR

The Compressor Discharge Sensor sends the compressor discharge temperature signal to the pack controller for compressor discharge overheat detection and warning activation.

PACK DISCHARGE SENSOR

The Pack Discharge Sensor sends the pack discharge temperature signals to the pack controller for pack discharge overheat detection and warning activation.





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8: PTS: PACK TEMPERATURE SENSOR
9: PDS: PACK DISCHARGE SENSOR
10: PNTS: PNEUMATIC TEMPERATURE SENSOR

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MANUAL FLOW CONTROL

Manual flow control is obtained by using the flow rotary selector on the AIR panel which allows three basic flow settings to be selected. The pack controller compares the flow demand with the actual flow and sends a command signal to the torque motor of the Flow Control Valve.

AUTO FLOW CONTROL

The selected flow setting is automatically modified in case of APU bleed air supply, one pack off, optional forward cargo cooling or one engine bleed off.

APU BLEED AIR SUPPLY

If the APU load valve is open, the flow is automatically set to 125 percent for both packs. This makes sure that the flow control valves are fully open. The flow regulation is in that case performed by the APU according to the APU flow demand sent by the Zone Controller to the ECB. This function has priority over manual flow selection.

ONE PACK OFF

When one pack flow control valve is closed, the remaining one is automatically set to 140 percent to make sure it is fully open. This function has priority over manual flow selection.

OPTIONAL FWD CARGO COOLING

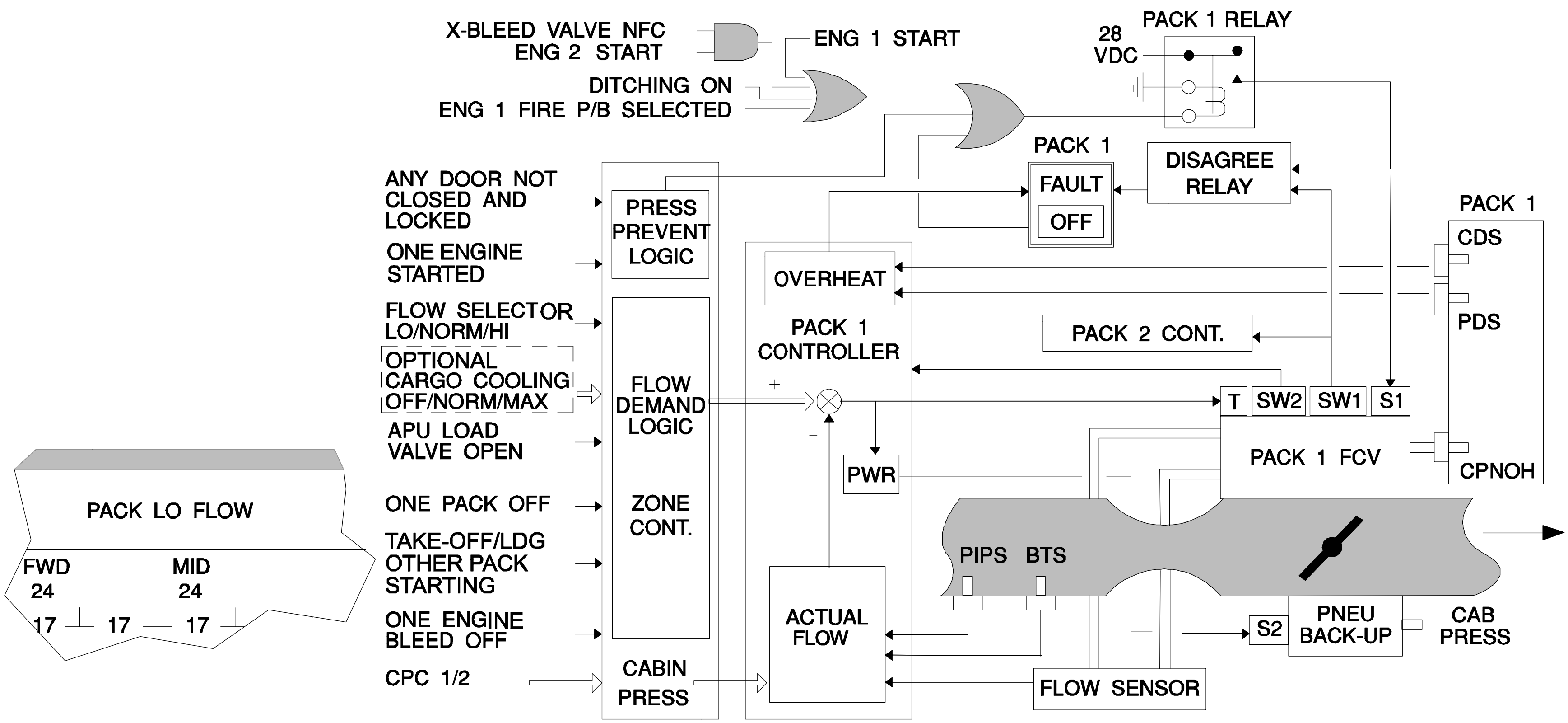
When the optional FWD cargo cooling is set to NORM or MAX, the flow will automatically be increased to compensate the flow delivered to the cargo compartment.

ONE ENGINE BLEED OFF

The maximum flow demand is limited when one engine bleed supply is off and during two pack operation.

TAKE-OFF/LANDING/OTHER PACK STARTING

The flow is automatically set to LO during take-off and landing phases or when starting the other pack.



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FLOW CONTROL VALVE CLOSURE

MANUAL ELECTRICAL CLOSURE

A manual and electrical closure of the Flow Control Valve is obtained by releasing out the associated PACK pushbutton. When the PACK P/B is released out, the solenoid S1 is directly energized by the PACK relay. The Flow Control Valve then closes whether solenoid S2 is energized or not.

AUTO ELECTRICAL CLOSURE

The auto electrical closure of the FCV occurs when its solenoid S1 is automatically energized.
Both FCVs automatically close in case of ditching selection or if any door is detected to be not closed and locked while the aircraft is in flight phase 2.

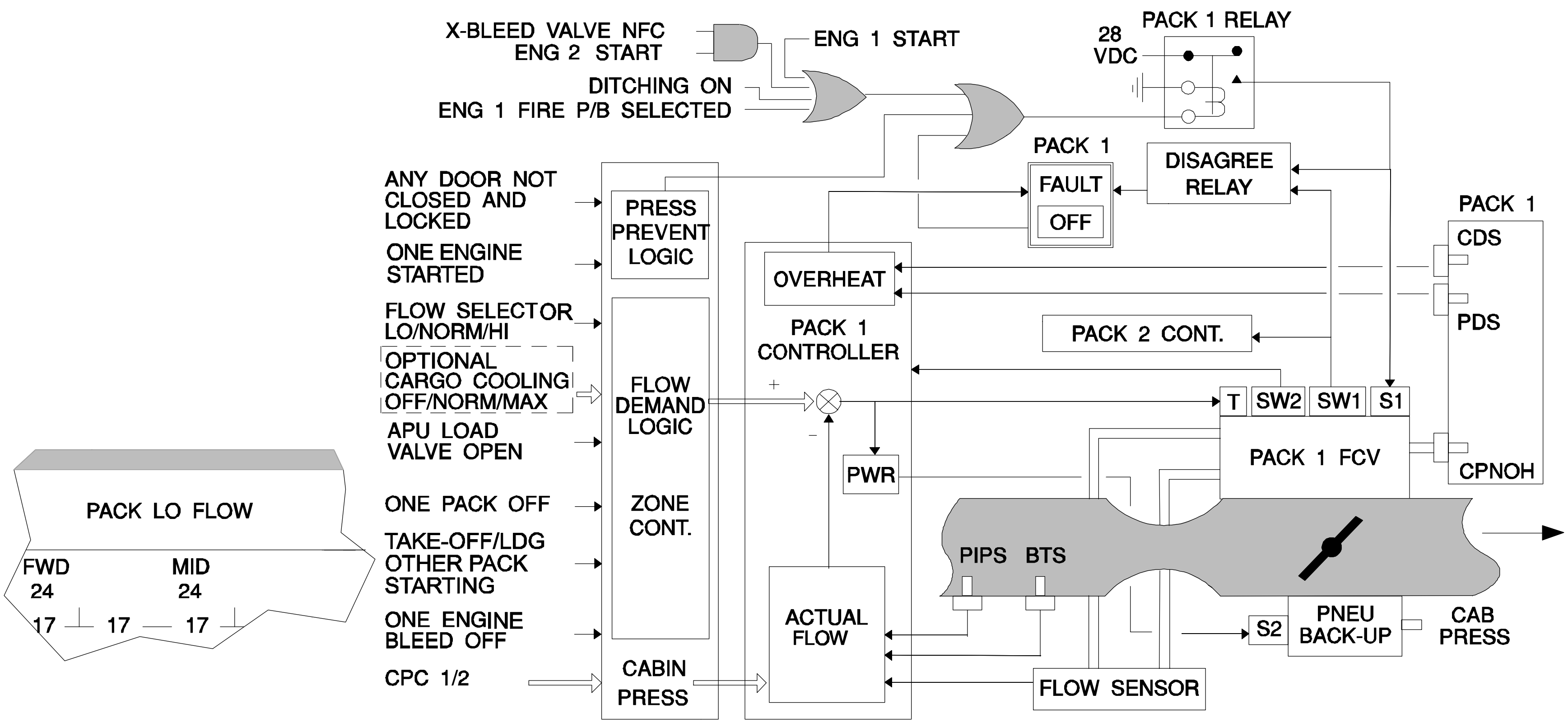
Note: Flight phase 2 is the time between the first engine start and the take-off power setting.

Each FCV also closes when an engine start is initiated (it depends on the engine and the cross-bleed valve status). It re-opens immediately at the end of the start sequence in flight and after a delay following the start sequence on ground.

FCV 1 closes if ENG 1 FIRE P/B is selected whereas
FCV 2 closes if ENG 2 FIRE P/B is selected.

PNEUMATIC CLOSURE

The valve closes in case of pack overheat detection by venting the flow control valve muscle pressure via the compressor pneumatic overheat sensor. The flow control valve starts to close at 235°C (455°F) and is fully closed at 260°C (500°F). The FCV also closes if the inlet pressure is less than 5 psi.



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ABNORMAL OPERATION

LOW FLOW SELECTION

If "LO" flow is selected by the crew and the zone temperature requirements can not be satisfied, an advisory to increase the flow by setting the flow selector to "NORM" or "HI" is transmitted to the SDAC. The advisory is output after a 10 minute delay depending on :

- flow selector position
- satisfied zone temperature demands
- aircraft not on ground.

CABIN PRESS SIGNAL LOSS

In case of loss of cabin pressure signals from cabin pressure controllers, the flow control valve will regulate a flow corresponding to a cabin altitude reference of 7000 feet in flight.

AUTO FLOW CTRL FAILURE

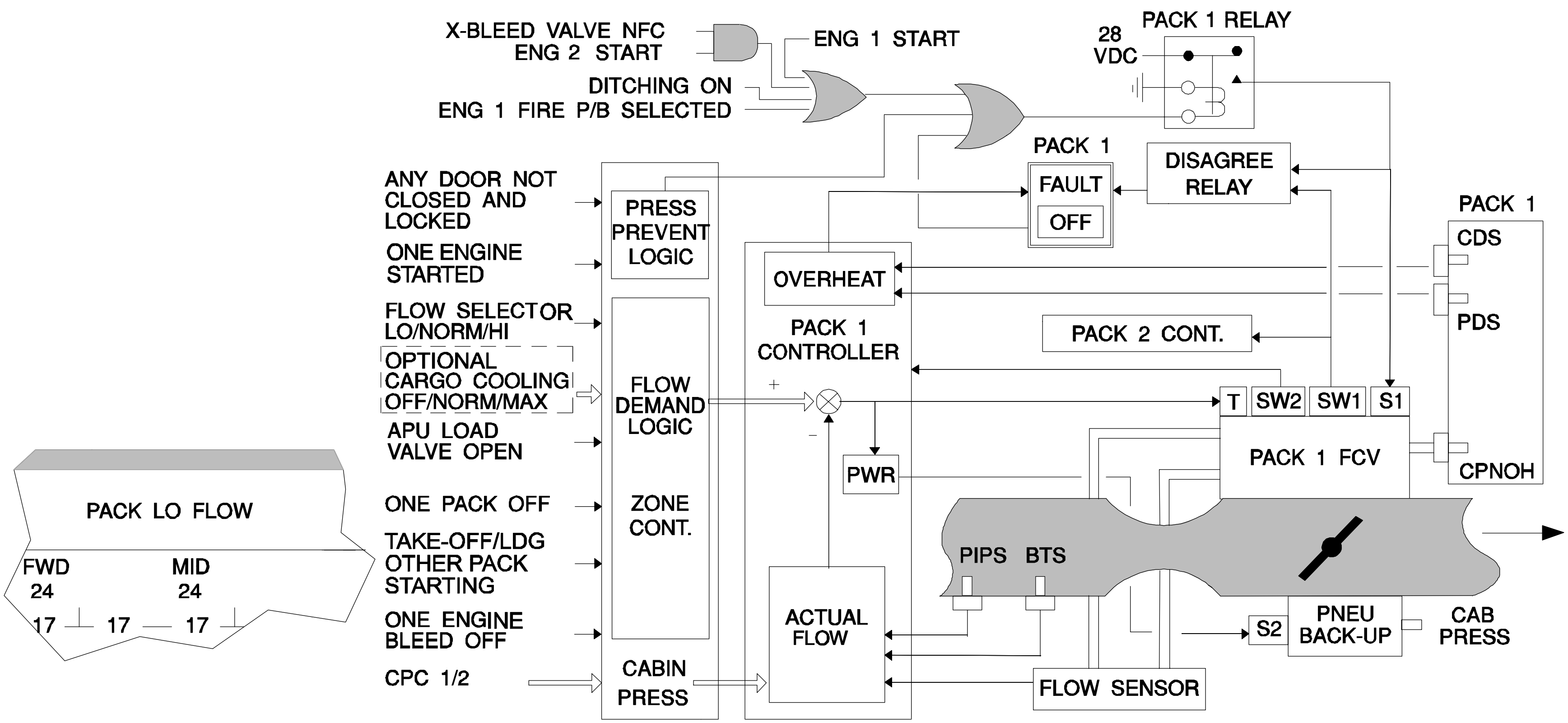
The flow control valve pneumatically regulates a constant flow equivalent to the NORM flow and proportional to the cabin pressure if S2 is de-energized. S2 is de-energized in different cases :

- electrical power failure
- pack controller failure
- flow regulation failure (torque motor, flow sensor, PIPS).

This pneumatic back-up mode is only active if S1 is de-energized as well.

FAULT LIGHT

The fault light comes on in case of pack discharge overheat, compressor discharge overheat or flow control valve position disagreement. There is a pack discharge overheat if the pack discharge temperature is higher than 95°C (203°F). There is a compressor discharge overheat if the compressor discharge temperature is higher than 260°C (500°F). Consequently, the FCV must be manually closed with the P/B.


X-BLEED VALVE NFC
ENG 2 START
ENG 1 START
DITCHING ON
ENG 1 FIRE P/B SELECTED
28 VDC
PACK 1 RELAY
PACK 1
FAULT
OFF
DISAGREE RELAY
ANY DOOR NOT CLOSED AND LOCKED
ONE ENGINE STARTED
FLOW SELECTOR LO/NORM/HI
OPTIONAL CARGO COOLING OFF/NORM/MAX
APU LOAD VALVE OPEN
ONE PACK OFF
TAKE-OFF/LDG OTHER PACK STARTING
ONE ENGINE BLEED OFF
CPC 1/2
PRESS PREVENT LOGIC
FLOW DEMAND LOGIC
ZONE CONT.
CABIN PRESS
OVERHEAT
PACK 1 CONTROLLER
PWR
ACTUAL FLOW
PACK 2 CONT.
PACK 1
CDS
PDS
CPNOH
T
SW2
SW1
S1
PACK 1 FCV
PIPS
BTS
S2
PNEU BACK-UP
CAB PRESS
FLOW SENSOR
PACK LO FLOW
FWD
24
MID
24
17
17
17

STUDENT NOTES:

FQW4200 GE Metric

TEMPERATURE CONTROL: PACK SENSORS D/O

BTS: Bleed Temperature Sensor
PIPS: Pack Inlet Pressure Sensor
FS: Flow Sensor
CIS: Compressor Inlet Sensor
CDS: Compressor Discharge Sensor
CPNOH: Compressor Pneumatic Overheat Sensor
HOS: Heat Exchanger Outlet Sensor
PTS: Pack Temperature Sensor
PDS: Pack Discharge Sensor
PNTS: Pneumatic Temperature Sensor

Each sensor sends its signals to the pack controller except the two pneumatic sensors. All electrical temperature sensors are double element sensing units.

BTS: BLEED TEMPERATURE SENSOR

The Bleed Temperature Sensor is used for the actual flow calculation.

PIPS: PACK INLET PRESSURE SENSOR

The Pack Inlet Pressure Sensor is used for the actual flow calculation.

FS: FLOW SENSOR

The flow sensor provides the differential pressure used for the actual airflow calculation. Note that this calculated flow is used for flow indication on the ECAM BLEED page, and used for flow and pack temperature control.

CIS: COMPRESSOR INLET SENSOR

The Compressor Inlet Sensor is used for Air Cycle Machine operation monitoring when associated to the Compressor Discharge Sensor. If the temperature difference between the compressor outlet and inlet is less than 10°C (50°F) under specific conditions, then the ACM is declared failed (seized). It is also used in back-up for compressor overheat detection in case of CDS failure.

CDS: COMPRESSOR DISCHARGE SENSOR

The Compressor Discharge Sensor is used for Air Cycle Machine operation monitoring when associated to the Compressor Inlet Sensor. If associated to the Heat exchanger Outlet Sensor, it is used for the main heat exchanger operation monitoring. It is also used to detect compressor overheat. Ram Air Doors receive an opening command when T>170°C (338°F). Warnings are triggered in the cockpit when T>260°C (500°F) and reset when T<180°C (156°F).

CPNOH: COMPRESSOR PNEUMATIC OVERHEAT SENSOR

The Compressor Pneumatic Overheat Sensor is used to protect the pack by pneumatically actuating the Flow Control Valve according to the compressor outlet temperature. As the temperature increases above 235°C (446°F), the FCV proportionally closes. At 260°C (500°F) it is fully closed.

1: BTS: BLEED TEMPERATURE SENSOR

2: PIPS: PACK INLET PRESSURE SENSOR

3: FS: FLOW SENSOR

4: CIS: COMPRESSOR INLET SENSOR

5: CDS: COMPRESSOR DISCHARGE SENSOR

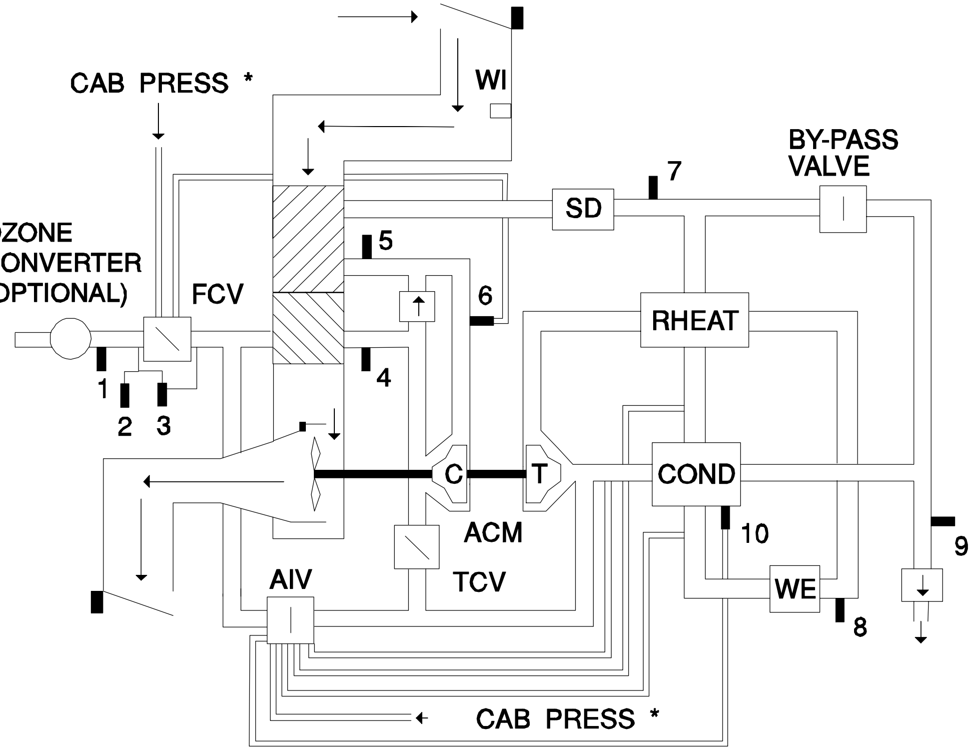
6: CPNOH: COMP PNEU OVERHEAT SENSOR

7: HOS: HEAT EXCHANGER OUTLET SENSOR

8: PTS: PACK TEMPERATURE SENSOR

9: PDS: PACK DISCHARGE SENSOR

10: PNTS: PNEUMATIC TEMPERATURE SENSOR



* : same input for AIV, FCV and TAPRV
AIV: Anti Ice Valve
TAPRV: Trim Air Pressure Regulating Valve
FCV: Flow Control Valve

WI: Water Injector
TCV: Temperature Control Valve
ACM: Air Cycle Machine
WE: Water Extractor

C: Compressor
T: Turbine
SP: Split Duct
COND: Condenser

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HOS: HEAT EXCHANGER OUTLET SENSOR

The Heat exchanger Outlet Sensor is used when associated to the Compressor Discharge Sensor to detect a loss of heat exchanger efficiency. The monitoring is performed by comparison of the CDS and HOS temperatures under specific conditions. The main heat exchanger will be considered contaminated when its efficiency decreases by approximately 15%.

PTS: PACK TEMPERATURE SENSOR

The Pack Temperature Sensor senses the water extractor oulet temperature for pack temperature control.

PDS: PACK DISCHARGE SENSOR

The Pack discharge Sensor is used for pack outlet temperature monitoring on the ECAM BLEED page. The Pack Discharge temperature is used as reference temperature for both pack temperature control in case of PTS failure or for pack 2 temperature control only if the optional FWD cargo cooling system is set to ON (both packs must be running in that case). It is also used to detect pack discharge overheat. Warnings in the cockpit are triggered when T>95°C (203°F) and reset when T<60°C (140°F).

PNTS: PNEUMATIC TEMPERATURE SENSOR

In case of pack controller or Temperature control valve failure, the Pneumatic Temperature Sensor pneumatically controls the anti-ice valve in order to keep the condenser outlet temperature at a fixed value. The Pneumatic Temperature Sensor modulates the condenser outlet temperature around 11°C (52°F).

1: BTS: BLEED TEMPERATURE SENSOR

2: PIPS: PACK INLET PRESSURE SENSOR

3: FS: FLOW SENSOR

4: CIS: COMPRESSOR INLET SENSOR

5: CDS: COMPRESSOR DISCHARGE SENSOR

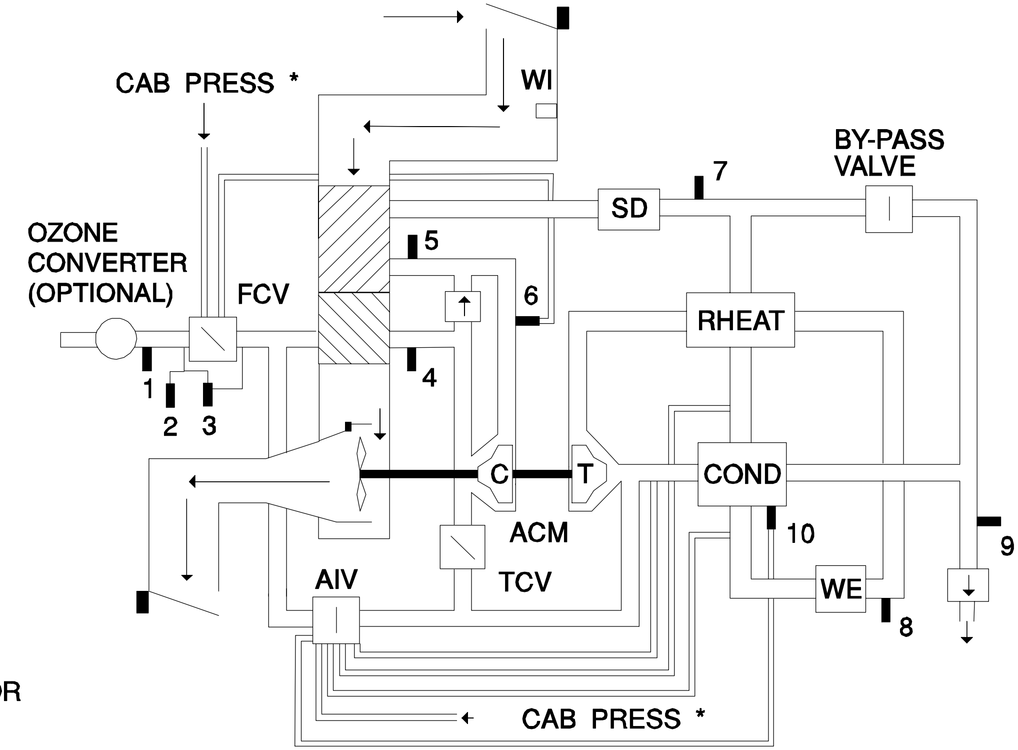
6: CPNOH: COMP PNEU OVERHEAT SENSOR

7: HOS: HEAT EXCHANGER OUTLET SENSOR

8: PTS: PACK TEMPERATURE SENSOR

9: PDS: PACK DISCHARGE SENSOR

10: PNTS: PNEUMATIC TEMPERATURE SENSOR



* : same input for AIV, FCV and TAPRV
AIV: Anti Ice Valve
TAPRV: Trim Air Pressure Regulating Valve
FCV: Flow Control Valve

WI: Water Injector
TCV: Temperature Control Valve
ACM: Air Cycle Machine
WE: Water Extractor

C: Compressor
T: Turbine
SP: Split Duct
COND: Condenser

STUDENT NOTES

TEMPERATURE CONTROL: PACK ABNORMAL OPERATION

Anti-Ice Function
Temperature Control Back-up Function
OVHT Protection
Bypass Mode
Heat Exchanger Contamination

ANTI-ICE FUNCTION

The primary function of the anti-ice valve is to remove ice build-up from components downstream of the turbine outlet.
The anti-ice valve pneumatically controls hot air discharge in the turbine outlet according to delta pressures sensed across the condenser.

TEMPERATURE CONTROL BACK-UP FUNCTION

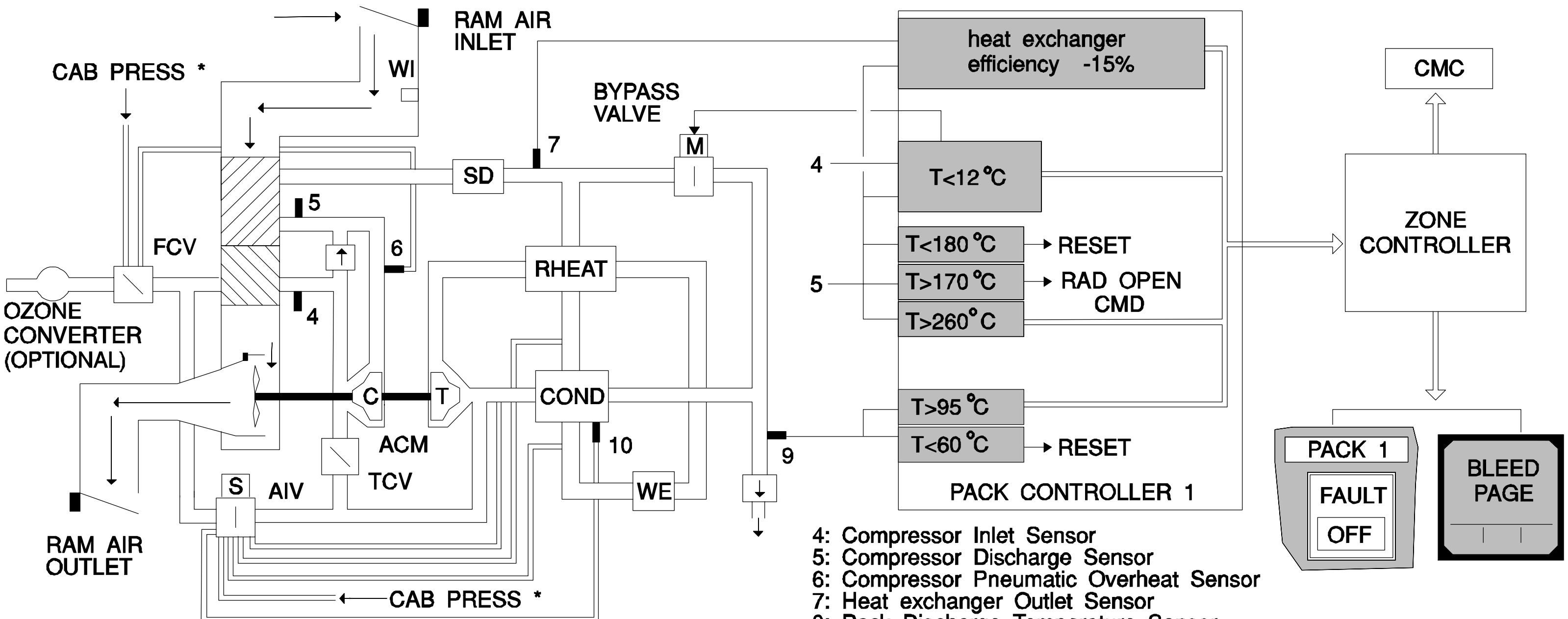
When there is a complete loss of pack controller or temperature control valve control, the anti-ice valve solenoid is de-energized. This permits the Pneumatic Temperature Sensor to pneumatically modulate the anti-ice valve position in order to keep the condenser oulet temperature around 11 degrees centigrade.
The Ram Air Flaps are set to a fixed open position during flight. The normal anti-ice mode remains unaffected by the temperature control back-up mode.

OVHT PROTECTION

Overheat protection is done by monitoring high temperatures at the most critical points of the pack. The first overheat protection is ensured by the Compressor Discharge Sensor. If the compressor outlet temperature is higher than 170°C (338°F), the Pack Controller overrides the normal pack temperature control and compels the Ram Air Flaps to open more in order to increase the ram air flow.
If the overheat condition persists, the Compressor Pneumatic Overheat Sensor protects the pack by pneumatically actuating the Flow Control Valve. The Flow Control Valve starts to close at 235°C (450°F). It is fully closed when the temperature reaches 260°C (500°F).
The Compressor Discharge Sensor and the Pack Discharge Sensor are used through the pack and zone controllers to trigger warnings in the cockpit and send a pack overheat message to the CMC.
This is done if:

- the CDS signals once a temperature higher than 260°C (500°F).
- the PDS signals a temperature higher than 95°C (203°F).

In case of warning, the flight crew is required to close the Flow Control Valve by means of the corresponding PACK pushbutton.
The pack overheat condition is reset if:
the corresponding PACK pushbutton is released out and the compressor discharge temperature is lower than 180°C (356°F) and the pack discharge temperature is lower than 60°C (140°F).



4: Compressor Inlet Sensor
5: Compressor Discharge Sensor
6: Compressor Pneumatic Overheat Sensor
7: Heat exchanger Outlet Sensor
9: Pack Discharge Temperature Sensor
10: Pneumatic Temperature Sensor

*: same input for AIV, TAPRV, and FCV.
AIV: Anti-Ice Valve
TAPRV: Trim Air Pressure Regulating Valve
FCV: Flow Control Valve

WI: Water Injector
TCV: Temperature Control Valve
ACM: Air Cycle Machine
WE: Water Extractor

C: Compressor
T: Turbine
SD: Split Duct
COND: Condenser

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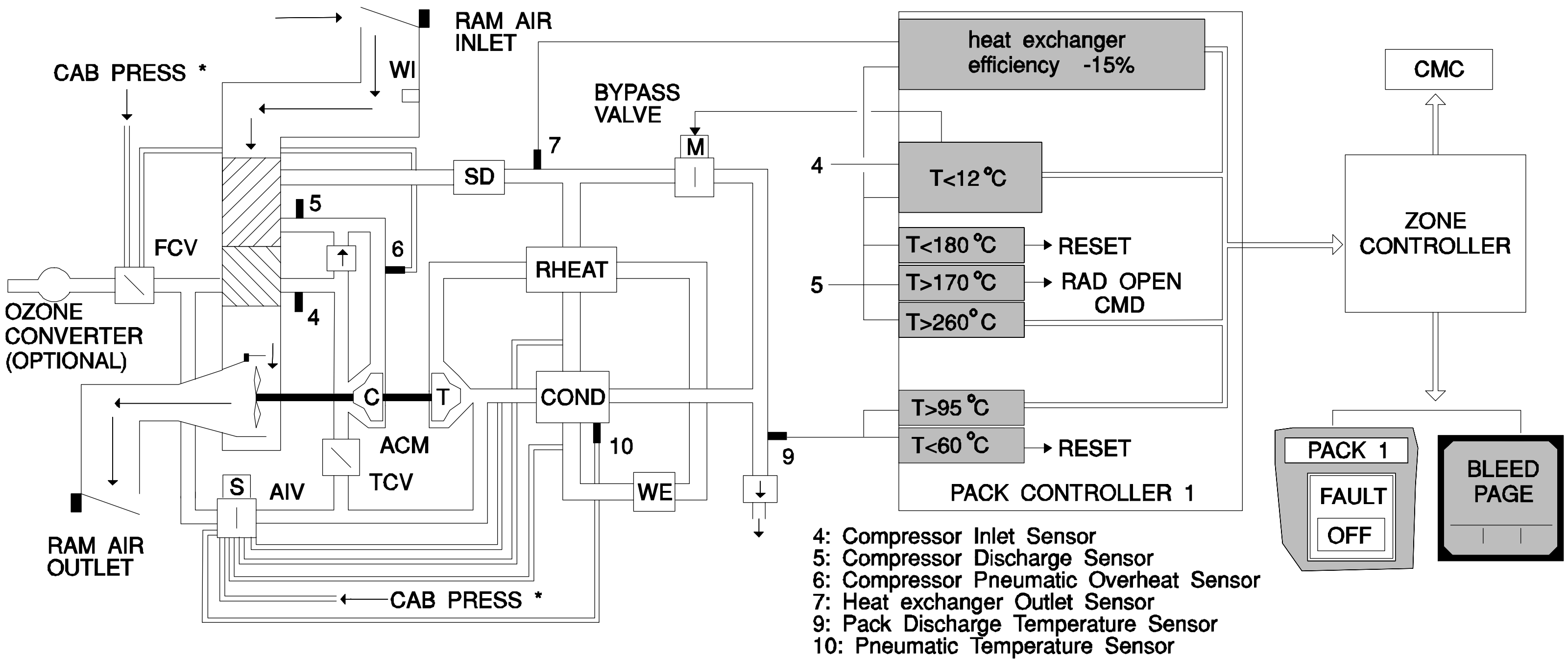
BYPASS MODE

The bypass valve opens under control of the pack controller if the air cycle machine is detected seized. Seizure is declared effective if the differential temperature between the compressor discharge and compressor inlet is less than 12 degrees centigrade under specific conditions.
During this bypass mode, the cooling is only performed by the heat exchangers and the PDS signals are used for the pack temperature control loop instead of the PTS signals.
Otherwise, temperature control through modulation of the Ram air doors and the TCV remains unaffected by this condition. In that case, the pack temperature demand limitation is fixed at -10 degrees centigrade regardless of number of packs.

HEAT EXCHANGER CONTAMINATION

The Heat exchanger Outlet Sensor is used in conjunction with the Compressor Discharge Sensor to monitor any loss of efficiency of the heat exchangers. The main heat exchanger will be considered contaminated when the heat exchangers efficiency decreases by approximately 15% under specific conditions. In that case, normal pack operation is maintained but a heat exchanger clogged message is sent to the CMC.



*: same input for AIV, TAPRV, and FCV.
AIV: Anti-Ice Valve
TAPRV: Trim Air Pressure Regulating Valve
FCV: Flow Control Valve

WI: Water Injector
TCV: Temperature Control Valve
ACM: Air Cycle Machine
WE: Water Extractor

C: Compressor
T: Turbine
SD: Split Duct
COND: Condenser

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STUDENT NOTES:

TEMPERATURE CONTROL: AIR DISTRIBUTION

GENERAL

The air distribution system supplies temperature controlled and conditioned air to the cabin and the cockpit.

RECIRCULATION SYSTEM

Used cabin air which has entered the underfloor area is drawn by recirculation fans to the mixer unit.

AIR CONDITIONING PACKS

The fresh air that enters the mixer unit in normal operation comes from the air conditioning packs.

EMERGENCY RAM AIR INLET

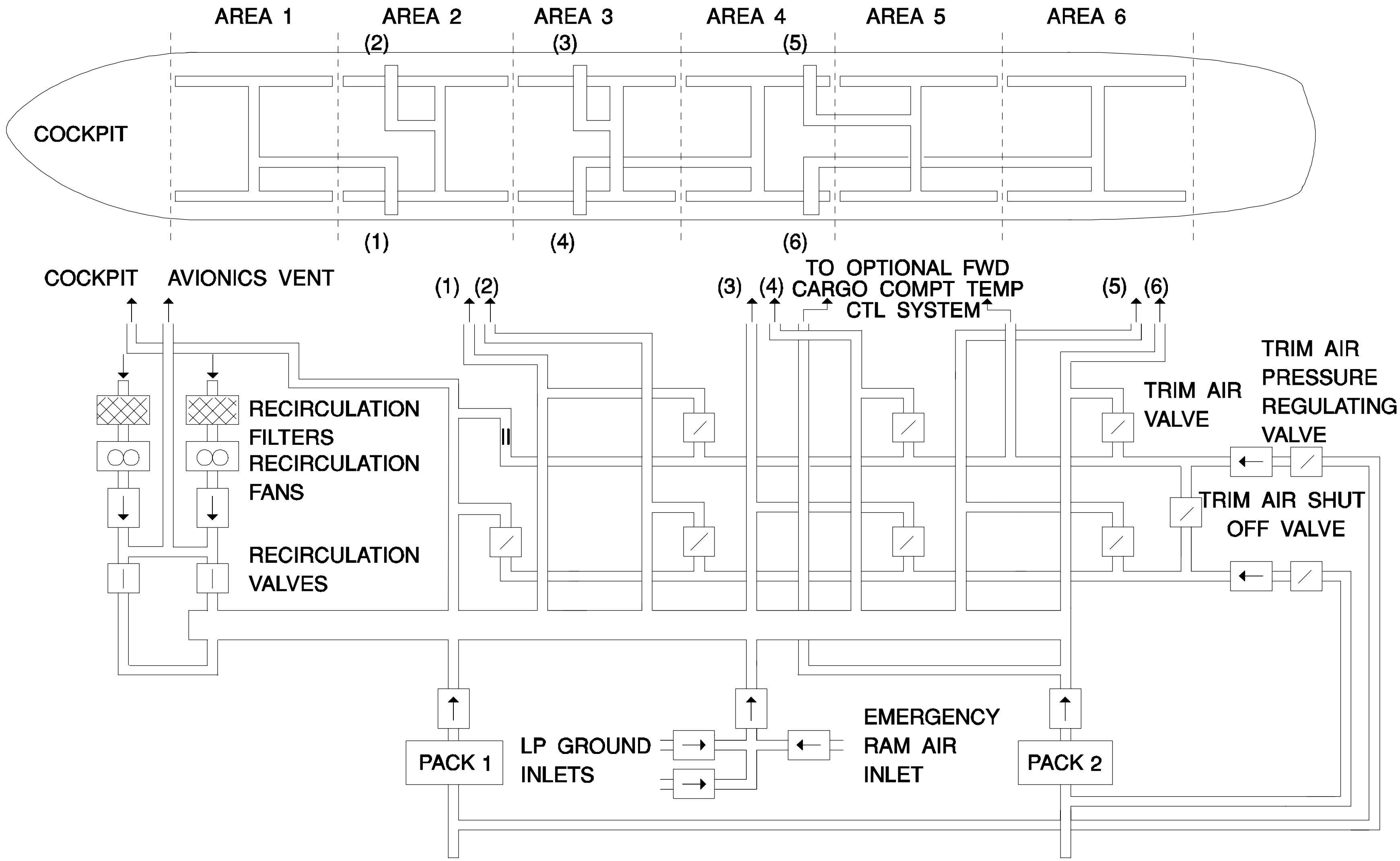
In flight, if both air conditioning packs are not serviceable, outside ambient air enters the mixer unit through the emergency ram air inlet.

LP GROUND CONNECTORS

When the aircraft is on ground, a ground air cart can be connected to the low pressure ground connectors. This can supply air to the distribution network without operation of the packs.

CABIN

The cabin is divided into 6 areas. Each one corresponds to a distribution duct coming from the mixer unit. In each zone, distribution is equally split between left hand and right hand sides.



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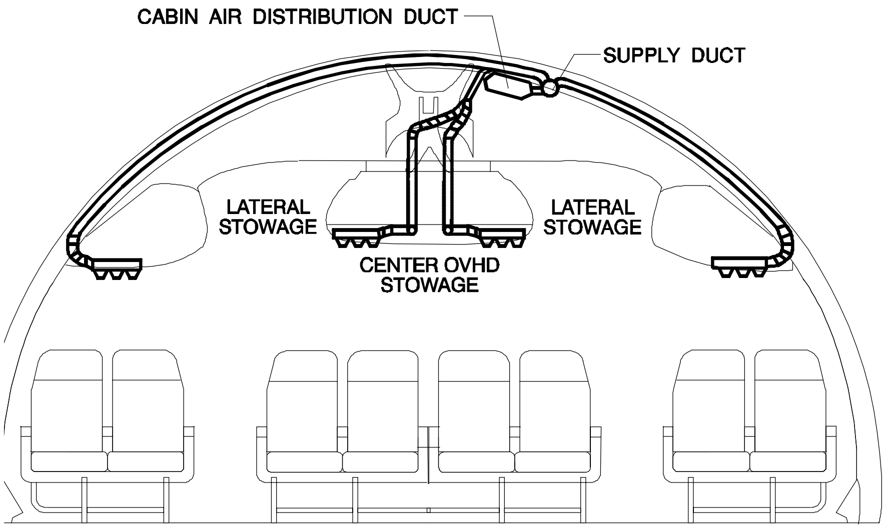
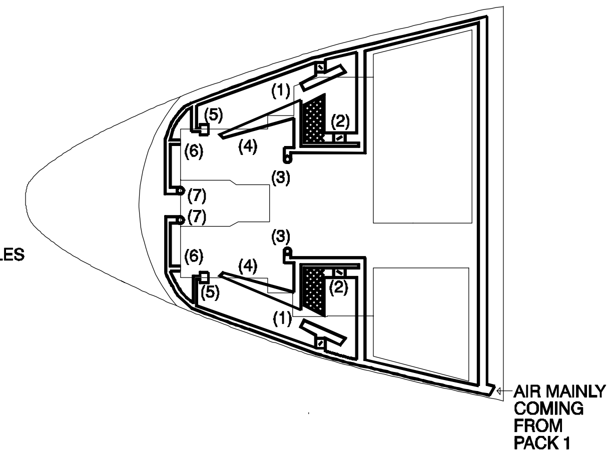
INDIVIDUAL AIR DISTRIBUTION

The system supplies temperature controlled and conditioned air from the cabin distribution ducts to each passenger through individual air outlets.
The distribution ducts are installed in the ceiling area of the cabin. The air then flows to supply ducts in the lateral and center overhead stowages and out of the individual air outlets.
The individual air outlets are installed in the Passenger Service Unit.
Flexible hoses connect the supply ducts to individual air outlets. Each individual air outlet is equipped with a ball mechanism which permits the airflow to be adjusted.
The same type of air outlet is also installed in the lavatories.

COCKPIT

Cockpit air supply mainly comes from pack 1 even if air goes through the mixer unit. It minimizes the possibility of smoke and odours entering the cockpit from other compartments.
Cooling and heating are provided by blowing temperature controlled air through several air outlets.





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STUDENT NOTES

TEMPERATURE CONTROL: TEMPERATURE REGULATION D/O

Principle
Flexible Zone Layout
Target Temperature
Duct Temperature Demand
Pack Temperature Demand
Pack Temperature Regulation
FWD Cargo Cooling Effects
Zone Temperature Regulation
Interfaces

PRINCIPLE

The Zone Controller determines a pack temperature demand, which corresponds to the lowest temperature demand of the four zones. This signal is sent to both pack controllers for basic air temperature regulation. Then final temperature adjustment is performed by trim air valves of zones for which the temperature demand is above the lowest value.

FLEXIBLE ZONE LAYOUT

Depending on the cabin configuration information sent by the Cabin Intercommunication Data System, the Zone Controller defines how the 6 cabin ducts are to be used and grouped in 3 zones. 25 different zone configurations are possible to improve passenger cabin flexibility.

TARGET TEMPERATURE

The target temperature is the selected temperature including an altitude correction and zone corrections for cabin zones only.
The altitude correction is an offset based on aircraft altitude to compensate for reduced humidity and surface temperature. It reaches 1.5 degrees celcius at an altitude of 40,000 feet, but it may be reduced to 0.75 degrees or 0 using the MCDU specific data menu.
The zone corrections are offsets selected by the flight attendants on the Programming and Indication Module which cannot exceed plus or minus 2.5 degrees celcius.

DUCT TEMPERATURE DEMAND

A duct temperature demand is calculated for each of the four zones. The duct temperature demand is the difference between the target temperature and the actual zone temperature.

PACK TEMPERATURE DEMAND

It corresponds to the lowest duct temperature demand of the four zones. Mixer unit sensor and cockpit upstream trim temperature sensor take into account temperature increase due to recirculated air.

PACK TEMPERATURE REGULATION

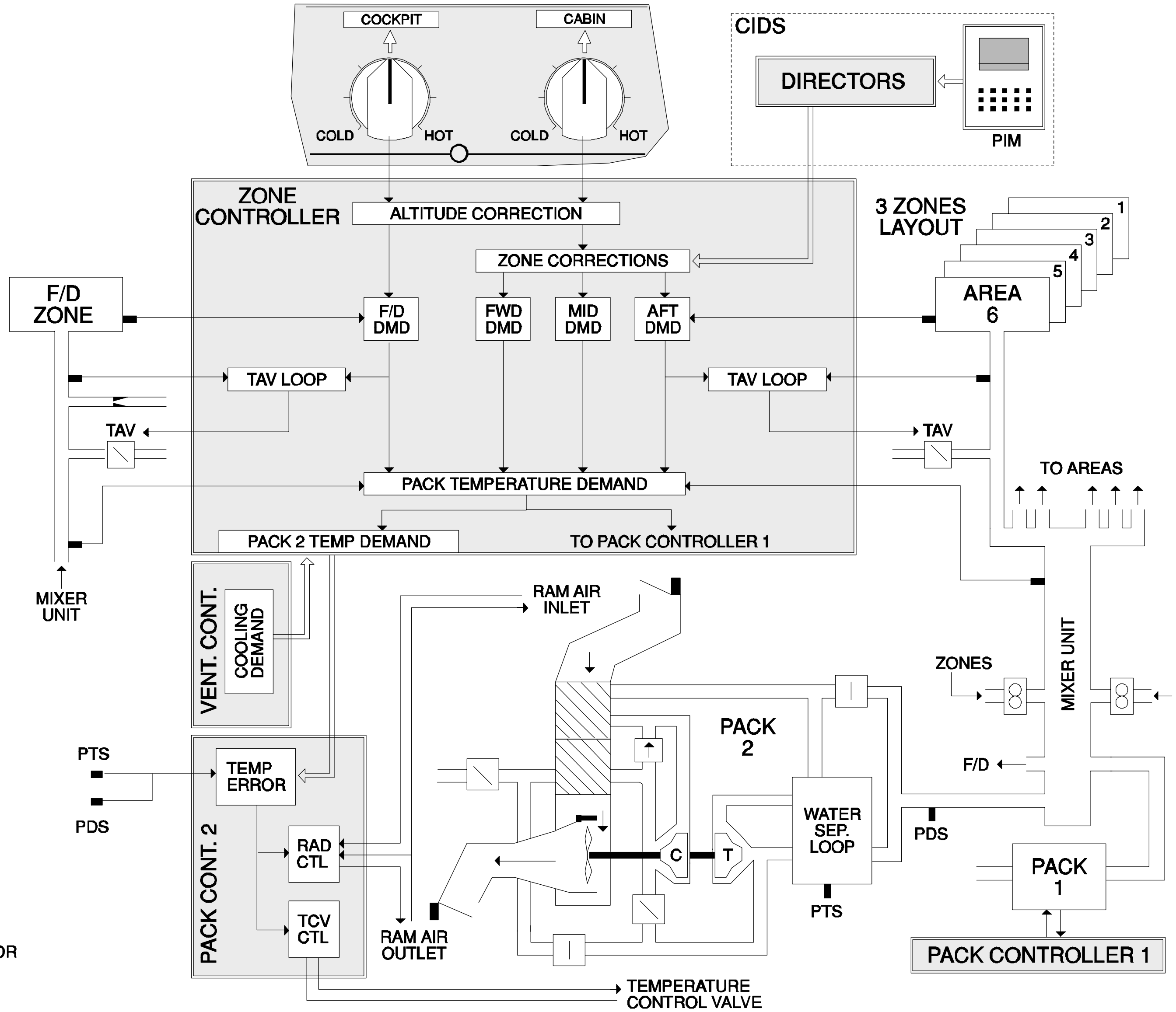
The off-set between the pack temperature demand and the actual pack temperature sensed by the Pack Temperature Sensor is used to control the Temperature Control Valve and the ram air doors. The Temperature Control Valve regulation enables short term regulation. For long term regulation, the ram air doors slowly take over from the Temperature Control Valve by modulating the ram air flow and enable the Temperature Control Valve to go back to its 25 degrees reference position to comply with flow requirements. Both packs regulate air at the same temperature level.

FWD CARGO COOLING EFFECTS

The installation of the optional forward cargo temperature control system will directly affect pack 2 temperature control. The cooling demand from the Ventilation Controller is compared to the pack temperature demand.
The lowest value is used as a revised pack temperature demand for pack 2. Thus both packs will not necessary regulate air at the same temperature level. Additionally, pack 2 will use the Pack Discharge Sensor instead of the Pack Temperature Sensor for its temperature control.

ZONE TEMPERATURE REGULATION

Each zone temperature regulation is performed by adding hot air to the air regulated in temperature by the packs. The signal used to drive the Trim Air Valves is the result of the comparison of the duct temperature demand with the actual duct temperature. The zone with the lowest temperature demand is already regulated in temperature and has no need to drive its dedicated Trim Air Valve(s) to open.



RAD = RAM AIR DOORS
TAV = TRIM AIR VALVE
PTS = PACK TEMP SENSOR
TCV = TEMP CONTROL VALVE
PDS = PACK DISCHARGE SENSOR

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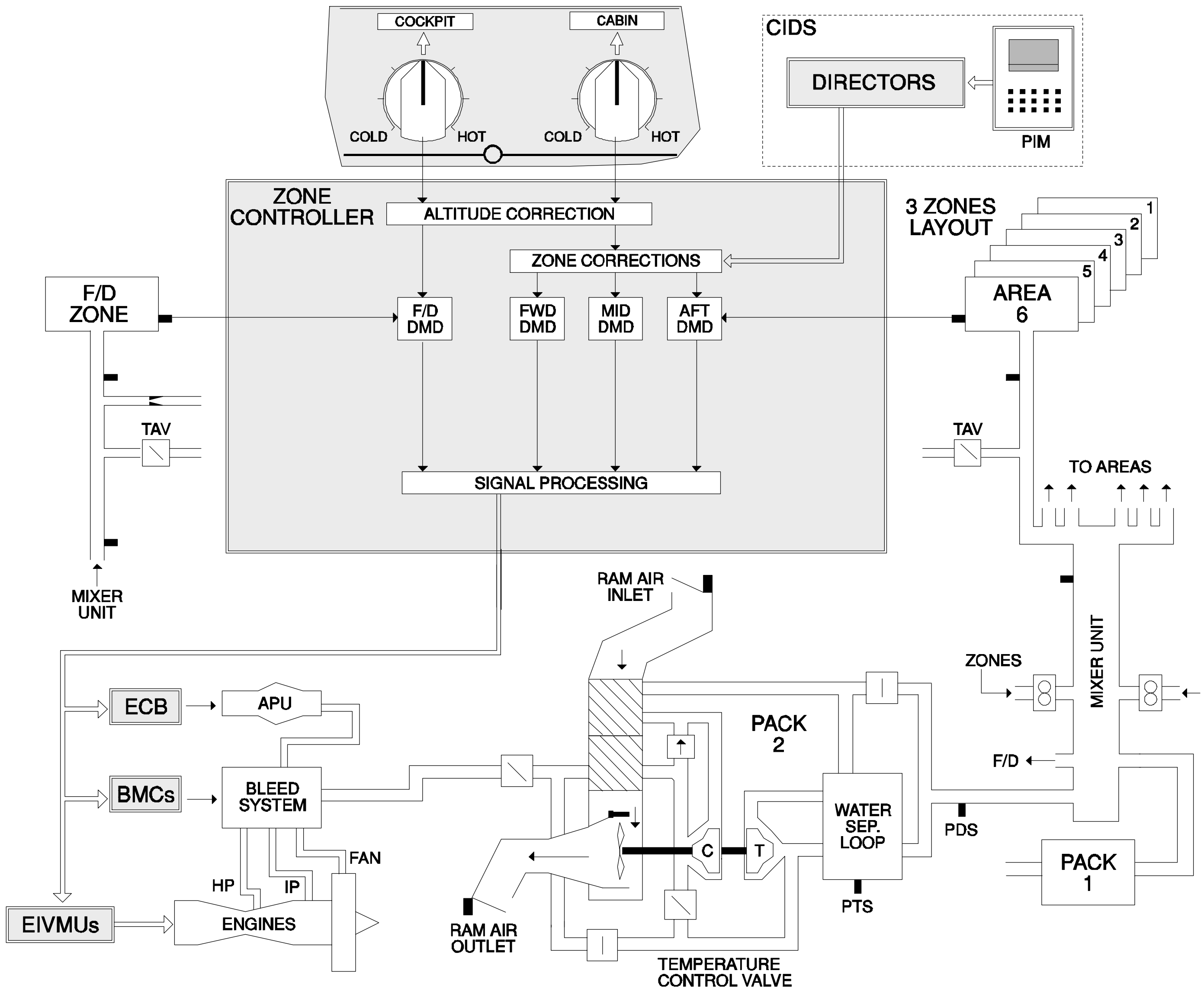
INTERFACES

The Zone Controller uses the duct temperature demands as reference signals in order to increase the APU flow demand or engine speed when temperature requirements cannot be satisfied due to insufficient flow in the packs. If temperature requirements cannot be satisfied due to very hot conditions, the zone controller asks the Bleed Monitoring Computers to decrease the bleed air temperature from 200 to 150 degrees celcius.



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STUDENT NOTES:

TEMPERATURE CONTROL:
ZONE TEMPERATURE CONTROL ABNORMAL OPERATION

Trim Air Supply Failure
Duct Overheat
Overpressure
Zone Controller Failure

TRIM AIR SUPPLY FAILURE

The Trim Air Shut Off Valve automatically opens when a Trim Air Pressure Regulating Valve has failed closed.
The Trim Air Shut Off Valve also automatically opens when a Trim Air Pressure Regulating Valve is spring loaded closed due to a pack deactivation.

The Trim Air Shut Off Valve is maintained closed if the Trim Air Pressure Regulating Valve is deactivated from the hot air pushbutton.
In case of deactivation or failure in closed position of both Trim Air Pressure Regulating Valves, the Trim Air Valves are commanded to close. The cabin temperature regulation is done by the packs.

DUCT OVERHEAT

A duct overheat condition exists when the trim air regulation mixes too much hot air in any distribution duct.
When any duct temperature reaches 88°C (190°F), a signal is sent to the ECAM and the FAULT light comes on, on the corresponding HOT AIR pushbutton.
The Zone Controller automatically sends a closure signal to the corresponding Trim Air Pressure Regulating Valve and to all its relative Trim Air Valves.
Note that the Trim Air Shut Off Valve also closes if it was already open.
The FAULT light goes off only when the duct temperature is lower than 70 degrees centigrade and the HOT AIR pushbutton is set to off.
The overheat condition is no longer valid below 70°C (158°F).
After these actions, the reset function may be performed by setting the HOT AIR pushbutton back to ON.

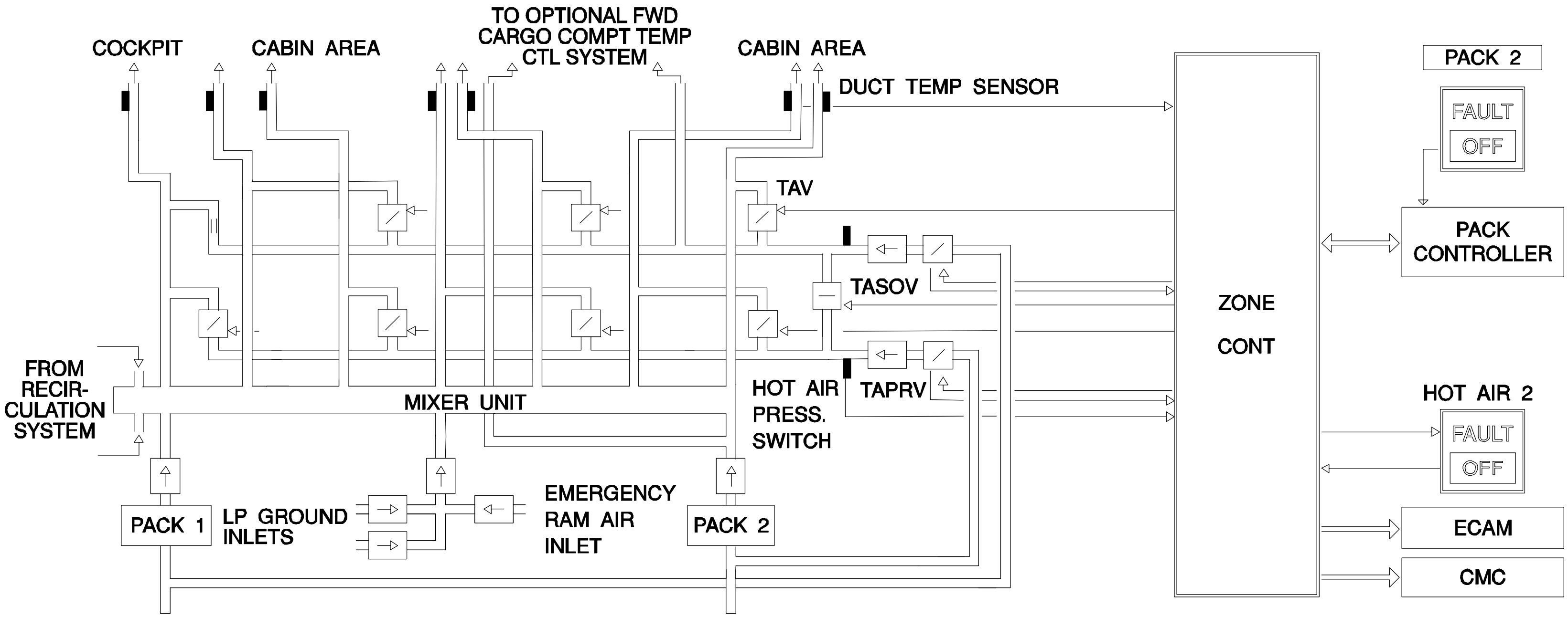
OVERPRESSURE

Each Trim Air Pressure Regulating Valve pneumatically operates to keep the downstream pressure at 4 psi above the cabin pressure.
When the pressure is detected at 6.5 psi above the cabin pressure by the associated Hot Air Pressure Switch, a signal is sent to the Zone Controller, then to the CMC as a failure message. There is no consequence on the system.

ZONE CONTROLLER FAILURE

The loss of power supply for the Zone Controller will lead to close the Trim Air Pressure Regulating Valves. The Trim Air Valves and the Trim Air Shut Off Valve remain in the last position. Fine adjustment temperature control is no longer possible.
Since there are no demands available for the Pack Controllers, the packs are controlled to default value demands. These are 100% for pack flow demand and 20°C (68°F) for pack temperature demand.
Data from the Zone Controller and Pack Controller transmitted via ARINC bus to cockpit systems and CMC is completely lost. This leads to the loss of the indications on the ECAM except for the flow control valves and emergency ram air inlet positions which are directly wired to the SDAC.
The following pack warnings are still available, since they are also directly wired to the SDAC:

- pack overheat
- pack regulation fault
- pack fault.



TAV: TRIM AIR VALVE

TAPRV: TRIM AIR PRESSURE REGULATING VALVE

TASOV: TRIM AIR SHUT OFF VALVE

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STUDENT NOTES

TEMPERATURE CONTROL : EMERGENCY RAM AIR INLET SYSTEM D/O

General
Operation

GENERAL

The aircraft is equipped with one emergency ram air inlet flap located at the lower left-hand side of the fuselage, sharing the same duct with the low pressure ground connections.

OPERATION

The emergency ram air inlet flap can be opened for aircraft ventilation in case of complete loss of the operation of the two packs or smoke removal.

The RAM AIR pushbutton must be set to ON to open the emergency ram air flap.

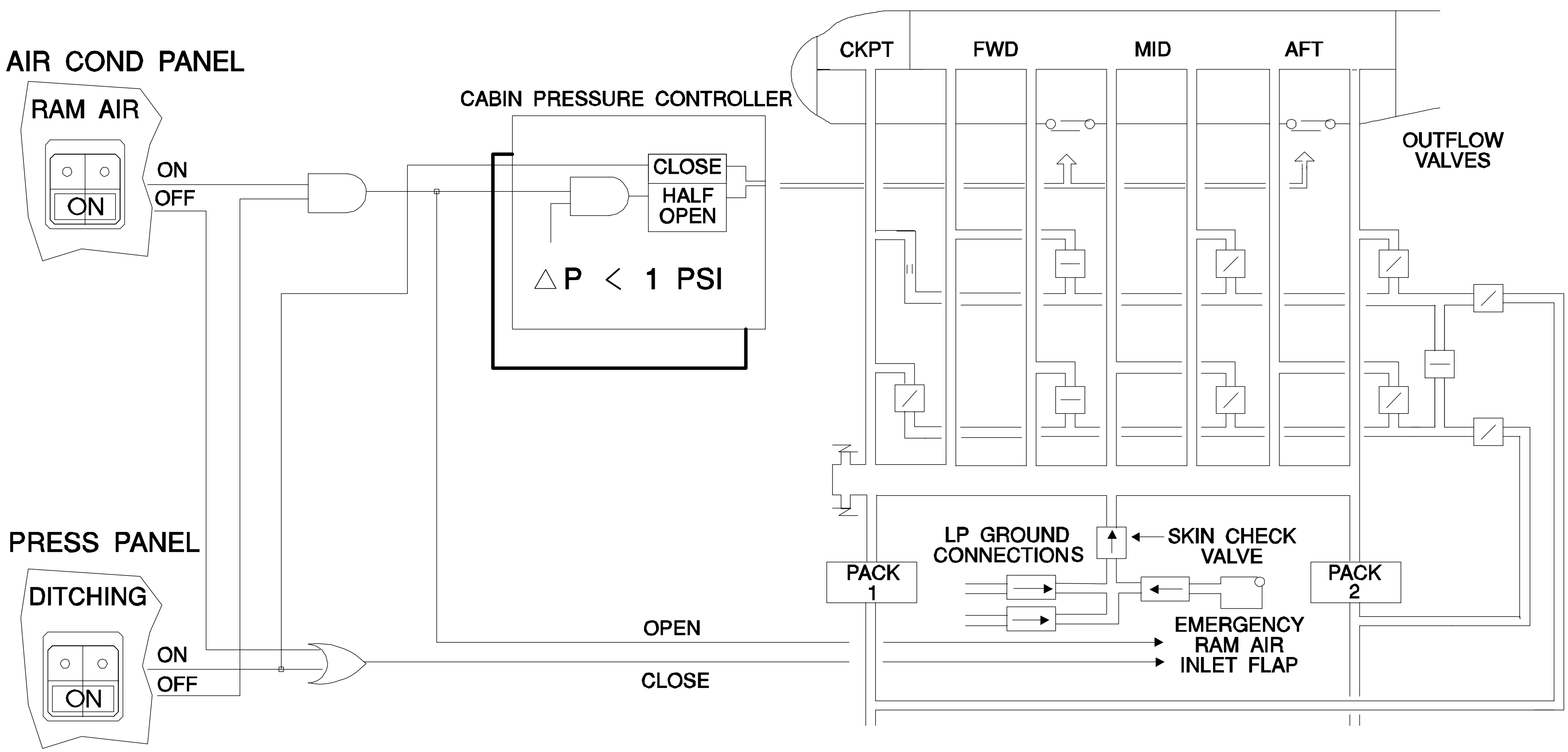
The EMERGENCY RAM AIR INLET FLAP opens when the RAM AIR pushbutton is set to ON and if DITCHING is not selected.

NOTE :

The flight crew procedure requests an aircraft descent to less than 10000 ft or MEA (Minimum En route Altitude).
However automatic regulation of both outflow valves remains.

The active cabin pressure controller half opens the outflow valves when the differential pressure is less than 1 psi.

The air then goes through the skin check valve to the mixer unit, when the downstream pressure of the skin check valve reaches 0,058 psi.



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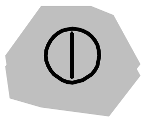
STUDENT NOTES:

TEMPERATURE CONTROL : ECAM PAGE PRESENTATION

Pack Flow Control Valve
Pack Inlet Flow
Compressor Outlet Temperature
Temperature Control Valve
Pack Discharge Temperature
By-pass Valve
Emergency Ram Air
Bleed Users
Hot Air 1 (2)
Trim Air Pressure Regulating Valve
Trim Air Shut Off Valve
Trim Air Valves
Zone Duct Temperature
Zone Temperature
Zone Controller Status
Air Ducts

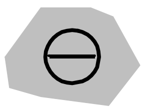
PACK FLOW CONTROL VALVE

The flow control valves indications are normally green.



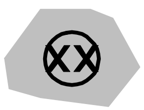
GREEN

: Valve not fully closed.



AMBER

: Valve fully closed.

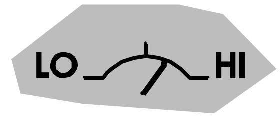


AMBER CROSSES

: Valve position data not available.

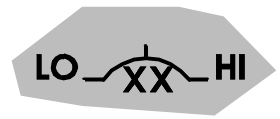
PACK INLET FLOW

The position of the needle represents the actual rate of pack flow.



GREEN NEEDLE

: LO = 70% of airflow.
: HI =130% of airflow.
The needle can vary from
62% to 137% of airflow.

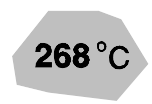


AMBER CROSSES

: The pack airflow data is not available.

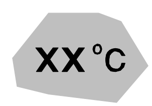
COMPRESSOR OUTLET TEMPERATURE

The compressor outlet temperature indications are normally green. The value varies by steps of 2°C (4°F).



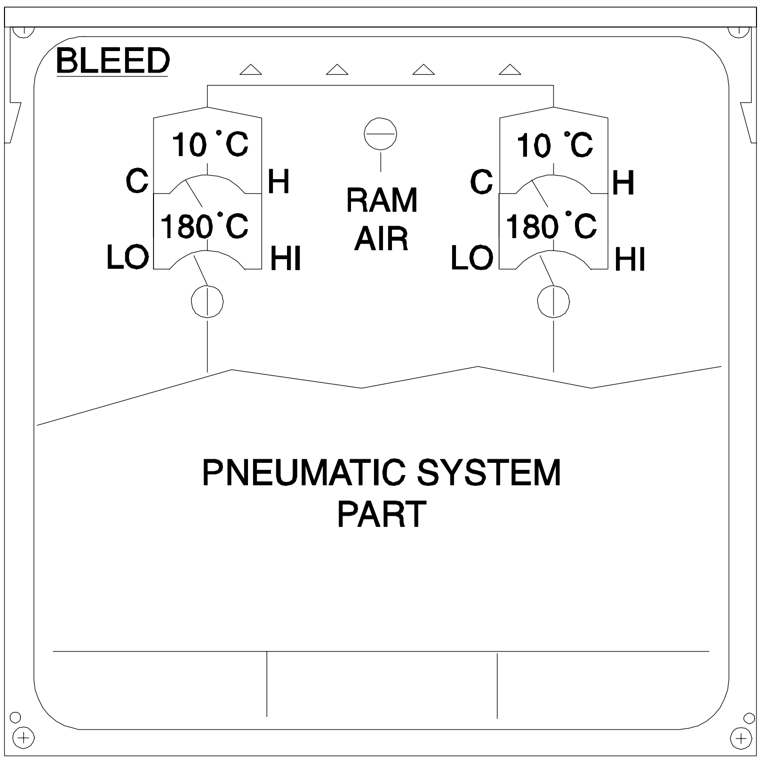
AMBER

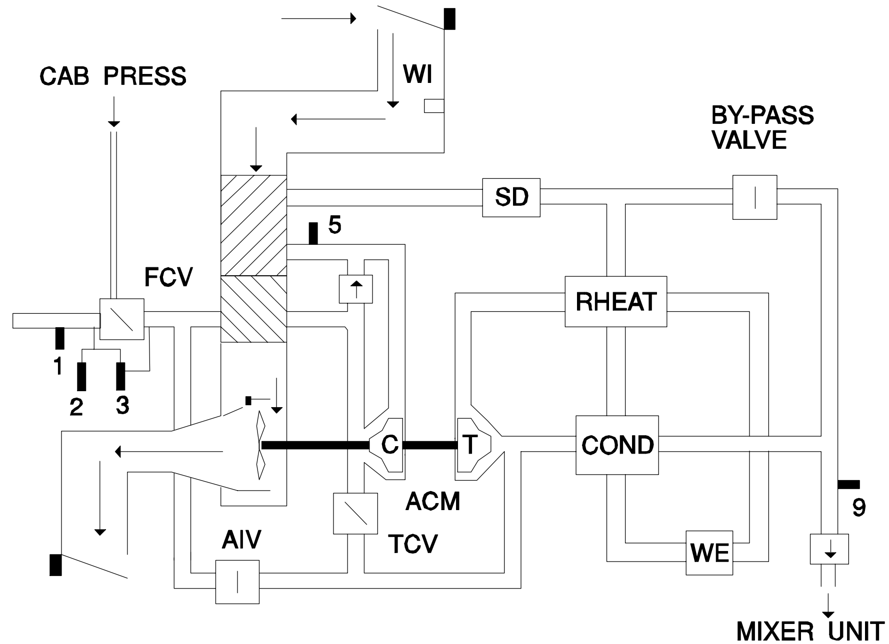
: The temperature indication exceeds 260°C (500°F). It becomes green again when the temperature drops below 180°C (356°F).



AMBER

: The temperature data is not available.





1: BTS : BLEED TEMP SENSOR
2: PIPS : PACK INLET PRESS SENSOR
3: FS : FLOW SENSOR
5: CDS : COMP DISCHARGE SENSOR
9: PDS : PACK DISCHARCHE SENSOR

FCV : FLOW CONTROL VALVE
AIV : ANTI ICE VALVE
TCV : TEMPERATURE CONTROL VALVE
ACM : AIR CYCLE MACHINE
COND : CONDENSER

T : TURBINE
C : COMPRESSOR
RHEAT : REHEATER
SD : SPLIT DUCT
WE : WATER EXTRACTOR
WI : WATER INJECTOR

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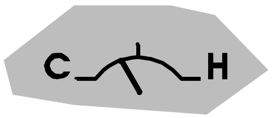
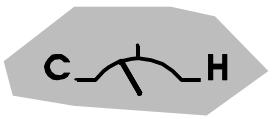
TEMPERATURE CONTROL VALVE

The needle position represents the position of the temperature control valve.



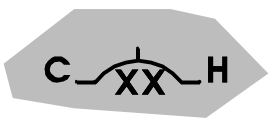
GREEN NEEDLE

: C (Cold) corresponds to a fully closed position.
: H (Hot) corresponds to a fully opened position.



AMBER NEEDLE

: The TCV is determined faulty.

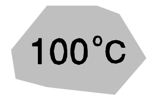


AMBER CROSSES

: The TCV position data is not available.

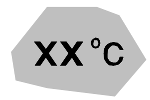
PACK DISCHARGE TEMPERATURE

The value represents the pack outlet temperature controlled by the pack controller. It is normally displayed in green. The value varies by steps of 2°C (4°F).



AMBER

: The temperature indication exceeds 95°C (203°F). It becomes green again when the temperature drops below 60°C (140°F).



AMBER

: The temperature data is not available.

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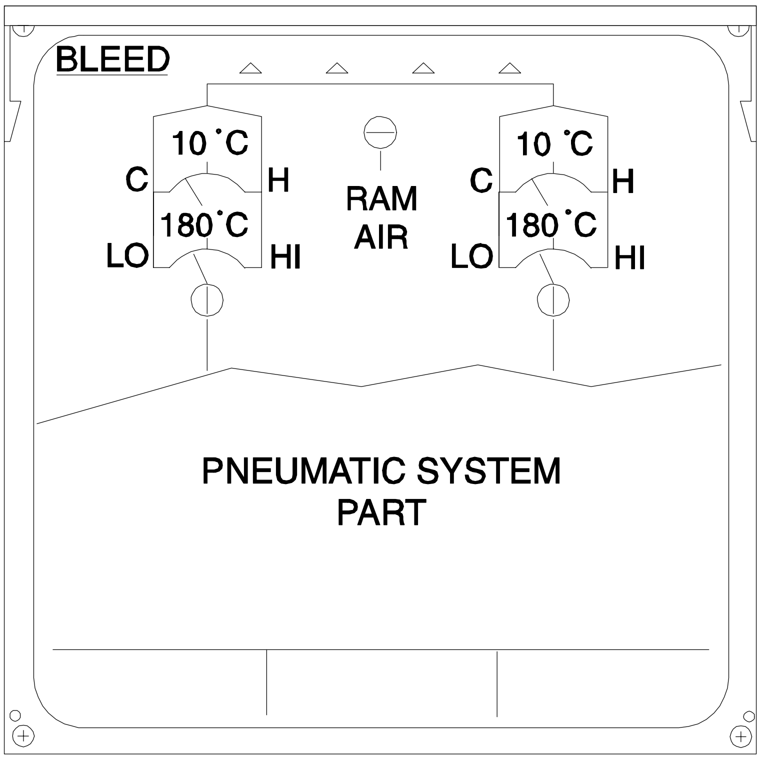

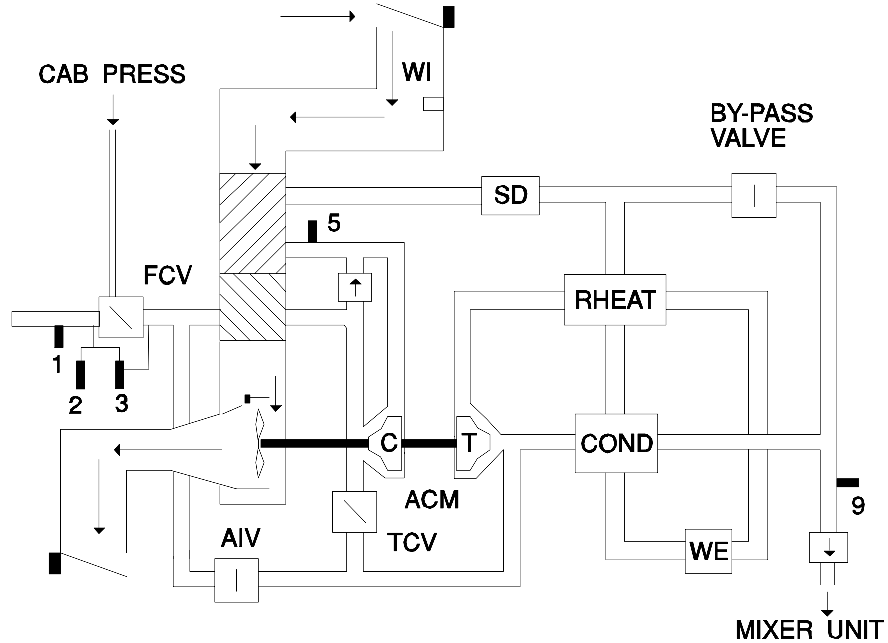

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WE : WATER EXTRACTOR
WI : WATER INJECTOR

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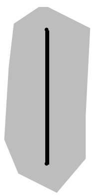
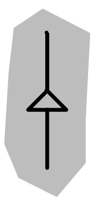
BY-PASS VALVE

Valve indications are displayed if the air cycle machine fails.



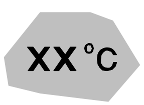
: By-pass valve fully closed.

GREY



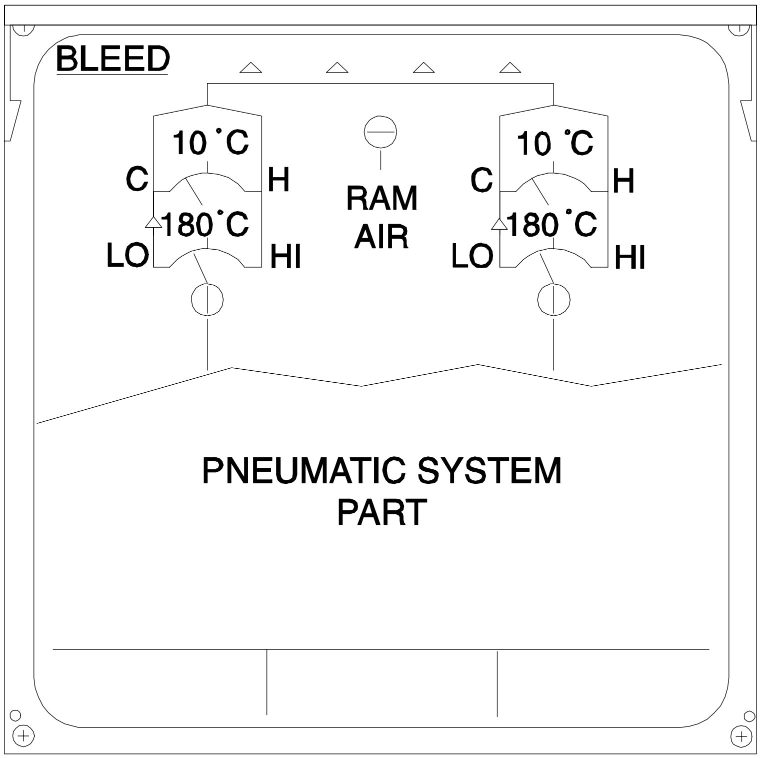
: By-pass valve not fully closed.

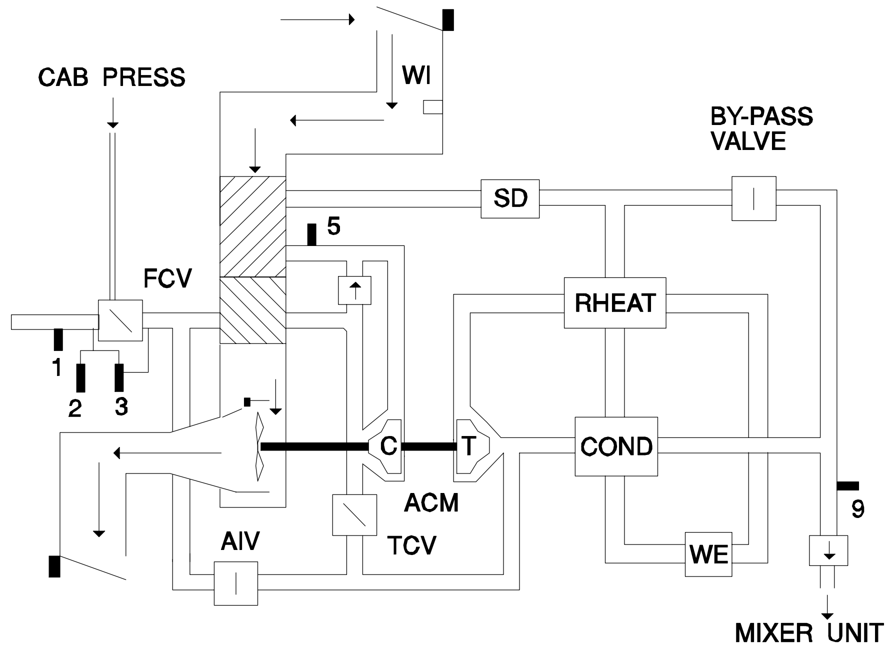
GREEN



: By-pass valve position data not available.

AMBER CROSSES





1: BTS : BLEED TEMP SENSOR
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WE : WATER EXTRACTOR
WI : WATER INJECTOR

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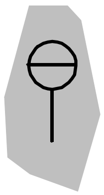
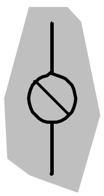
EMERGENCY RAM AIR

The Ram air valve indications are normally displayed in green.



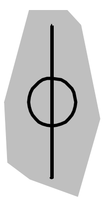
GREEN

: Valve normally closed.



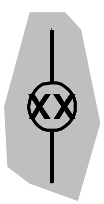
AMBER VALVE
GREEN DUCTS

: Undetermined position, valve in transit.



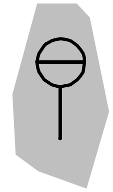
GREEN

: Valve normally open.



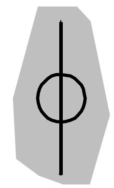
AMBER CROSSES

: Valve position data not available.



AMBER VALVE
GREEN DUCT

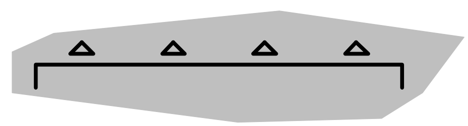
: Valve fully closed and disagrees with command.



AMBER VALVE
GREEN DUCTS

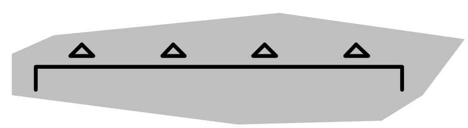
: Valve open on ground or valve position open but disagrees with command.

BLEED USERS



GREEN

In normal operation, bleed users are displayed in green



AMBER

The two flow control valves and the Ram-air valve are fully closed.

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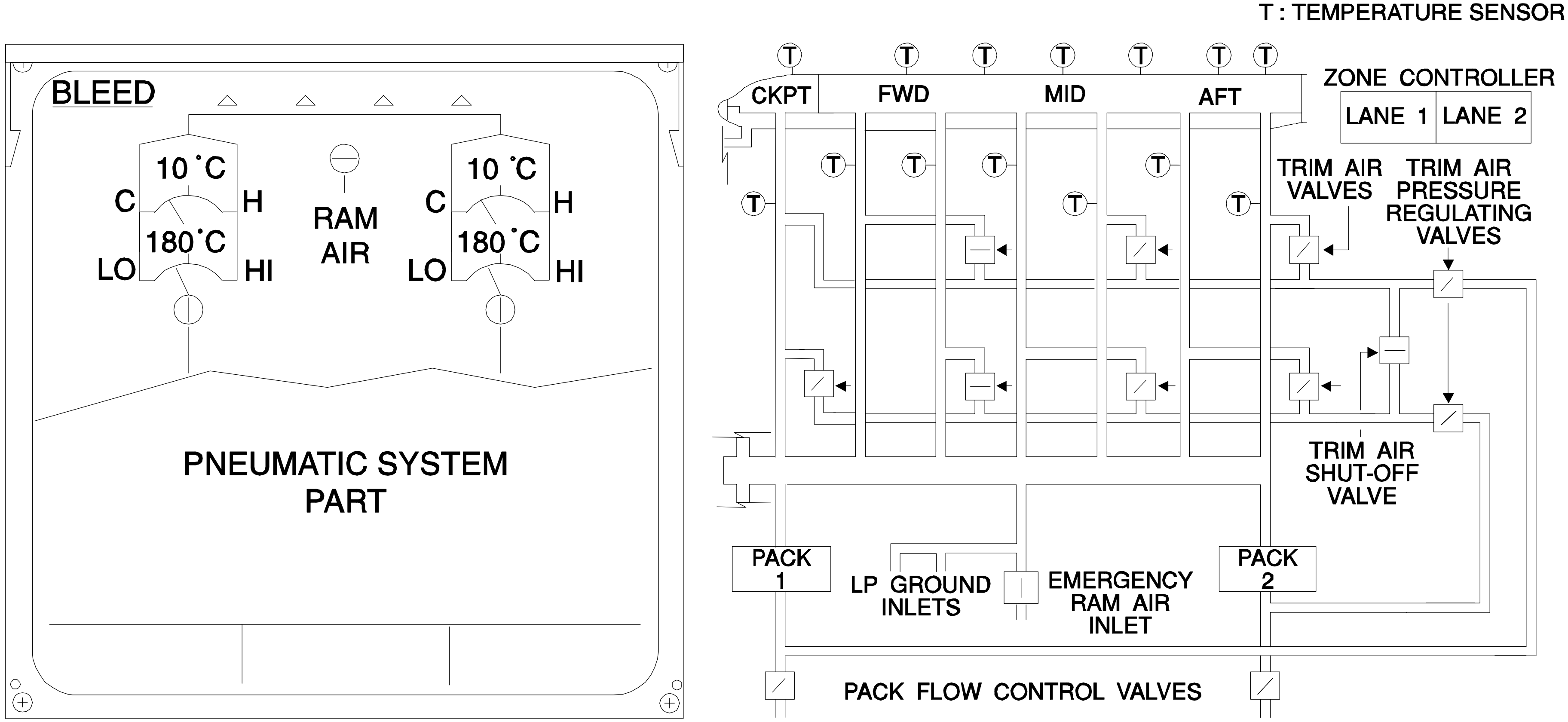

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HOT AIR 1 (2)

Hot air color indications give the pack flow control valve positions.

GREEN

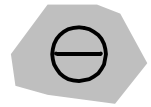
: Respective flow control valve not fully closed or valve position data not available

AMBER

: Flow control valve fully closed.

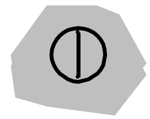
TRIM AIR PRESSURE REGULATING VALVE

These indications give the Trim Air Pressure Regulating Valve positions.



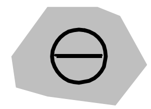
GREEN

: Valve normally closed.



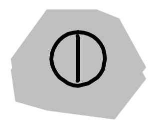
GREEN

: Valve normally open.



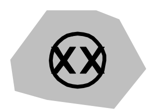
AMBER

: Valve abnormally closed.



AMBER

: Valve abnormally open.



AMBER CROSSES
GREEN CIRCLE

: Position data not available.

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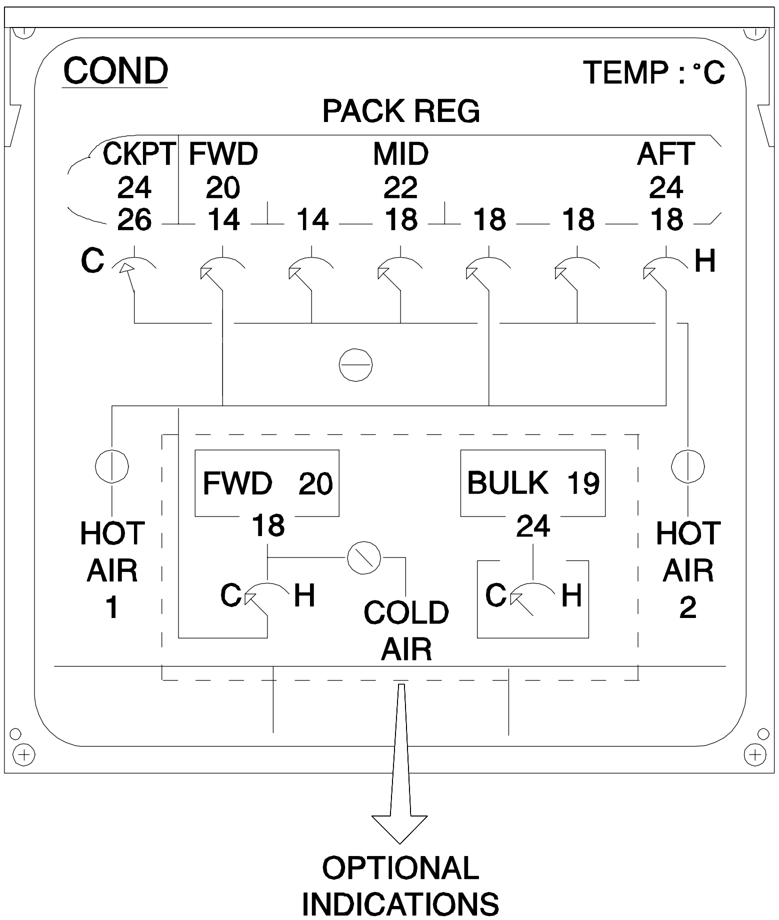

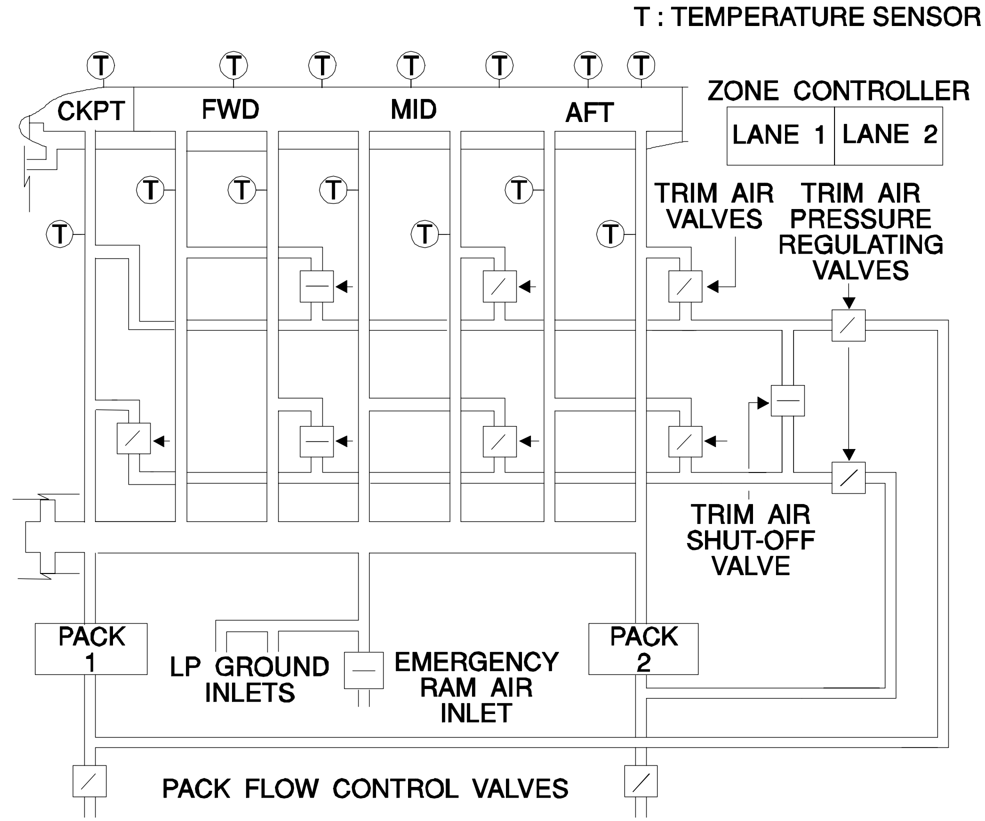

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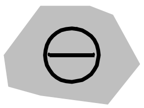
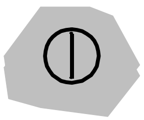
TRIM AIR SHUT OFF VALVE

These indications give the Trim Air Shut-off Valve position.



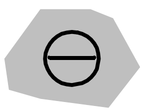
GREEN

: Valve normally closed.



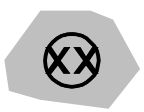
GREEN

: Valve normally open.



AMBER

: Valve abnormally closed.

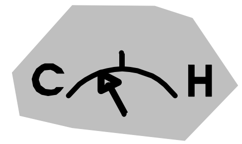


AMBER CROSSES

: Position data not available.

TRIM AIR VALVES

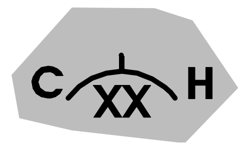
The position of the needle represents the valve position and consequently the hot air flow.



GREEN NEEDLE

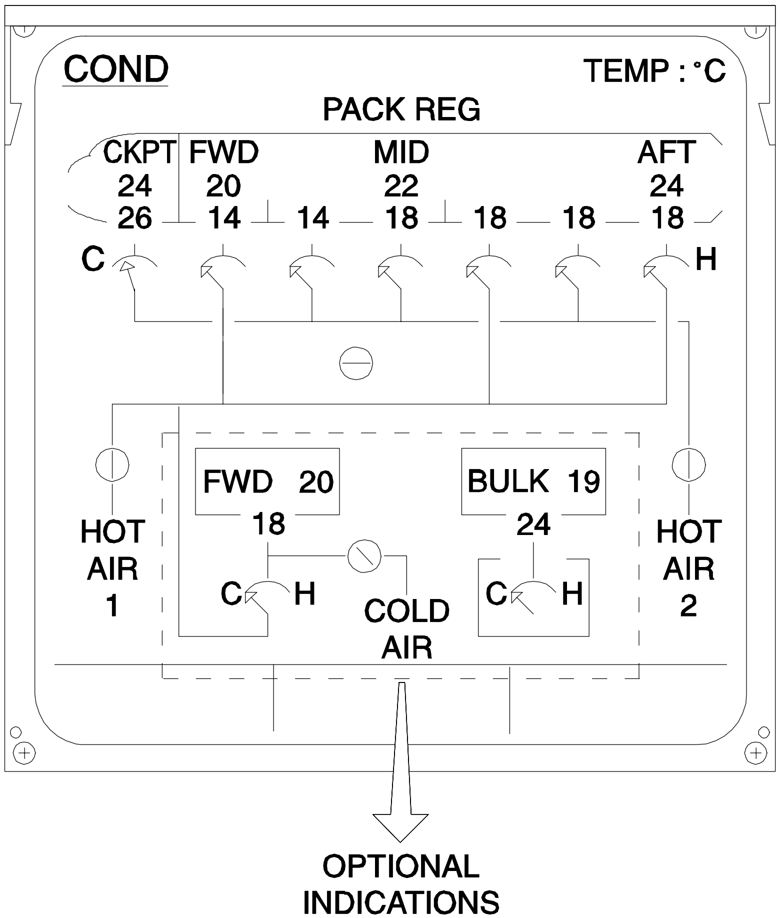
: H (Hot), valve fully open.

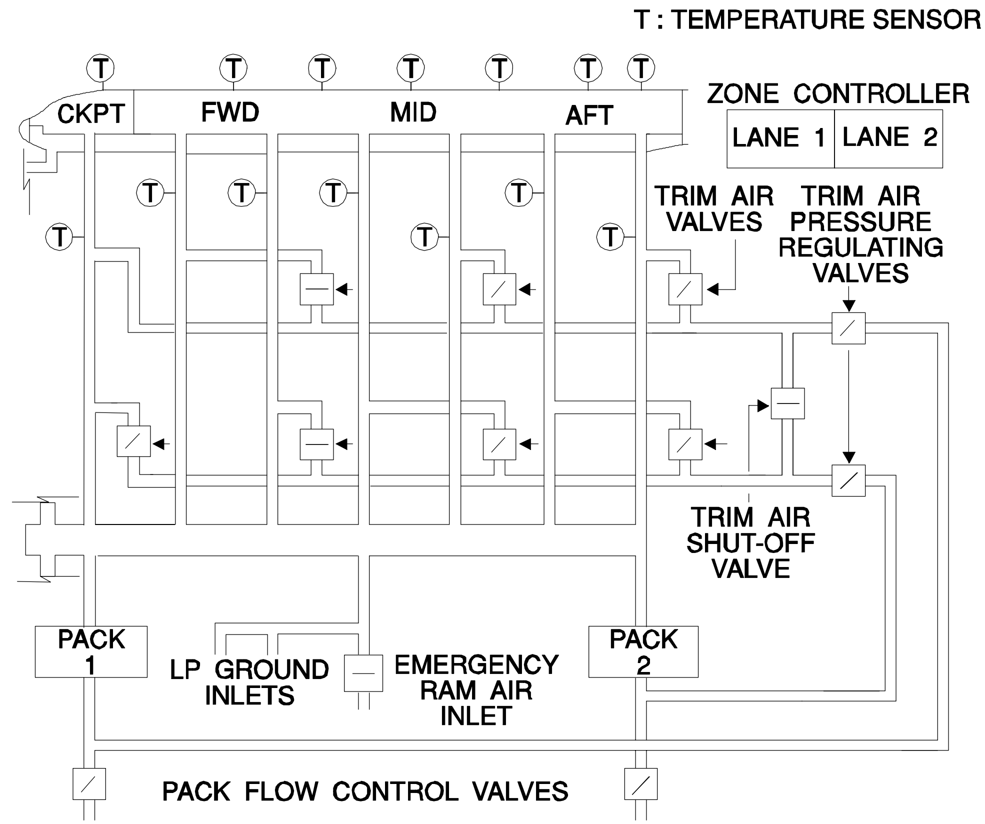
: C (Cold), valve fully closed.



AMBER CROSSES

: Valve position data is not available.


COND
TEMP : °C
PACK REG
CKPT
FWD
MID
AFT
24
20
22
24
26
14
14
18
18
18
18
C
H
HOT AIR 1
HOT AIR 2
FWD 20
18
BULK 19
24
C
H
C
H
COLD AIR
OPTIONAL INDICATIONS


T : TEMPERATURE SENSOR
CKPT
FWD
MID
AFT
ZONE CONTROLLER
LANE 1
LANE 2
TRIM AIR VALVES
TRIM AIR PRESSURE REGULATING VALVES
TRIM AIR SHUT-OFF VALVE
PACK 1
LP GROUND INLETS
EMERGENCY RAM AIR INLET
PACK 2
PACK FLOW CONTROL VALVES

ZONE DUCT TEMPERATURE

The zone duct temperature indications are normally displayed in green. The temperature varies by steps of 2°C (4°F).

90

AMBER

: The temperature indication exceeds 88°C (190°F). It becomes green again when the temperature drops below 70°C (158°F).

XX °C

AMBER

: The temperature data is not available.

ZONE TEMPERATURE

The zone temperature indications are always displayed in green. The temperature varies by steps of 1°C (2°F).

24

GREEN

: Temperature normal display.

XX °C

AMBER

: The temperature data is not available.

These indications are also displayed on the ECAM CRUISE page. The temperature varies by steps of 1°C (2°F).

24

GREEN

: Temperature normal display.

XX °C

AMBER

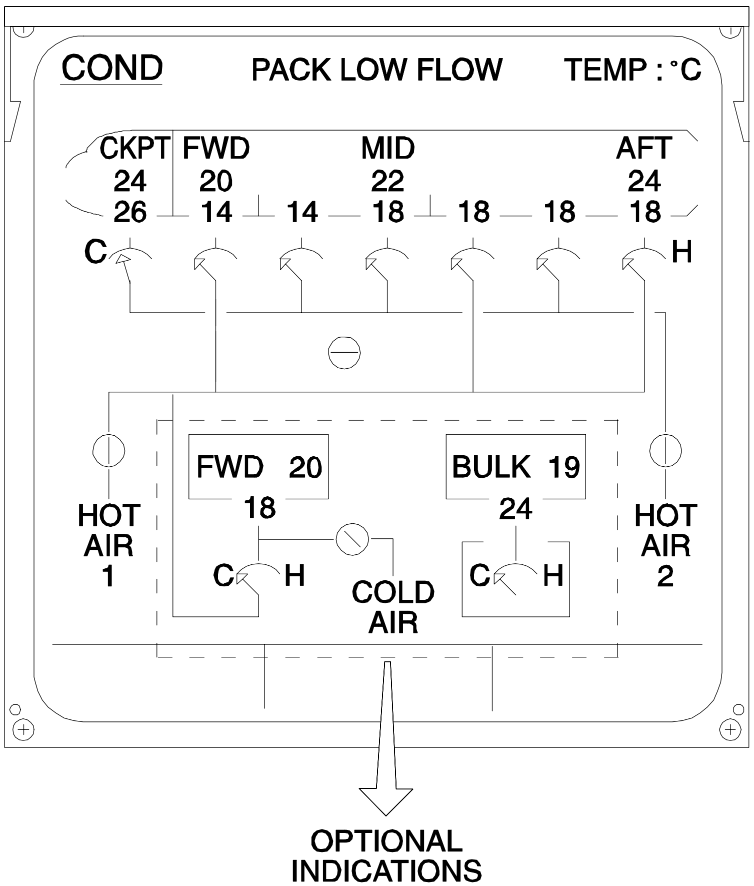
: The temperature data is not available.

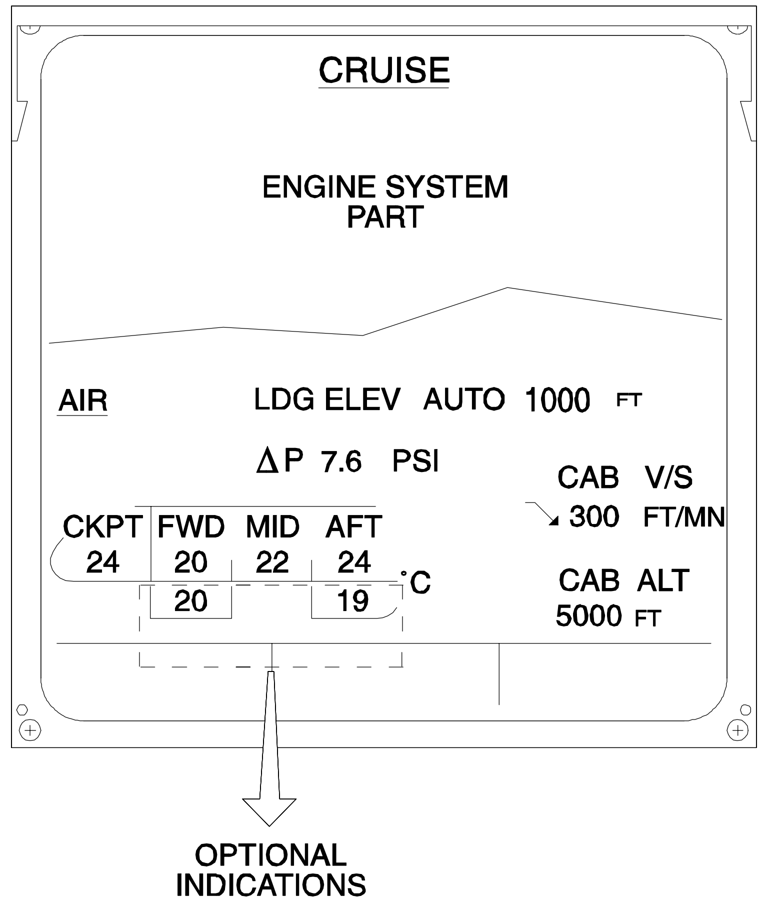
A green pulsing flow increase request warning is displayed when the flow is insufficient to reach the selected temperature.

PACK LO FLOW

GREEN

: This green pulsing message is displayed when the air flow is insufficient to reach the selected zone temperature. Not displayed otherwise.





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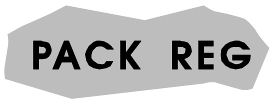
ZONE CONTROLLER STATUS

The PACK REG indication appears in green when the zone controller is inoperative.

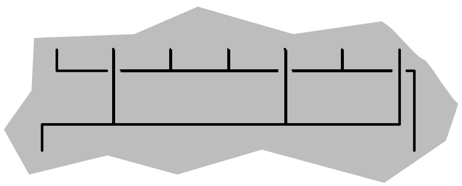


GREEN

: The zone controller is inoperative (both channels are faulty) or the data related to the zone controller state is not available.

AIR DUCTS

The ducts are normally colored in green.



AMBER

The air distribution is not yet operative (engine starting sequence) or air system failure or associated FCV fully closed..

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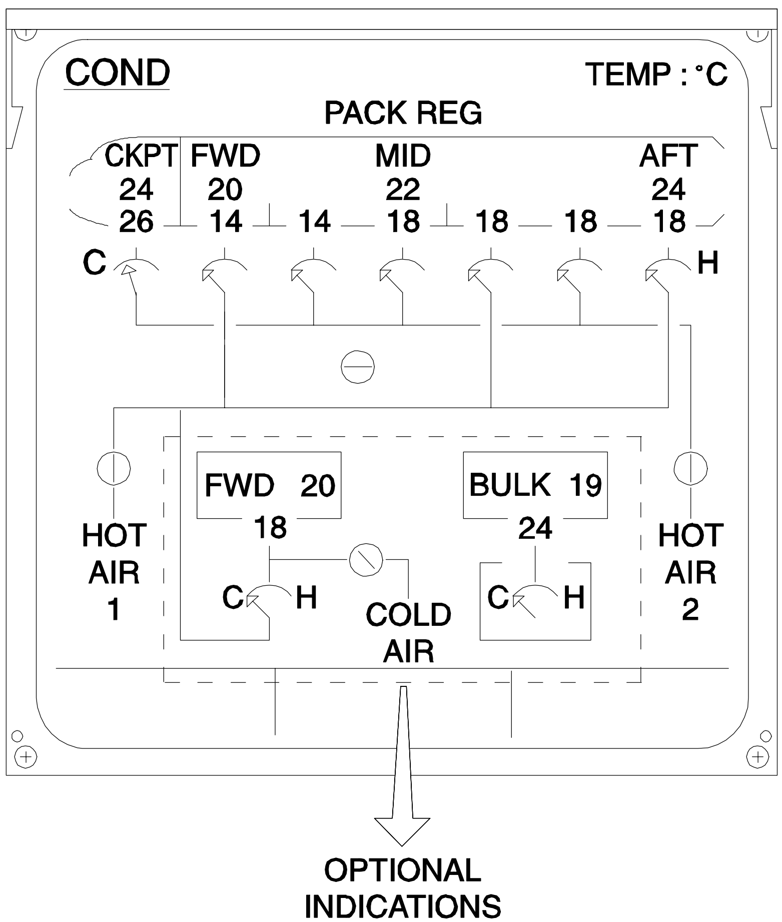
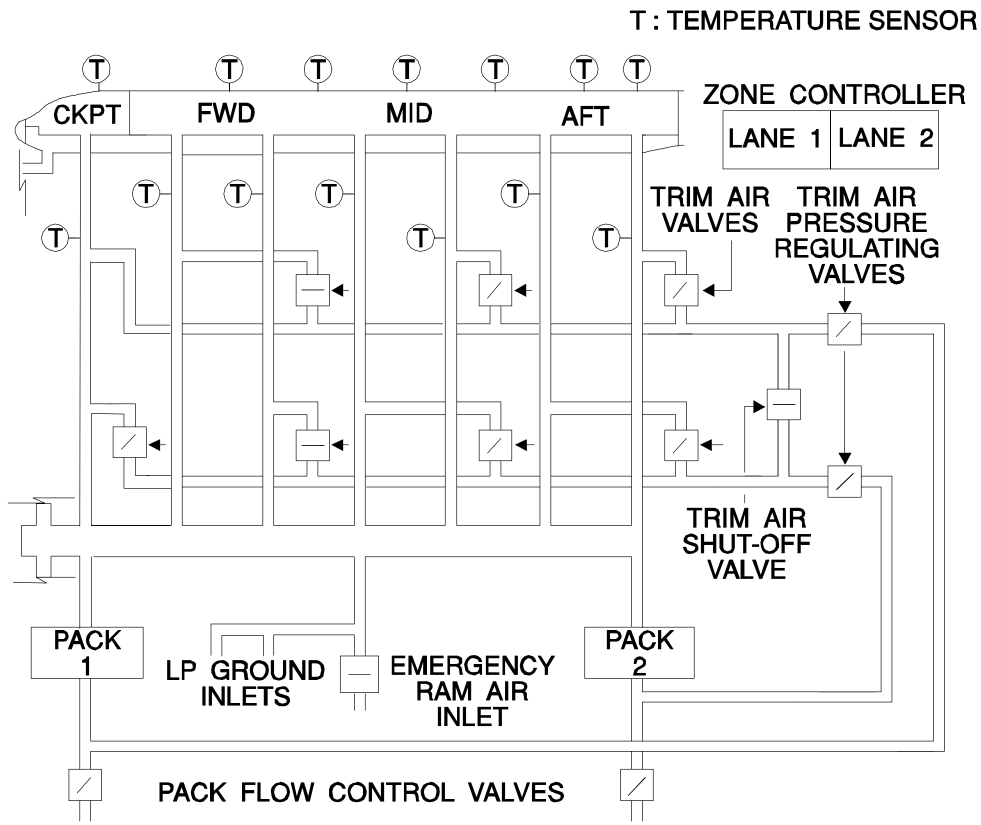




FQW4200 GE Metric

STUDENT NOTES

TEMPERATURE CONTROL :
WARNINGS AND OPERATING LIMITATIONS

PACK 1(2) OFF
PACK 1(2) FAULT
PACK 1(2) OVHT
PACK 1+2 FAULT
PACK REGUL FAULT
DUCT OVERHEAT
ZONE REGUL FAULT
HOT AIR SYSTEM 1(2) FAULT
Operating Limitations

PACK 1(2) OFF

Pack pushbutton was set to OFF with no failure.

PACK 1(2) FAULT

Pack valve disagrees with selected position.
Pack FAULT light remains on as long as the disagreement exists.

PACK 1(2) OVHT

Pack compressor outlet temperature is above limits (260°C) or pack outlet temperature is above limits (95°C).
The FAULT light remains on as long as the overheat is present.

PACK 1+2 FAULT

Pack valves disagree with selected position.
Pack FAULT lights remain on as long as the disagreement exists.

PACK REGUL FAULT

Pack 1(2) FAULT (by-pass mode):
Air by-passes the air cycle machine and is cooled by the heat exchanger.

DUCT OVHT

A zone duct overheat is detected (temperature above 88°C).
Optimized temperature regulation for half of the corresponding zone is lost.

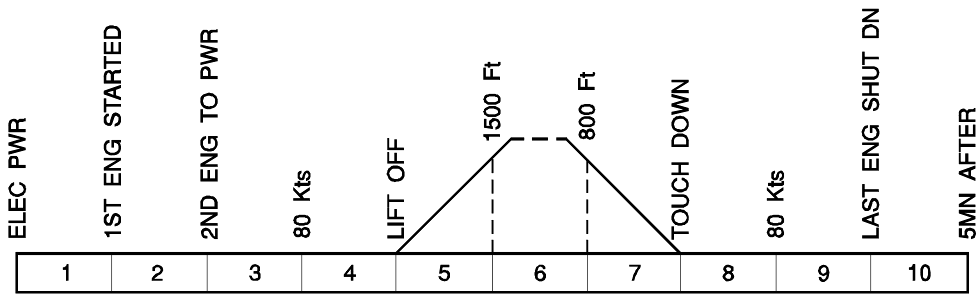
ZONE REGUL FAULT

First example : zone controller fault.

Both channels of the zone controlle are inoperative:
PACK REG appears in green on ECAM.
- optimized temperature is lost.
- the packs are controlled to deliver a fixed temperature ; flow manual selection is lost.
- on ECAM, all temperature indications are removed.

Second example : fault of both hot air valves.

Both hot air valves failed close :
- optimized regulation is lost.
- trim air valves are driven to full closed position.
- the selected cockpit temperature is maintained by PACK 1.
- the selected cabin temperature is maintained by PACK 2.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
PACK 1(2) OFF	SINGLE CHIME	MASTER CAUT	BLEED	NIL	1 to 5 7 to 10
PACK 1(2) FAULT	SINGLE CHIME	MASTER CAUT	BLEED	PACK FAULT lt	3, 4, 5, 7, 8
PACK 1(2) OVHT	SINGLE CHIME	MASTER CAUT	BLEED	PACK FAULT lt	3, 4, 5, 7, 8
PACK 1 + 2 FAULT	SINGLE CHIME	MASTER CAUT	BLEED	PACK FAULT lt	3, 4, 5, 7, 8
PACK REGUL FAULT	NIL	NIL	BLEED	NIL	3, 4, 5, 7, 8
DUCT OVHT	SINGLE CHIME	MASTER CAUT	COND	HOT AIR FAULT lt	3, 4, 5, 7, 8
ZONE REGUL FAULT	NIL	NIL	COND	NIL	3, 4, 5, 7, 8

HOT AIR SYSTEM 1(2) FAULT

HOT AIR valve 1 and HOT AIR cross valve failed closed.
Optimized temperature regulation of half of the corresponding zone is lost.

OPERATING LIMITATIONS

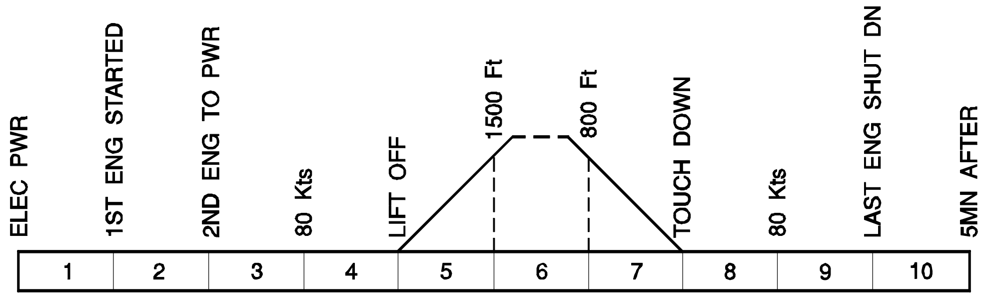
On ground, if any door is not closed and locked with at least one engine running, both pack flow control valves remain closed. The valves will reopen after the door(s) is (are) closed or the engine(s) is (are) shutdown. So, the aircraft cannot be pressurized.

Air conditioning with LO PRESS ground unit:

It is prohibited to use conditioned air simultaneously from packs and LP ground units.

Emergency ram air inlet :

open it only if ΔP is lower than 1 psi.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
HOT AIR SYS 1(2) FAULT	NIL	NIL	COND	NIL	3, 4, 5, 7, 8

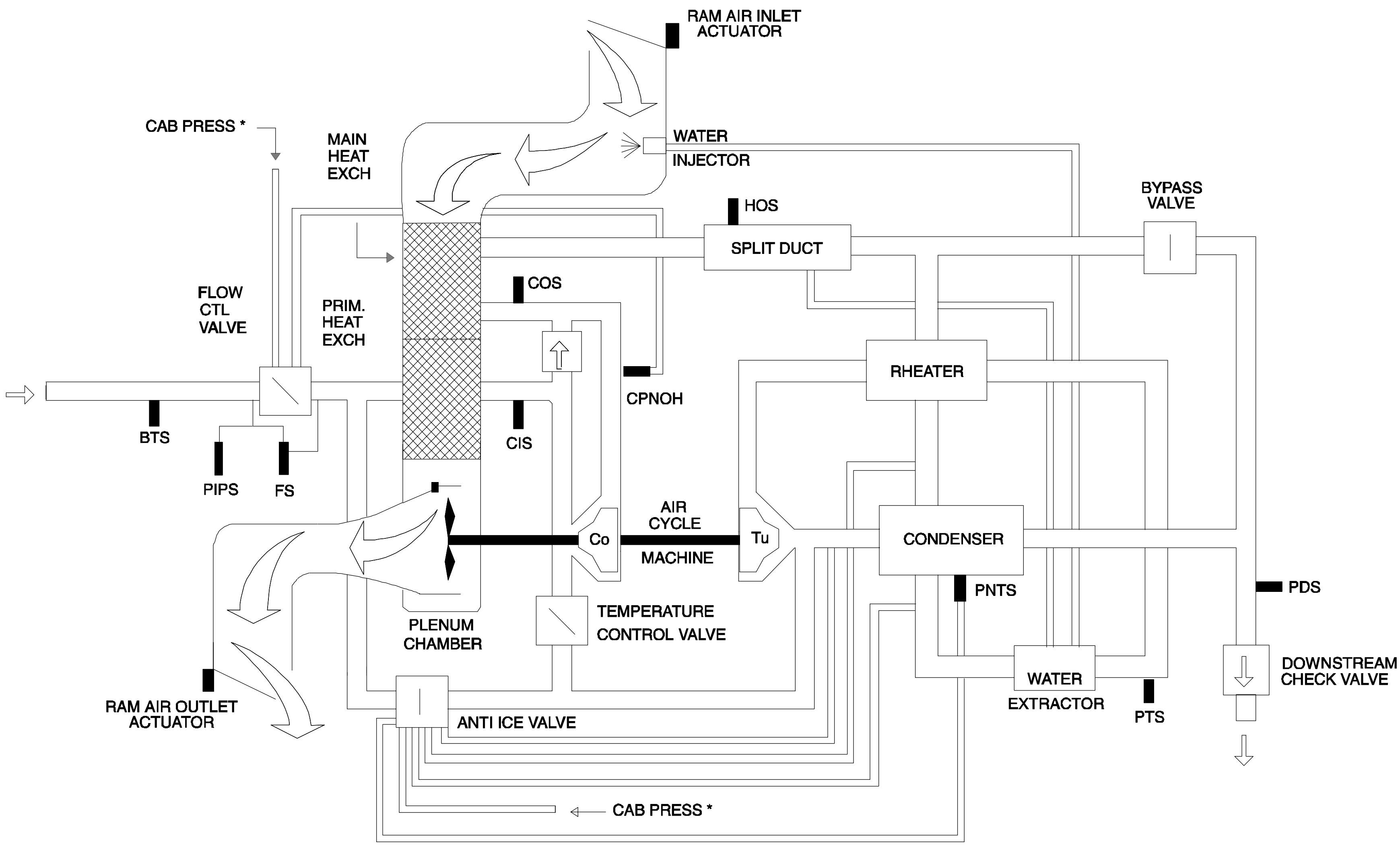
STUDENT NOTES:

TEMPERATURE CONTROL : PACK COMPONENTS/1

Safety Precautions
Flow control valve
Temperature control valve
Anti ice valve
Bypass valve

SAFETY PRECAUTIONS

Make sure that air is not supplied to the air conditioning system from the main engine, the APU or a ground source.
Hot compressed air can cause injury to personnel.



FQW4200 GE Metric

FLOW CONTROL VALVE

FIN / ZONE

LH PACK
FIN : 511 HB
Zone : 191
RH PACK
FIN : 512 HB
Zone ; 192

COMPONENT DESCRIPTION

The FCVs adjust the quantity of hot bleed air that flows to the trim air valves and the packs.
Each valve has a butterfly valve and a venturi (4). The valve is opened or closed by the action of a pneumatic actuator (1) (spring loaded closed). The latter is vented by the CPNOH to discharge the muscle pressure in case of compressor overheat.
A microswitch is used to provide the fully or not fully closed position signal to the associated PC.
The valve is equipped with a visual indicator and a lever (8) to manually close it if necessary. A locking screw (9) makes the deactivation of the FCV possible.

SPECIAL DESIGN

The Flow Control Valve also has :
- an ON/OFF solenoid (7).
energized : FCV closed
de-energized : FCV regulating
- a control solenoid(6).
energized : electrical regul. mode
de-energized : pneumatic back-up mode
- an electro pneumatic regulator (3) for the electrical regulation mode. It is composed of a torque motor (2) which drives a cam to change thesize of an orifice.
- a pneumatic regulator (5) for the pneumatic back-up mode. It has a poppet and a relief valve.
- there are pressure ports on the valve body for the PIPS and the flow sensor.

DEACTIVATION ACTIVATION

(1) Comply with the safety precautions.
(2) Get access to the Flow Control Valve.
(3) Release the associated PACK pushbutton switch to the OFF position.
(4) Remove and discard the lockwire from the locking screw (9).
(5) Move the locking screw from the position (A) to the position (B).
(6) Safety the locking screw with a lockwire.
(7) Put a warning notice in the cockpit to tell the flight crew that FCV 1(2) is deactivated.
(8) Make an entry in the A/C logbook.

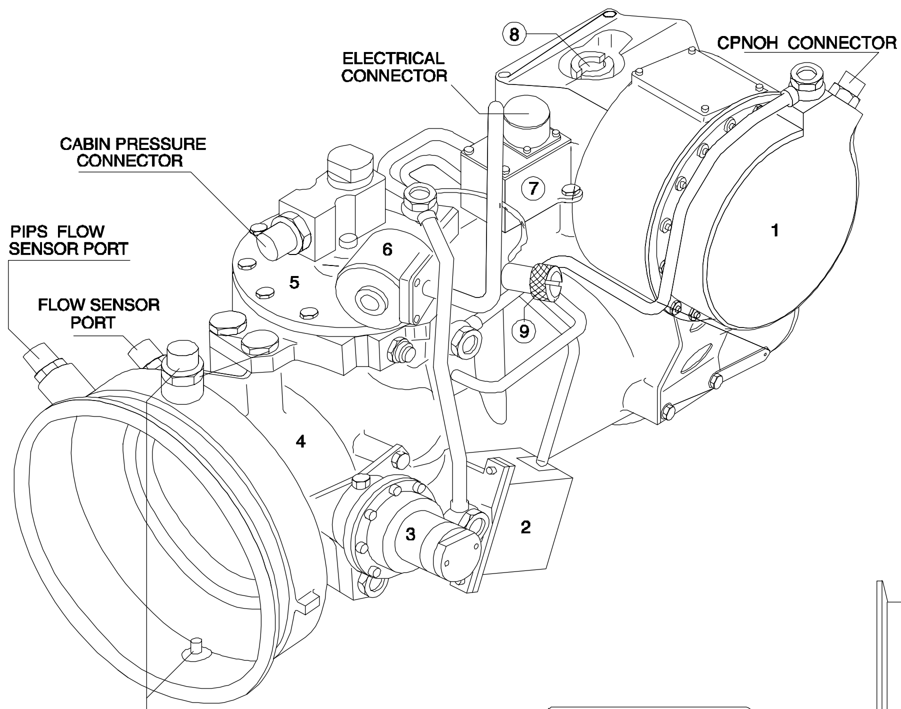
REMOVAL INSTALLATION

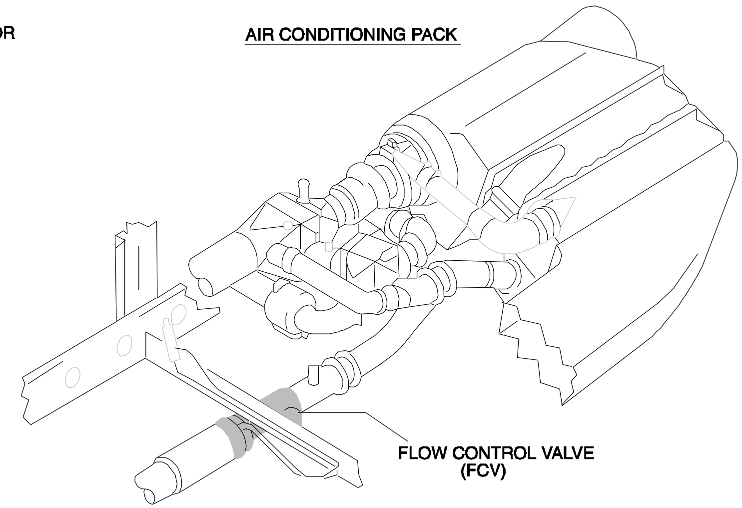
The Flow Control Valve is attached to the airframe by means of a tie rod and connected to the duct with clamps (respect the torques during the installation).
Comply with the safety precautions during the valve removal and installation.
Do the operational test of the system to complete the Flow Control Valve installation.

SAFETY PRECAUTIONS

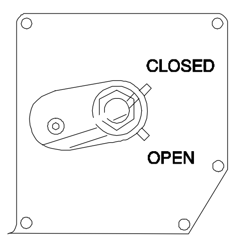
(1) Open, safety, and tag the circuit breakers listed in the AMM.
(2) Make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) pushbutton switches are released and put a warning notice in position to tell persons not to operate them.
(3) Make sure that the HP and LP ground connectors are not connected to a ground air supply source. Put a warning notice in position to tell persons not to supply the ground air sources.
(4) Do not touch the valve until it is cool enough to prevent burns.

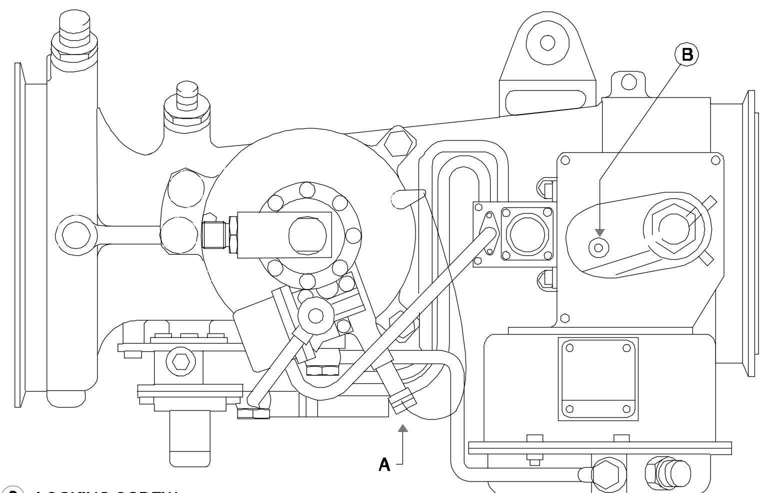
CPNOH : COMPRESSOR PNEUMATIC OVERHEAT SENSOR





PIPS : PACK INLET PRESSURE SENSOR





1. ACTUATOR
2. TORQUE MOTOR
3. ELECTRO PNEUMATIC REGULATOR
4. VALVE BODY
5. PNEUMATIC REGULATOR
6. CTL SOLENOID(S2)
7. ON/OFF SOLENOID(S1)
8. MANUAL LEVER VISUAL INDICATOR
9. LOCKING SCREW :
   - A ACTIVATION POSITION
   - B DEACTIVATION POSITION

FQW4200 GE Metric

TEMPERATURE CONTROL VALVE

FIN / ZONE

LH PACK
FIN : 521HH3
Zone : 191
RH PACK
FIN : 522HH3
Zone : 192

COMPONENT DESCRIPTION

The temperature control valve has an actuator and a valve body. The actuator consists of a stepper motor, a reduction gearbox with mechanical endstops and a microswitch for the fully closed position monitoring. There are two potentiometers installed on the end of the shaft for the valve position monitoring. The valve body has a butterfly valve and a manual lever to show the valve position and make manual overriding possible.

DEACTIVATION ACTIVATION

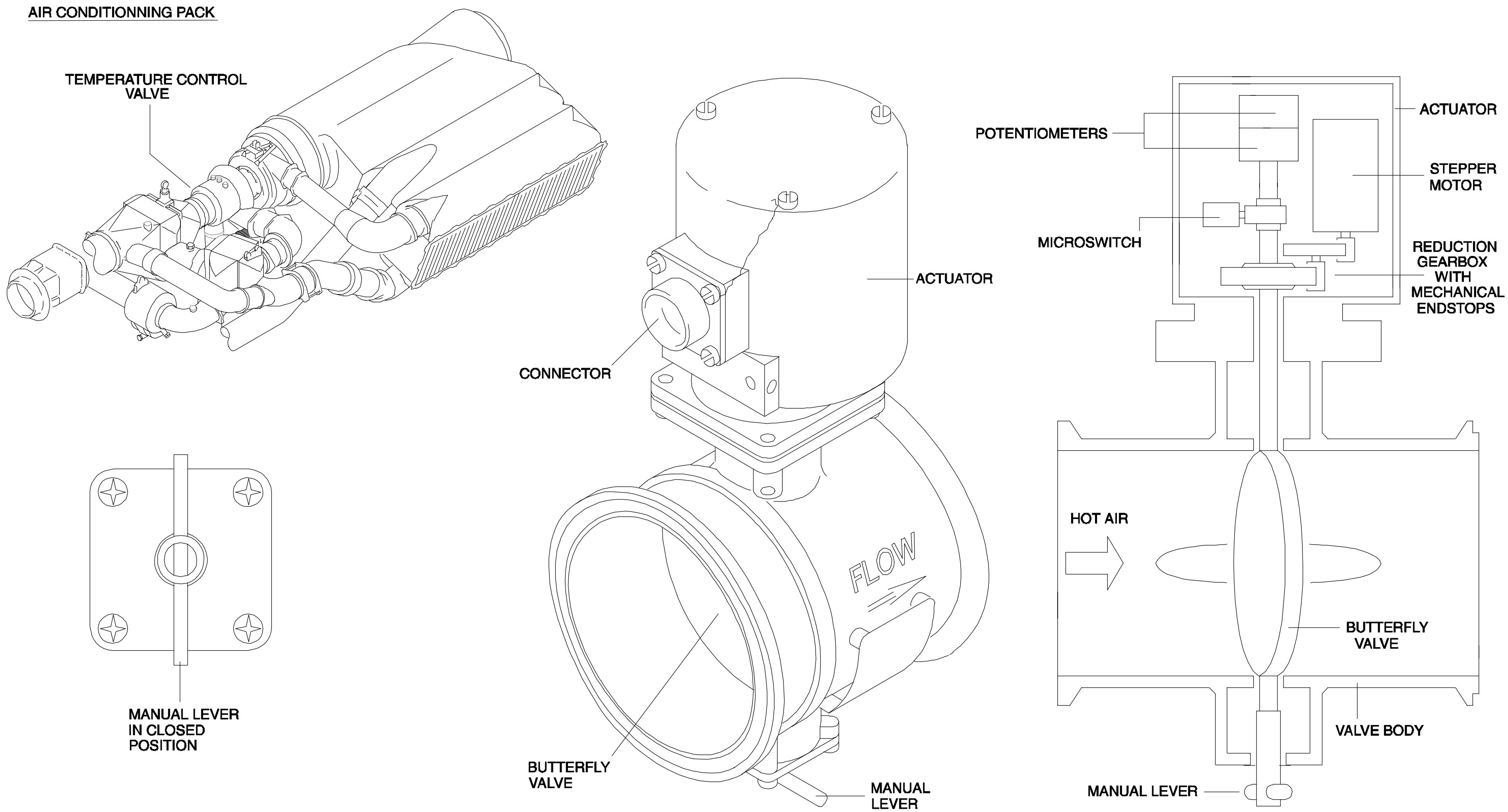
(1) Comply with the safety precautions.
(2) Get access to the temperature control valve.
(3) Disconnect and safety the electrical connector.
(4) Put blanking caps on the disconnected electrical connectors.
(5) Set the manual lever to the closed position.
(6) Put a warning notice in the cockpit indicating the TCV deactivation and make an entry in the logbook.

REMOVAL INSTALLATION

The temperature control valve is attached to the air cycle machine with a V-clamp and connected to the duct line with clamps and bellows. Comply with the safety precautions during the valve removal. Do the operational test of the pack control and indicating system to complete the temperature control valve installation.

SAFETY PRECAUTIONS

(1) Open, safety, and tag the circuit breakers listed in the AMM.
(2) Make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) pushbutton switches are released and put a warning notice in position to tell people not to operate them.
(3) Make sure that the HP and LP ground connectors are not connected to a ground air supply source but tagged.
(4) Do not touch the valve until it is cool enough.



FQW4200 GE Metric

ANTI ICE VALVE

FIN / ZONE

LH PACK
FIN : 521HH1
Zone : 191
RH PACK
FIN : 522HH1
Zone : 192

COMPONENT DESCRIPTION

The anti ice valve has a trailing probe which supplies inlet air pressure to a reference pressure regulator (3). The latter supplies a constant outlet pressure to a high pressure delta P servo (4) and a low pressure delta P servo (6). These two delta P servos detect icing condition across the condenser and if so, they control a pressure actuator (1) (spring loaded closed). The latter then opens a butterfly valve. There is a visual indicator and a manual override (7).

SPECIAL DESIGN

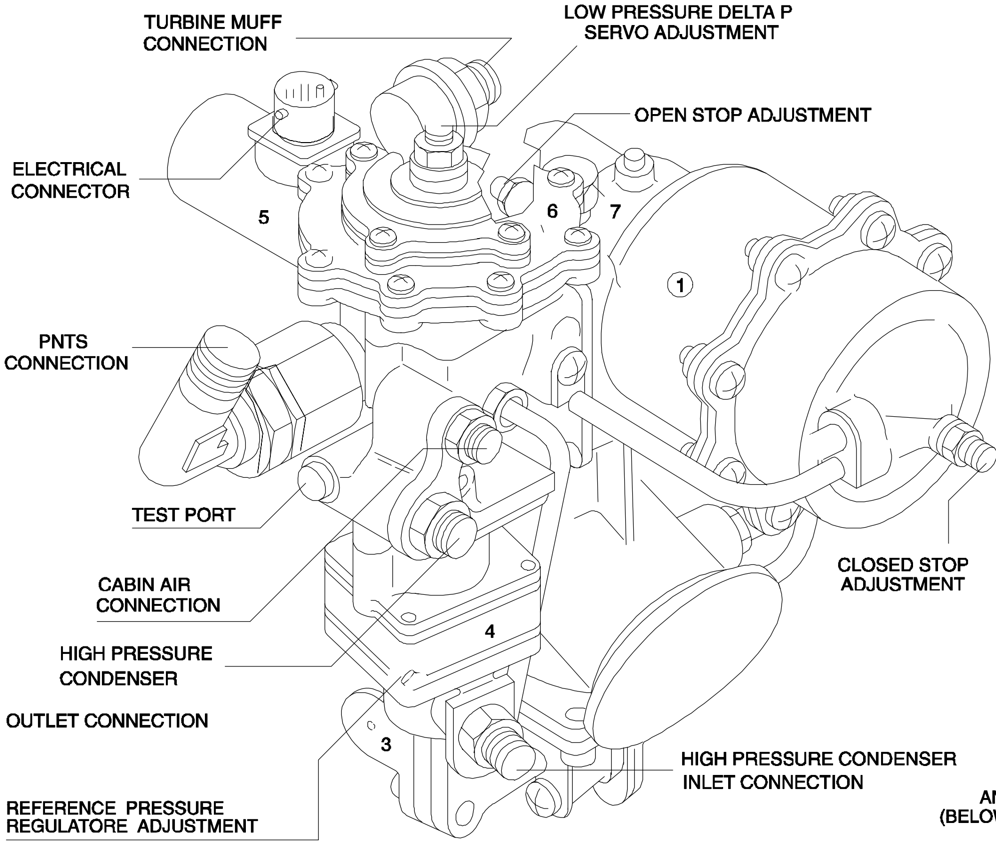
The anti ice valve also has a solenoid valve (5).
- it is energized during normal operation (anti ice mode).
- it is de-energized in case of pack controller or TCV failure and consequently allows the PNTS to control the pressure delivered to the pneumatic actuator (1). In that case the anti ice valve regulates the pack outlet temperature to a fixed setting and the anti ice function remains unaffected.

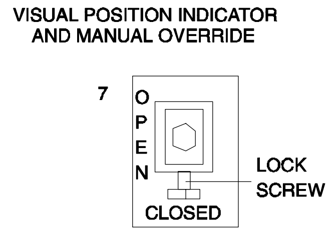
REMOVAL INSTALLATION

The anti ice valve is attached to the condenser with screws and nuts and connected to the duct line with clamps.Both valves are interchangeable.
Comply with the safety precautions during the valve removal and installation and do the system test of the pack control and indicating system to complete the anti ice valve installation.

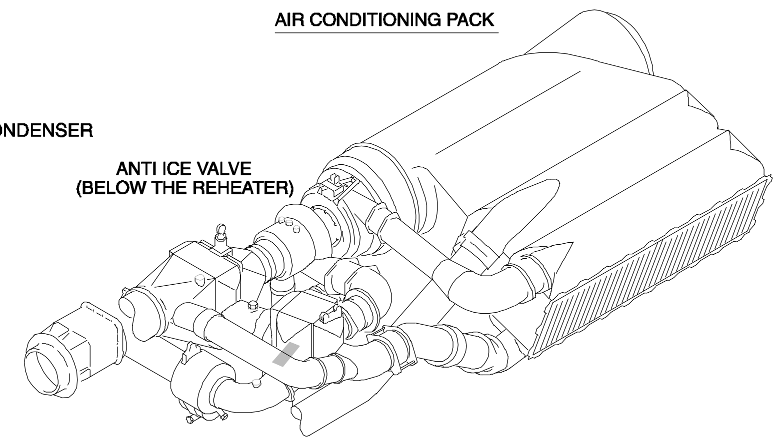
SAFETY PRECAUTIONS

(1) Open, safety, and tag the circuit breakers listed in the AMM.
(2) Make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) pushbutton switches are released and put a warning notice in position to tell people not to operate them.
(3) Make sure that the HP and LP ground connectors are not connected to a ground air supply source but tagged.
(4) Do not touch the valve until it is cool enough.





1 PRESSURE ACTUATOR
2 VALVE BODY
3 PRESSURE REGULATOR
4 HIGH-PRESSURE DELTA P SERVO
5 SOLENOID VALVE
6 LOW-PRESSURE DELTA P SERVO



PNTS : PNEUMATIC TEMPERATURE SENSOR

FQW4200 GE Metric

BYPASS VALVE

FIN / ZONE

LH PACK
FIN : 521HH2
Zone : 191
RH PACK
FIN : 522HH2
Zone : 192

COMPONENT DESCRIPTION

The bypass valve is a two position valve. It has an actuator composed of an electrical motor (28VDC), a reduction gearbox and two microswitches. A manual lever is installed above the actuator to manually change the valve position if necessary. The valve body has a butterfly valve and a position indicator located at bottom of the valve body.

DEACTIVATION ACTIVATION

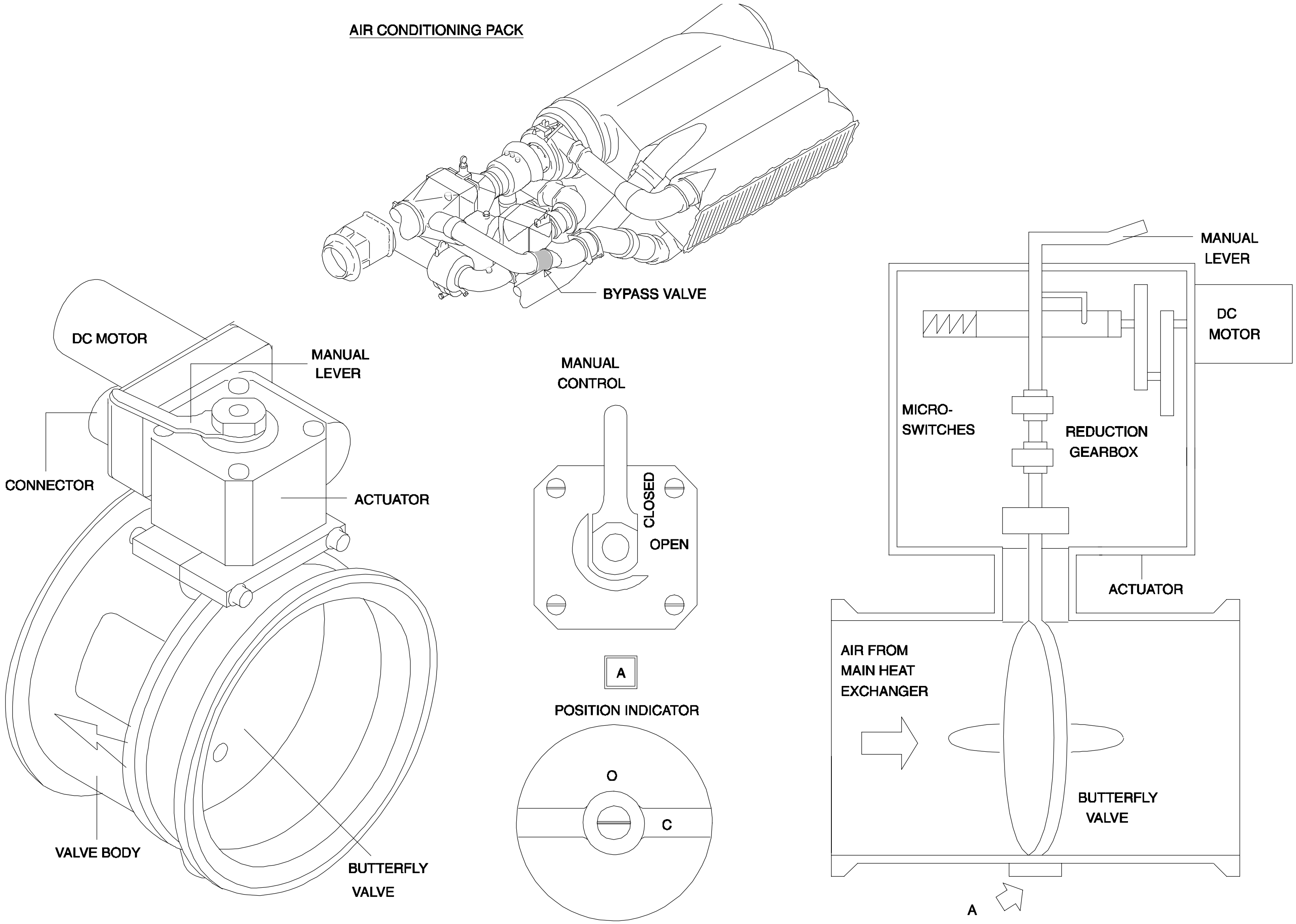
(1) Comply with the safety precautions.
(2) Get access to the bypass valve.
(3) Disconnect and safety the electrical connector.
(4) Put blanking caps on the disconnected electrical connectors.
(5) Set the manual lever to the closed position.
(6) Put a warning notice in the cockpit indicating the bypass valve deactivation and make an entry in the logbook.

REMOVAL INSTALLATION

The bypass valve is connected to the duct line and attached to the reheater with clamps. Make sure that the bypass valve is in in vertical position. The arrow on the valve must point to the duct.
Comply with the safety precautions during the valve removal and installation and do the operational test of the pack control and indicating system to complete the bypass valve installation.

SAFETY PRECAUTIONS

(1) Open, safety, and tag the circuit breakers listed in the AMM.
(2) Make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) pushbutton switches are released and put a warning notice in position to tell people not to operate them.
(3) Make sure that the HP and LP ground connectors are not connected to a ground air supply source but tagged.
(4) Do not touch the valve until it is cool enough.



FQW4200 GE Metric

STUDENT NOTES

TEMPERATURE CONTROL : ZONE COMPONENTS

SAFETY PRECAUTIONS

Make sure that the air conditioning system is not supplied with air from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel.

STUDENT NOTES

TRIM AIR PRESSURE REGULATING VALVES

FIN / ZONE

FIN : 638HK, 639HK
Zone : 192 , 191

COMPONENT DESCRIPTION

The Trim Air Pressure Regulating valve consists of a spring loaded pneumatic actuator and a butterfly valve. The latter regulates the trim air pressure in order to keep it around 4 psi above the cabin pressure. If the pressure downstream of the valve increases, then the pneumatic actuator retracts. If the pressure decreases, then the pneumatic actuator extends and the butterfly valve moves to a more open position. If there is no electrical power to the solenoid, the valve fully closes.
There is a double microswitch to detect the fully open and fully closed positions. A manual lever shows the valve position and makes manual overriding possible.

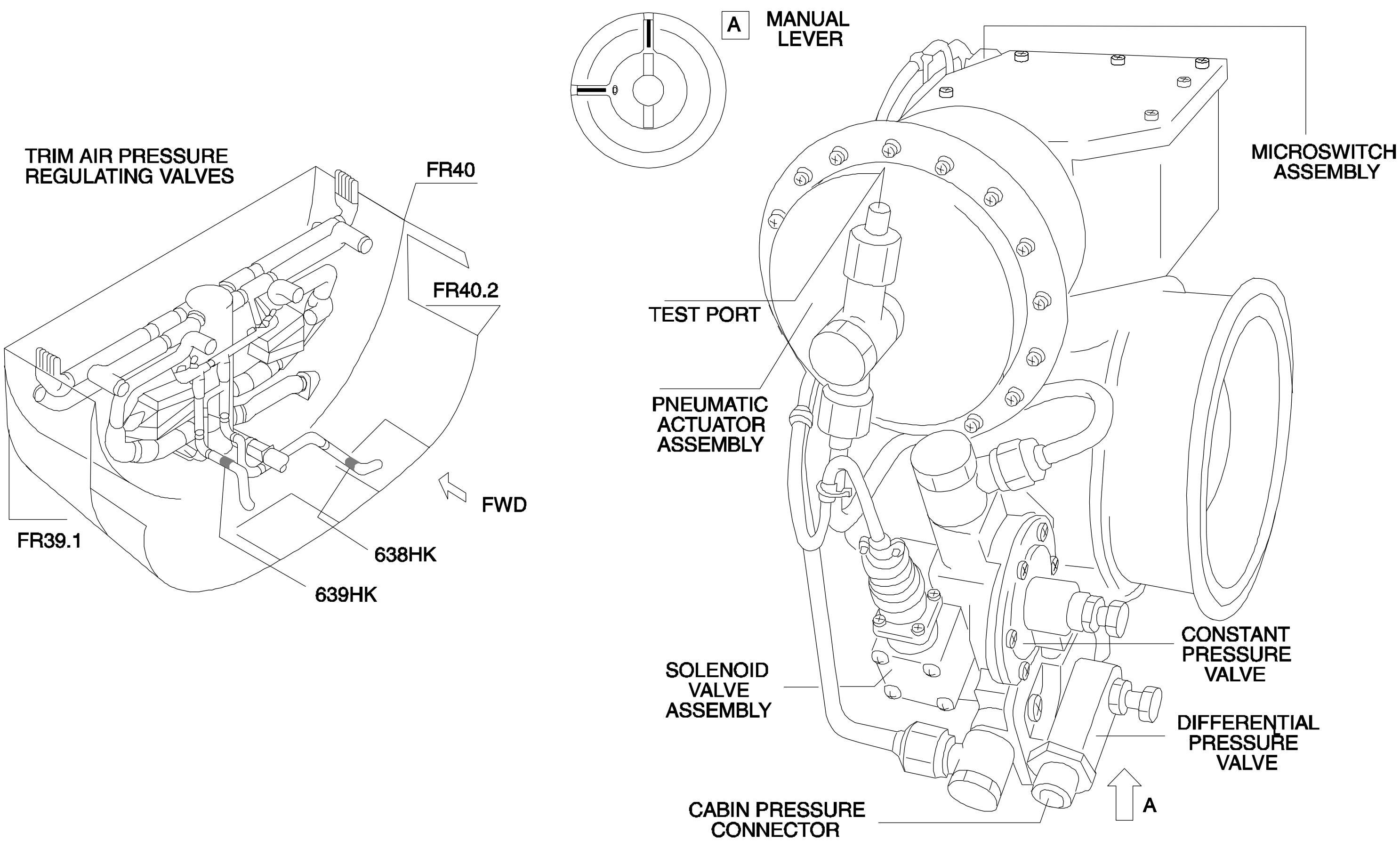
VALVE DEACTIVATION

(1) comply with the safety precautions :
(a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.
(b) make sure that the LP and HP ground connectors are not supplied and are tagged with a warning notice telling people not to supply the ground air sources.
(2) close the Trim Air Pressure Regulating Valve with the manual lever.
(3) disconnect the electrical connector.
(4) put a blanking cap on the electrical connector.
(5) put a warning notice in the cockpit to tell the flight crew the Trim Air Pressure Regulating valve is deactived.

REMOVAL INSTALLATION

WARNING : do not touch the valve until it is cool enough to prevent burns.

- open, safety and tag the circuit breakers listed in the AMM.
- remove the access panel :
193BB for 639HK and 192JB for 638HK.
- comply with the safety precautions :
  (a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.
  (b) make sure that the LP and HP ground connectors are not supplied.
- the valve is attached to the ducts by means of clamps.
- do the system test of the cockpit and cabin temperature control.



FQW4200 GE Metric

TRIM AIR SHUT-OFF VALVE

FIN / ZONE

FIN : 649HK
Zone : 137

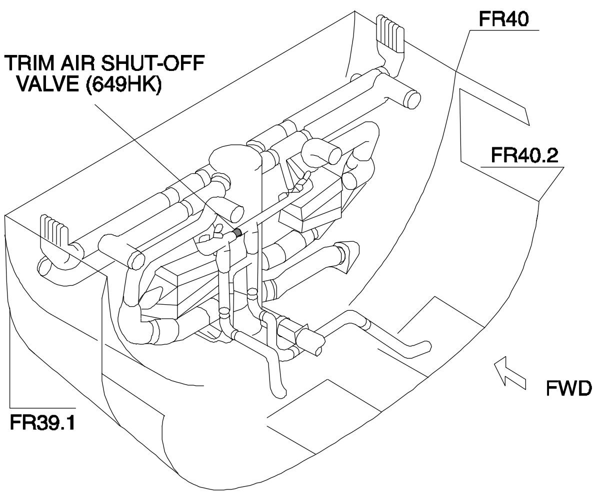
COMPONENT DESCRIPTION

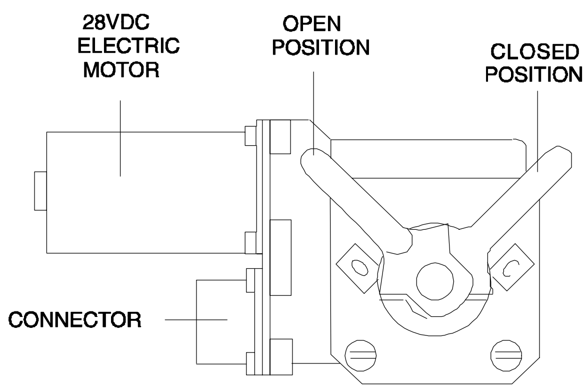
The Trim Air Shut-off Valve has a 28VDC electric motor and a butterfly valve with two positions (fully closed and fully open).
In normal operation, the valve is fully closed, but opens if a signal is sent from the zone controller.
After the valve has reached its end position, the power is switched off by 2 internal microswitches.
Two additional switches are provided for valve position and function monitoring. A manual lever shows the valve position and makes manual overriding possible.

REMOVAL INSTALLATION

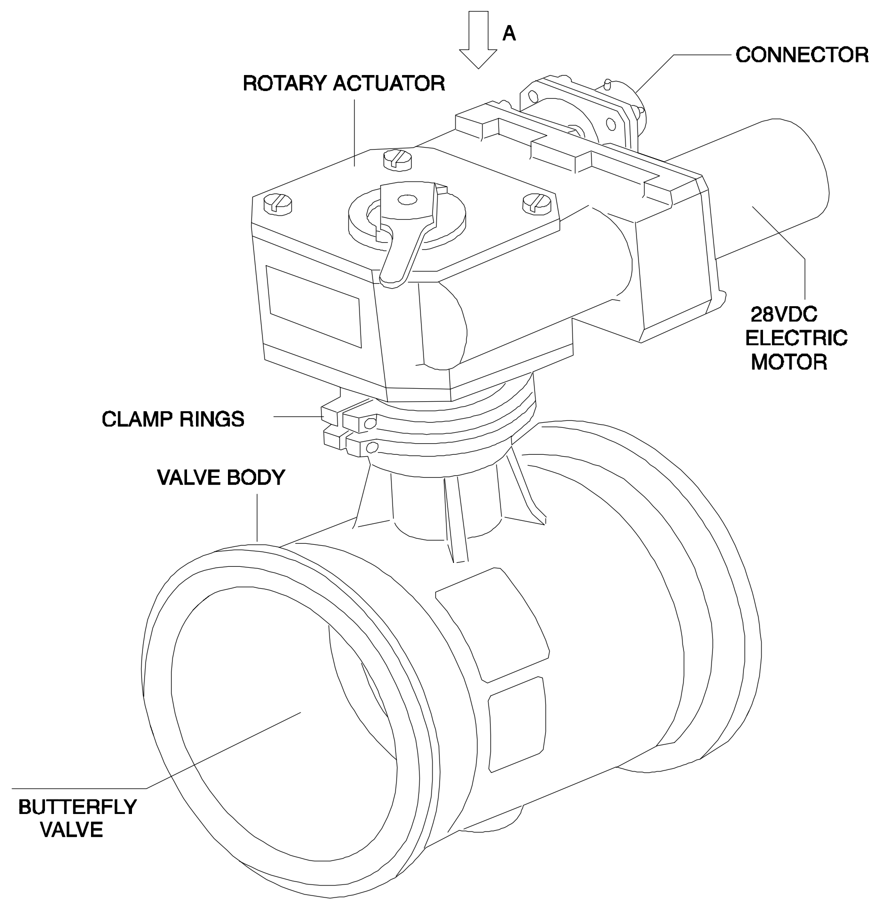
WARNING : do not touch the valve until it is cool enough to prevent burns.

- remove the access panel 131CX.
- open, safety and tag the circuit breakers listed in the AMM.
- comply with the safety precautions :
  (a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.
  (b) make sure that the LP and HP ground connectors are not supplied.
- the valve is attached to the ducts by means of clamps.
- do the system test of the cockpit and cabin temperature control.





A MANUAL LEVER



FQW4200 GE Metric

TRIM AIR VALVE

FIN / ZONE

FIN : 631HK, 632HK, 633HK, 634HK, 635HK, 636 HK, 637HK
Zone : 137 , 138 , 138 , 137 , 138 , 137 , 137

COMPONENT DESCRIPTION

The cockpit and cabin Trim Air Valves have an actuator and a valve body. The actuator has a stepper motor, a reduction gearbox with 2 mechanical end stops used to limit the rotation of the gear shaft in both directions and two microswitches to indicate the fully open and fully closed positions. 2 Potentiometers are installed on the end of the shaft but no longer used by the zone controller for monitoring. A manual lever shows the valve position and makes manual overriding possible.

VALVE DEACTIVATION

(1) comply with the safety precautions :

(a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.

(b) make sure that the LP and HP ground connectors are not supplied and are tagged with a warning notice telling people not to supply the ground air sources.

(2) close the Trim Air Valve with the manual lever.
(3) disconnect the electrical connector.
(4) put a blanking cap on the electrical connector.
(5) put a warning notice in the cockpit to tell the flight crew the trim air valve(s) is(are) deactivated.

REMOVAL INSTALLATION

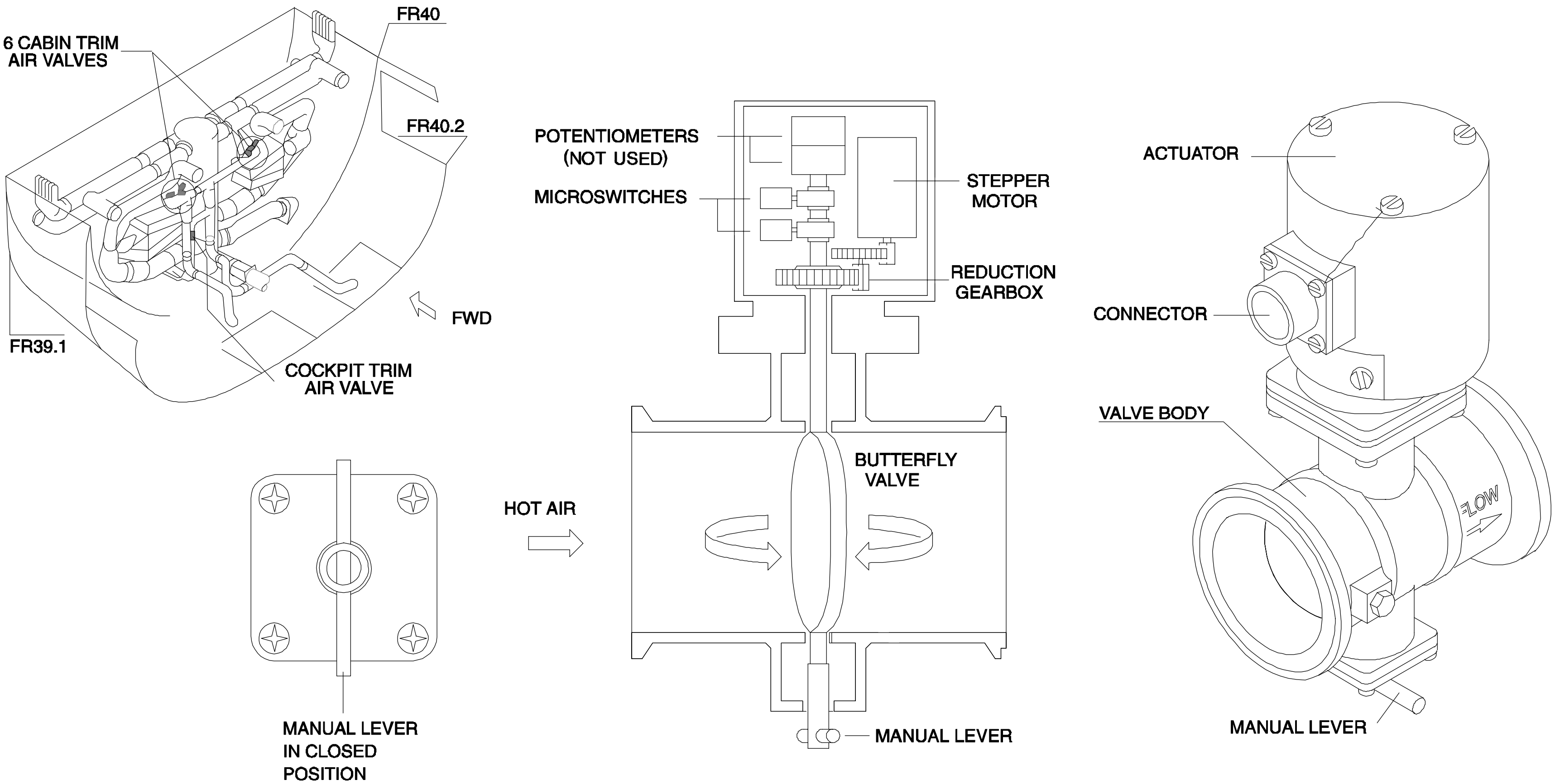
WARNING : do not touch the valve until it is cool enough to prevent burns.

- remove the access panel :
131CX for 631HK, 634HK, 636HK
132CX for 632HK, 633HK, 635HK
131CX and 131BX for 637HK.
- open, safety and tag the circuit breakers listed in the AMM.
- comply with the safety precautions :

(a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.

(b) make sure that the LP and HP ground connectors are not supplied.

- the valve is attached to the ducts by means of clamps.
- do the system test of the cockpit and cabin temperature control.



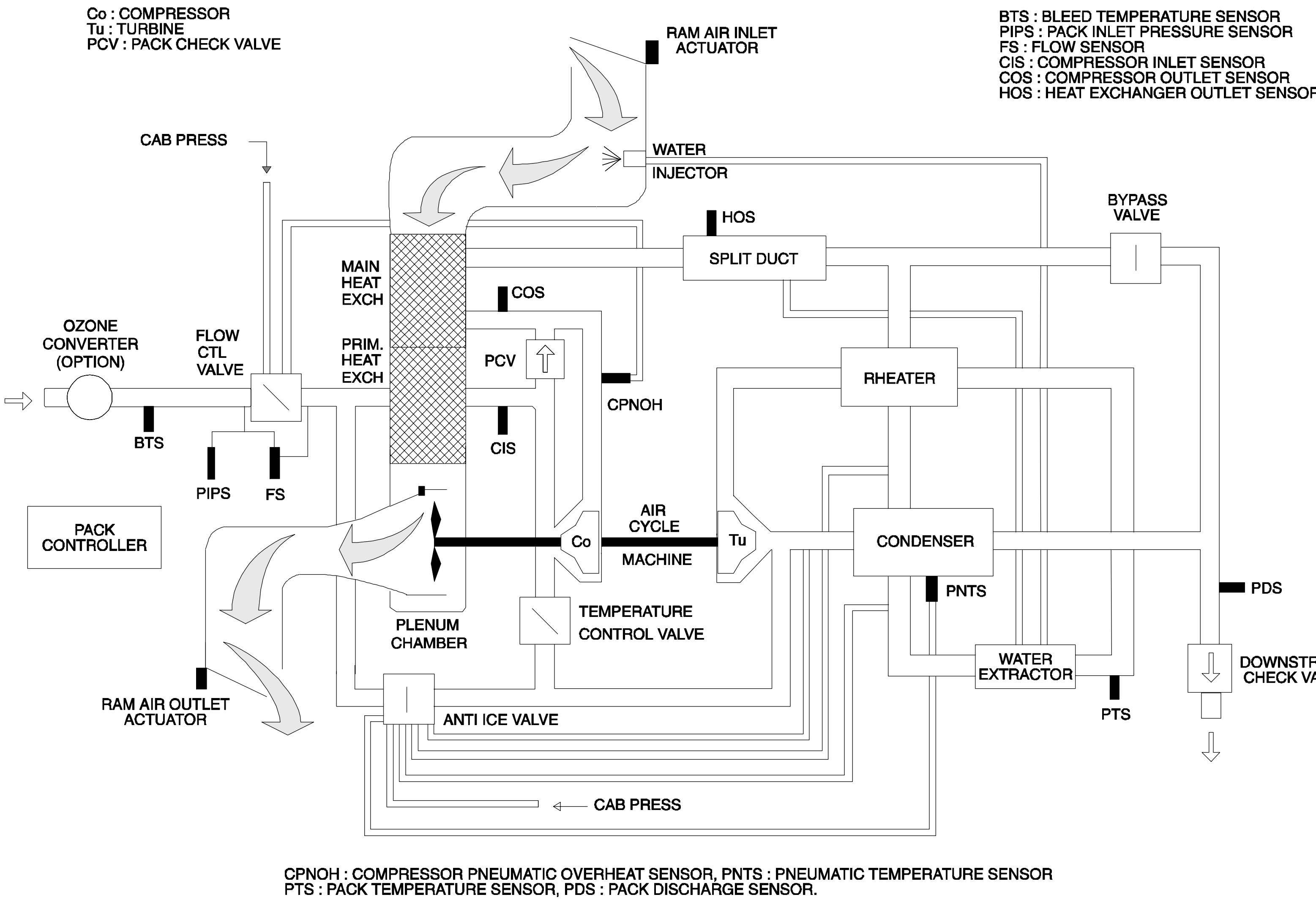
FQW4200 GE Metric

STUDENT NOTES

TEMPERATURE CONTROL : PACK COMPONENTS/2

SAFETY PRECAUTIONS

Make sure that air is not supplied to the air conditioning system from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel (The APU BLEED, ENG BLEED and PACK pushbutton switches must be released out).



FQW4200 GE Metric

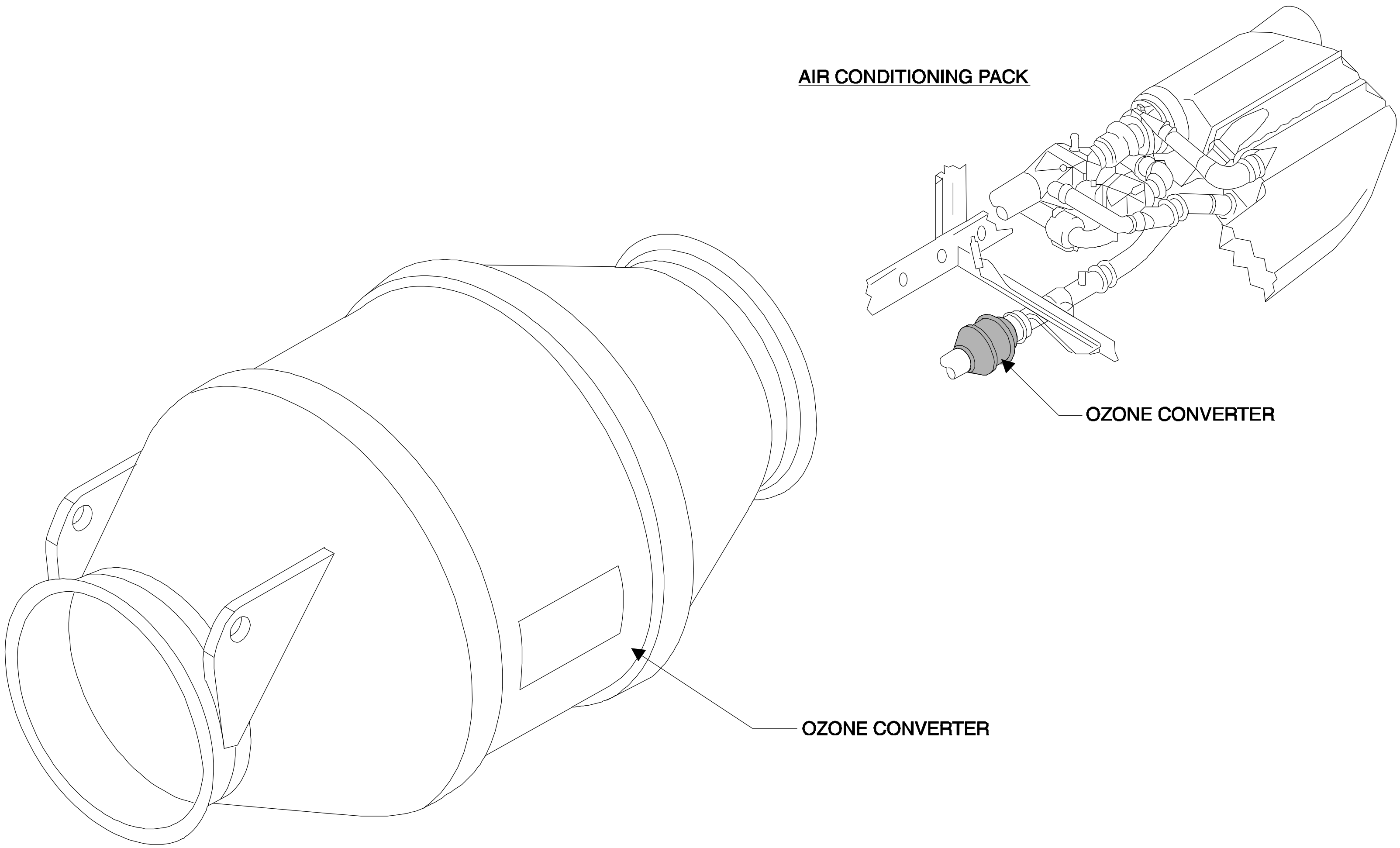
OZONE CONVERTER (OPTION)

FIN/ZONE

LH PACK
FIN: 5511HB
ZONE: 191
RH PACK
FIN: 5512HB
ZONE: 192

COMPONENT DESCRIPTION

The optional ozone converter transforms the ozone contained in the bleed air into oxygen by catalytic effect.



FQW4200 GE Metric

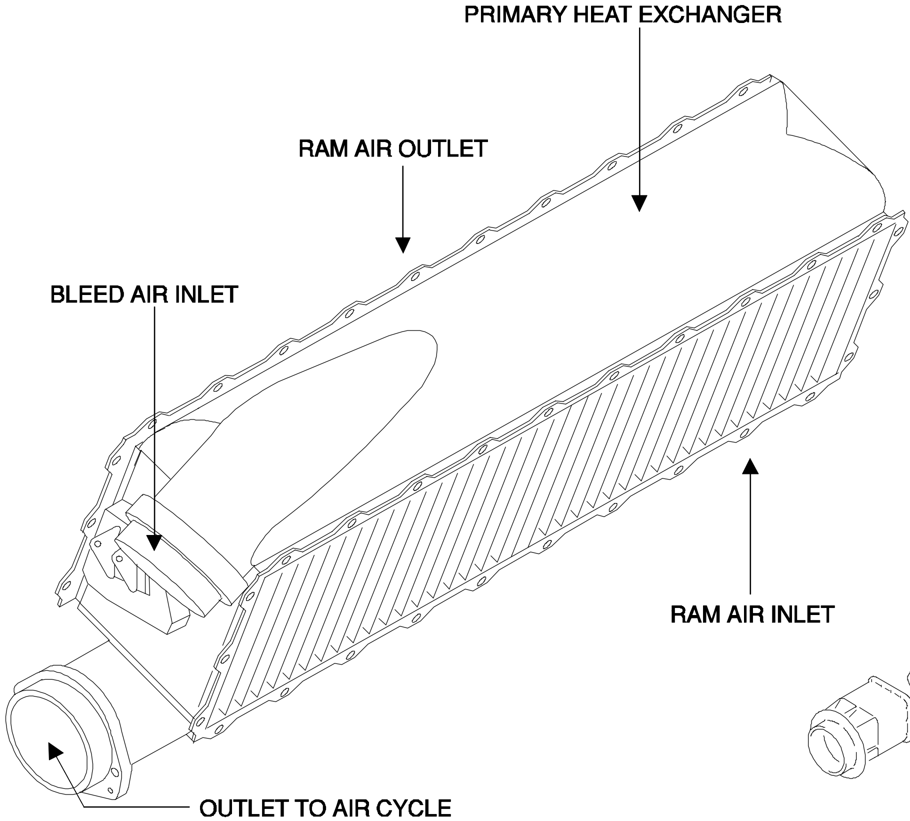
PRIMARY HEAT EXCHANGER

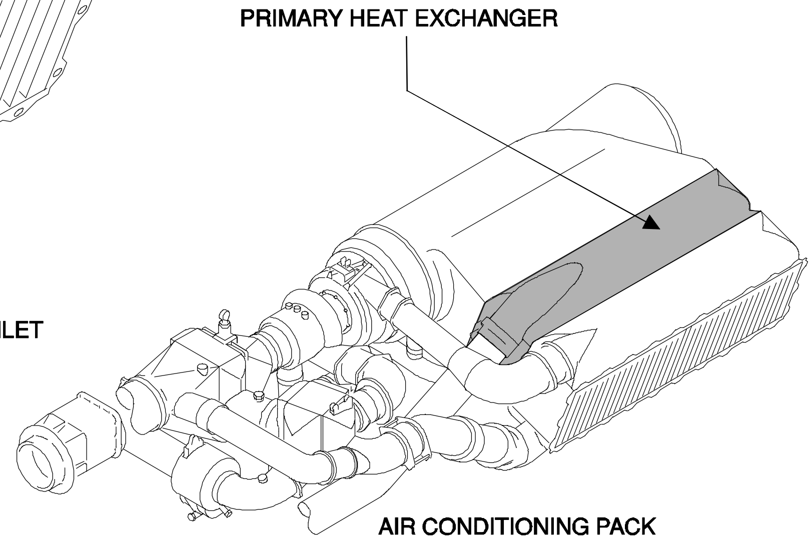
FIN/ZONE

LH PACK
FIN: 521HH18
ZONE: 191
RH PACK
FIN: 522HH18
ZONE: 192

COMPONENT DESCRIPTION

The primary heat exchanger is made from aluminum alloy.
It is of plate and fin type and has a single-pass crossflow configuration.
It has a bleed air inlet and an outlet to the compressor. It also has a ram air inlet and a ram air outlet.





FQW4200 GE Metric

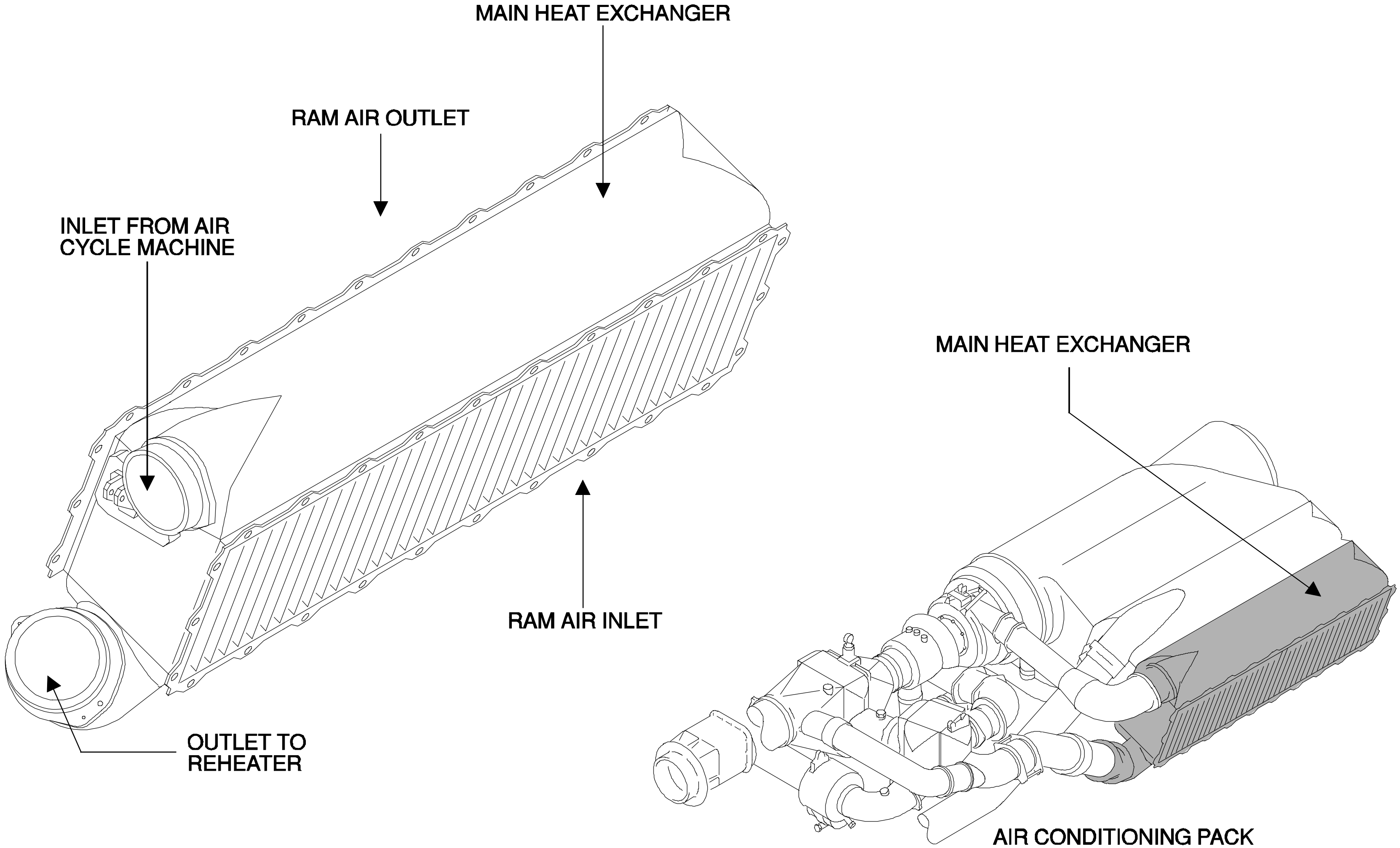
MAIN HEAT EXCHANGER

FIN/ZONE

LH PACK
FIN: 521HH19
ZONE: 191
RH PACK
FIN: 522HH19
ZONE: 192

COMPONENT DESCRIPTION

The main heat exchanger is made from aluminum alloy.
It is of plate and fin type and has a single-pass crossflow configuration.
It has an inlet from the compressor and an outlet to the reheater. It also has a ram air inlet and a ram air outlet.



FQW4200 GE Metric

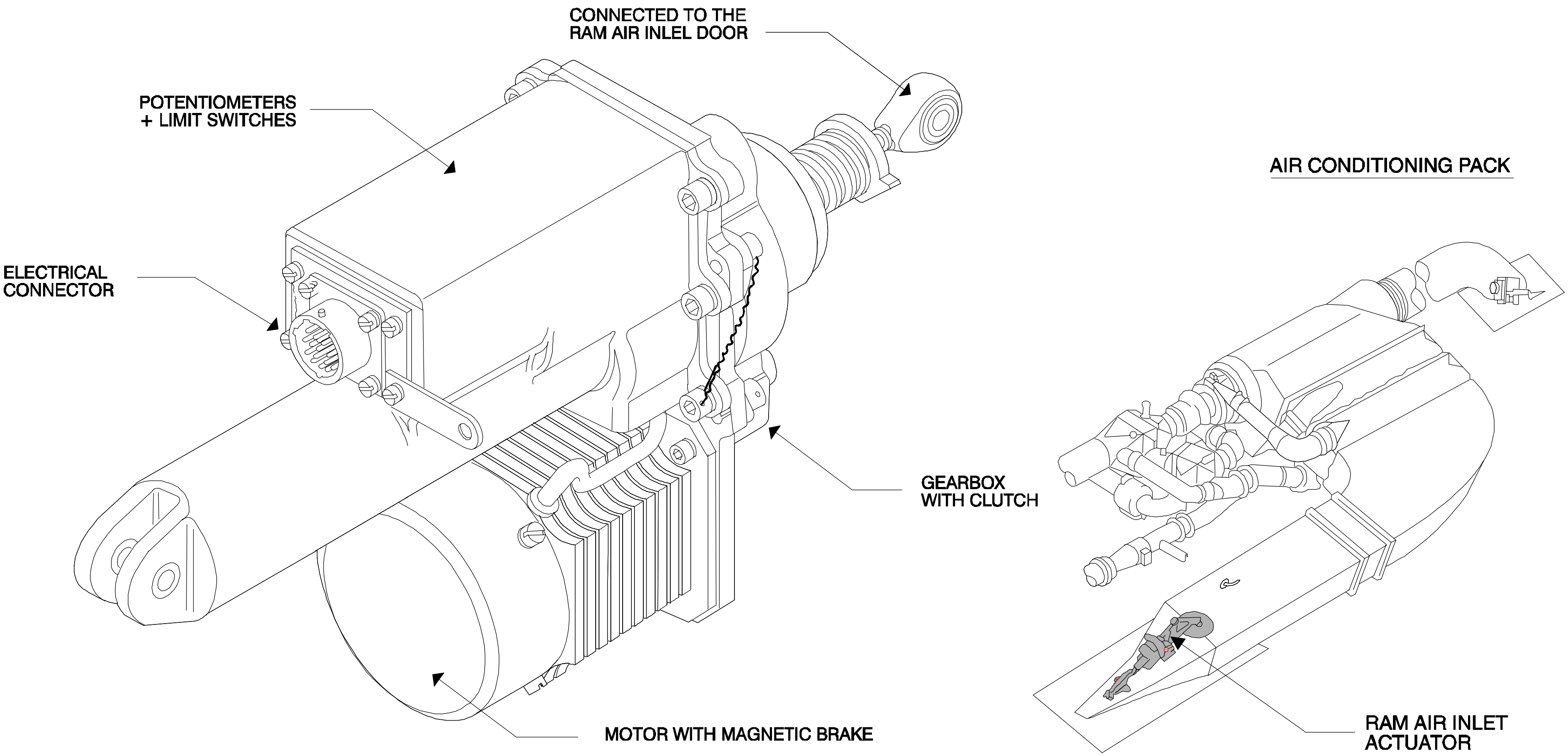
RAM AIR INLET ACTUATOR

FIN/ZONE

LH PACK
FIN: 533HH
ZONE: 191
RH PACK
FIN: 534HH
ZONE: 192

COMPONENT DESCRIPTION

An electrical motor drives an actuator through a reduction gearbox. A torque limiting clutch prevents damage to the actuator if there is too much torque. A magnetic brake stops the actuator if there is no electrical power. The actuator transmits its position through a transmission gear train to two potentiometers. Two limit switches keep the actuator safe from damage in case of failure of the potentiometers.



FQW4200 GE Metric

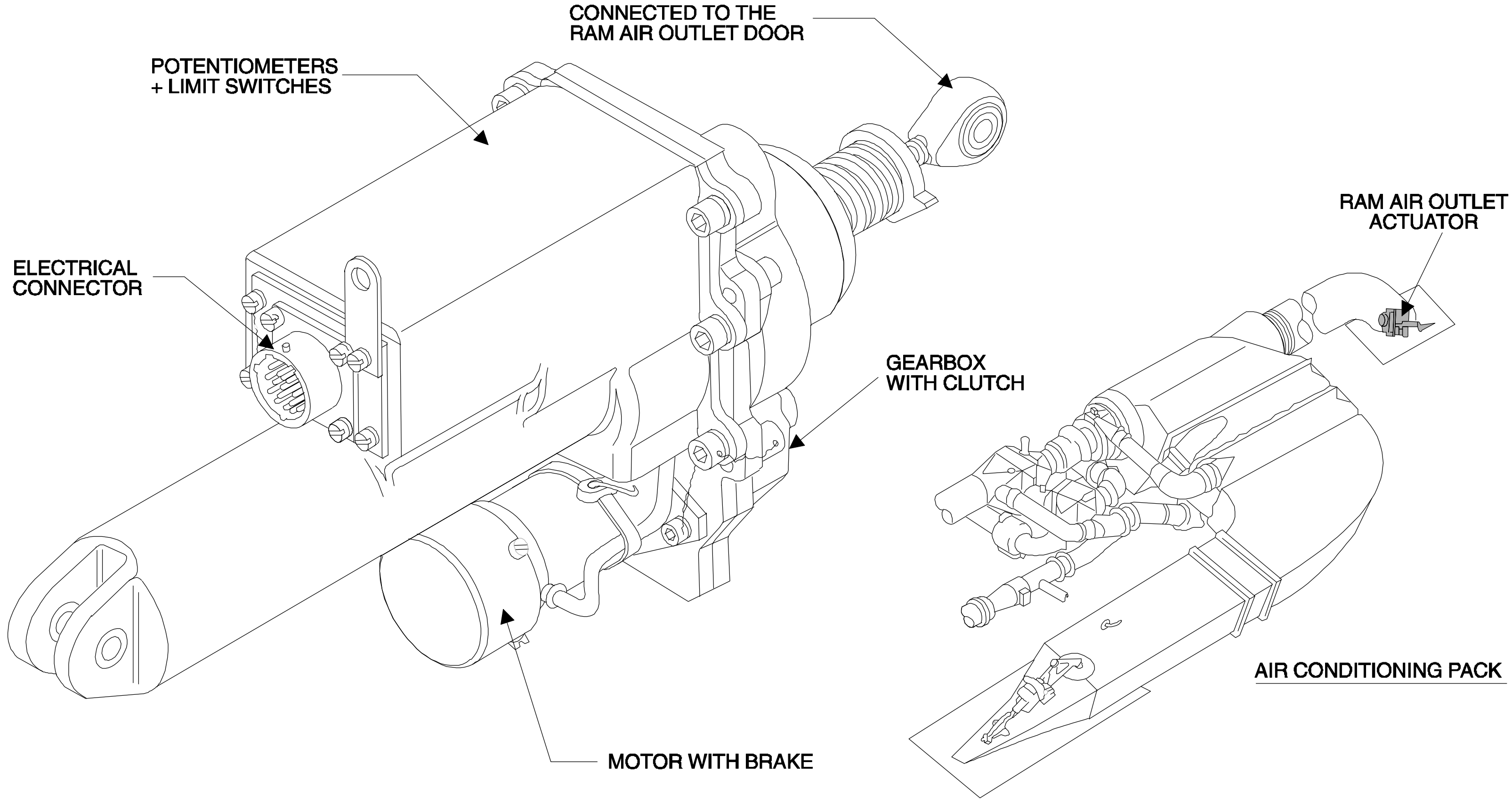
RAM AIR OUTLET ACTUATOR

FIN/ZONE

LH PACK
FIN: 535HH
ZONE: 191
RH PACK
FIN: 536HH
ZONE: 192

COMPONENT DESCRIPTION

An electrical motor drives an actuator through a reduction gearbox. A torque limiting clutch prevents damage to the actuator if there is too much torque. A brake stops the actuator if there is no electrical power.
The actuator transmits its position through a transmission gear train to two potentiometers.
Two limit switches keep the actuator safe from damage in case of failure of the potentiometers.



FQW4200 GE Metric

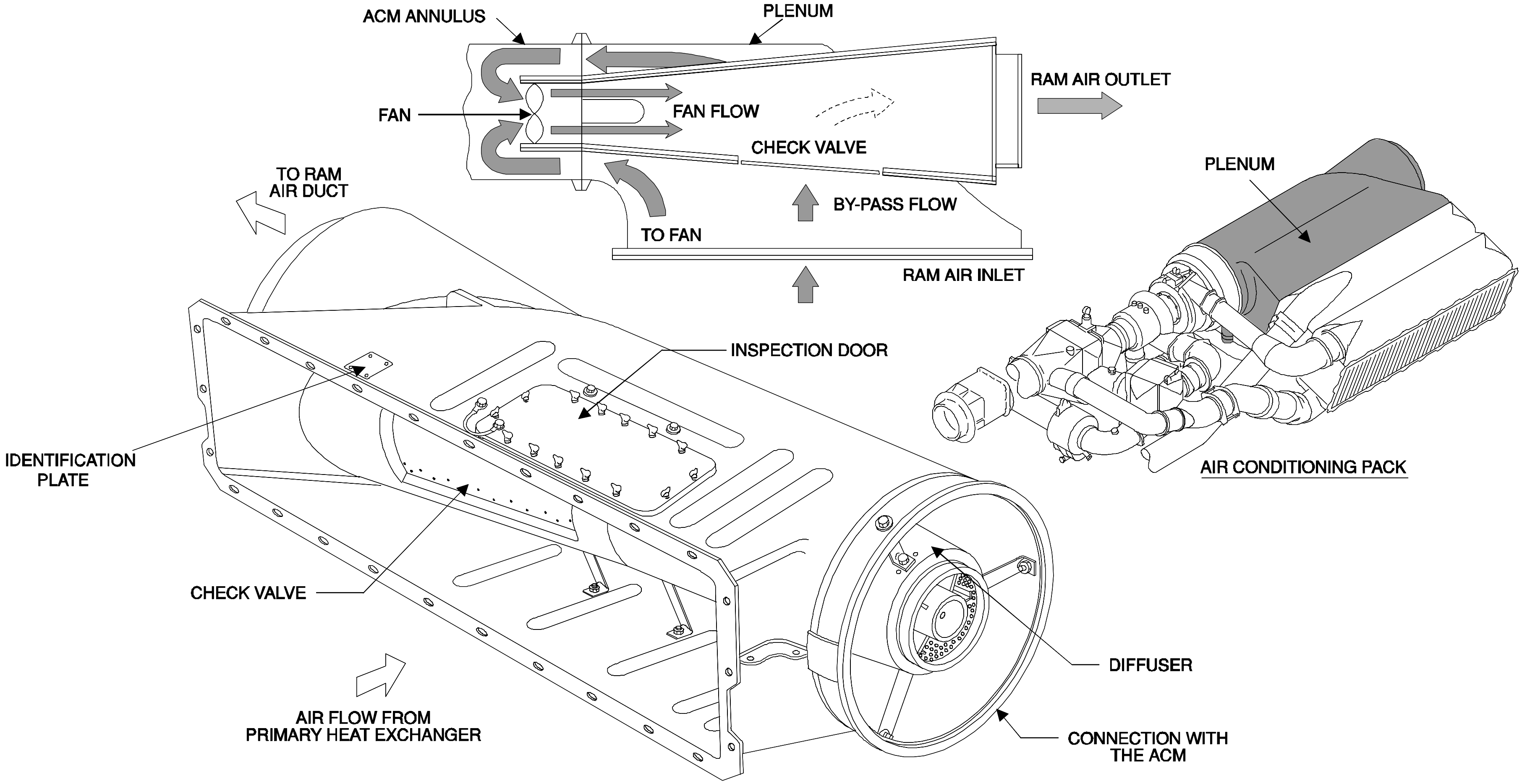
PLENUM CHAMBER

FIN/ZONE

LH PACK
FIN: 521HH17
ZONE: 191
RH PACK
FIN: 522HH17
ZONE: 192

COMPONENT DESCRIPTION

The plenum has a glass reinforced fiber housing with an inspection door. A soundproofed diffuser is installed into the housing, with a spring loaded check valve and a mechanical stop.
The air flow comes from the primary heat exchanger.
It is then extracted by the air cycle machine fan and sent to the ram air outlet through a diffuser.
If the ram air flow is greater than the diffuser air flow, then the air will bypass the fan by opening the check valve.



FQW4200 GE Metric

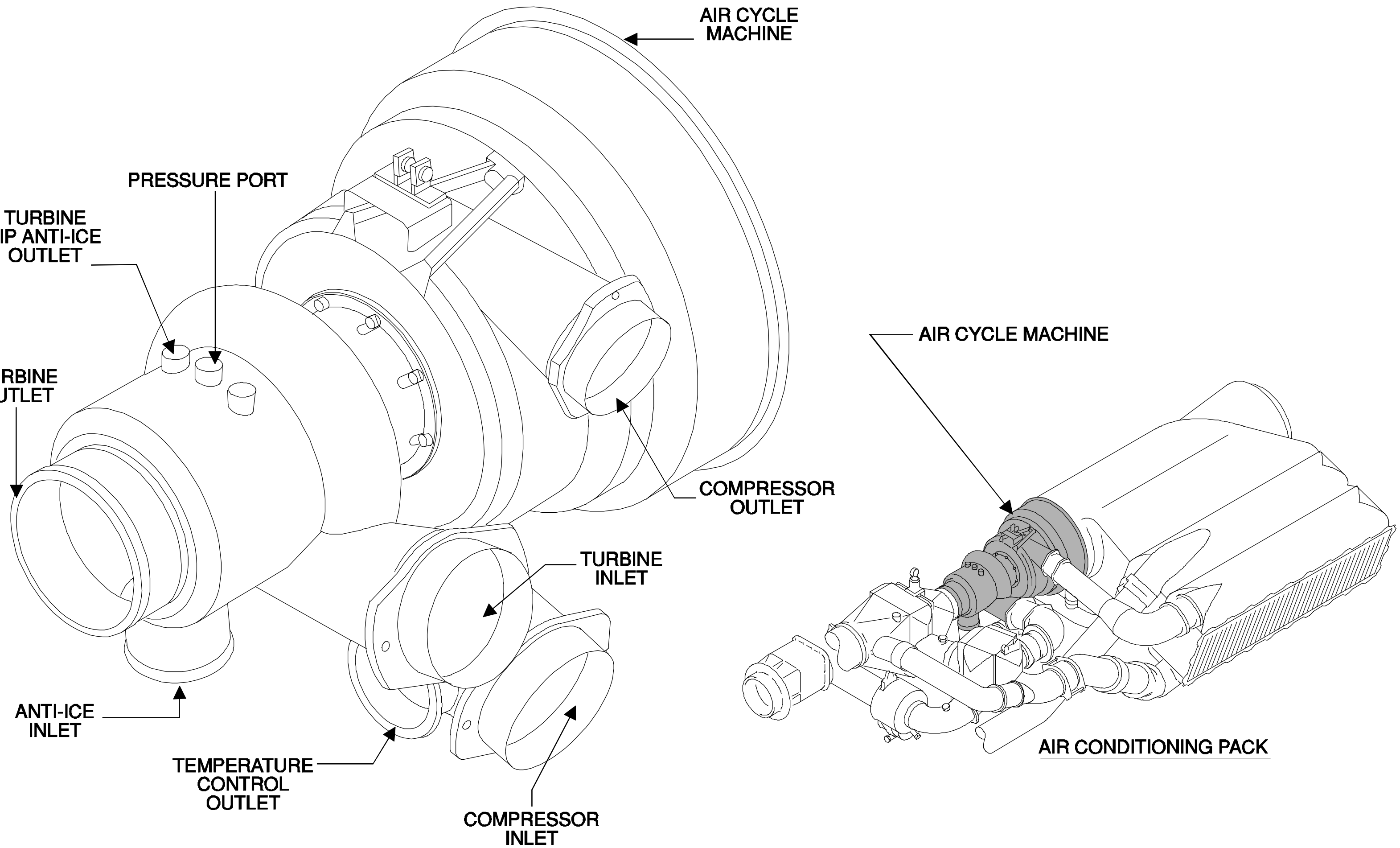
AIR CYCLE MACHINE

FIN/ZONE

LH PACK
FIN: 521HH12
ZONE: 191
RH PACK
FIN: 522HH12
ZONE: 192

COMPONENT DESCRIPTION

The air cycle machine (ACM) contains a fan, a compressor and a turbine wheel, all installed on the same shaft, which is supported by journal and thrust air-bearings (There is no need of oil lubrication of moving components).
To prevent icing conditions in the turbine, hot air is tapped from the compressor outlet and supplied to the turbine outlet lip.
Hot air is also supplied to the condenser header bar from the same tapping.
Normal operating speed of the ACM is between 20,000 and 50,000 RPM depending on the bleed pressure and flow.



FQW4200 GE Metric

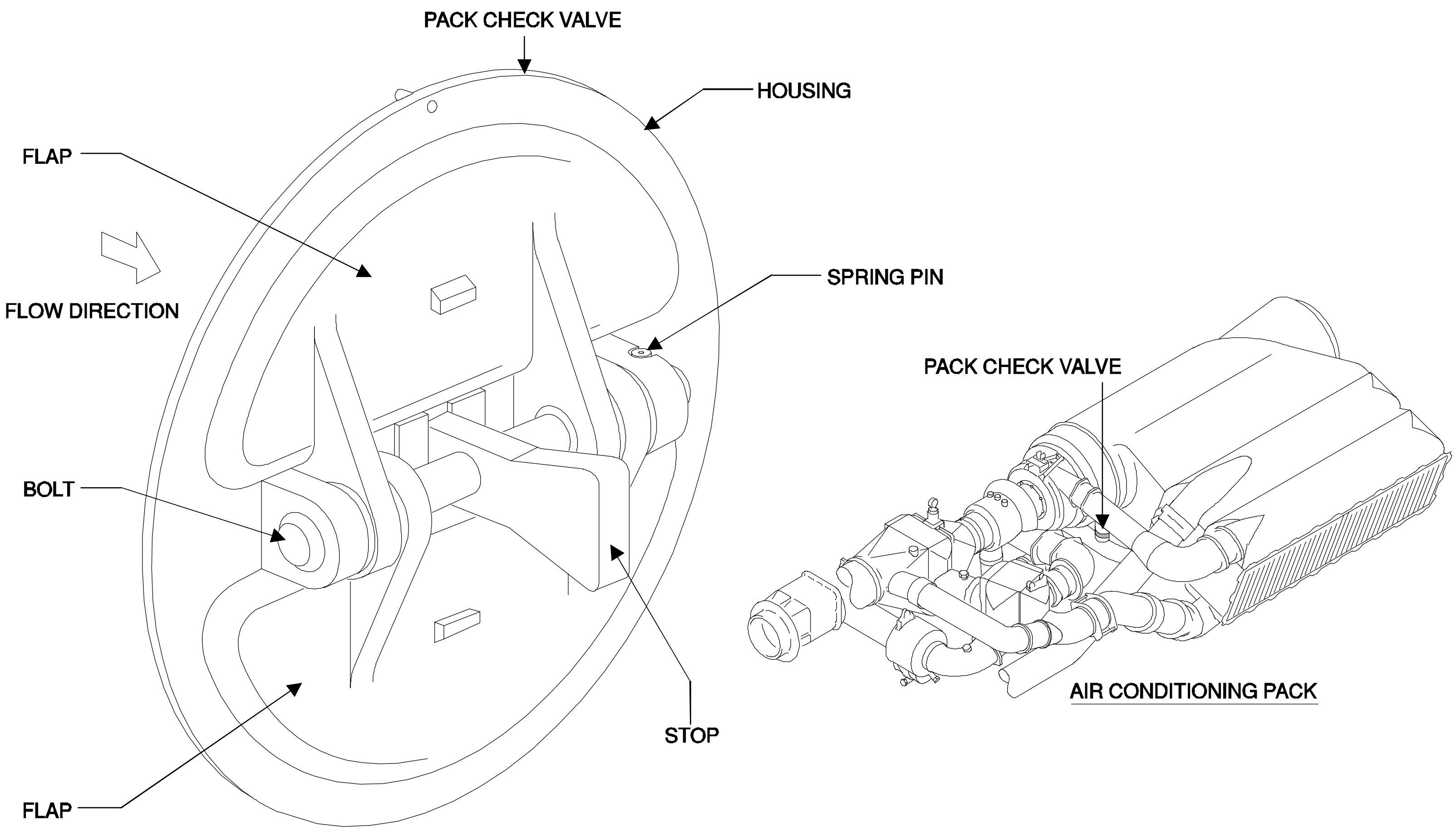
PACK CHECK VALVE

FIN/ZONE

LH PACK
FIN: 521HH21
ZONE: 191
RH PACK
FIN: 522HH21
ZONE: 192

COMPONENT DESCRIPTION

The pack check valve is composed of a housing with two semicircular flaps installed on a hinge bar.
Springs hold the two flaps in closed position.
Air flow from the primary heat exchanger causes the flaps to open and thus, bypass the compressor when the ACM is seized or during pack start.



FQW4200 GE Metric

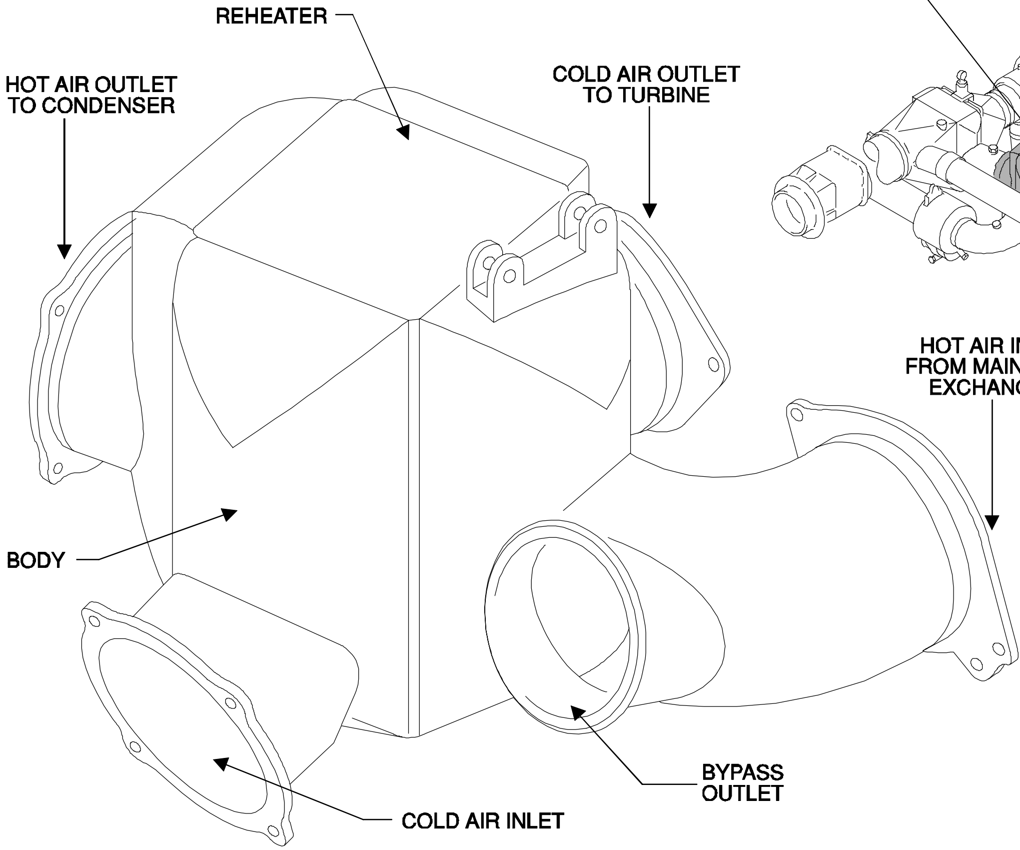
REHEATER

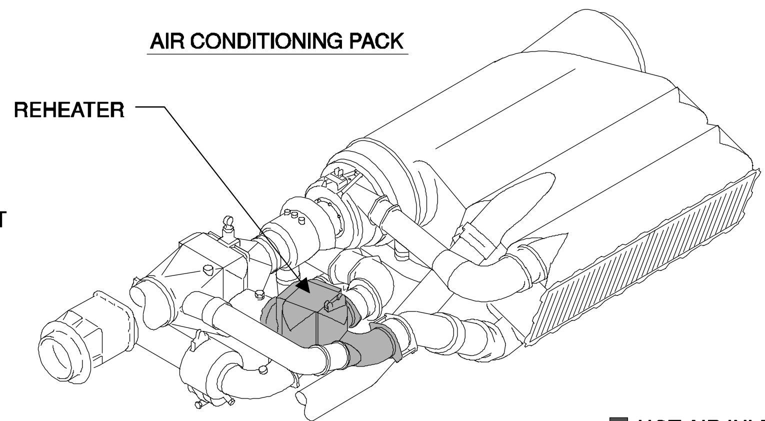
FIN/ZONE

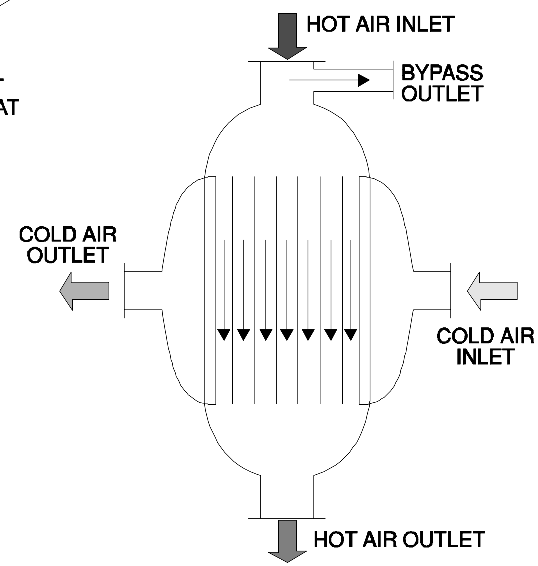
LH PACK
FIN: 521HH15
ZONE: 191
RH PACK
FIN: 522HH15
ZONE: 192

COMPONENT DESCRIPTION

The reheater is a single-pass crossflow air-to-air heat exchanger.
Air leaving the main heat exchanger is cooled prior to entering the condenser and water extractor.
Cool air from the condenser and water extractor is reheated prior to entering the turbine expansion stage of the ACM.







FQW4200 GE Metric

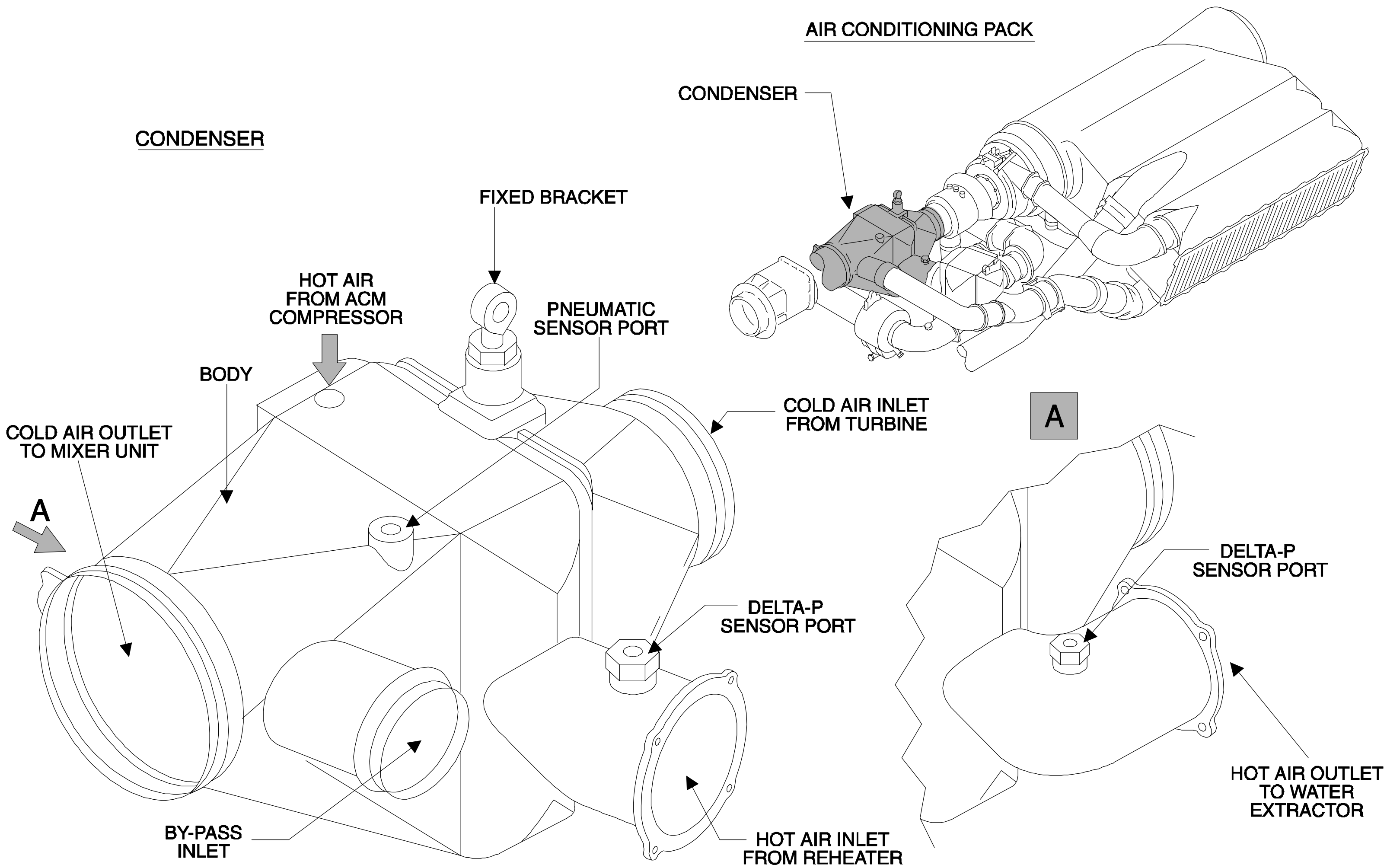
CONDENSER

FIN/ZONE

LH PACK
FIN: 521HH13
ZONE: 191
RH PACK
FIN: 522HH13
ZONE: 192

COMPONENT DESCRIPTION

The condenser is a single-pass crossflow air-to-air heat exchanger.
The core consists of two smaller core modules arranged in a parallel flow configuration with a space between the modules.
This allows a portion of the turbine outlet air to flow through even in excessive icing conditions.
To reduce ice formation, hot air is tapped from the ACM compressor outlet and ducted through the condenser.
There is a port for the pneumatic temperature sensor (PNTS).



FQW4200 GE Metric

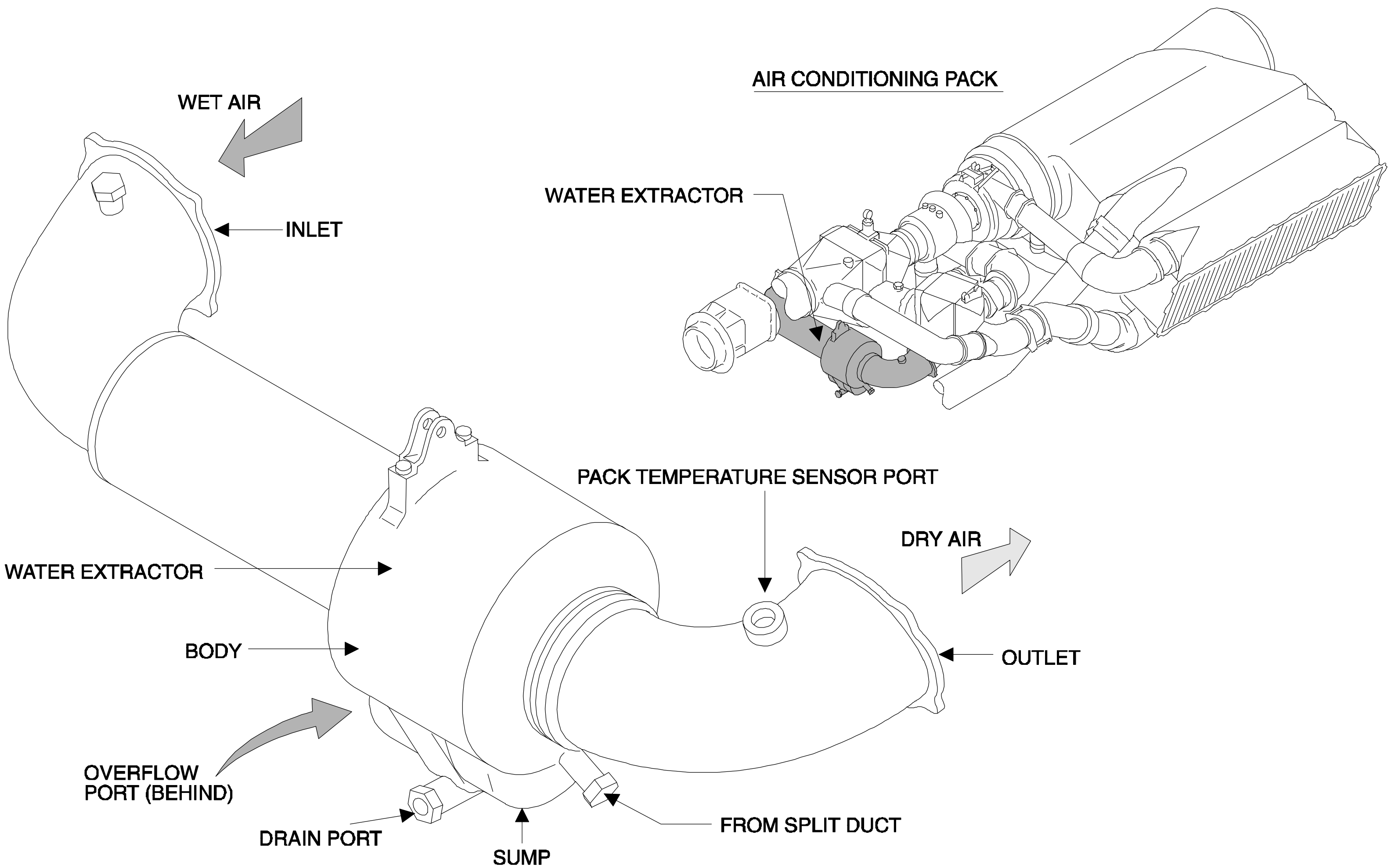
WATER EXTRACTOR

FIN/ZONE

LH PACK
FIN: 521HH14
ZONE: 191
RH PACK
FIN: 522HH14
ZONE: 192

COMPONENT DESCRIPTION

Swirl vanes at the water extractor inlet create a vortex, forcing water to collect on the walls of the unit.
The water then drains into a sump where it is collected.
The sump has three threaded connection ports. One is for the connection to the water injector. An other one is for the connection to the split duct. The last one is an overflow drain, which must remain open all the time.
There is also a port for the pack temperature sensor (PTS).



FQW4200 GE Metric

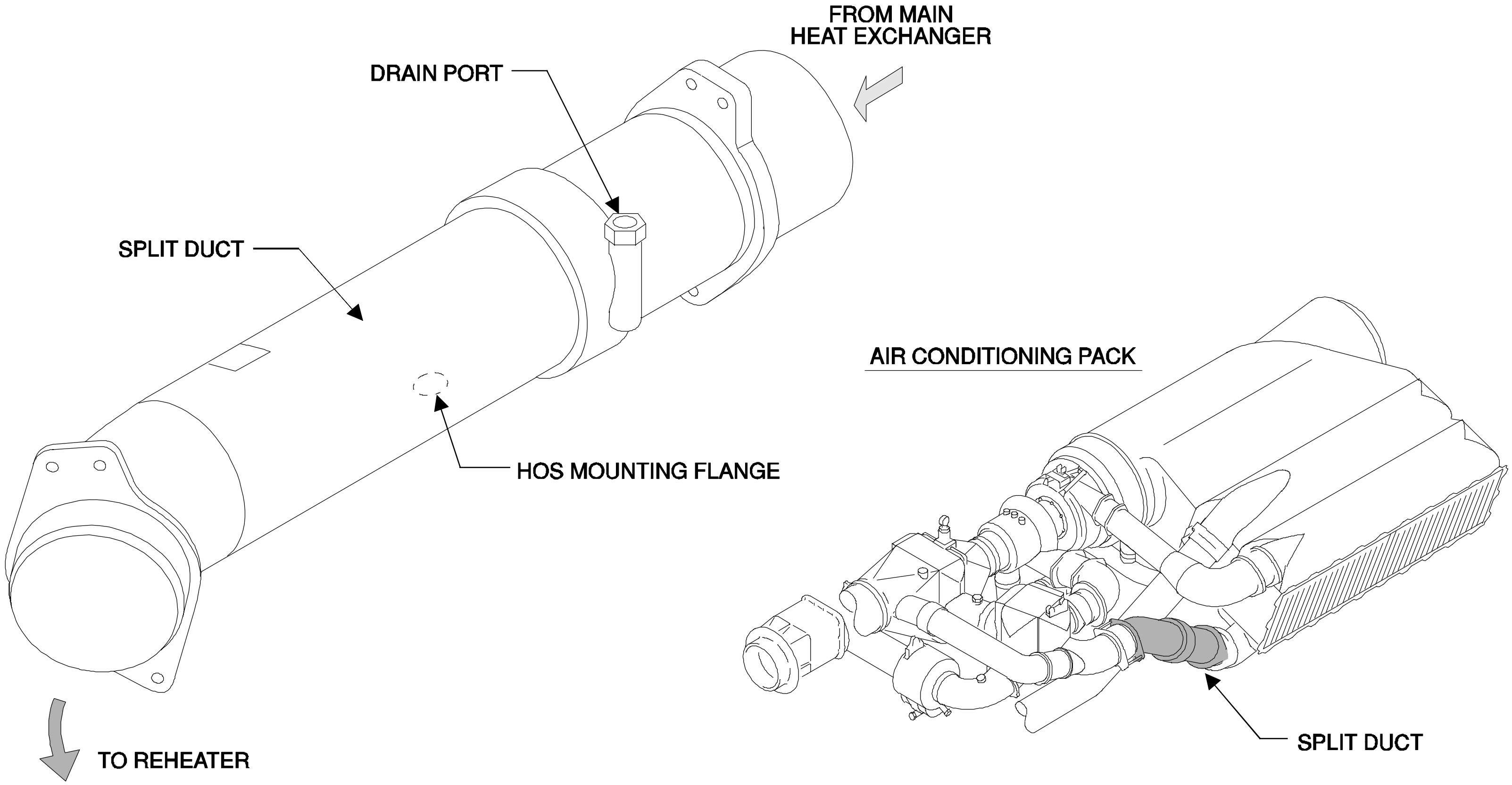
SPLIT DUCT

FIN/ZONE

LH PACK
FIN: 521HH20
ZONE: 191
RH PACK
FIN: 522HH20
ZONE: 192

COMPONENT DESCRIPTION

The split duct contains a water drain fitting and a mounting manifold for the heat exchanger outlet temperature sensor (HOS).
The drain fitting is attached to a drain manifold which is attached to the duct.
Inside the duct are several openings which allow condensed water to be removed from the air stream.



FQW4200 GE Metric

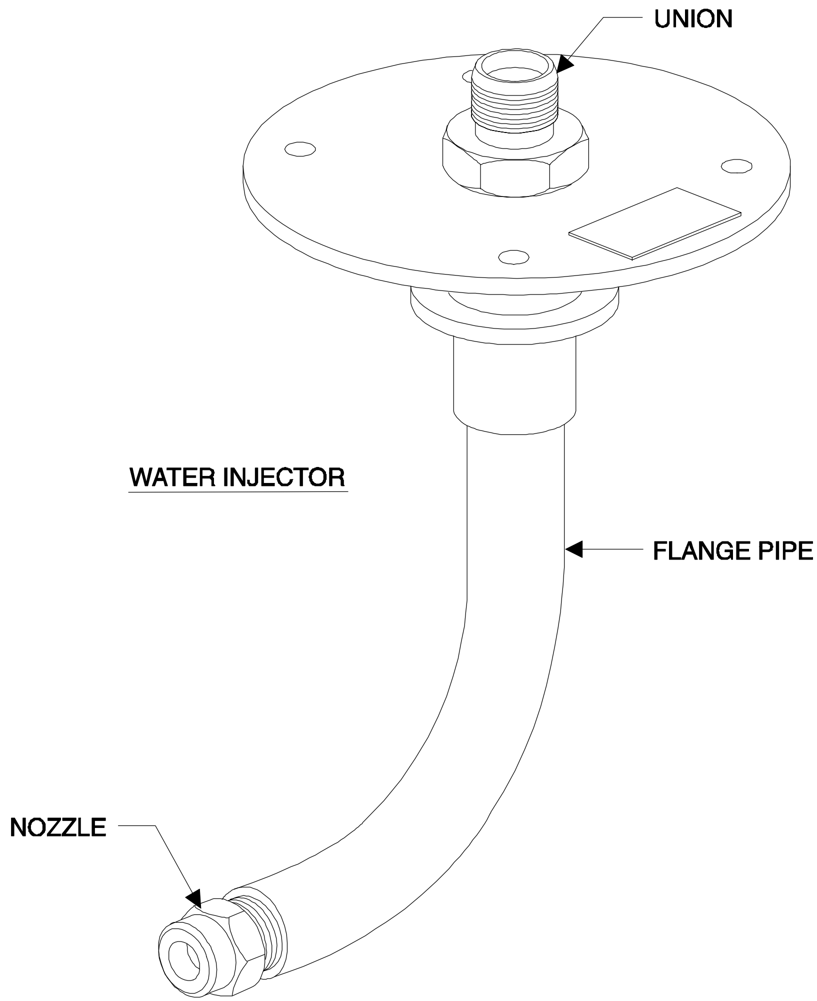
WATER INJECTOR

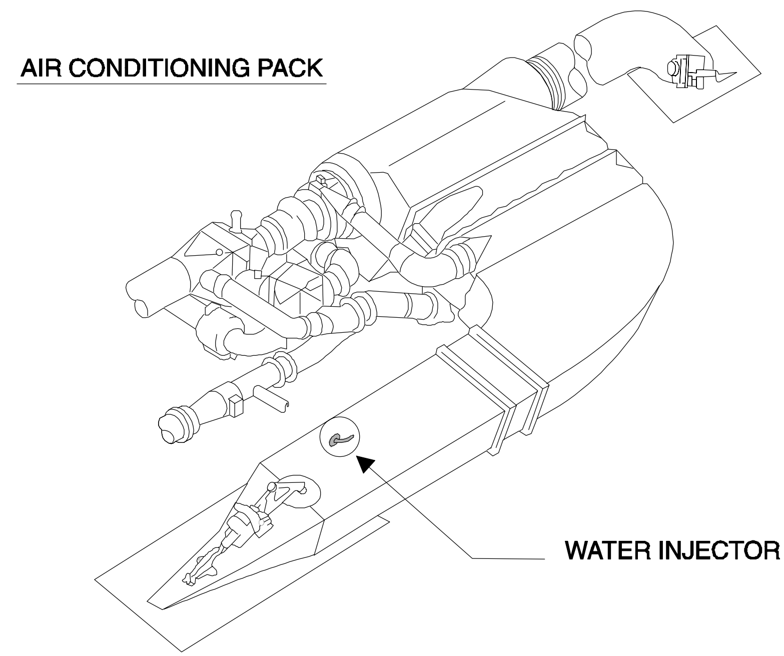
FIN/ZONE

LH PACK
FIN: 5531HB
ZONE: 191
RH PACK
FIN: 5532HB
ZONE: 192

COMPONENT DESCRIPTION

The water injector has a plate, a tube and a nozzle.
Liquid water, collected by the split duct and the water extractor, is ducted to the injector.
The nozzle then sprays the water into the ram air inlet to increase the cooling effects of the ram air flow.





FQW4200 GE Metric

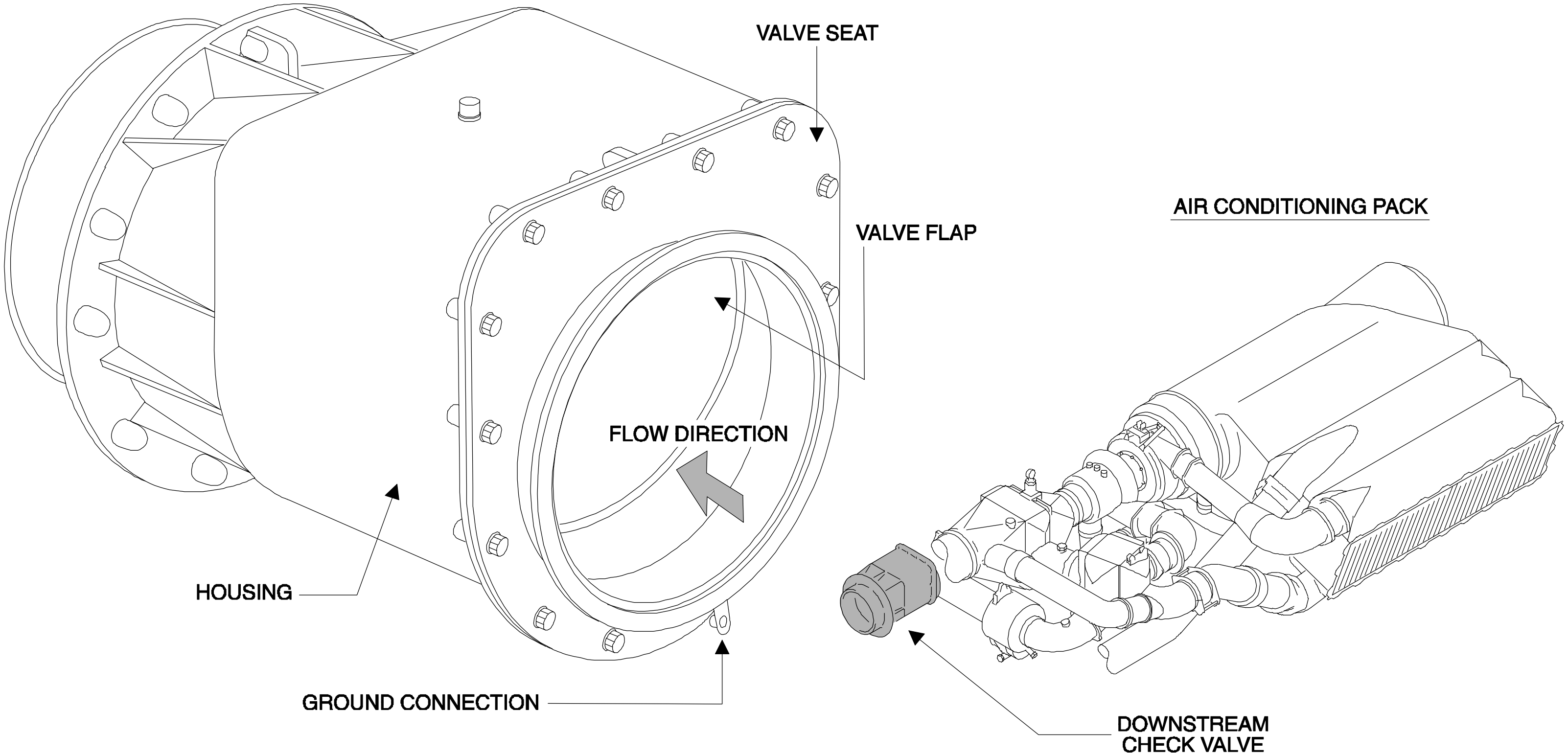
DOWNSTREAM CHECK VALVE

FIN/ZONE

LH PACK
FIN: 5533HB
ZONE: 191
RH PACK
FIN: 5534HB
ZONE: 192

COMPONENT DESCRIPTION

The downstream check valve is composed of a body and a flap.
The latter is held closed by a spring when the pack is not operating.



FQW4200 GE Metric

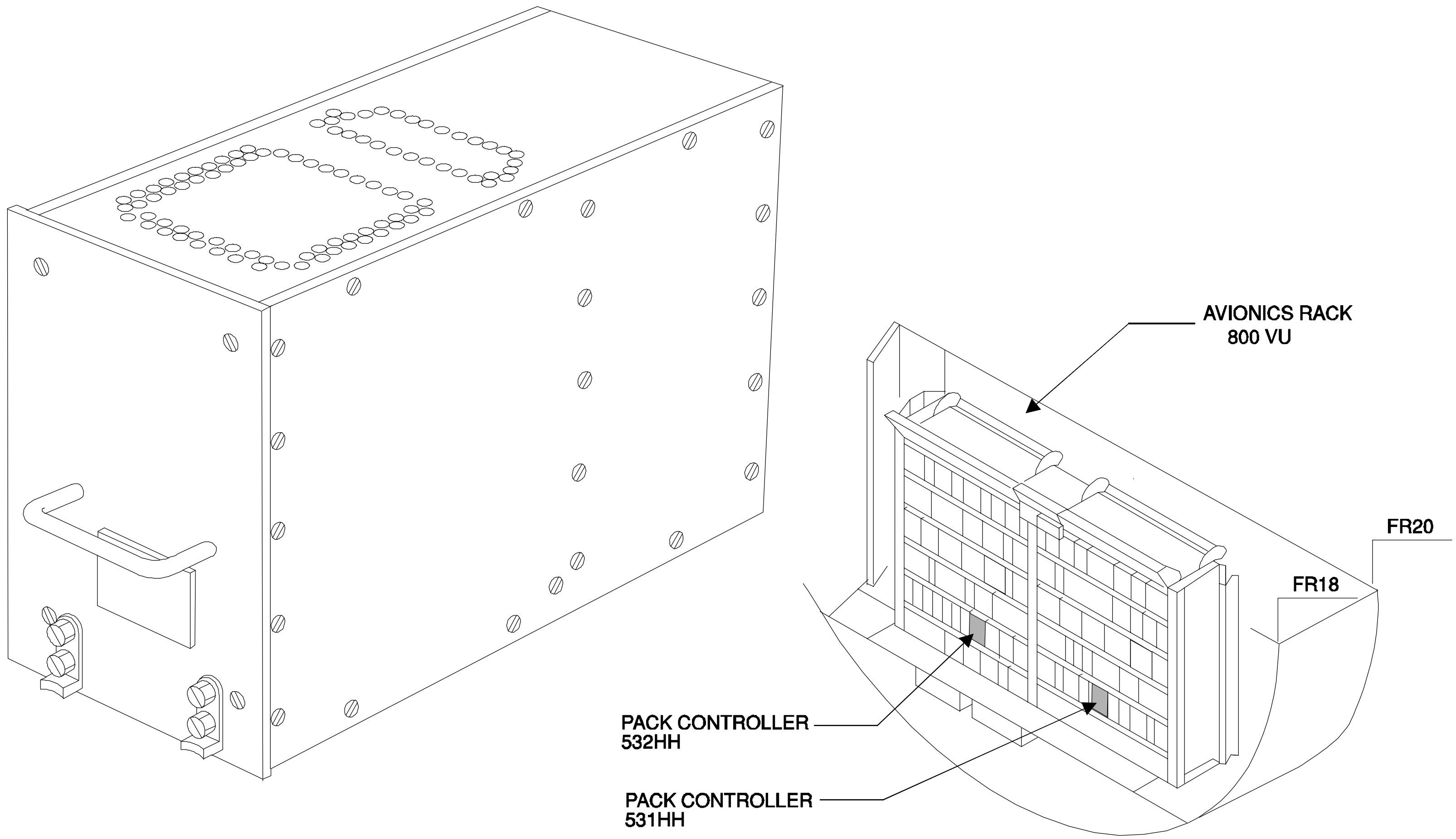
PACK CONTROLLER

FIN/ZONE

PACK CONTROLLER 1
FIN: 531HH
ZONE: 121
PACK CONTROLLER 2
FIN: 532HH
ZONE: 122

COMPONENT DESCRIPTION

The pack controller contains two independent computer lanes, each of which is capable of performing all control and monitoring functions. One of these lanes is designated as being "active" while the other lane remains in a passive "hot-standby"mode.
An automatic change-over occurs at the end of each flight or during the flight, if there is a failure in the active lane.
Should a fault exist in both lanes, active control will be passed to the lane with the least significant fault.
A covered RS232 test equipment connector is on the front of the controller and an ARINC 600 connector on the back.



FQW4200 GE Metric

STUDENT NOTES

TEMPERATURE CONTROL : PACK SENSOR COMPONENTS

Safety precautions
Bleed Temperature Sensor (BTS)
Pack Inlet Pressure Sensor (PIPS)
Flow Sensor (FS)
Compressor Inlet Sensor (CIS)
Compressor Outlet Sensor (COS)
Compressor Pneumatic Overheat Sensor (CPNOH)
Heat Exchanger Outlet Sensor (HOS)
Pack Temperature Sensor (PTS)
Pneumatic Temperature Sensor (PNTS)
Pack Discharge Sensor (PDS)

SAFETY PRECAUTIONS

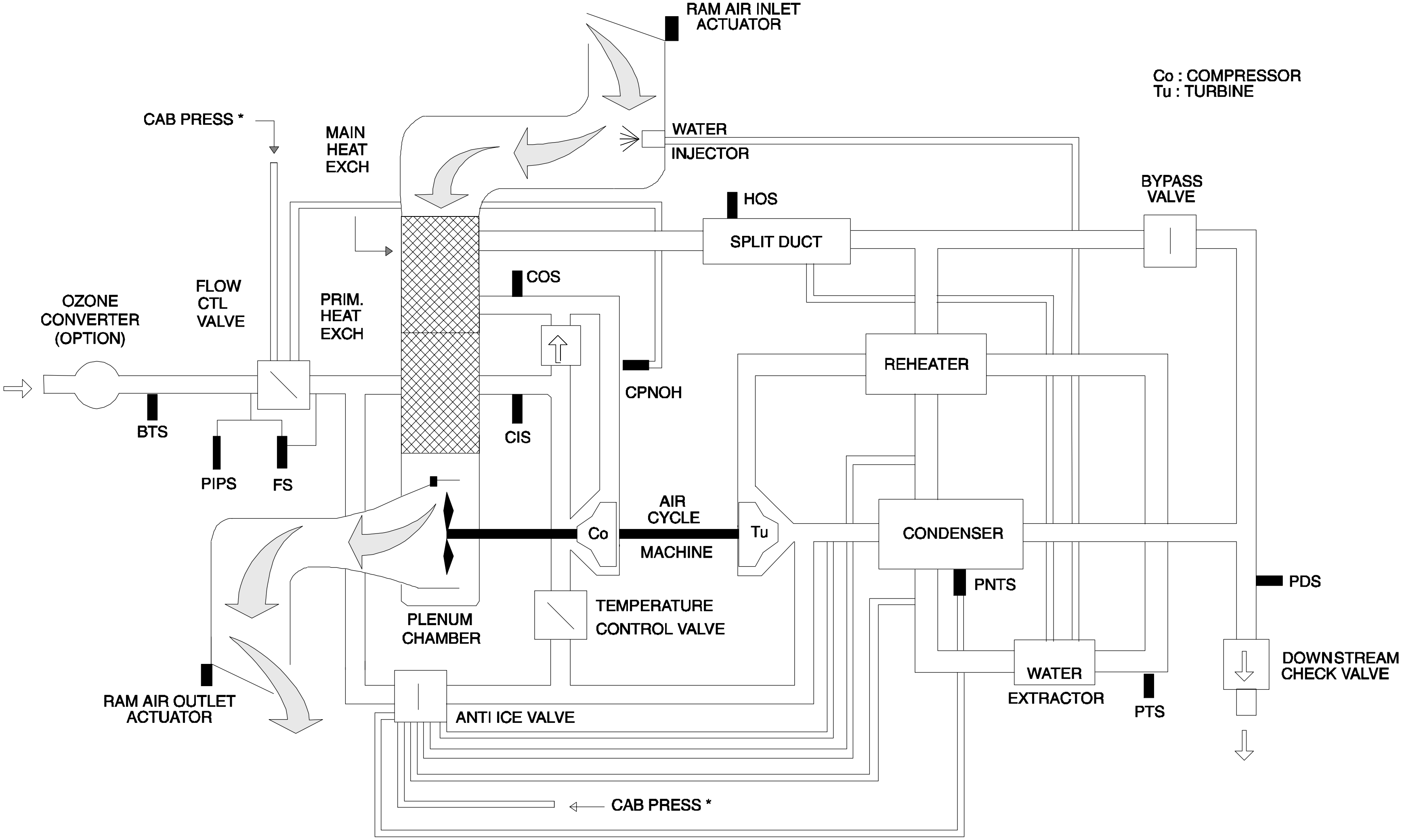
Before removal of any sensor :

(1) please make sure that the applicable circuit breakers listed in the AMM are open, safetied and tagged.

(2) make sure that the APU and ENG BLEED pushbutton switches are released and tagged.

(3) make sure that PACK 1 and PACK 2 pushbutton switches are released and tagged.

(4) make sure that the HP ground connectors are not supplied with HP ground air and are tagged.



FQW4200 GE Metric

BLEED TEMPERATURE SENSOR (BTS)

FIN / ZONE

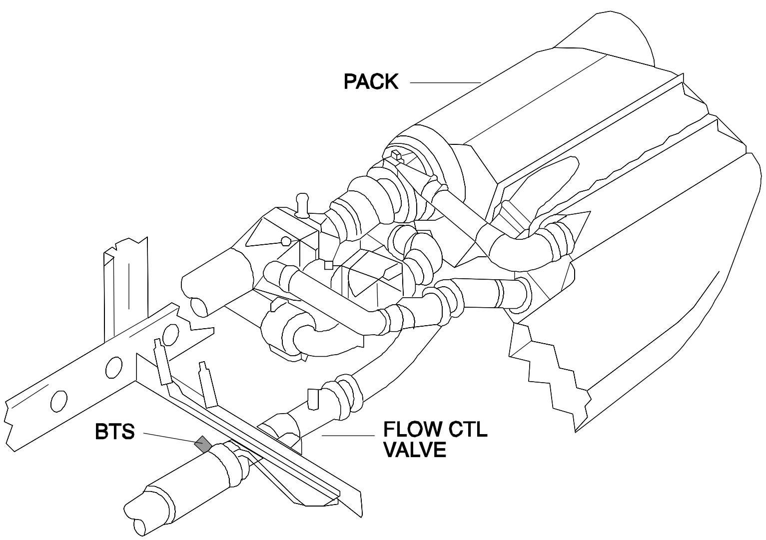
FIN : 539HH, 540HH

Zone : 191, 192

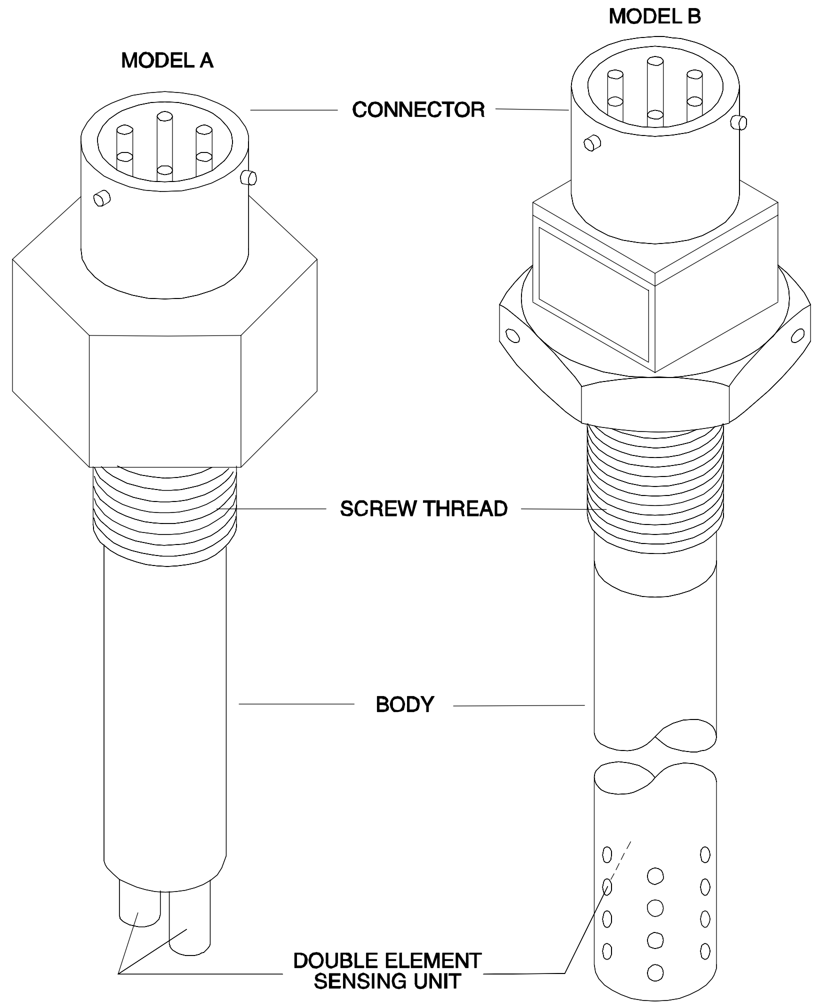
COMPONENT DESCRIPTION

The bleed temperature sensor (BTS) is a double element sensing unit which sends temperature information to both lanes of the associated pack controller. The sensor has a pin connector for electrical connection and a tubular body.

Two different models are available.



BLEED TEMPERATURE SENSOR



FQW4200 GE Metric

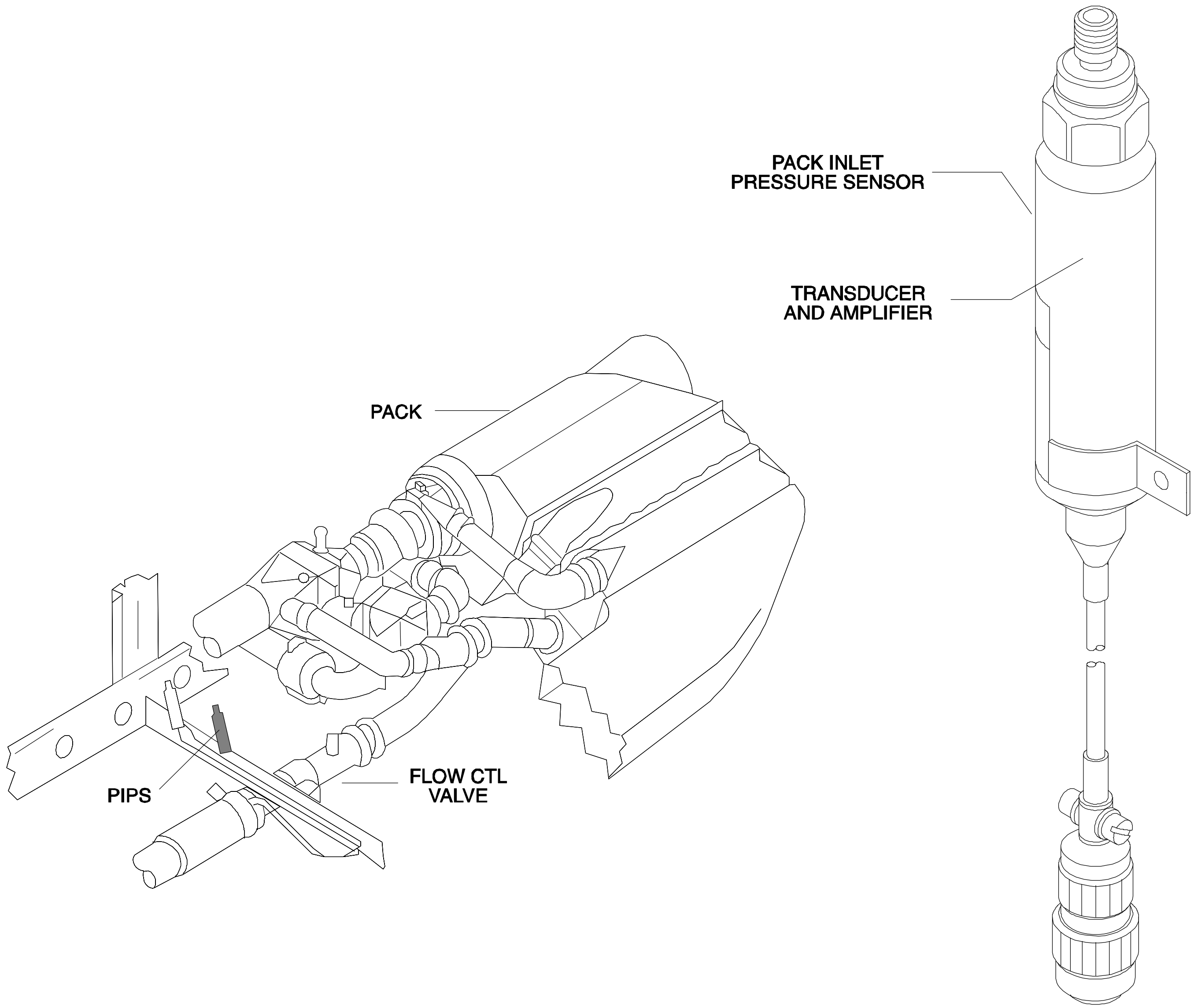
PACK INLET PRESSURE SENSOR (PIPS)

FIN / ZONE

FIN : 537HH, 538HH
Zone : 191, 192

COMPONENT DESCRIPTION

The pack inlet pressure sensor (PIPS) has a pressure transducer and an amplifier. It changes the pressure to an electrical signal and sends it to the associated pack controller.



FQW4200 GE Metric

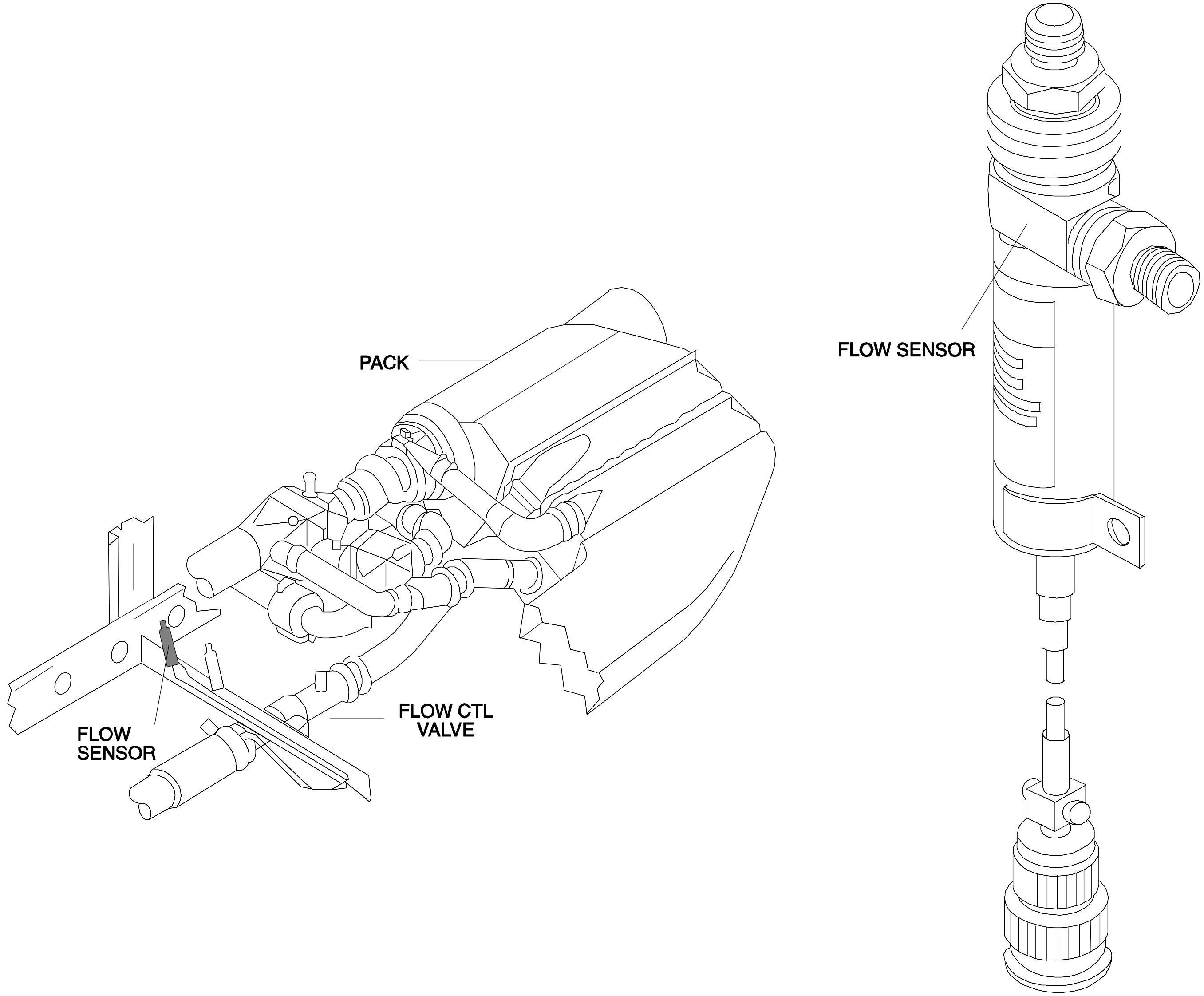
FLOW SENSOR (FS)

FIN / ZONE

FIN : 513HB, 514HB
Zone : 191, 192

COMPONENT DESCRIPTION

The flow sensor (FS) has two pressure transducers in the body. The pressure transducers change the pressure to an electrical signal.



FQW4200 GE Metric

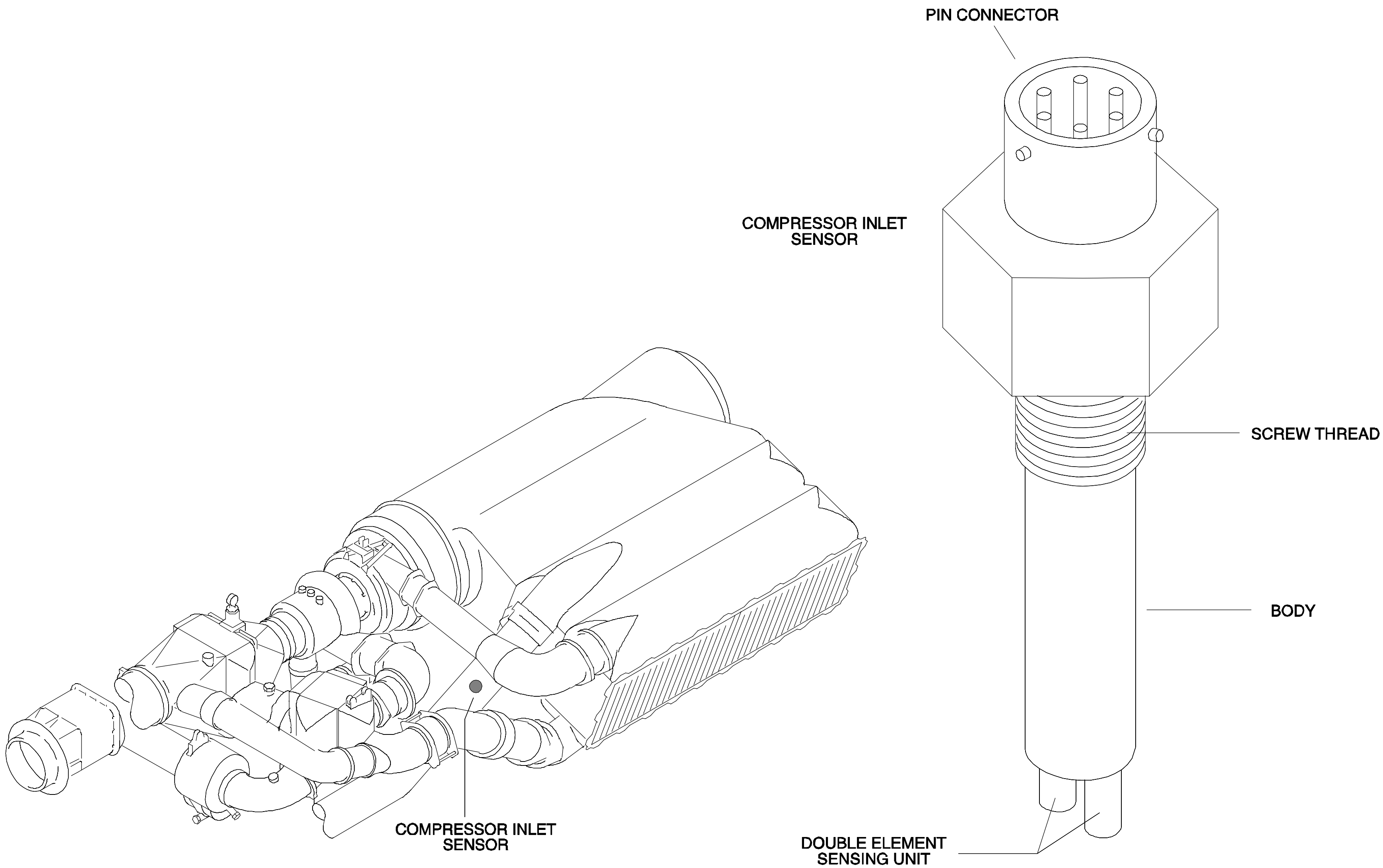
COMPRESSOR INLET SENSOR (CIS)

FIN / ZONE

FIN : 521HH5, 522HH5
Zone : 191, 192

COMPONENT DESCRIPTION

The compressor inlet sensor (CIS) is a double element sensing unit which sends temperature information to both lanes of the associated pack controller. The sensor has a pin connector for electrical connection and a tubular body.



FQW4200 GE Metric

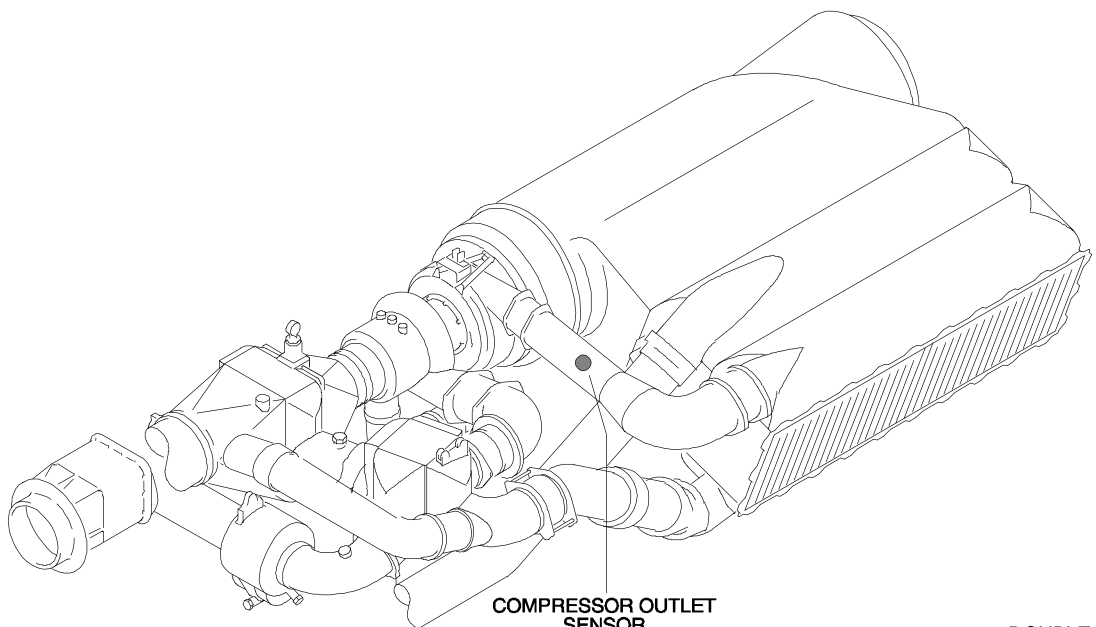
COMPRESSOR OUTLET SENSOR (COS)

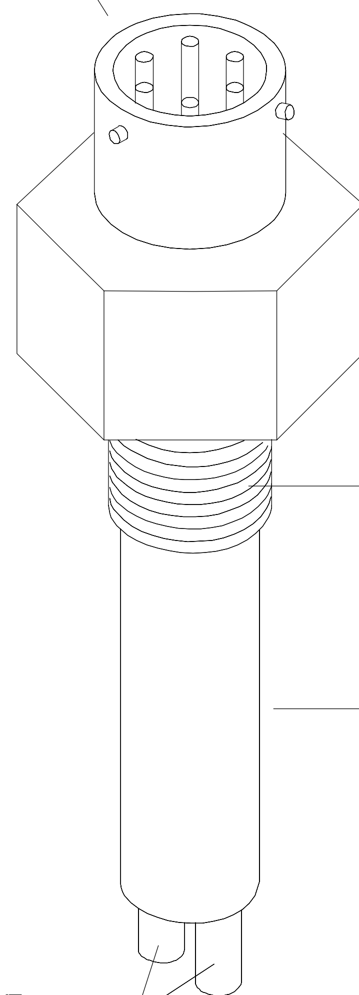
FIN / ZONE

FIN : 521HH6, 522HH6
Zone : 191, 192

COMPONENT DESCRIPTION

The compressor outlet sensor (COS) is a double element sensing unit which sends temperature information to both lanes of the associated pack controller. The sensor has a pin connector for electrical connection and a tubular body.


COMPRESSOR OUTLET SENSOR
FQW4200 GE Metric


PIN CONNECTOR
COMPRESSOR OUTLET SENSOR
SCREW THREAD
BODY
DOUBLE ELEMENT SENSING UNIT

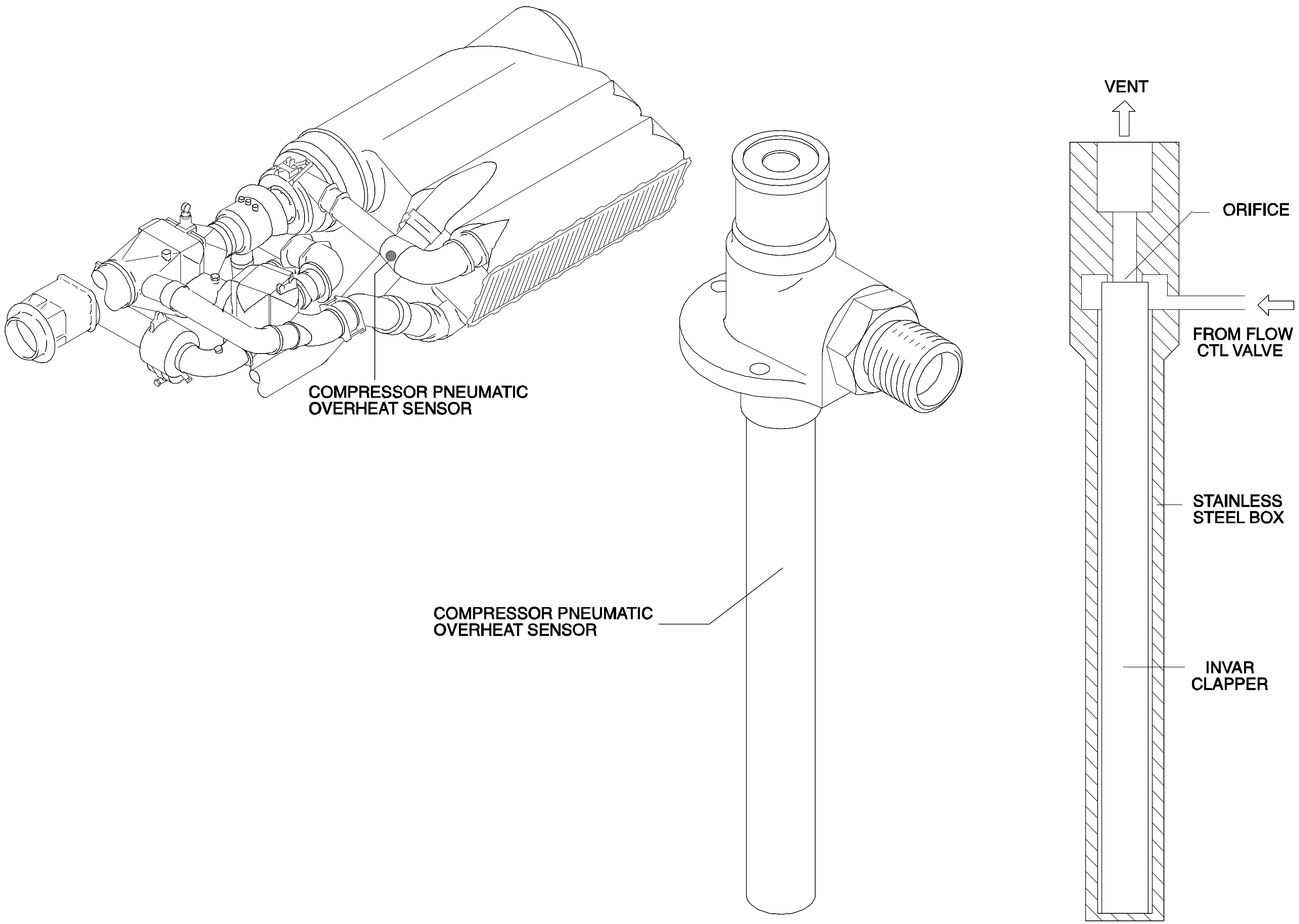
COMPRESSOR PNEUMATIC OVERHEAT SENSOR (CPNOH)

FIN / ZONE

FIN : 521HH22, 522HH22
Zone : 191, 192

COMPONENT DESCRIPTION

The compressor pneumatic overheat sensor has a clapper made of metal with low expansion factor in a stainless steel body. If the temperature changes, the metals contract or expand differently and the size of the orifice changes. This changes the pressure in the line to the Flow Control Valve.



FQW4200 GE Metric

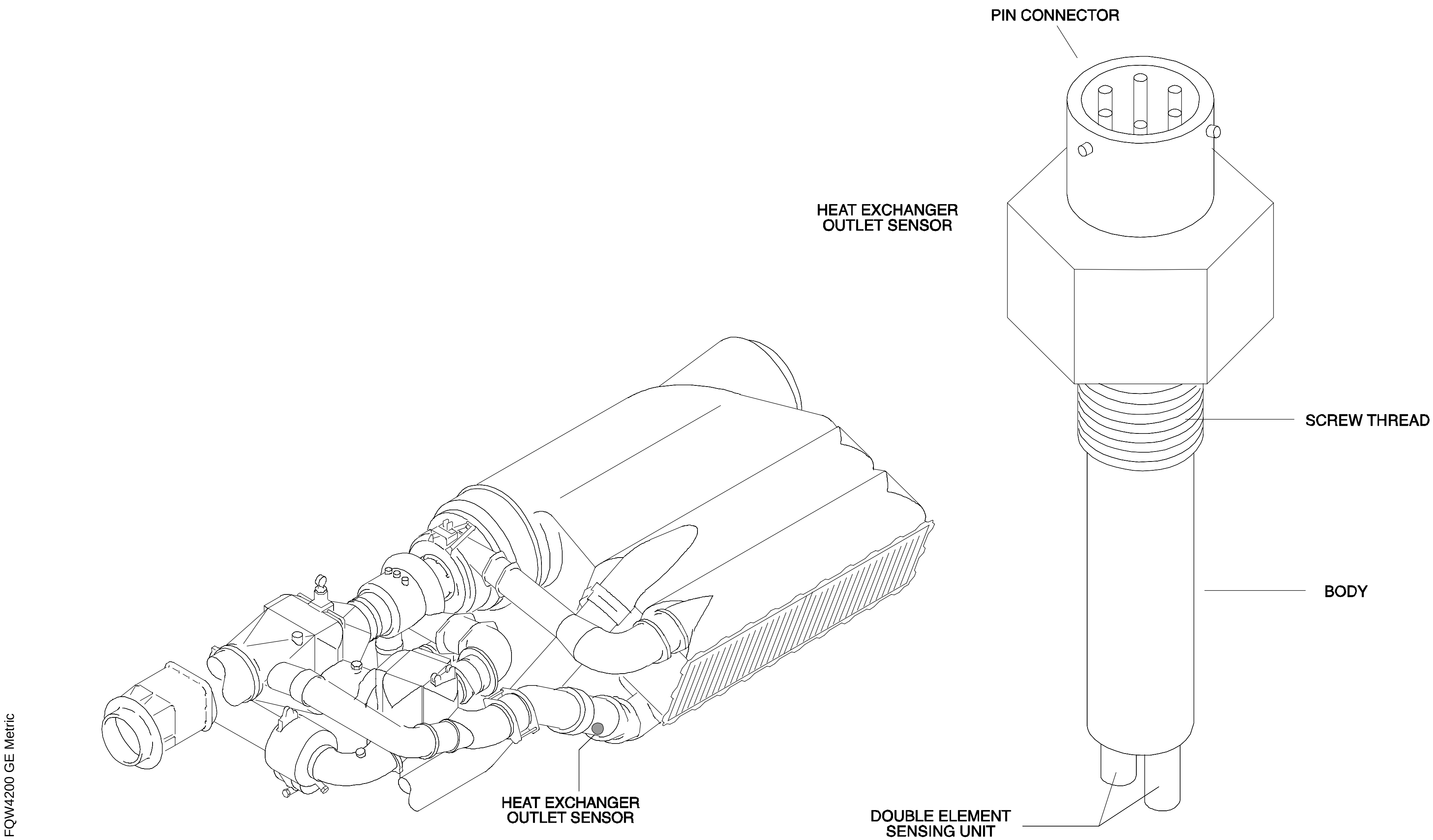
HEAT EXCHANGER OUTLET SENSOR (HOS)

FIN / ZONE

FIN : 521HH7, 522HH7
Zone : 191, 192

COMPONENT DESCRIPTION

The heat exchanger outlet sensor (HOS) is a double element sensing unit which sends temperature information to both lanes of the associated pack controller. The sensor has a pin connector for electrical connection and a tubular body.


PIN CONNECTOR
HEAT EXCHANGER
OUTLET SENSOR
SCREW THREAD
BODY
HEAT EXCHANGER
OUTLET SENSOR
DOUBLE ELEMENT
SENSING UNIT
FQW4200 GE Metric

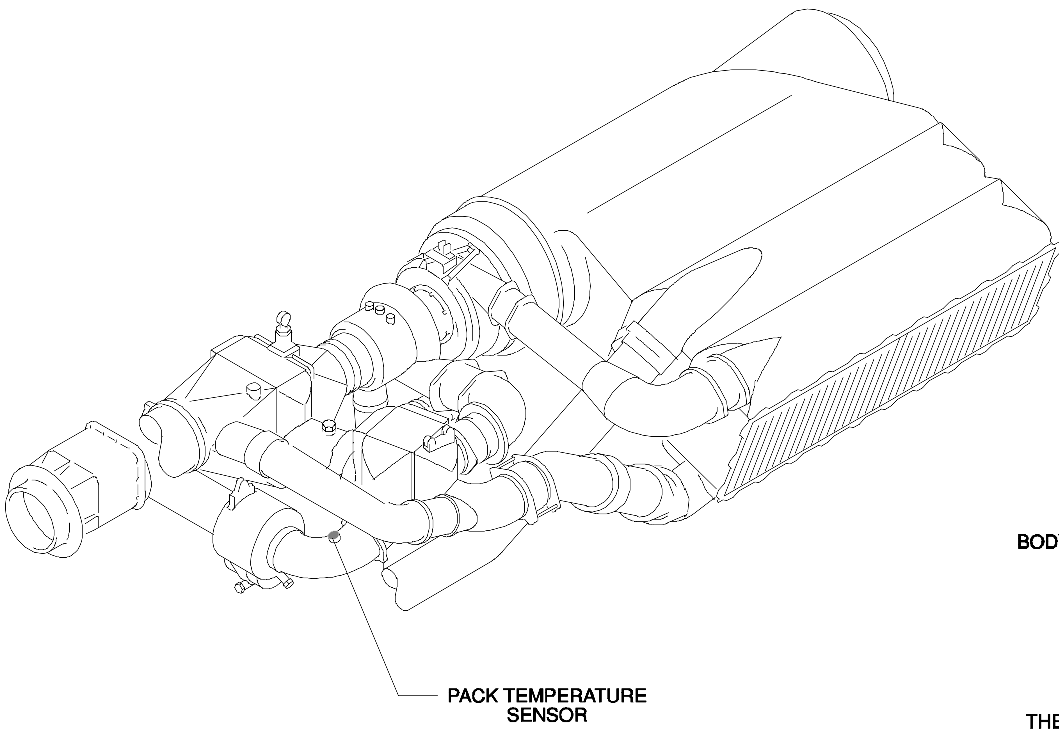
PACK TEMPERATURE SENSOR (PTS)

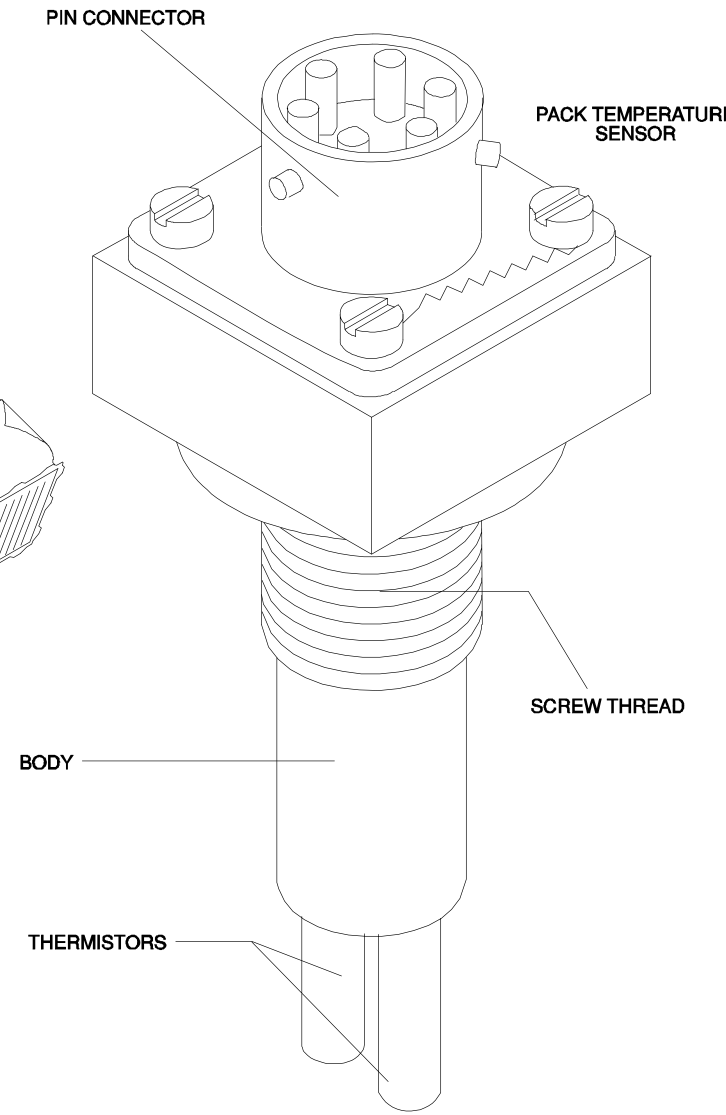
FIN / ZONE

FIN : 521HH8, 522HH8
Zone : 191, 192

COMPONENT DESCRIPTION

The pack temperature sensor (PTS) is a double element sensing unit which sends temperature information to both lanes of the associated pack controller. The sensor has a pin connector for electrical connection and a tubular body.





FQW4200 GE Metric

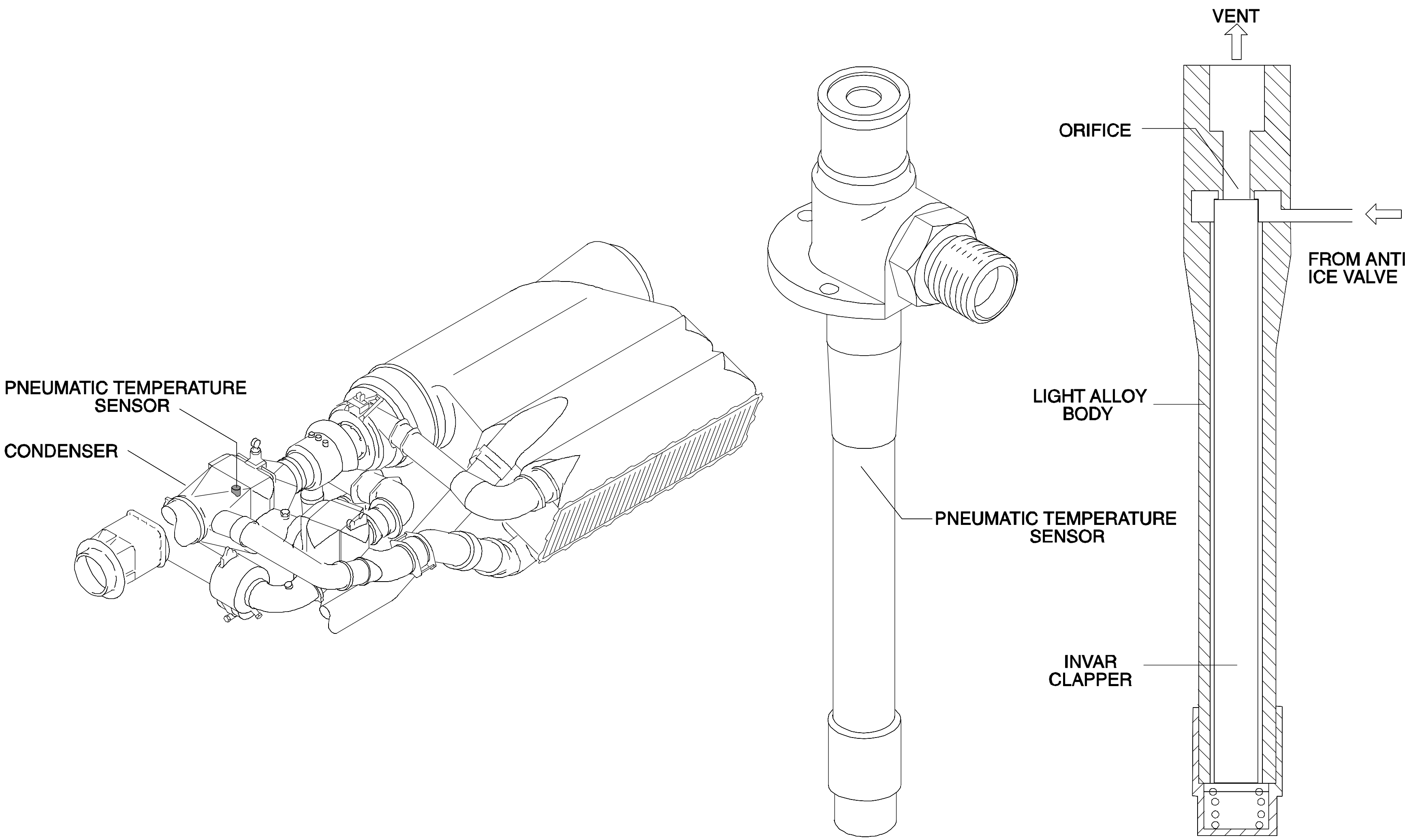
PNEUMATIC TEMPERATURE SENSOR (PNTS)

FIN / ZONE

FIN : 521HH23, 522HH23
Zone : 191, 192

COMPONENT DESCRIPTION

The pneumatic temperature sensor (PNTS) has an invar clapper in a light alloy body. If the temperature changes, the metals contract or expand differently and the size of the orifice changes. This enables the anti ice valve to regulate the pack outlet temperature.



FQW4200 GE Metric

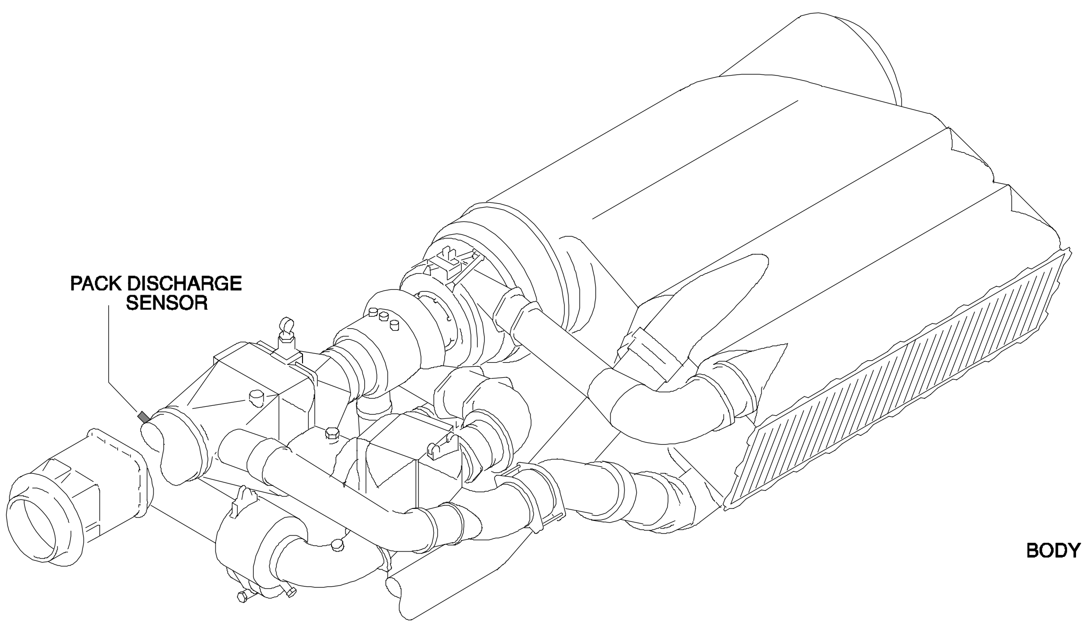
PACK DISCHARGE SENSOR (PDS)

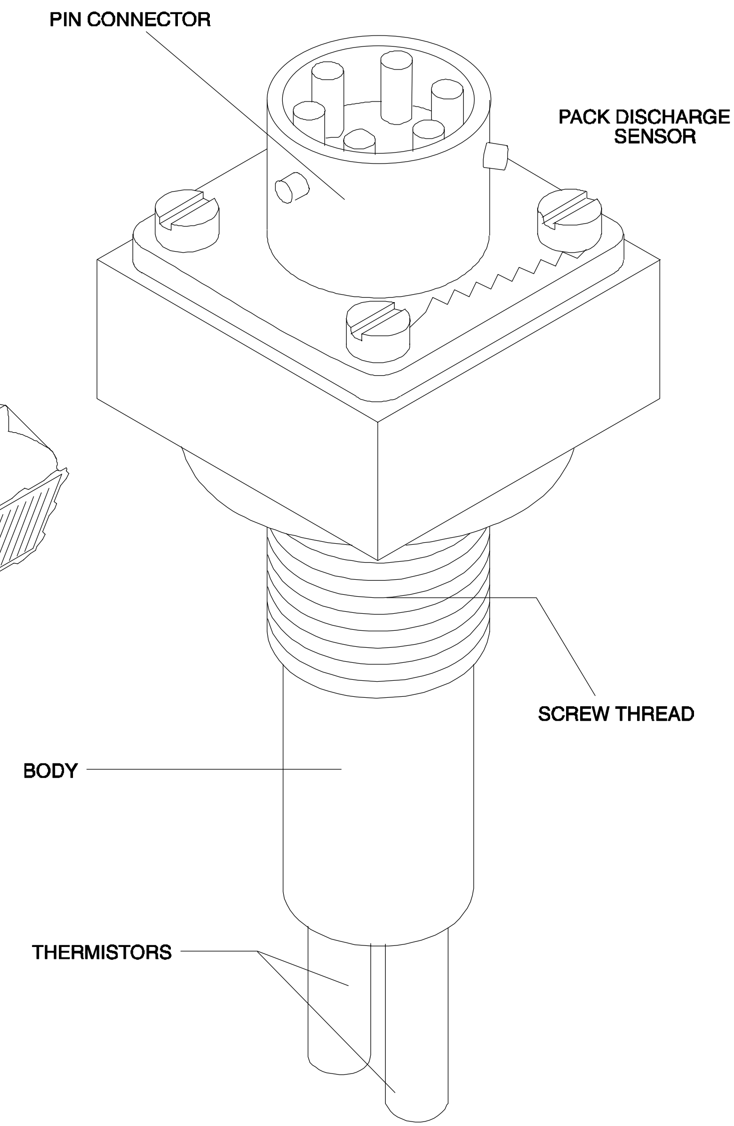
FIN / ZONE

FIN : 541HH, 542HH
Zone : 191, 192

COMPONENT DESCRIPTION

The pack discharge sensor (PDS) is a double element sensing unit which sends temperature information to both lanes of the associated pack controller. The sensor has a pin connector for electrical connection and a tubular body.





FQW4200 GE Metric

STUDENT NOTES

TEMPERATURE CONTROL : ZONE AND EMERGENCY RAM-AIR-INLET SYSTEM COMPONENTS

Safety Precautions
Zone Temperature Controller
Cockpit Temperature Sensor
Cabin Temperature Sensors
Duct Temperature Sensors
Trim Air Check Valves
Hot Air Pressure Switches
Emergency Ram-air-inlet Actuator
Emergency Ram-air-inlet Check Valve
Ground Connection Check Valves
Skin Check Valve

SAFETY PRECAUTIONS

Make sure that the air is not supplied to the air conditioning system from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel (The APU BLEED, ENG BLEED and PACK pushbutton switches must be released out).

STUDENT NOTES

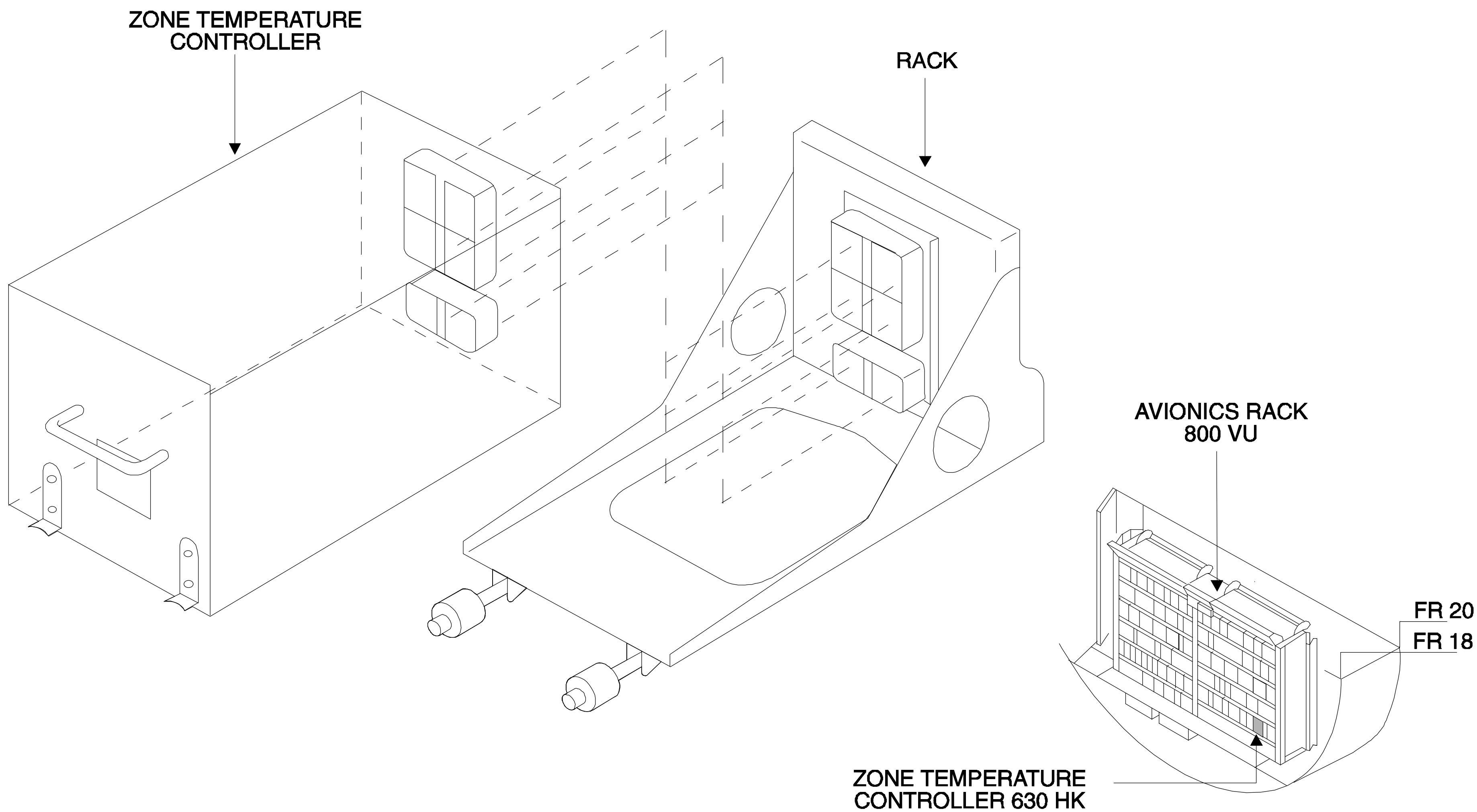
ZONE TEMPERATURE CONTROLLER

FIN/ZONE

FIN : 630HK
Zone : 120

COMPONENT DESCRIPTION

The zone temperature controller contains two independent computer lanes, each of which is capable of performing all control and monitoring functions. One of these lanes is designated as being "active" while the other lane remains in a passive "hot-standby" mode. An automatic change-over occurs at the end of each flight or during the flight, if there is a failure in the active lane. Should a fault exist in both lanes, active control will be passed to the lane with the least significant fault. A covered RS232 test equipment connector is on the front of the controller and an ARINC 600 connector on the back.



FQW4200 GE Metric

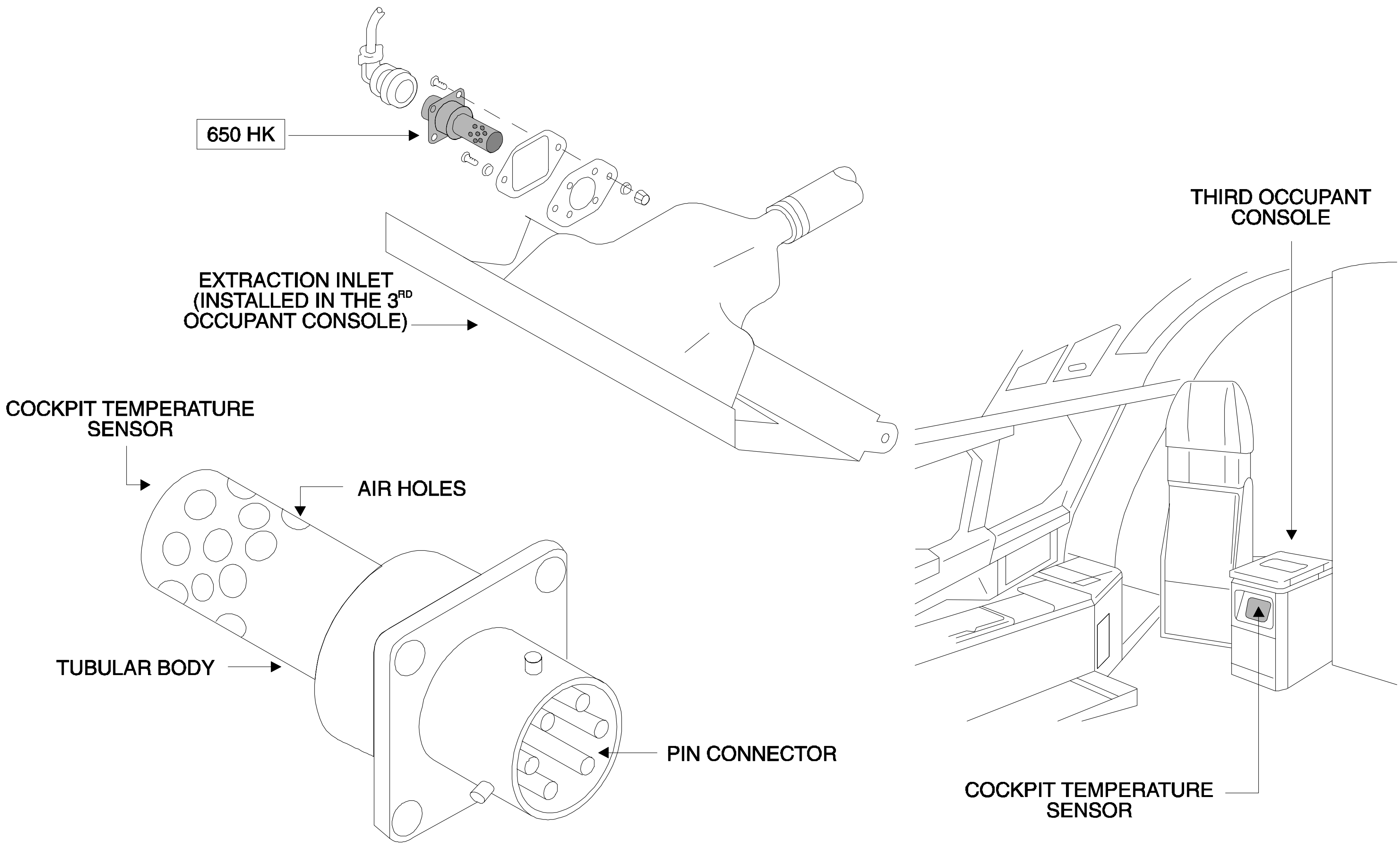
COCKPIT TEMPERATURE SENSOR

FIN/ZONE

FIN : 650HK
Zone : 210

COMPONENT DESCRIPTION

The cockpit temperature sensor has two thermistors in a tubular body. One thermistor is for temperature control in lane 1 and the other one for temperature control in lane 2. The body has holes to permit air to flow through and a pin connector for electrical connection.



FQW4200 GE Metric

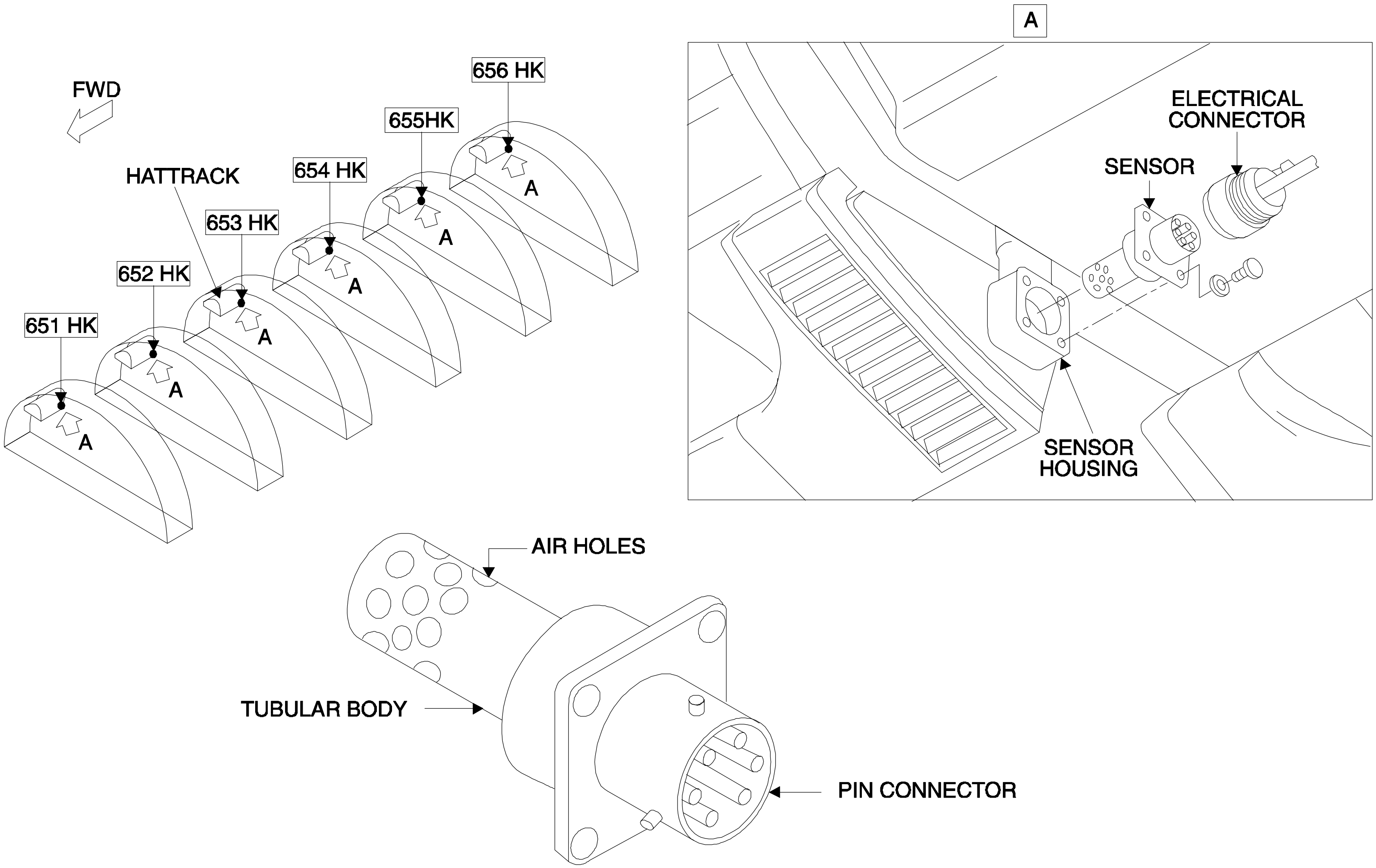
CABIN TEMPERATURE SENSORS

FIN/ZONE

FIN : 651HK, 652HK, 653HK, 654HK, 655HK, 656HK
Zone : 234, 254, 264

COMPONENT DESCRIPTION

There is one sensor for each of the six areas. Each sensor has two thermistors in a tubular body. One thermistor is for temperature control in lane 1 and the other one for temperature control in lane 2. The body has holes to permit air to flow through it and a pin connector for electrical connection.



CABIN TEMPERATURE SENSOR

FQW4200 GE Metric

DUCT TEMPERATURE SENSORS

FIN/ZONE

MIXER-UNIT TEMPERATURE SENSOR
FIN : 640HK
Zone : 138

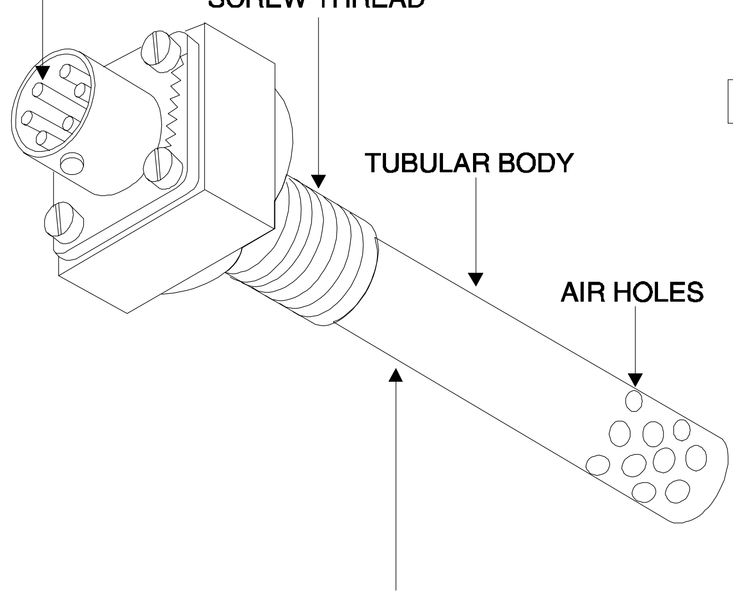
CABIN DUCT TEMPERATURE SENSORS
FIN : 641HK, 642HK, 643HK, 644HK, 645HK, 646HK
Zone : 137, 138, 138, 137, 138, 137

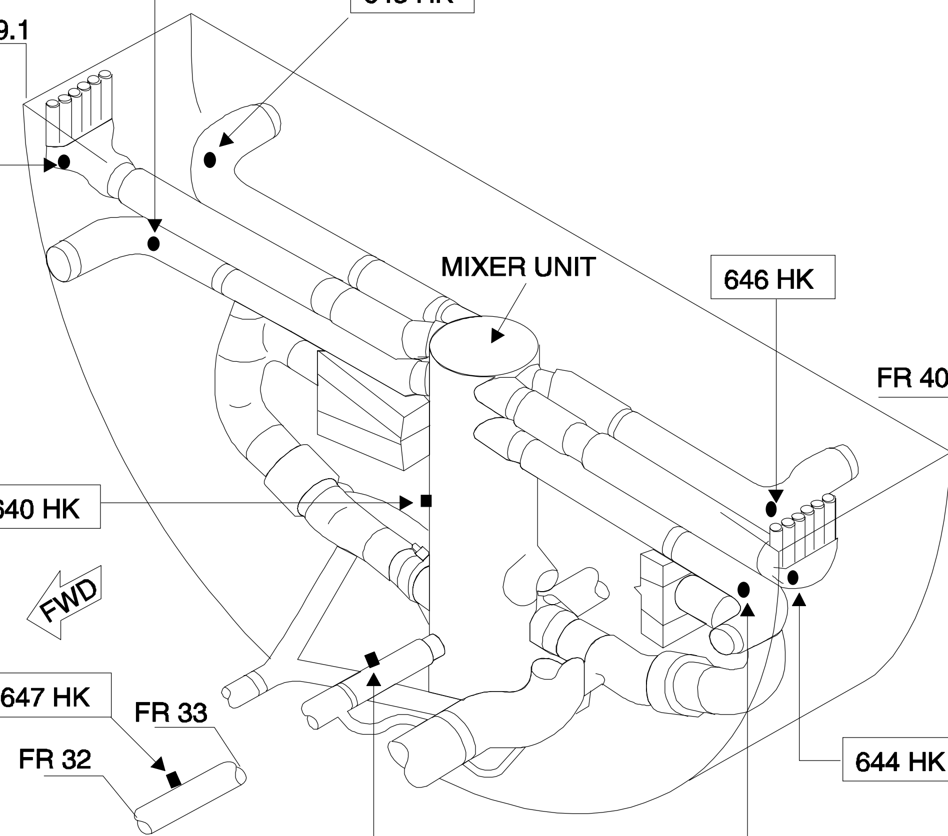
COCKPIT DUCT TEMPERATURE SENSOR
FIN : 647HK
Zone : 133

COCKPIT UPSTREAM TRIM TEMPERATURE SENSOR
FIN : 648HK
Zone : 137

COMPONENT DESCRIPTION

The duct temperature sensors have two thermistors each in a tubular body. One thermistor is for temperature control in lane 1 and the other one for temperature control in lane 2. The body has holes to permit air to flow through and a pin connector for electrical connection.





FQW4200 GE Metric

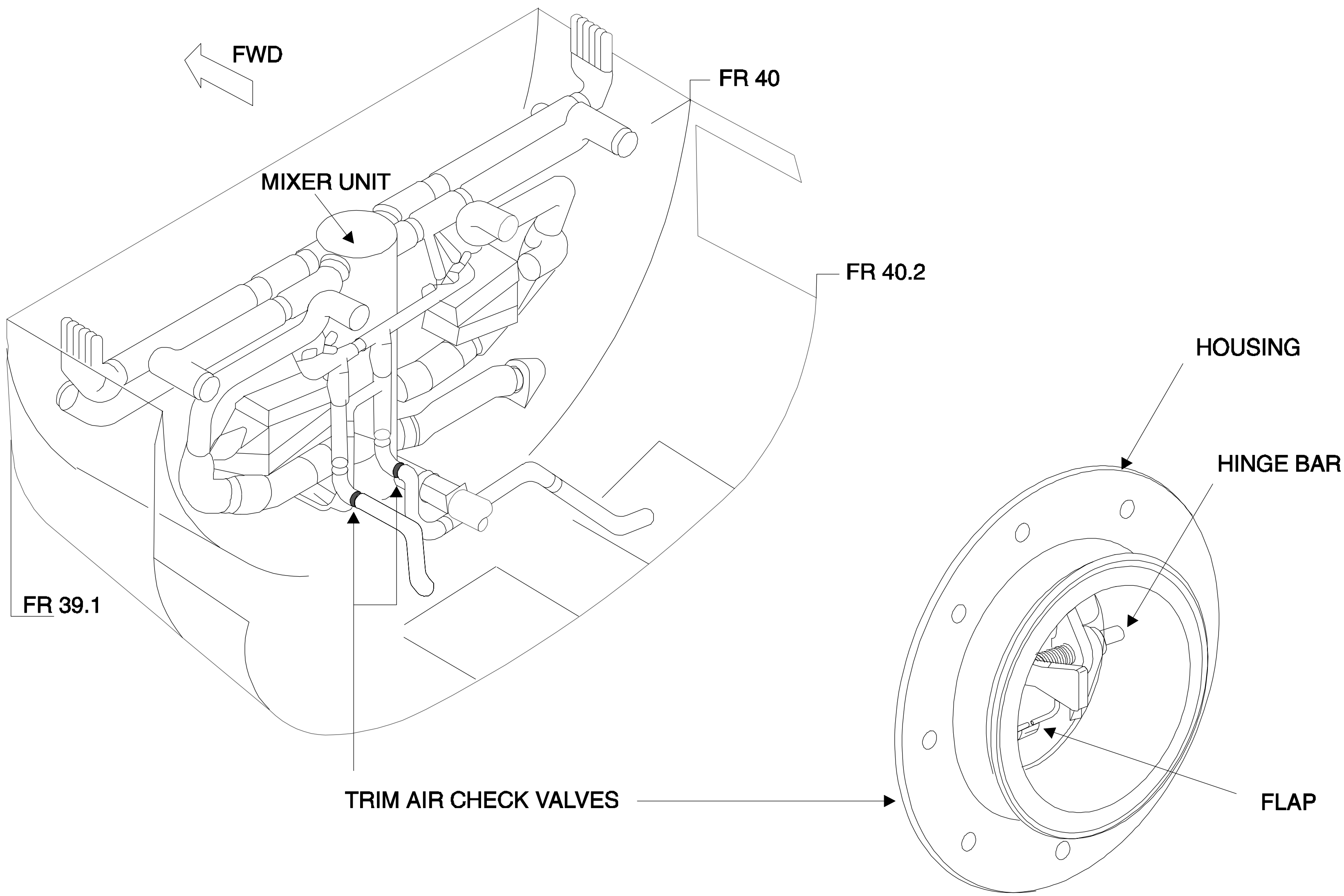
TRIM AIR CHECK VALVES

FIN/ZONE

FIN : 5631HK, 5632HK
Zone : 137, 138

COMPONENT DESCRIPTION

Each trim air check valve is composed of a housing with two semi-circular flaps installed on a hinge bar. Springs hold the two flaps in the closed position. Hot airflow from the trim air pressure regulating valves causes the flaps to open. Reverse flow causes the flaps to close.



FQW4200 GE Metric

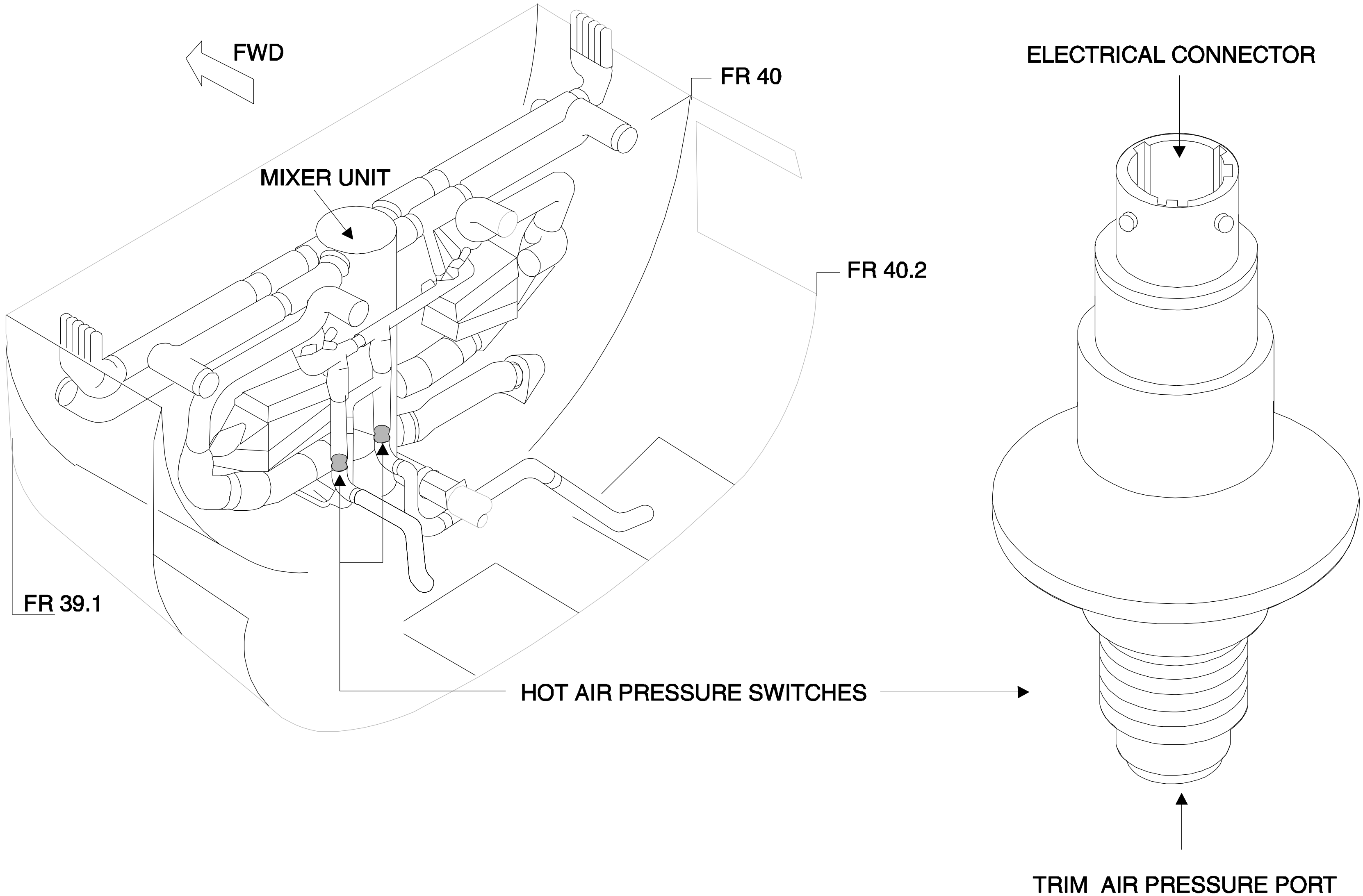
HOT AIR PRESSURE SWITCHES

FIN/ZONE

FIN : 681HK, 682HK
Zone : 137, 138

COMPONENT DESCRIPTION

Each hot air pressure switch has a stainless-steel diaphragm. When it is pressurized, it applies a force to a snap-action disk spring. At around 6.5PSI, the disk spring moves across and pushes a microswitch. When the pressure decreases to around 5PSI, the disk spring returns to its normal position and the microswitch opens.



FQW4200 GE Metric

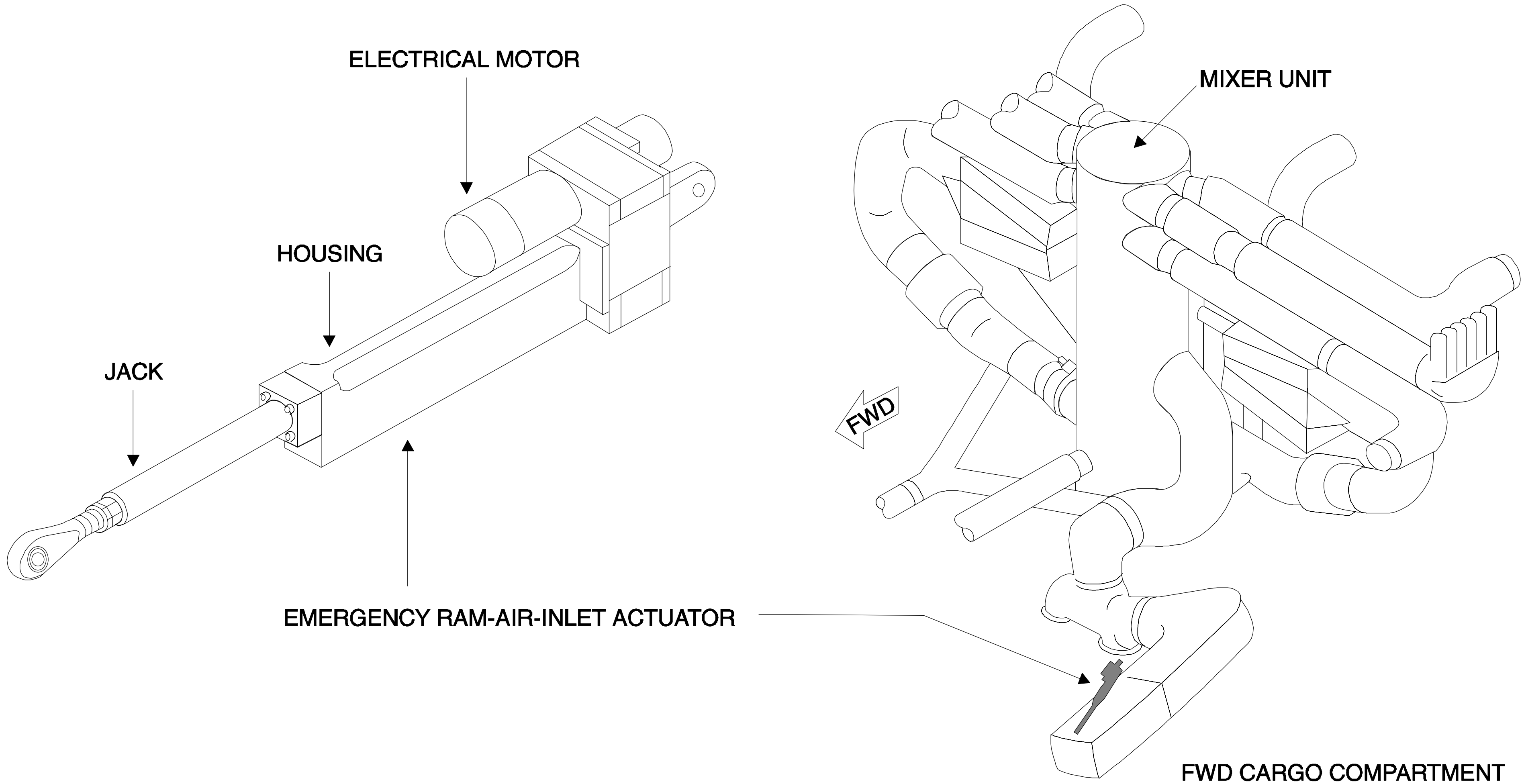
EMERGENCY RAM-AIR-INLET ACTUATOR

FIN/ZONE

FIN : 551HZ
Zone : 137

COMPONENT DESCRIPTION

The emergency ram-air-inlet actuator is an electromechanical actuator. A permanent magnetic-field motor drives a two-step gear train. The motor has altitude-safe brushes and an electromagnetic brake which operates if there is no electrical power. A jack gives the linear movement for emergency ram-air-inlet door actuation. A limit switch is installed at each end of travel.



FQW4200 GE Metric

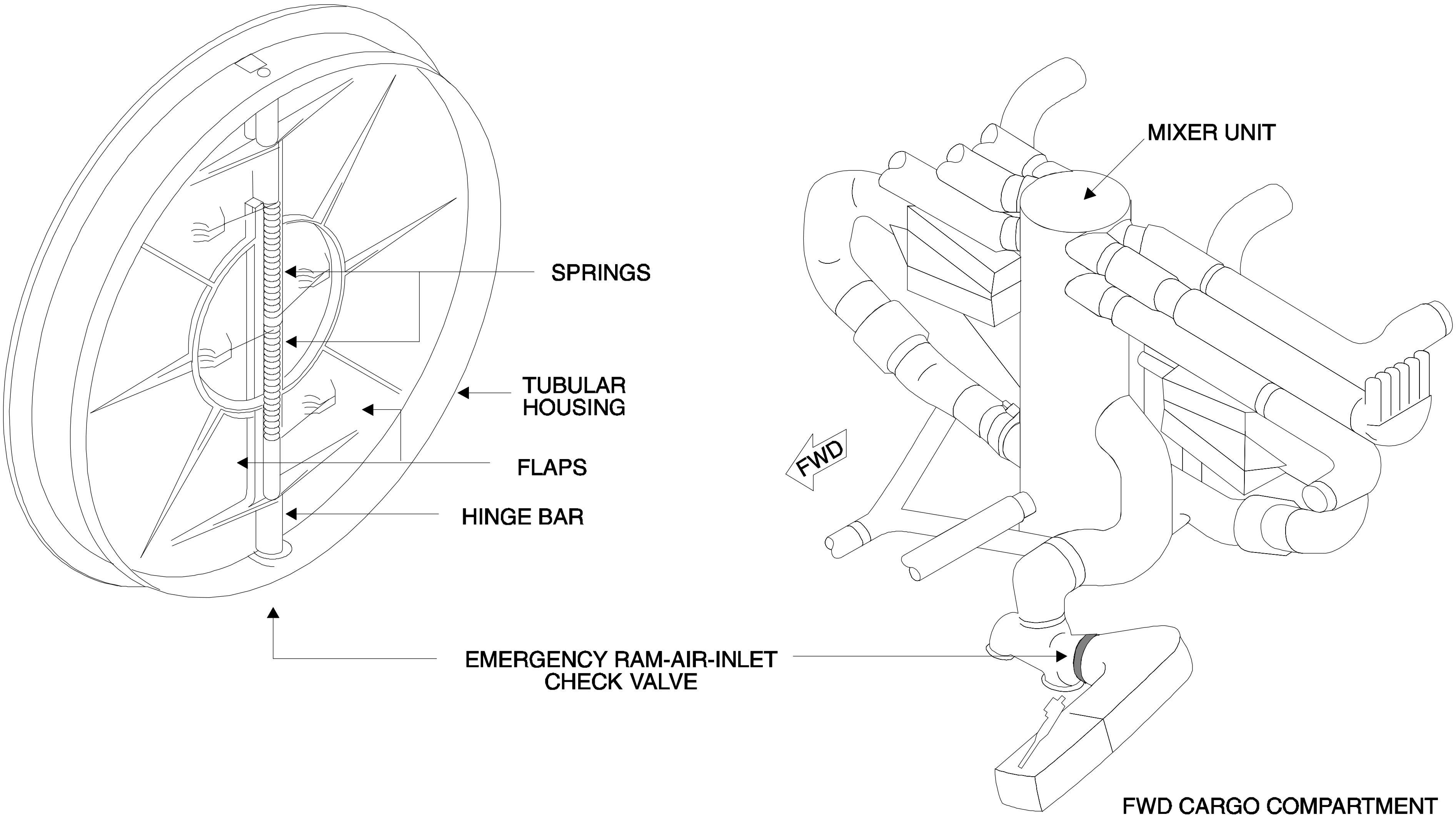
EMERGENCY RAM-AIR-INLET CHECK VALVE

FIN/ZONE

FIN : 5551HB
Zone : 137

COMPONENT DESCRIPTION

The emergency ram-air-inlet check valve is composed of a housing with two semi-circular flaps installed on a hinge bar. Springs hold the two flaps in the closed position. Airflow from the ram-air-inlet causes the flaps to open. Reverse flow causes the flaps to close.



FQW4200 GE Metric

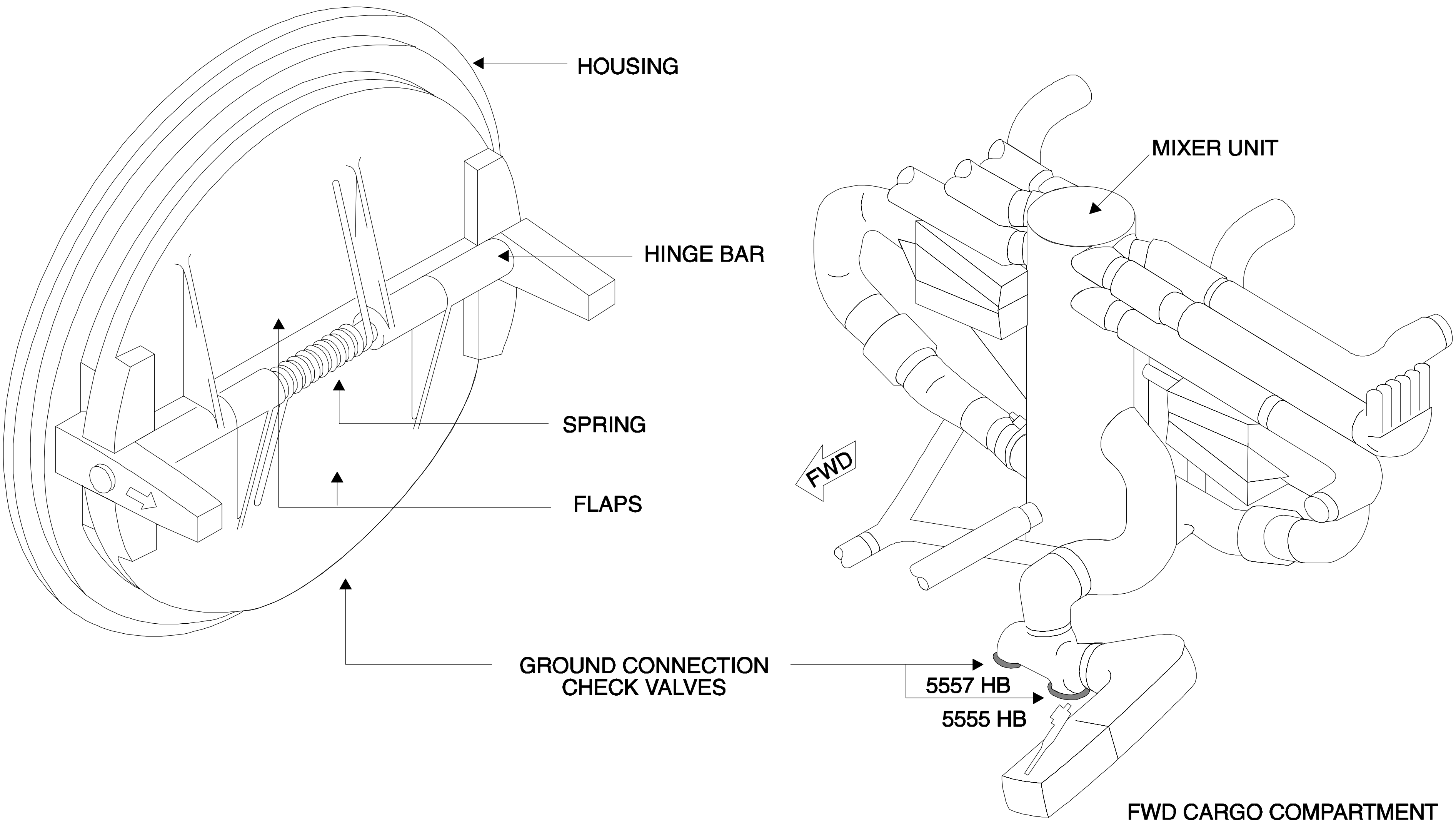
GROUND CONNECTION CHECK VALVES

FIN/ZONE

FIN : 5555HB, 5557HB
Zone : 137

COMPONENT DESCRIPTION

Each ground connection check valve is composed of a housing with two semi-circular flaps installed on a hinge bar. Springs hold the two flaps in the closed position. Airflow from the LP ground connections causes the flaps to open. Reverse flow causes the flaps to close.



FQW4200 GE Metric

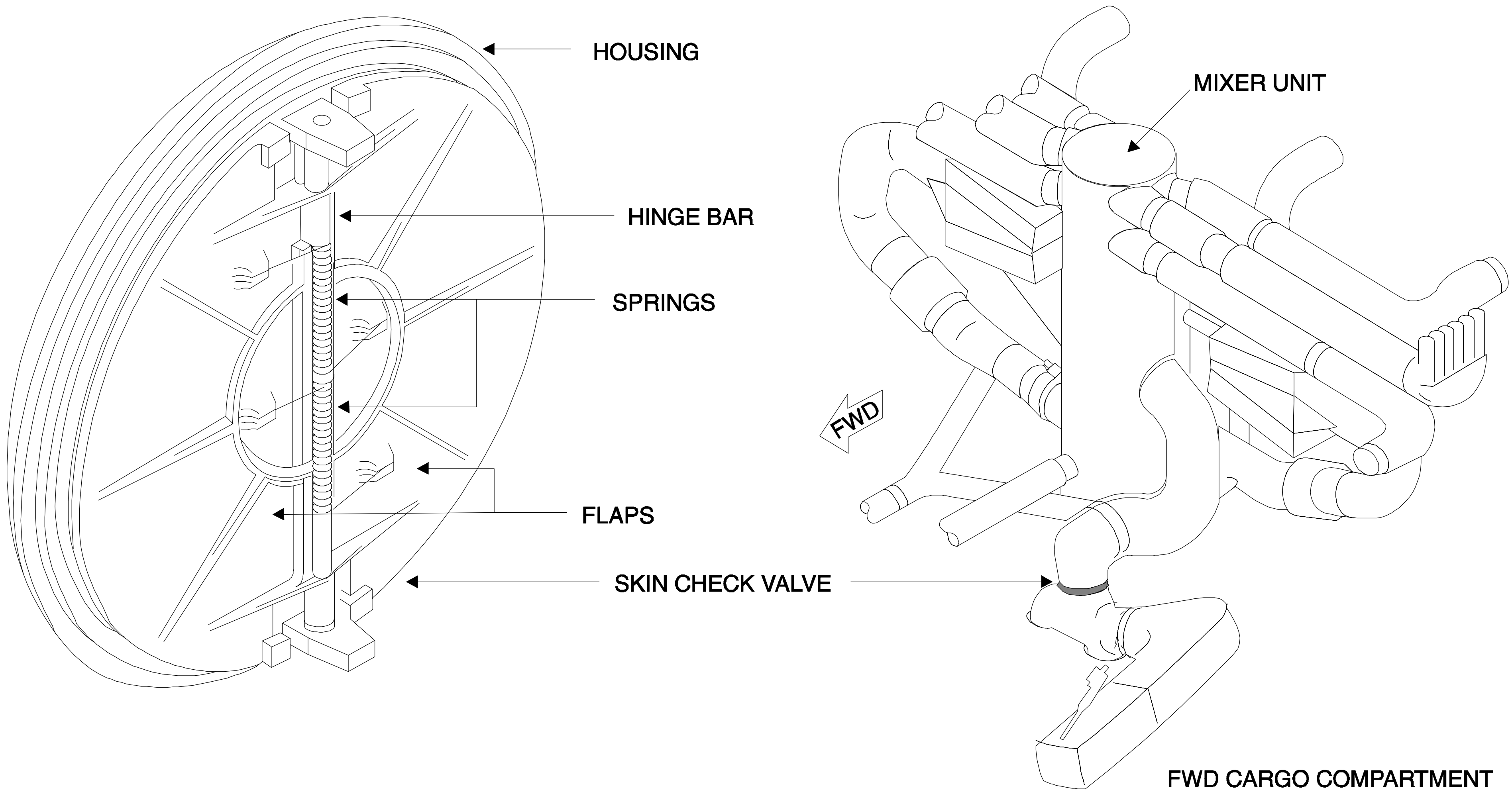
SKIN CHECK VALVE

FIN/ZONE

FIN : 5553HB
Zone : 137

COMPONENT DESCRIPTION

The skin check valve is composed of a housing with two semi-circular flaps installed on a hinge bar. Springs hold the two flaps in the closed position. Airflow from the ram air inlet or the LP ground connections causes the flaps to open. Reverse flow from the mixer unit causes the flaps to close.



FQW4200 GE Metric

STUDENT NOTES

TEMPERATURE CONTROL : EXTERNAL INTERFACES

DMU (OPTION)
CPC 1
CMC 1, 2
ECB
Vent. Cont.
SDAC 1, 2
EIVMU 1, 2,
CIDS 1, 2
BMC 1, 2,
LGCIU 2
Pneumatic Eng Anti-ice Signals
Ground Speed Signals
Eng Fire P/B
Zone Cont. / Pack Cont.

DMU (OPTION)

Lane 1 or Lane 2 of the zone controller sends temperature system data to the Data Management Unit for the Aircraft Condition Monitoring System.

CPC 1

The Cabin Pressure Controllers send signals to the zone controller for temperature correction control and pack heat exchanger monitoring.

Signals : Top of climb, top of descent, cruise configuration.
Used for : Temperature correction.
Signal : Total Air Temperature.
Used for : Heat exchanger monitoring.
Signal : cabin press.
Used for : flow control.

Both Cabin Pressure Controllers receive a RAM AIR pushbutton ON selection signal from the AIR panel.

This, to increase the fuselage ventilation by driving the outflow valves to the half open position.

CMC 1, 2

The Centralized Maintenance Computers are connected to lane 1 and lane 2 of the zone controller for system monitoring.

Inputs : Flight information and BITE command from CMC 1.
Used for : BITE demand.
Outputs : Temperature control and wing anti ice systems BITE, information to CMC 1 and CMC 2.
Used for : system monitoring.

ECB

Lane 1 or lane 2 of the zone controller sends an APU flow demand to the Electronic Control Box to increase the APU bleed flow if the cooling capacity cannot be reached.

APU flow calculation is performed when the zone controller receives an APU bleed valve open signal from the Electronic Control Box.

VENT. CONT.

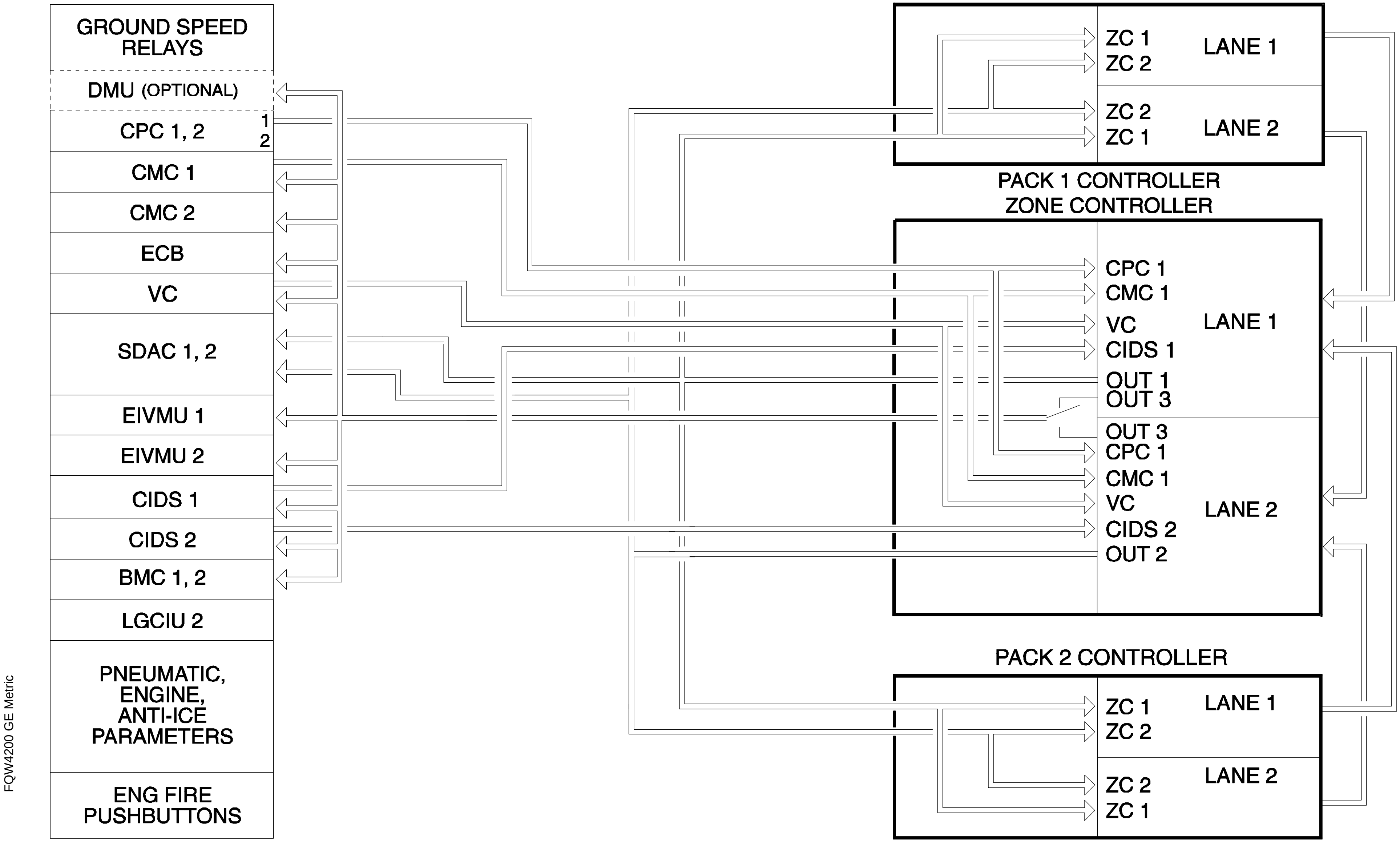
Lane 1 or lane 2 of the zone controller sends a Trim Air Pressure Regulating Valve 1 and Trim Air Shut off Valve fully closed position signal, for the optional FWD cargo Trim Air Valve closure.

Each FCV position signal is used for the recirculation valve control and for the cold air valve control if the FWD cargo temperature control system is installed (the cold air valve closes when at least one FCV closes).

A Galley and Toilets fan FAULT signal is sent to the zone controller if on ground, the cabin temperature sensors are no longer ventilated.
Consequently a fixed temperature demand depending on TAT is computed.

The Ventilation Controller sends several signals to the Zone Controller if the FWD cargo temperature control system is installed:

- The FWD cargo cooling demand for pack 2 temperature control
- The FWD cargo cargo cooling selector setting for packs flow control and APU flow demand calculation.
- The FWD cargo duct overheat signal or the FWD heating installed signal associated to the Ventilation controller fault signal for the TAPRV 1 and TASOV closure.


GROUND SPEED RELAYS
DMU (OPTIONAL)
CPC 1, 2
1
2
CMC 1
CMC 2
ECB
VC
SDAC 1, 2
EIVMU 1
EIVMU 2
CIDS 1
CIDS 2
BMC 1, 2
LGCIU 2
PNEUMATIC, ENGINE, ANTI-ICE PARAMETERS
ENG FIRE PUSHBUTTONS
ZC 1
ZC 2
LANE 1
ZC 2
ZC 1
LANE 2
PACK 1 CONTROLLER
ZONE CONTROLLER
CPC 1
CMC 1
VC
CIDS 1
OUT 1
OUT 3
LANE 1
OUT 3
CPC 1
CMC 1
VC
CIDS 2
OUT 2
LANE 2
PACK 2 CONTROLLER
ZC 1
ZC 2
LANE 1
ZC 2
ZC 1
LANE 2
FQW4200 GE Metric

SDAC 1,2

Warnings and Indications are transmitted to the System Data Acquisition computers via ARINC buses for system monitoring and indicating.

The zone controller and each pack controller send FAULT and overheat signals to SDAC 1 and 2 for warning and indication purposes.

Both SDACs also receive pushbutton position, valves position and disagreement signals of FCV position for warning and monitoring.

EIVMU 1, 2

Lane 1 or lane 2 of the zone controller sends a duct demand temperature signal to each Engine Interface and Monitoring Unit.

This is used in the temperature control loop in order to increase engine idle speed until a sufficient cooling capacity is obtained.

The Engine Interface and Vibration Monitoring Units send an engine start signal to the flow control valve engine start relays for flow control valve closure.

EIVMU 1 and 2 send a take-off thrust signal to each pack controller via the zone controller for pack ram air inlet closure at take-off and landing.

CIDS 1, 2

The Cabin Intercommunication Data System sends the temperature selection on the forward attendant panel for temperature control.

Each CIDS receives actual and target temperatures for indication on the forward attendant panel.

BMC 1, 2

Lane 1 or lane 2 of the zone controller sends the wing anti ice status and the 150 degrees Celcius demand to each Bleed Monitoring Computer.

Signals : WAI ON/OFF and WAI valves low pressure
Used for : electrical closure logic of HP bleed valve
Signals : WAI valves position
Used for : 150°C (302°F) bleed air demand if pack inlet temperature is too high to maintain the selected temperature.

LGCIU 2

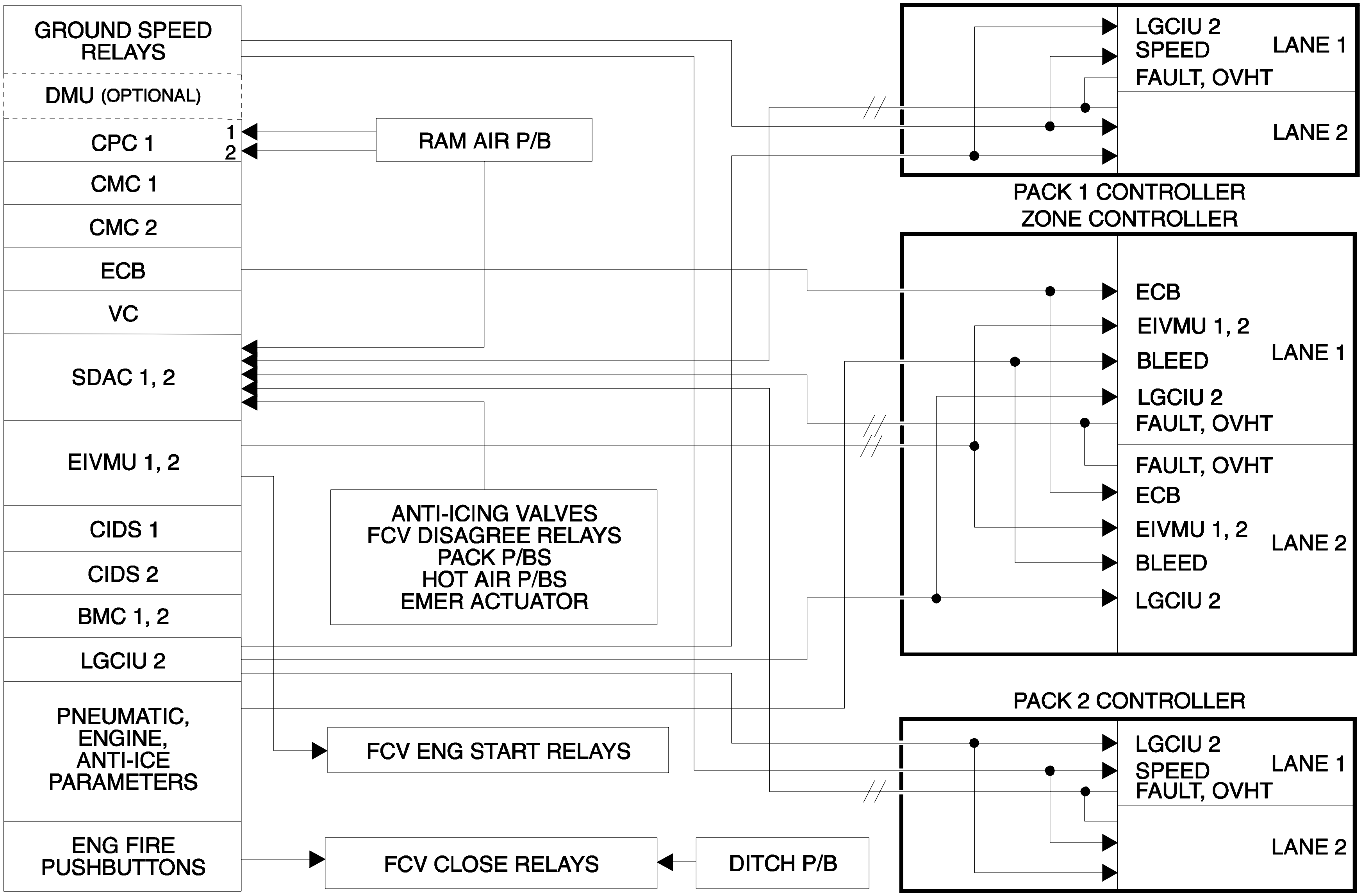
Landing Gear Control Interface Unit 2 sends a flight or ground aircraft status to the zone controller.

It is used for all logics needing flight/ground information and used by pack controllers for pack ram air closure at take-off and landing.

PNEUMATIC ENG ANTI-ICE SIGNALS

Pneumatic, engine and anti ice systems send discrete signals to the zone controller.

Signals : TAPRV, cross feed valve, and HP fuel valve positions Wing anti-ice and nacelles anti-ice valves positions.
Used for : processing a bleed air system status to EIVMU for engine idle speed calculation.
Anti-ice signals are also used for maintenance purposes through the CMC.


GROUND SPEED RELAYS
DMU (OPTIONAL)
CPC 1
1
2
CMC 1
CMC 2
ECB
VC
SDAC 1, 2
EIVMU 1, 2
CIDS 1
CIDS 2
BMC 1, 2
LGCIU 2
PNEUMATIC, ENGINE, ANTI-ICE PARAMETERS
ENG FIRE PUSHBUTTONS
RAM AIR P/B
ANTI-ICING VALVES
FCV DISAGREE RELAYS
PACK P/BS
HOT AIR P/BS
EMER ACTUATOR
FCV ENG START RELAYS
FCV CLOSE RELAYS
DITCH P/B
LGCIU 2
SPEED
FAULT, OVHT
LANE 1
LANE 2
PACK 1 CONTROLLER
ZONE CONTROLLER
ECB
EIVMU 1, 2
BLEED
LGCIU 2
FAULT, OVHT
LANE 1
FAULT, OVHT
ECB
EIVMU 1, 2
BLEED
LGCIU 2
LANE 2
PACK 2 CONTROLLER
LGCIU 2
SPEED
FAULT, OVHT
LANE 1
LANE 2

GROUND SPEED SIGNALS

Both pack controllers receive a signal of wheel speed higher than 70 knots for pack ram air inlet closure at landing.

ENG FIRE P/B

Each pack Flow Control Valve receives a closure signal when at least one of its associated fire pushbuttons is released out or if the ditching pushbutton is selected ON.

ZONE CONT. / PACK CONT.

Both pack controllers mainly receive pack temperature, flow and BITE demand signals and send back BITE data and system display information.

Zone controller to pack controllers:
Signals: Pack temperature demand, mach, TAT, static pressure, cabin altitude, zone controller and ARINC buses status.
Used for: Pack temperature control.

The zone controller also sends to each pack controller, pack flow demand and APU valve position for pack flow control as well as BITE demand for system monitoring and take-off signal for pack ram air inlet closure.

Pack controllers to the zone controller:
Signal : BITE information.
Used for : System monitoring.
Signals : Pack warning & indication.
Used for : System display.
Signal : pack inlet press.
Used for : BMCs for abnormal pressure warning logic.

COCKPIT / CABIN VENTILATION : SYSTEM PRESENTATION

COCKPIT/CABIN

GENERAL

Cabins are ventilated by mixed air from the mixer unit and hot air from the trim air valves.

The cockpit is ventilated with fresh air from pack 1 mainly and hot air from its dedicated trim air valve.

FILTERS

Filters are installed at the inlet of the cabin air recirculation circuit.

CLOGGING INDICATORS

The clogging indicators are differential pressure switches used to generate maintenance information in case of filter clogging.

RECIRCULATION FANS

Two recirculation fans feed the mixer unit with air from the cabin.
In addition, they are used as blowers for the avionics ventilation.

The recirculation fans are controlled from the CAB FANS pushbutton switch on the overhead panel.
The fans automatically stop in case of DITCHING.

CHECK VALVES

Check valves are installed to prevent reverse flow when recirculation fans are OFF.

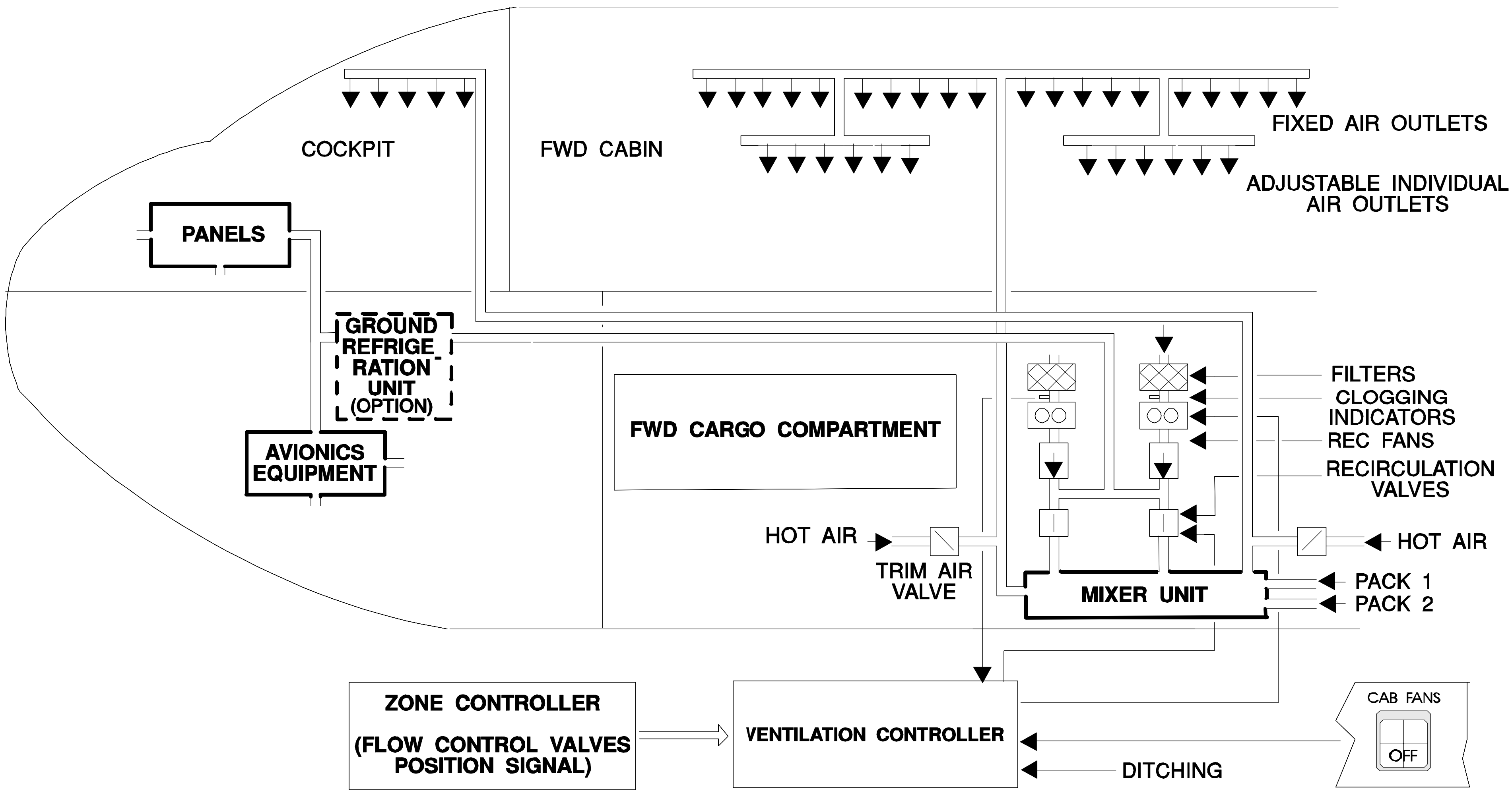
RECIRCULATION VALVES

The recirculation valves are normally open.
They close when both packs are OFF to keep the avionics equipment sufficiently ventilated.

The signal indicating that both packs are OFF is sent by the zone controller.

AIR OUTLETS

Conditioned air tapped from the main distribution ducts is sent to the individual and fixed air outlets.



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LAVATORY/GALLEY

GENERAL

Lavatory and galley ventilation air is ducted from the main cabin air distribution supply.

Air is discharged overboard by differential pressure or by an Extraction Fan.

Cabin temperature sensors are ventilated with cabin air drawn by the Extraction Fan.

EXTRACTION FAN

The Extraction Fan operates on ground when electrical power is available and in flight when delta P is lower than 1 psi.

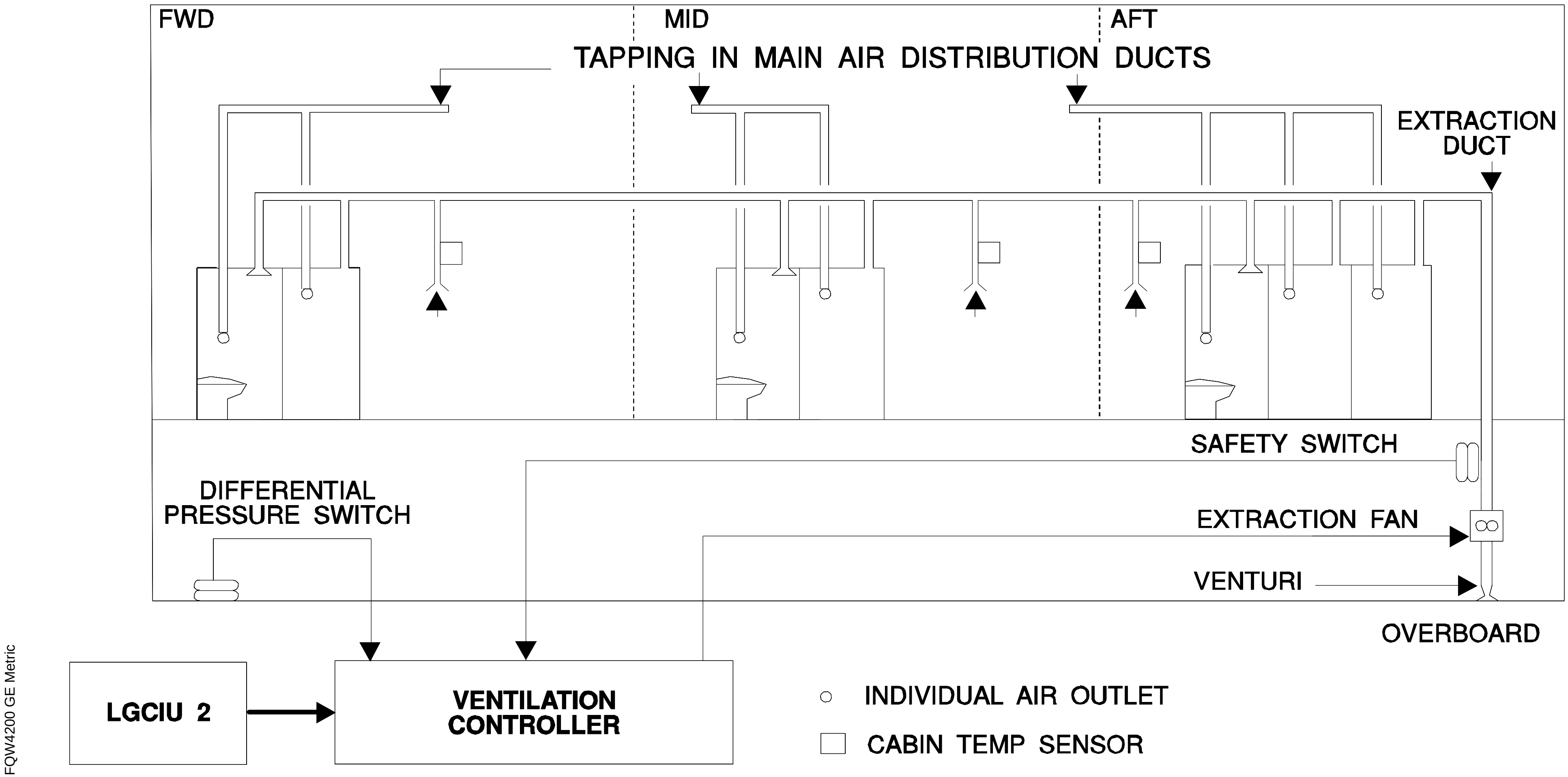
The Extraction Fan is controlled by the ventilation controller.
The ground/flight signal comes from Landing Gear Control Interface Unit 2 (LGCIU).

DIFFERENTIAL PRESSURE SWITCH

The Differential Pressure Switch serves to detect when delta P is lower than 1 psi for extraction fan operation control.

SAFETY SWITCH

A Safety Switch detects any abnormal low pressure and sends signals to the ventilation controller for condition monitoring.


FWD
MID
AFT
TAPPING IN MAIN AIR DISTRIBUTION DUCTS
EXTRACTION DUCT
SAFETY SWITCH
DIFFERENTIAL PRESSURE SWITCH
EXTRACTION FAN
VENTURI
OVERBOARD
LGCIU 2
VENTILATION CONTROLLER
INDIVIDUAL AIR OUTLET
CABIN TEMP SENSOR
FQW4200 GE Metric

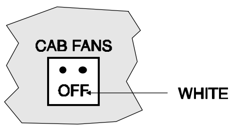
STUDENT NOTES:

COCKPIT / CABIN VENTILATION : SYSTEM CONTROLS AND INDICATING

Cab Fans Pushbutton Switch
Fans Reset Pushbutton
Fan Indication

CAB FANS PUSHBUTTON SWITCH

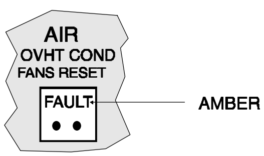
The CAB FANS pushbutton switch enables the crew to simultaneously stop both recirculation fans. When the CAB FANS pushbutton switch is pressed in, both recirculation fans run provided there is no overheat condition.



Both recirculation fans are switched off.

FANS RESET PUSHBUTTON

The Fan Reset pushbutton indicates an overheat of at least one fan controlled by the ventilation controller and enables the crew to reset it.

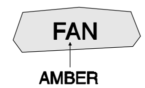


There is a recirculation fan overheat.

When the P/B is pressed, the fan restarts and the fault light goes off provided the overheat condition has disappeared.

FAN INDICATION

The fan indication is not displayed in normal operation or when the fan state data is not available.



The respective recirculation fan is faulty, or the CAB FANS pushbutton switch is selected OFF or the ventilation controller is faulty.

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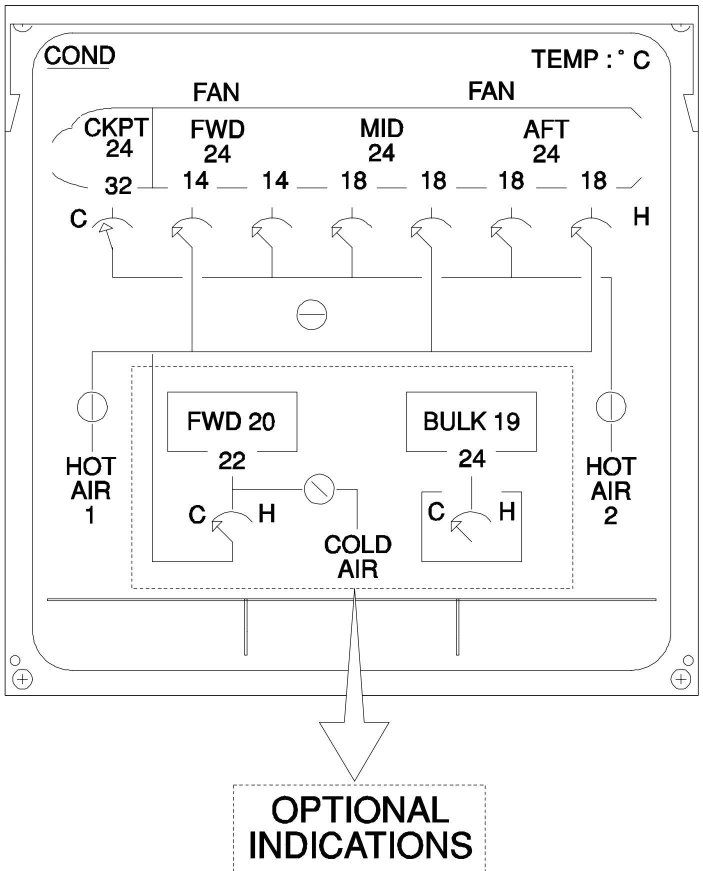

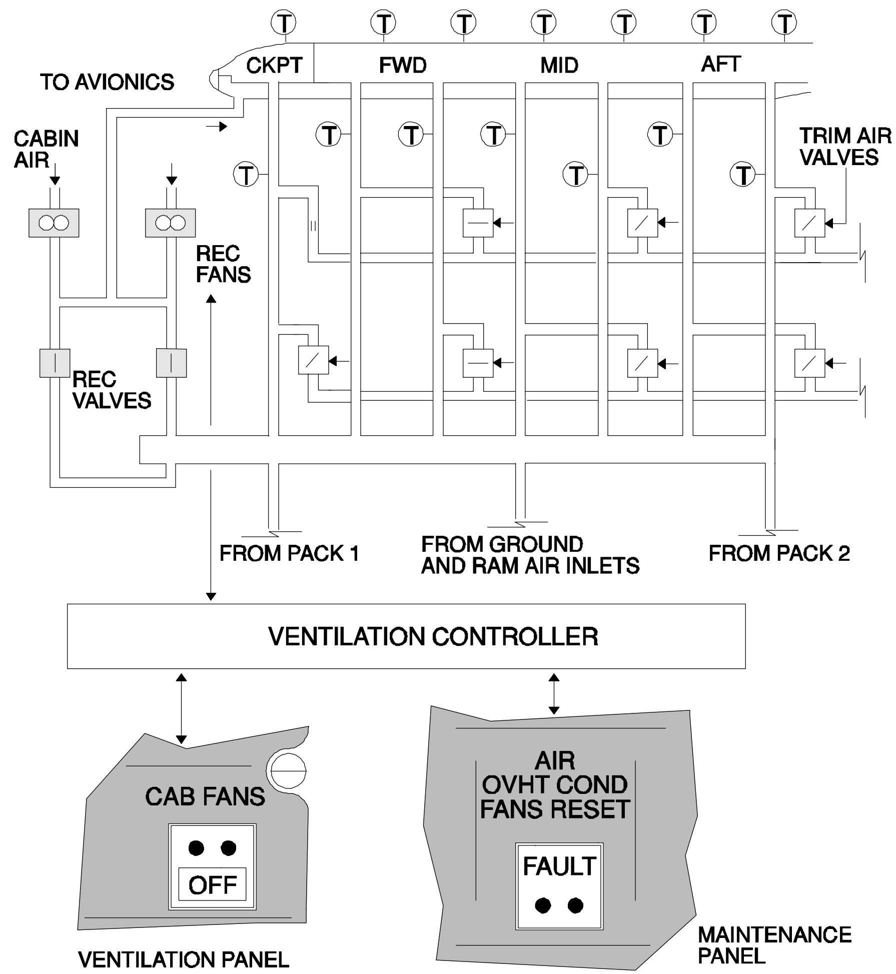

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STUDENT NOTES

COCKPIT / CABIN VENTILATION : WARNINGS

L+R CAB VENT FAULT
VENT SYS FAULT
LAV + GALLEY FAN FAULT

L+R CAB VENT FAULT

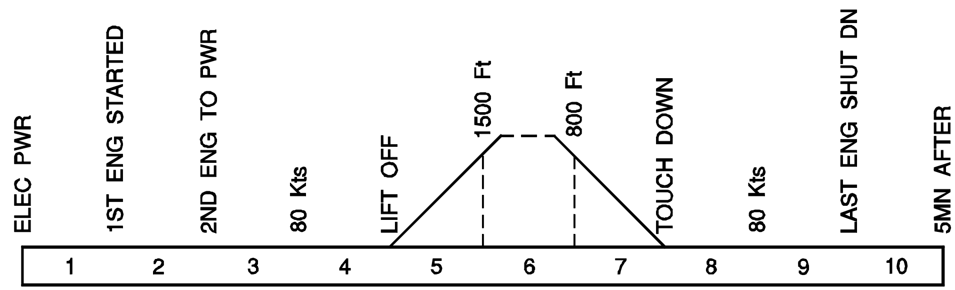
Both cabin fans are lost. The avionics ventilation is ensured by fresh air blown from the packs.

VENT SYS FAULT

The ventilation controller (VC) is faulty. The procedure will request you to increase the pack flow.

LAV + GALLEY FAN FAULT

The lavatory and galley fan is lost. Ventilation is then ensured by differential pressure as long as it is greater than 1 psi.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
L+R CAB VENT FAULT	SINGLE CHIME	MASTER CAUTION	COND	FAN FAULT LIGHT	3, 4, 5, 7, 8
VENT SYS FAULT	SINGLE CHIME	MASTER CAUTION	COND	NIL	3, 4, 5, 7, 8
LAV + GALLEY FAN FAULT	NIL	NIL	NIL	FAN FAULT LIGHT	3, 4, 5, 7, 8, 9

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STUDENT NOTES

COCKPIT / CABIN VENTILATION : COMPONENTS/1

Safety Precautions
Recirculation Valve

SAFETY PRECAUTIONS

Before any recirculation valve removal, open, safety, and tag the circuit breakers listed in the AMM.

On the AIR control panel 225VU :

(a) Make sure that the APU BLEED, the ENG BLEED and the PACK 1(2) pushbutton switches are released.

(b) Put a warning notice to tell people not to operate these pushbutton switches.

On the HP and LP ground connectors, put warning notices to tell people not to supply the A/C with ground air.

STUDENT NOTES

RECIRCULATION VALVE

FIN/ZONE

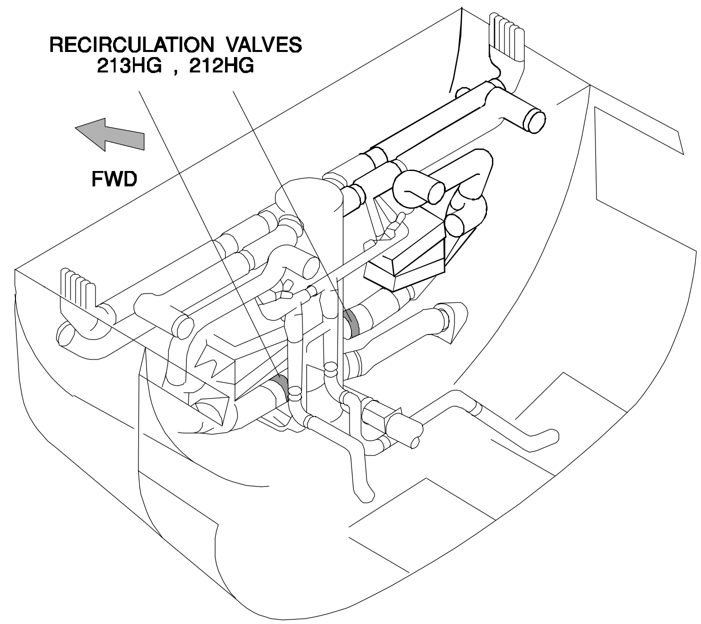
RIGHT HAND RECIRCULATION VALVE
FIN : 212HG
ZONE :138
LEFT HAND RECIRCULATION VALVE
FIN : 213HG
ZONE : 137

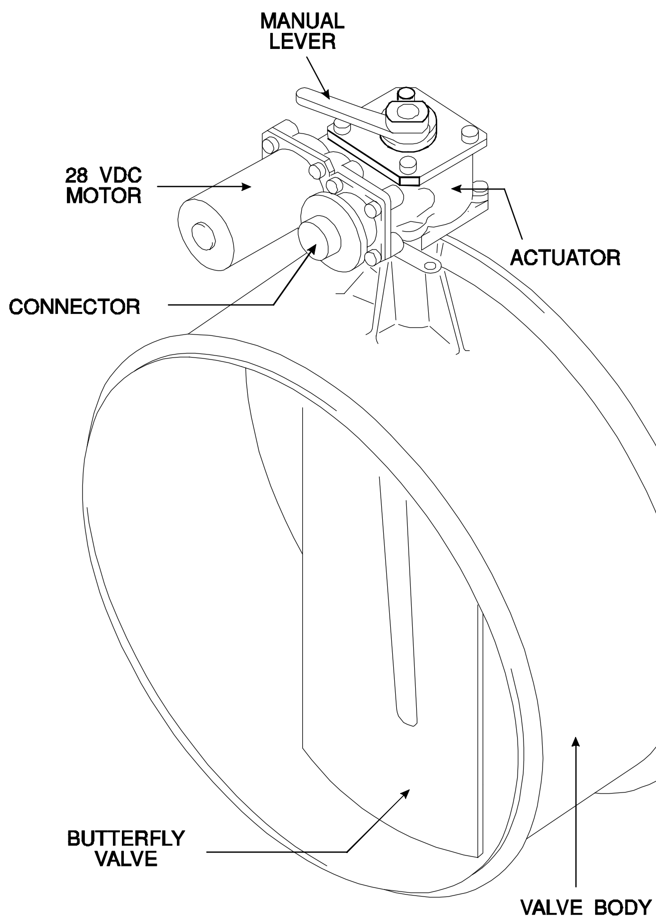
COMPONENT DESCRIPTION

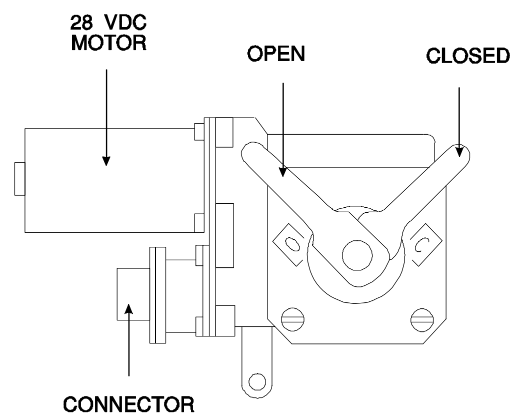
The two recirculation valves have a 28VDC electric motor, a manual lever, an actuator and a butterfly valve. The electric motor drives the actuator to open or close the valve. In close position, they operate as restrictors. The manual lever enables the maintenance staff to see the valve position and to manualy change it if necessary.

REMOVAL / INSTALLATION

- get access to the FWD cargo compartment.
- remove the access panel 132CX for 212HG or 131CX for 213HG.
- open the door 132AZ.
- remove the clamps, the sleeve and finally the valve.
- respect the torque during clamp installation then install the bonding strap.
- do the operational test of the LDCC ventilation system.







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STUDENT NOTES

COCKPIT / CABIN VENTILATION : COMPONENTS /2

Safety Precautions
Ventilation Controller
FWD Recirculation Filters
AFT Recirculation Filters
Clogging Indicators
Recirculation Fans
Recirculation Check Valves
Cockpit Individual Air Outlets
Cabin Individual Air Outlets
Galley And Lavatory Extraction Fan
Galley And Lavatory Safety Switch
Galley And Lavatory Differential Pressure Switch
Lavatory Individual Air Outlets

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SAFETY PRECAUTIONS

Make sure that air is not supplied to the air conditioning system from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel (The APU BLEED, ENG BLEED and PACK pushbutton switches must be released out).

STUDENT NOTES

VENTILATION CONTROLLER

FIN/ZONE

FIN : 280HN

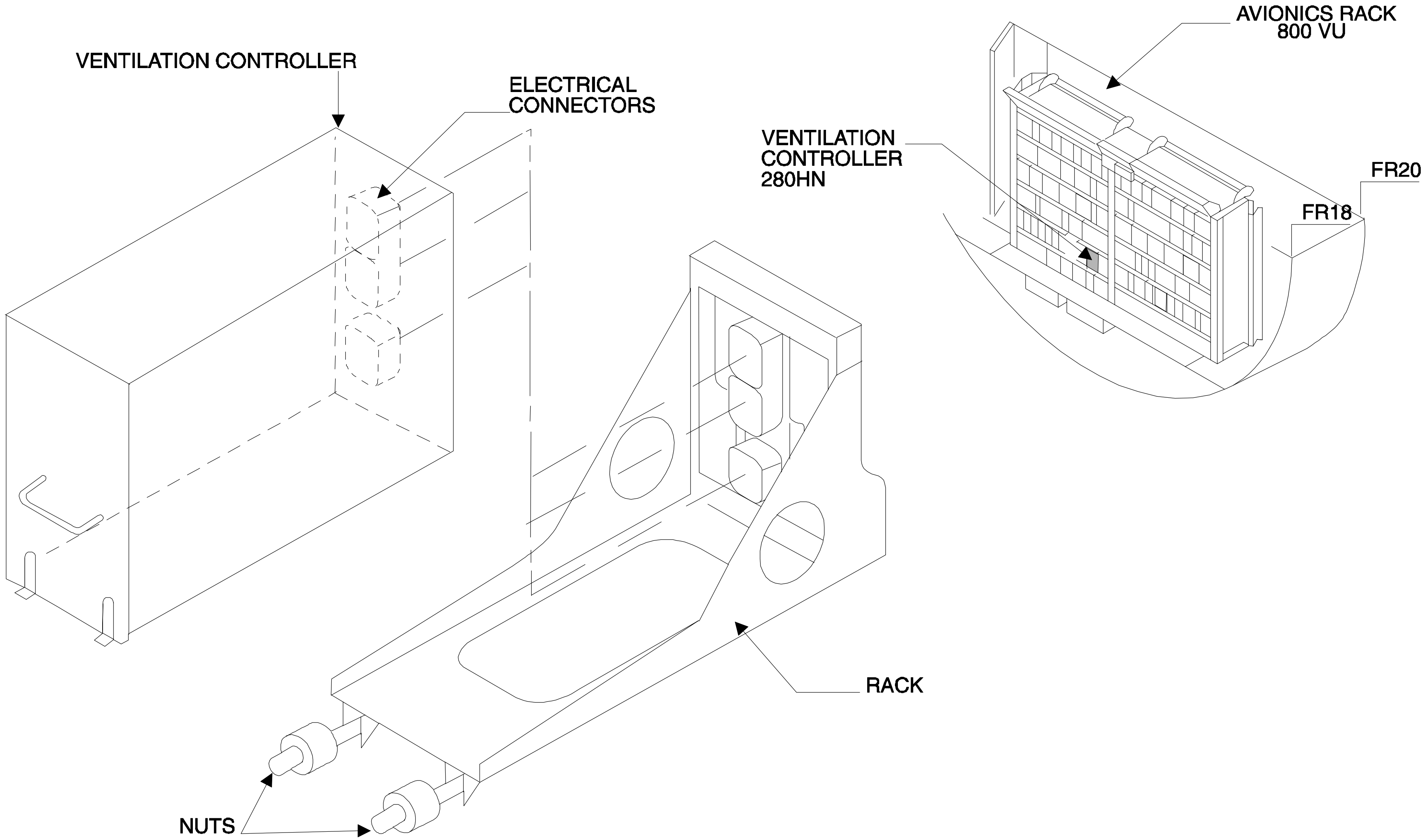
Zone : 121

COMPONENT DESCRIPTION

The ventilation controller contains two independent computer lanes, each of which is capable of performing all control and monitoring functions.

One of these lanes is designated as being "active" while the other lane remains in a passive "hot-standby"mode.

An automatic change-over occurs after each flight leg. The optional functions are activated, if installed, via pin programming.



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FWD RECIRCULATION FILTERS

FIN/ZONE

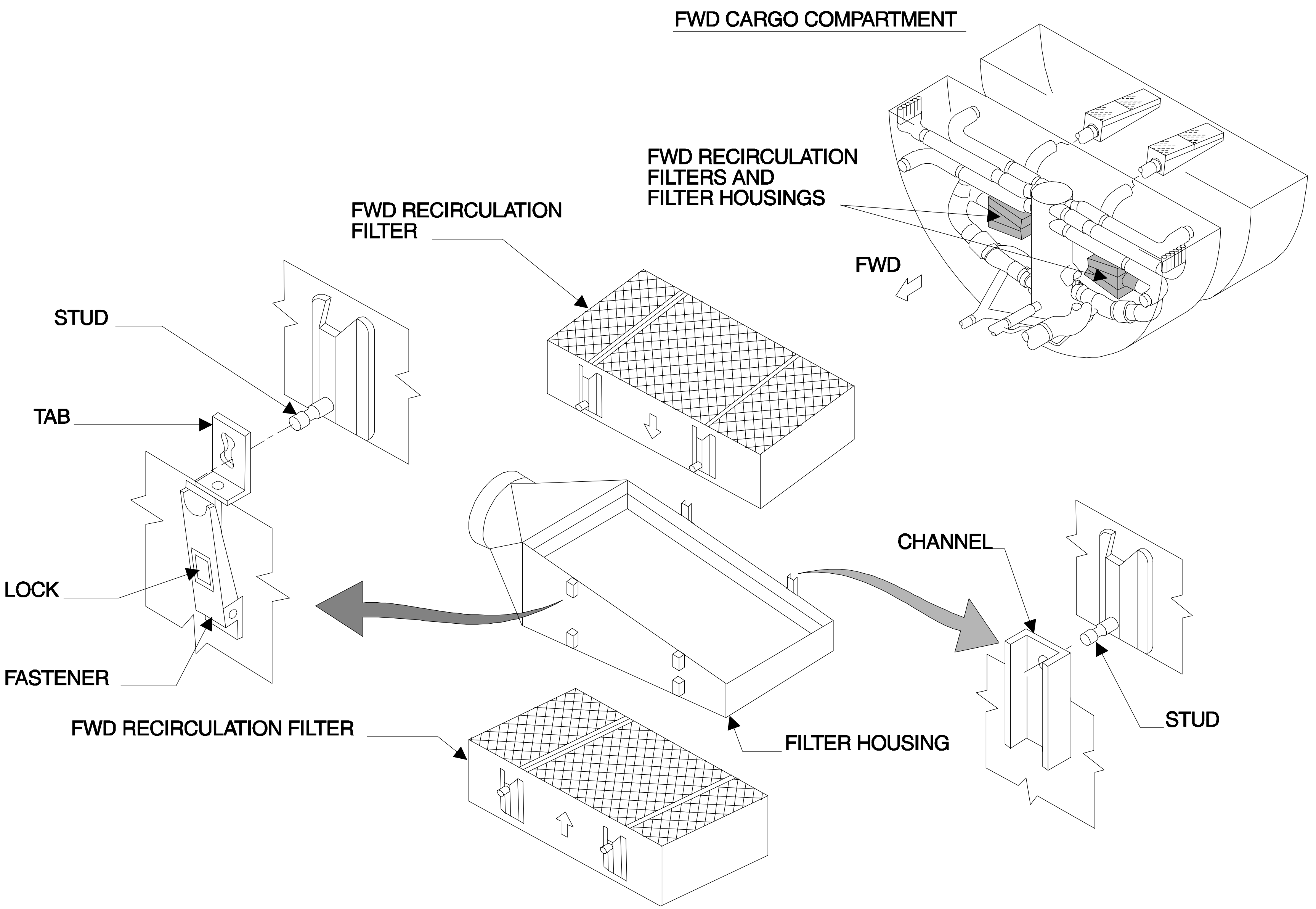
FILTERS
FIN : 5250HG, 5252HG, 5251HG, 5253HG
Zone : 138, 138, 137, 137
FILTER HOUSINGS
FIN : 5210HG, 5211HG
Zone : 138,137

COMPONENT DESCRIPTION

Each FWD recirculation filter housing is a duct with a double frame and a pressure port for the clogging indicator.
Two filters are fitted on each housing by means of four studs and four fasteners with locks and tabs.
The four FWD recirculation filters are interchangeable but not cleanable. Air sealing is ensured by two silicone seals.

REMOVAL/INSTALLATION

Comply with the safety precautions.
-get access to the filter(s)
(1) Move the locks to the filter and open the fasteners
(2) Release each of the two fasteners
(3) Pull the tabs off the studs
(4) Disengage the channels from the two studs and pull the filter
(5) Remove the filter from its mounting.
 (a) Engage the two studs into the related holes in the channels.
 (b) Put the two tabs in position and engage them in the grooves of the studs.
 (c) Close the fasteners.



FQW4200 GE Metric

AFT RECIRCULATION FILTERS

FIN/ZONE

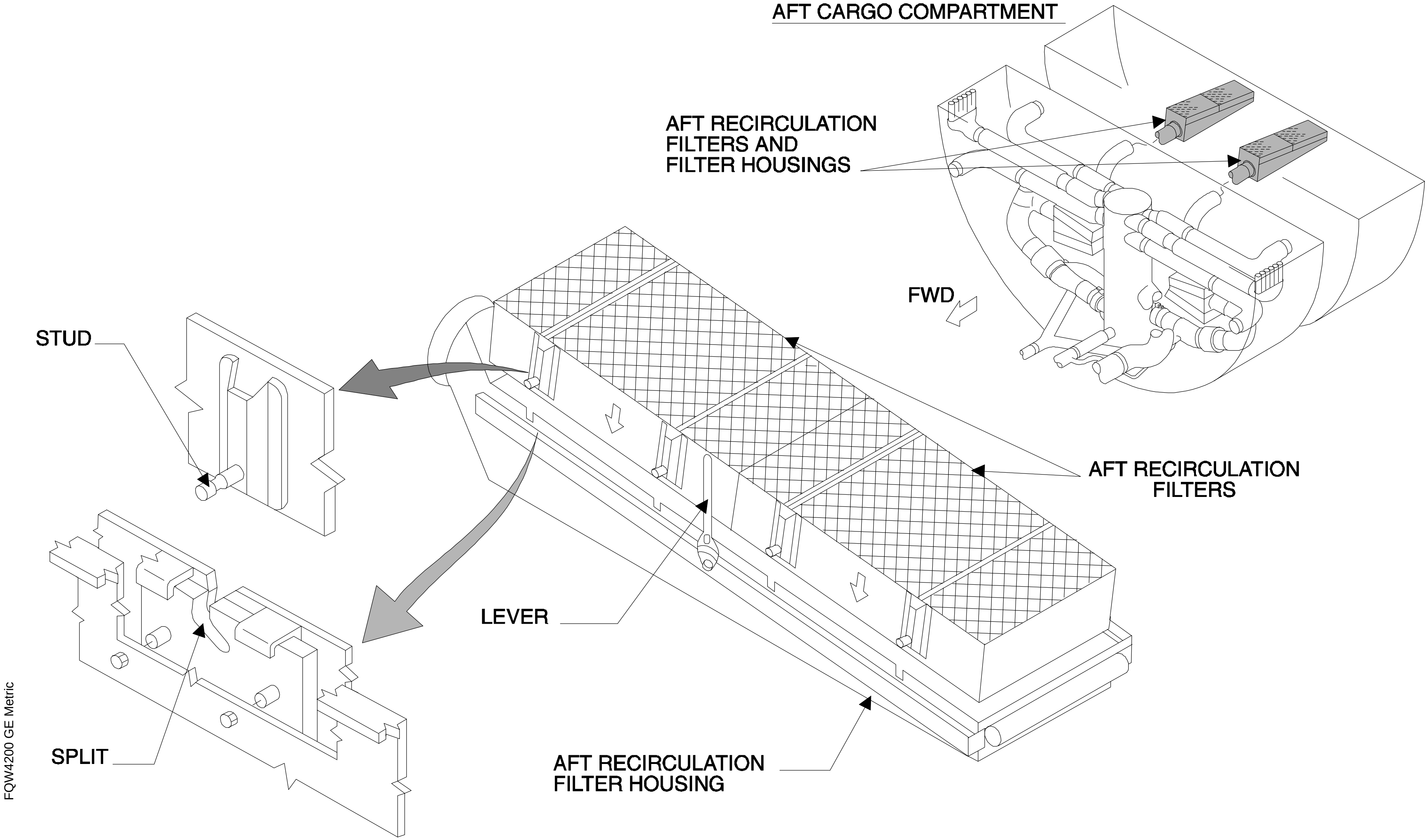
FILTERS
FIN : 5254HG, 5256HG, 5255HG, 5257HG
Zone : 152, 152, 151, 151
FILTER HOUSINGS
FIN : 5212HG, 5213HG
Zone : 152, 151

COMPONENT DESCRIPTION

Each AFT recirculation filter housing is a duct with a single frame. Two filters are fitted on each housing by means of four studs and a lever. The four AFT recirculation filters are interchangeable but not cleanable. Air sealing is ensured by a silicone seal.

REMOVAL/INSTAL

Comply with the safety precautions.
-get access to the filter(s)
(1) Pull out the lever to disengage the two filters of the filter housing.
(2) Remove the filter(s).
(a) Put the recirculation filter(s) in position on the filter housing.
(b) Engage the four studs of the filter in the splits of the filter housing.
(c) Push the lever to lock the studs.


AFT CARGO COMPARTMENT
AFT RECIRCULATION FILTERS AND FILTER HOUSINGS
FWD
STUD
AFT RECIRCULATION FILTERS
LEVER
SPLIT
AFT RECIRCULATION FILTER HOUSING
FQW4200 GE Metric

CLOGGING INDICATORS

FIN/ZONE

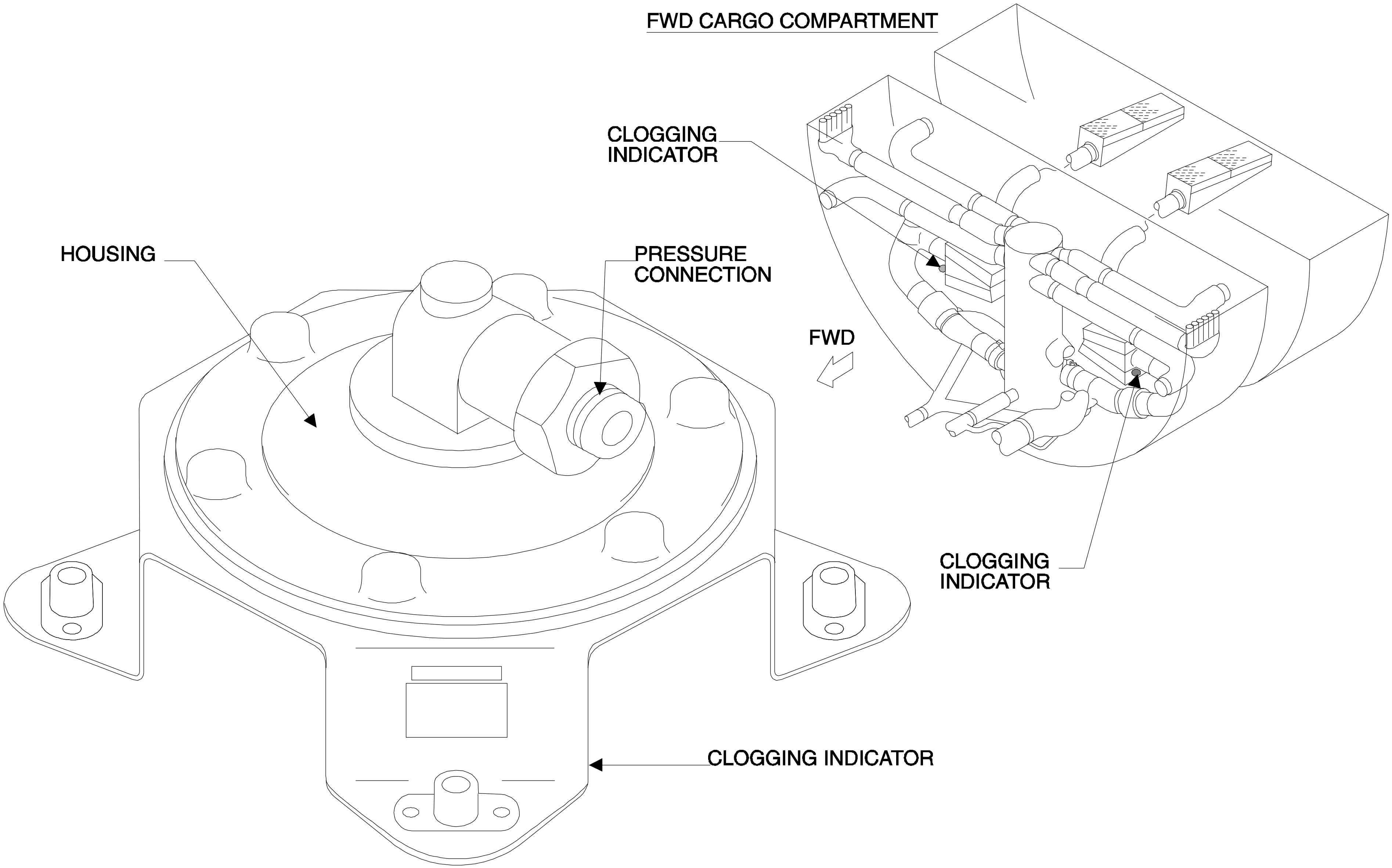
FIN : 214HG, 215HG

Zone : 138, 137

COMPONENT DESCRIPTION

The clogging indicators are differential pressure switches. There is a duct installed between the clogging indicator and the FWD recirculation filter housing.

When a recirculation filter is clogged, the pressure switch operates and sends data to the ventilation controller.



FQW4200 GE Metric

RECIRCULATION FANS

FIN/ZONE

FIN : 210HG, 211HG

Zone : 138,137

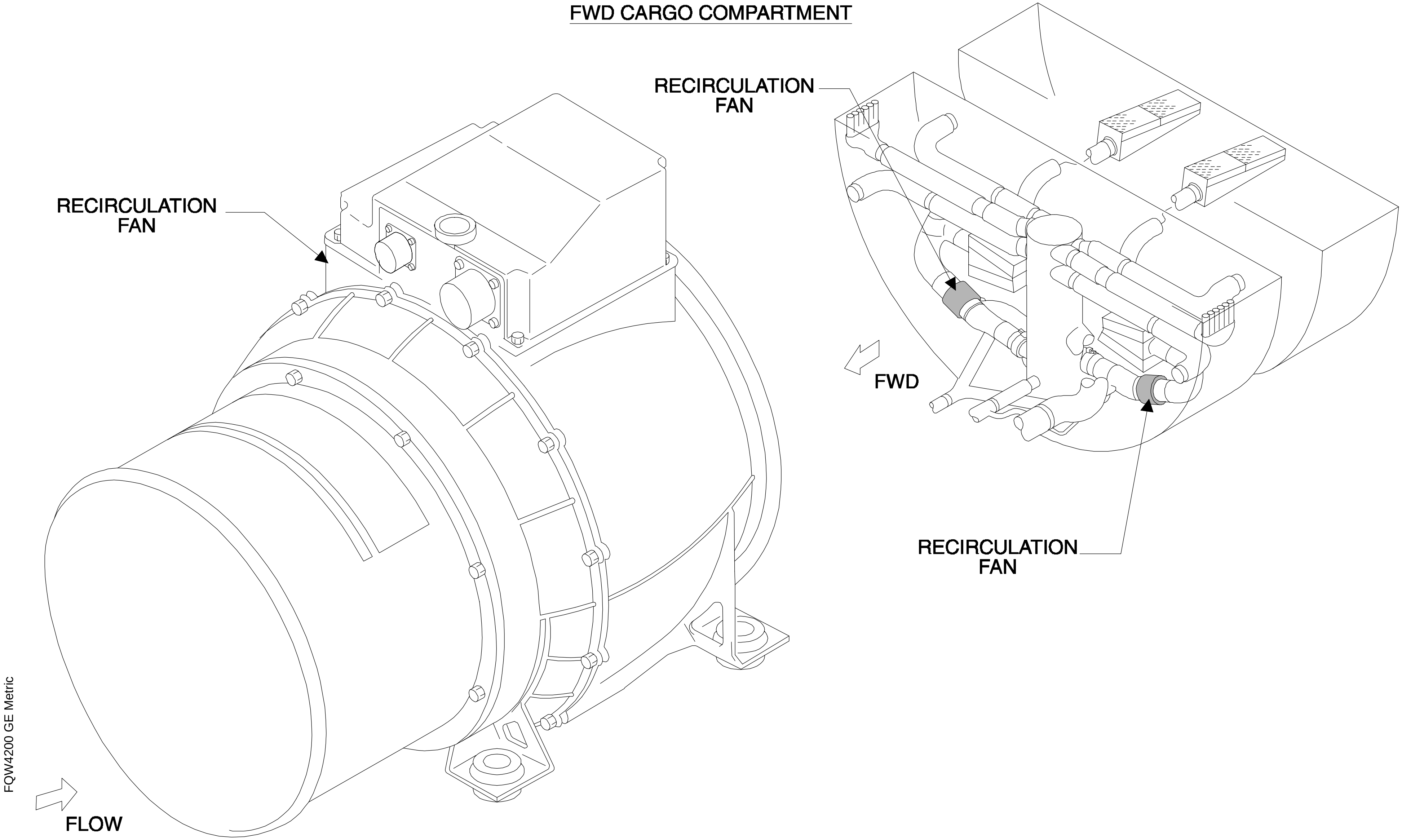
COMPONENT DESCRIPTION

Each recirculation fan has a 3 phase induction motor (115/200VAC) and a fan wheel with high efficiency blades in a housing.

The induction motor drives the fan wheel.

Three thermal switches stop the fan if the stator temperature reaches 180° C (356° F). The fan is reset from the cockpit by the OVHT COND FANS RESET P/B (3HN).

Arrows on the fan housing show the airflow direction and the fan wheel rotation direction.


FWD CARGO COMPARTMENT
RECIRCULATION FAN
RECIRCULATION FAN
FWD
RECIRCULATION FAN
FLOW
FQW4200 GE Metric

RECIRCULATION CHECK VALVES

FIN/ZONE

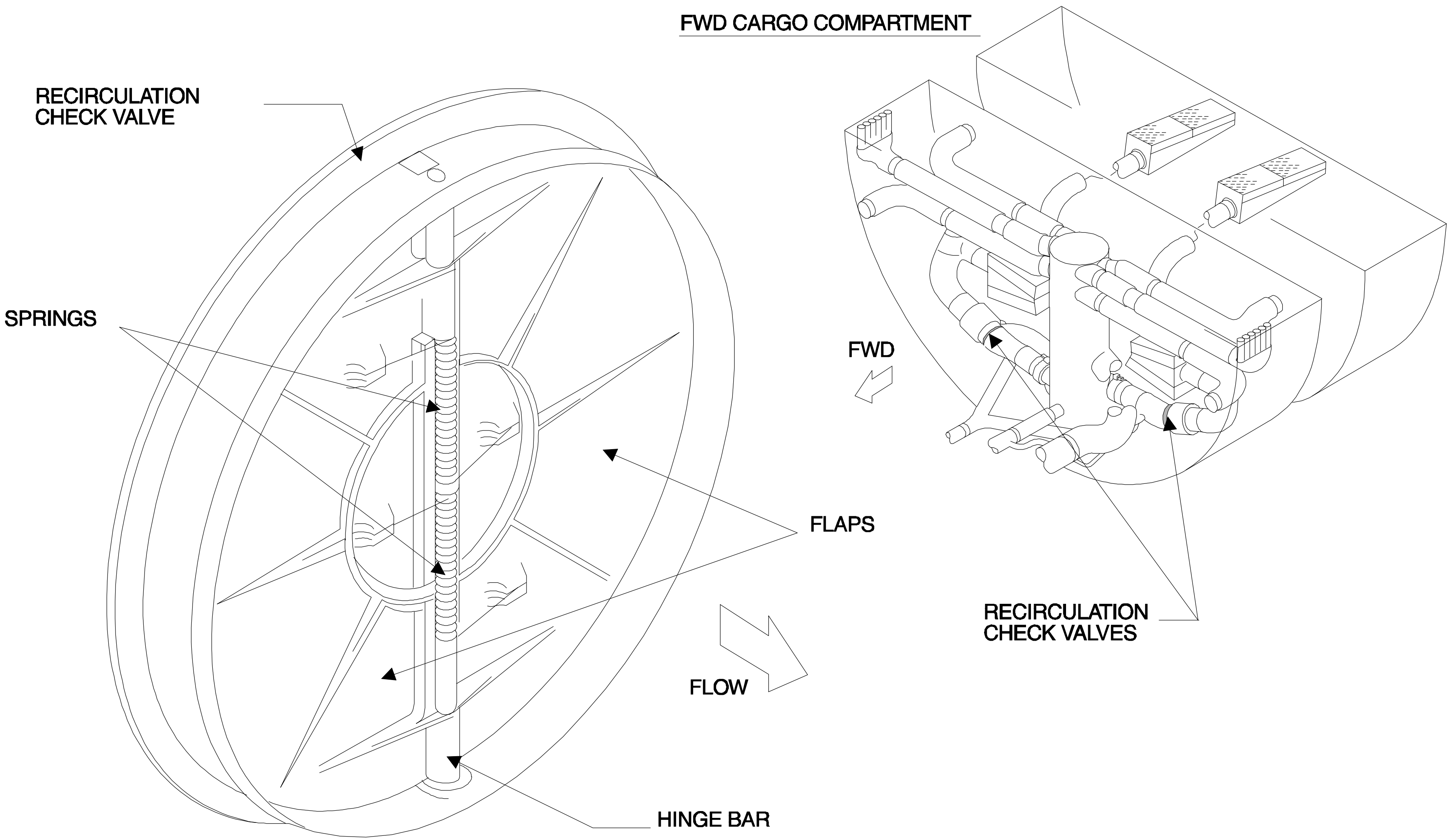
FIN : 5214HG, 5215HG

Zone : 138, 137

COMPONENT DESCRIPTION

Each recirculation check valve is composed of a housing with two semi-circular flaps installed on a hinge bar. Springs hold the two flaps in the closed position.

Airflow from the recirculation fans causes the flaps to open. Reverse flow from the mixer unit causes the flaps to close.



FQW4200 GE Metric

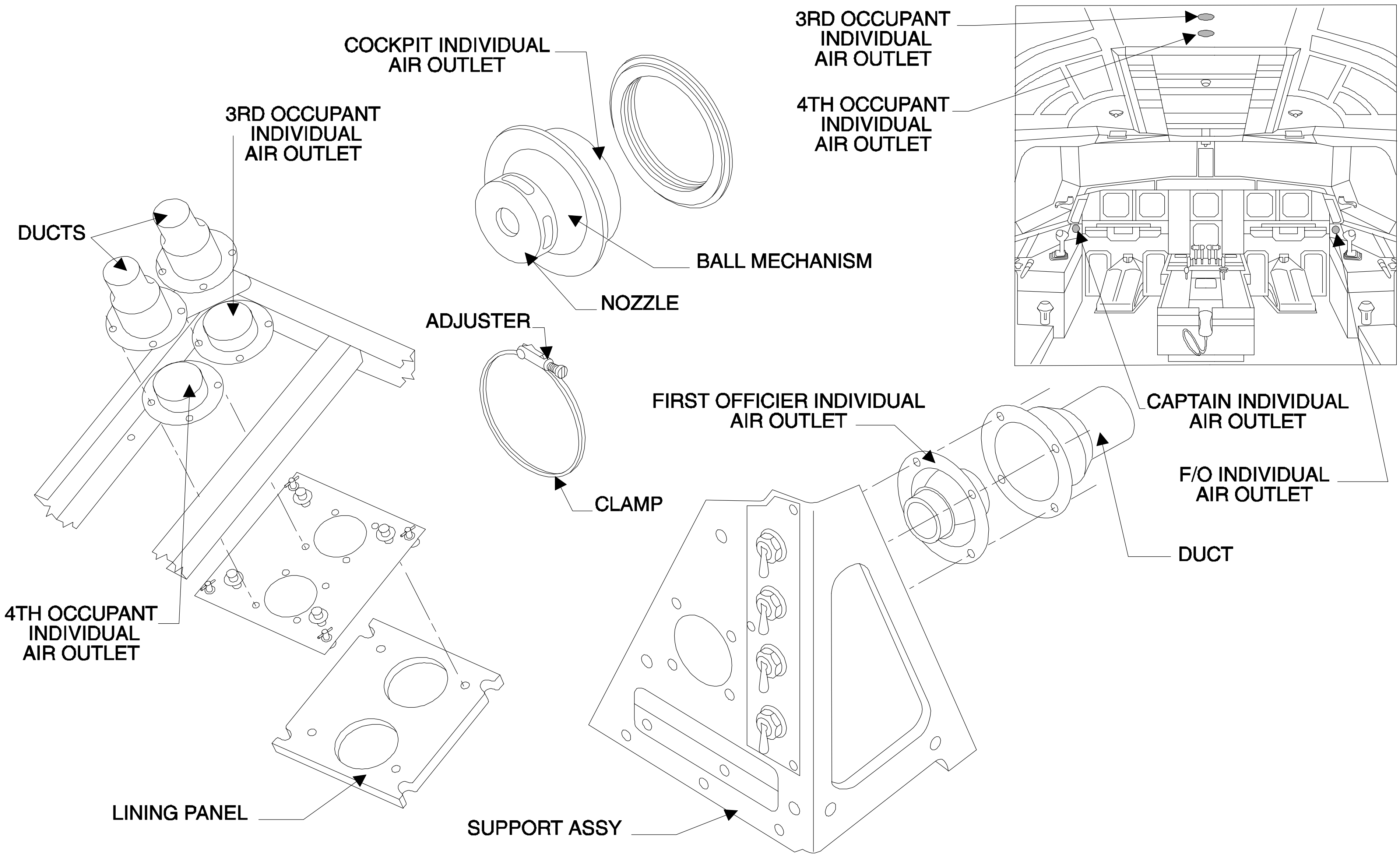
COCKPIT INDIVIDUAL AIR OUTLETS

FIN/ZONE

FIRST OFFICER
FIN : 5220HG
Zone : 212
CAPTAIN
FIN : 5221HG
Zone : 211
THIRD AND FOURTH OCCUPANTS
FIN : 5222HG, 5223HG
Zone : 212

COMPONENT DESCRIPTION

The cockpit individual air outlet has a nozzle and a ball mechanism in order to adjust the quantity and direction of conditioned air.
To increase the conditioned air flow, you must turn the nozzle counterclockwise. To decrease the conditioned air flow, you must turn the nozzle clockwise.
A clamp holds the individual air outlet in position. It has an adjuster to adjust and tighten it.



FQW4200 GE Metric

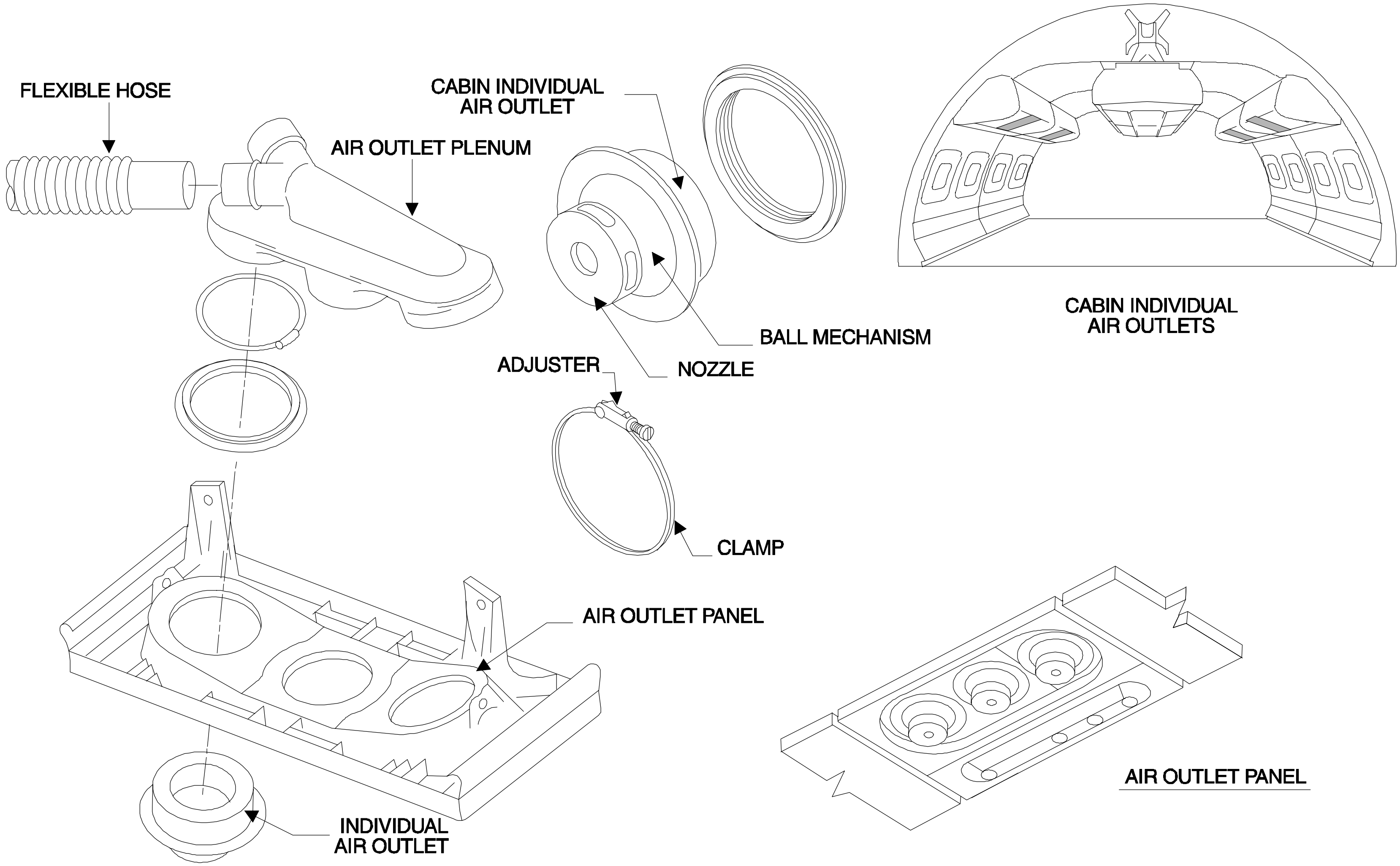
CABIN INDIVIDUAL AIR OUTLETS

FIN/ZONE

LATERAL OVERHEAD STOWAGE COMPARTMENT
FIN : 5400HG
Zone : 200
CENTRAL OVERHEAD STOWAGE COMPARTMENT
FIN : 5402HG
Zone : 200

COMPONENT DESCRIPTION

The cabin individual air outlet has a nozzle and a ball mechanism in order to adjust the quantity and direction of conditioned air.
To increase the conditioned air flow, you must turn the nozzle counterclockwise. To decrease the conditioned air flow, you must turn the nozzle clockwise.
A clamp holds the individual air outlet in position. It has an adjuster to adjust and tighten it.



FQW4200 GE Metric

GALLEY AND LAVATORY EXTRACTION FAN

FIN/ZONE

FIN : 231HU

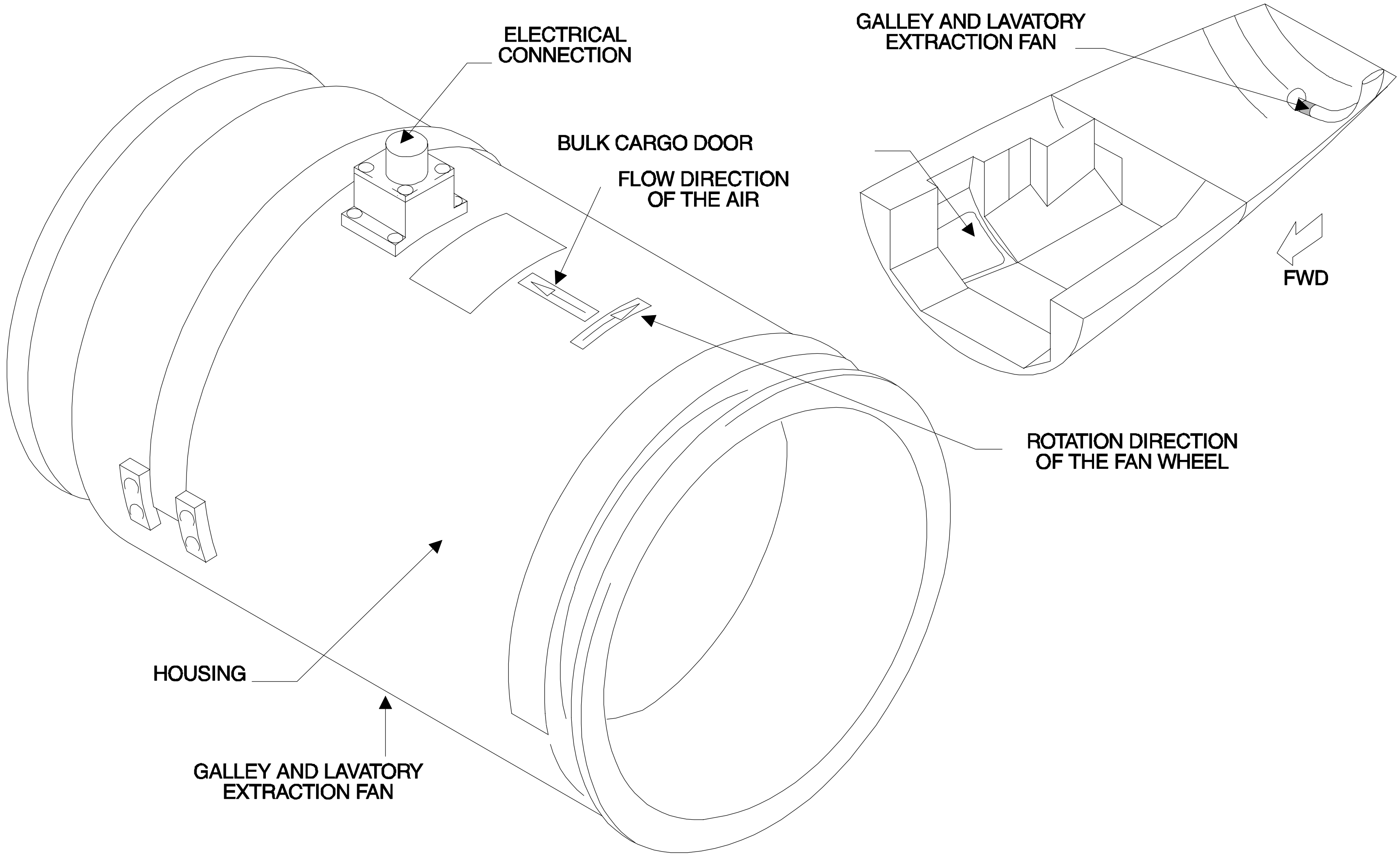
Zone : 171

COMPONENT DESCRIPTION

The galley and lavatory extraction fan has a 3 phase induction motor (115/200VAC) and a fan wheel with high efficiency blades in a housing. The induction motor drives the fan wheel.

Three thermal switches stop the fan if the stator temperature reaches 140° C (284° F). The fan is reset from the cockpit by the OVHT COND FANS RESET P/B (3HN).

Arrows on the fan housing show the airflow direction and the fan wheel rotation direction. This extraction fan and the AFT cargo compartment extraction fan (optional system) are identical and thus interchangeable.



FQW4200 GE Metric

GALLEY AND LAVATORY SAFETY SWITCH

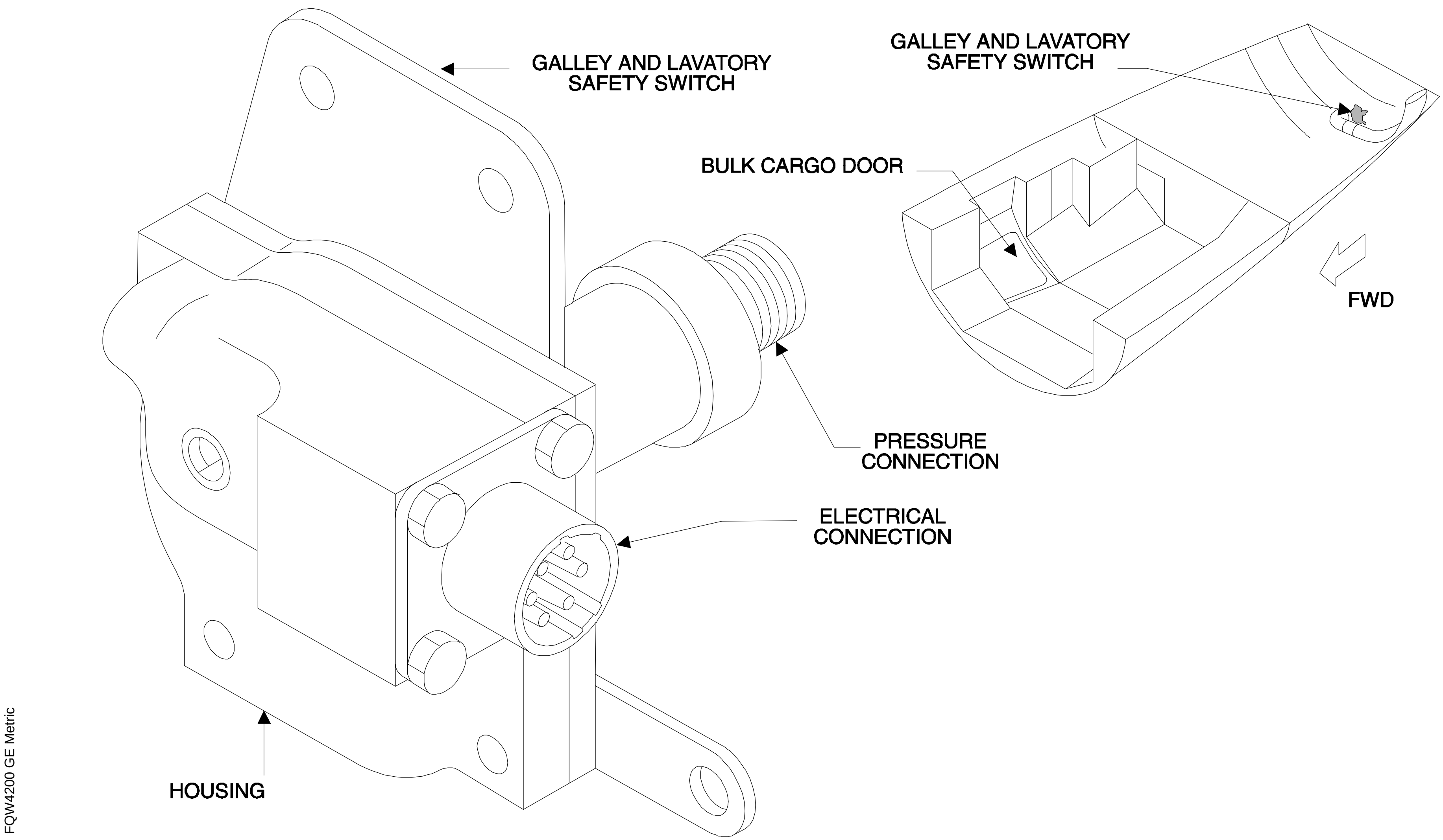
FIN/ZONE

FIN : 233HU

Zone : 171

COMPONENT DESCRIPTION

The galley and lavatory safety switch has switching elements sealed in a housing. It sends a signal to the ventilation controller if the negative differential pressure between the fuselage and the extraction duct is greater than 33 mbar (0.48 psi).


GALLEY AND LAVATORY
SAFETY SWITCH
GALLEY AND LAVATORY
SAFETY SWITCH
BULK CARGO DOOR
FWD
PRESSURE
CONNECTION
ELECTRICAL
CONNECTION
HOUSING
FQW4200 GE Metric

GALLEY AND LAVATORY DIFFERENTIAL PRESSURE SWITCH

FIN/ZONE

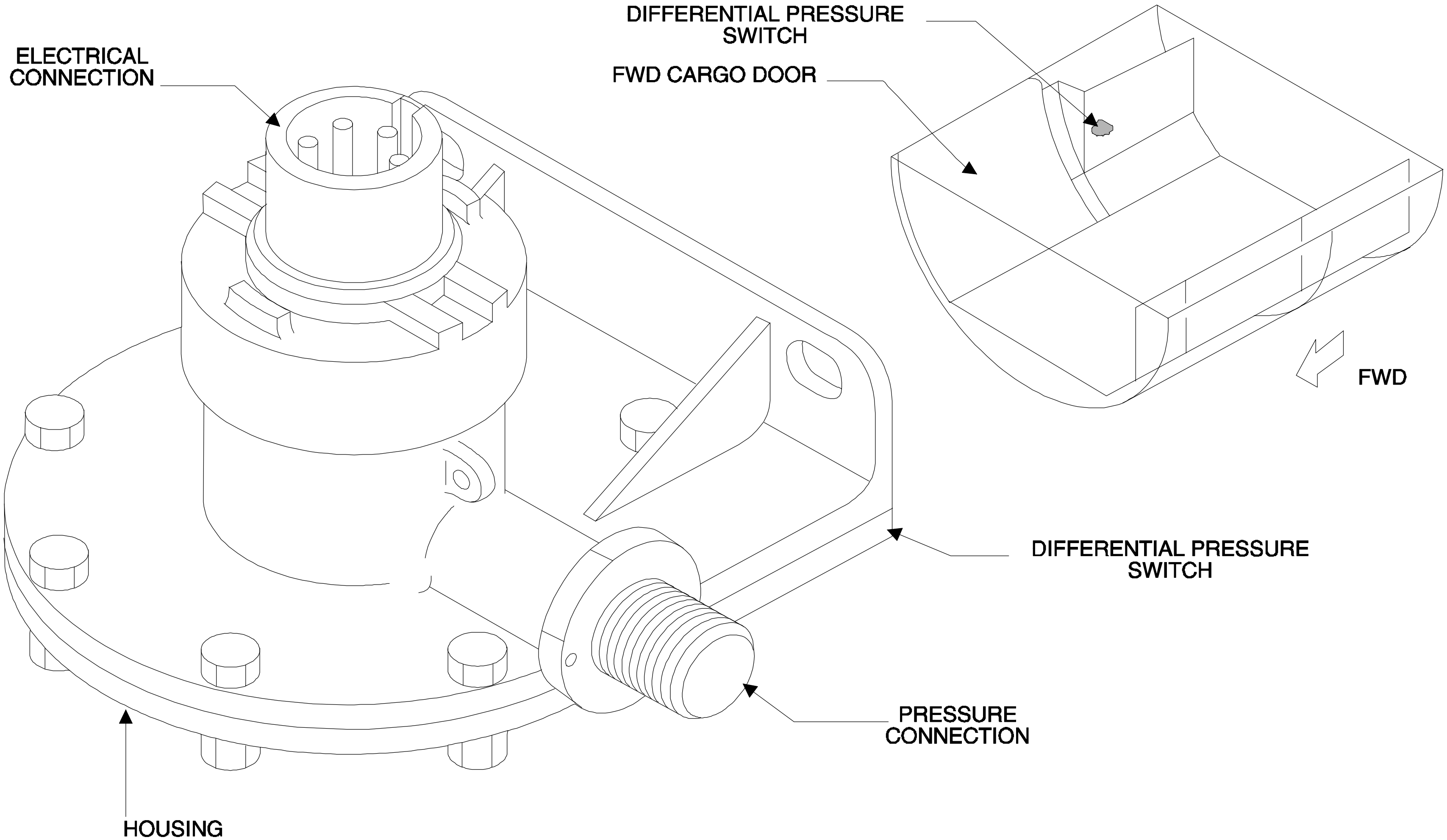
FIN : 232HU

Zone : 132

COMPONENT DESCRIPTION

The galley and lavatory differential pressure switch has switching elements sealed in a housing. An external port is installed in the FWD cargo compartment door frame and connected to the differential pressure switch.

The latter sends a signal to the ventilation controller for the extraction fan control if the difference between the aircraft internal and external pressure is lower than 1 psi.



FQW4200 GE Metric

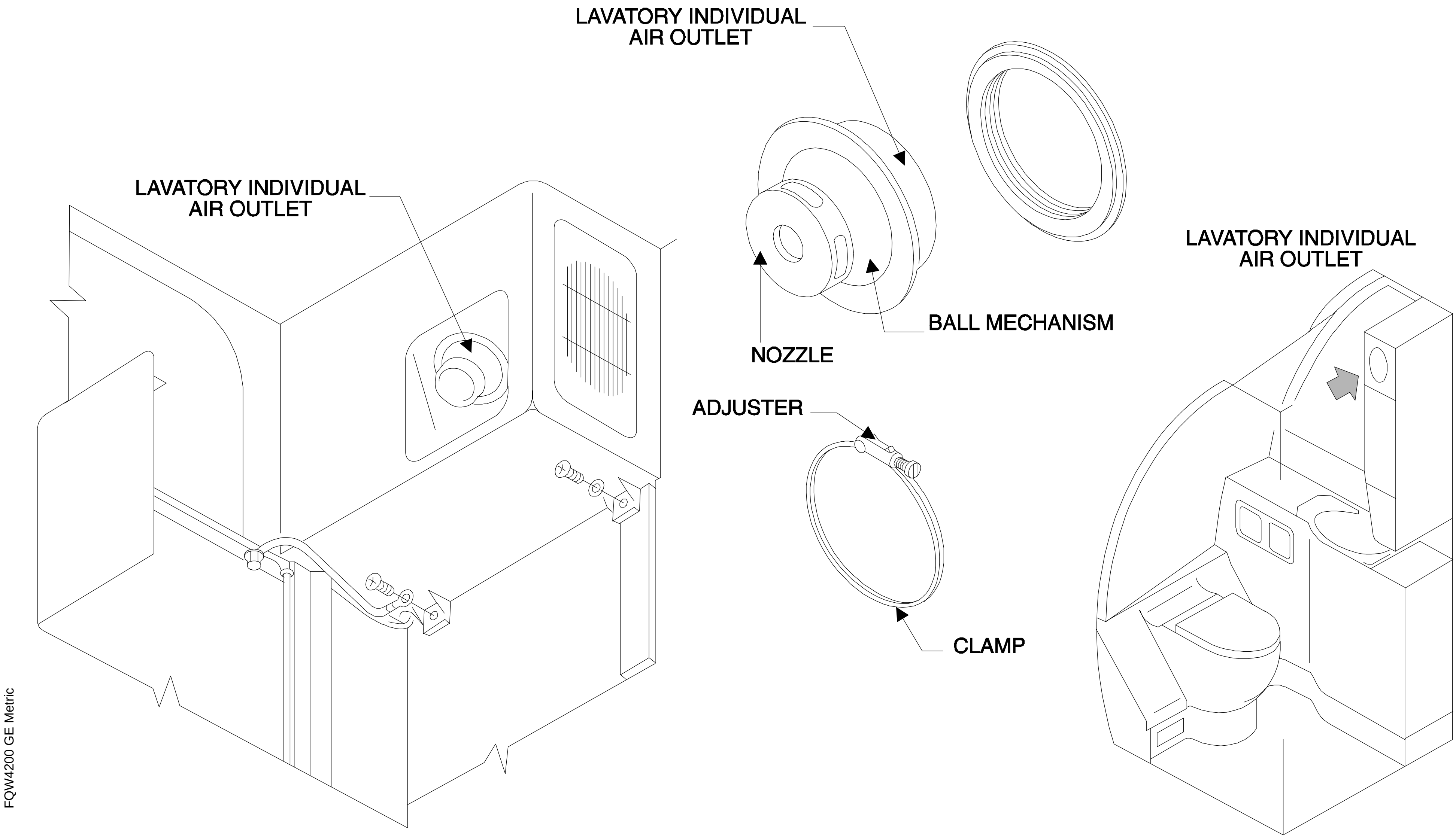
LAVATORY INDIVIDUAL AIR OUTLETS

FIN/ZONE

FIN : 5300HG, 5302HG
5304HG, 5306HG
5308HG, 5310HG
5312HG, 5314HG
Zone : variable

COMPONENT DESCRIPTION

The lavatory individual air outlet has a nozzle and a ball mechanism in order to adjust the quantity and direction of conditioned air.
To increase the conditioned air flow, you must turn the nozzle counterclockwise. To decrease the conditioned air flow, you must turn the nozzle clockwise.
A clamp holds the individual air outlet in position. It has an adjuster to adjust and tighten it.


LAVATORY INDIVIDUAL AIR OUTLET
LAVATORY INDIVIDUAL AIR OUTLET
NOZZLE
BALL MECHANISM
ADJUSTER
CLAMP
LAVATORY INDIVIDUAL AIR OUTLET
FQW4200 GE Metric

STUDENT NOTES

COCKPIT / CABIN VENTILATION : INTERFACES

System Data Acquisition Concentrator
Zone Controller
Centralized Maintenance Computer
Smoke Detection and Control Unit
Landing Gear Control and Interface Unit
Aircraft Emergency Configuration
Ditching Pushbutton
Ventilation Controller Reset Switch
Fan Reset Pushbutton
Cargo Air Cond Panel
Recirculation Valves
Recirculation Fans Recirculation Filters
Extract Fan
Underpressure Switch
Differential Pressure Switch

SYSTEM DATA ACQUISITION CONCENTRATOR

The ventilation controller provides SDAC 1 and SDAC 2 with temperature indications, valve positions and warning messages through two ARINC buses.

A ventilation controller fault discrete signal is also sent to both SDACs.

ZONE CONTROLLER

The zone controller provides the ventilation controller with flow control valve positions through an ARINC bus.

These positions are used for recirculation valve control.

CENTRALIZED MAINTENANCE COMPUTER

The ventilation controller is a type 1 system and provides both CMCs with failure and maintenance information.

CMC 1 sends flight information and BITE commands.

SMOKE DETECTION AND CONTROL UNIT

The Smoke Detection and Control Unit is informed about an inoperative galley and toilets fan, this is because the lavatory smoke detectors only work correctly if they are supplied with compartment extracted air.

LANDING GEAR CONTROL AND INTERFACE UNIT

The Landing Gear Control and Interface Unit sends a discrete ground signal to each lane of the ventilation controller.

It is used for the galley and toilet fan control and for the clogging indicator signal validation as well as for some monitoring logics.

AIRCRAFT EMERGENCY CONFIGURATION

Two electrical aircraft emergency configuration signals coming from a relay logic are used to stop the galley and toilets extraction fan.

DITCHING PUSHBUTTON

The ditching discrete signal is used to stop both recirculation fans.

VENTILATION CONTROLLER RESET SWITCH

One reset discrete signal is sent to each ventilation controller lane, in order to reset it.

FAN RESET PUSHBUTTON

A fan reset signal is sent to the ventilation controller, in order to reset the galley and toilets extraction fan and the recirculation fans.

CARGO AIR COND PANEL

The CAB FANS pushbutton switch sends a discrete signal to the ventilation controller to deactivate the recirculation system.

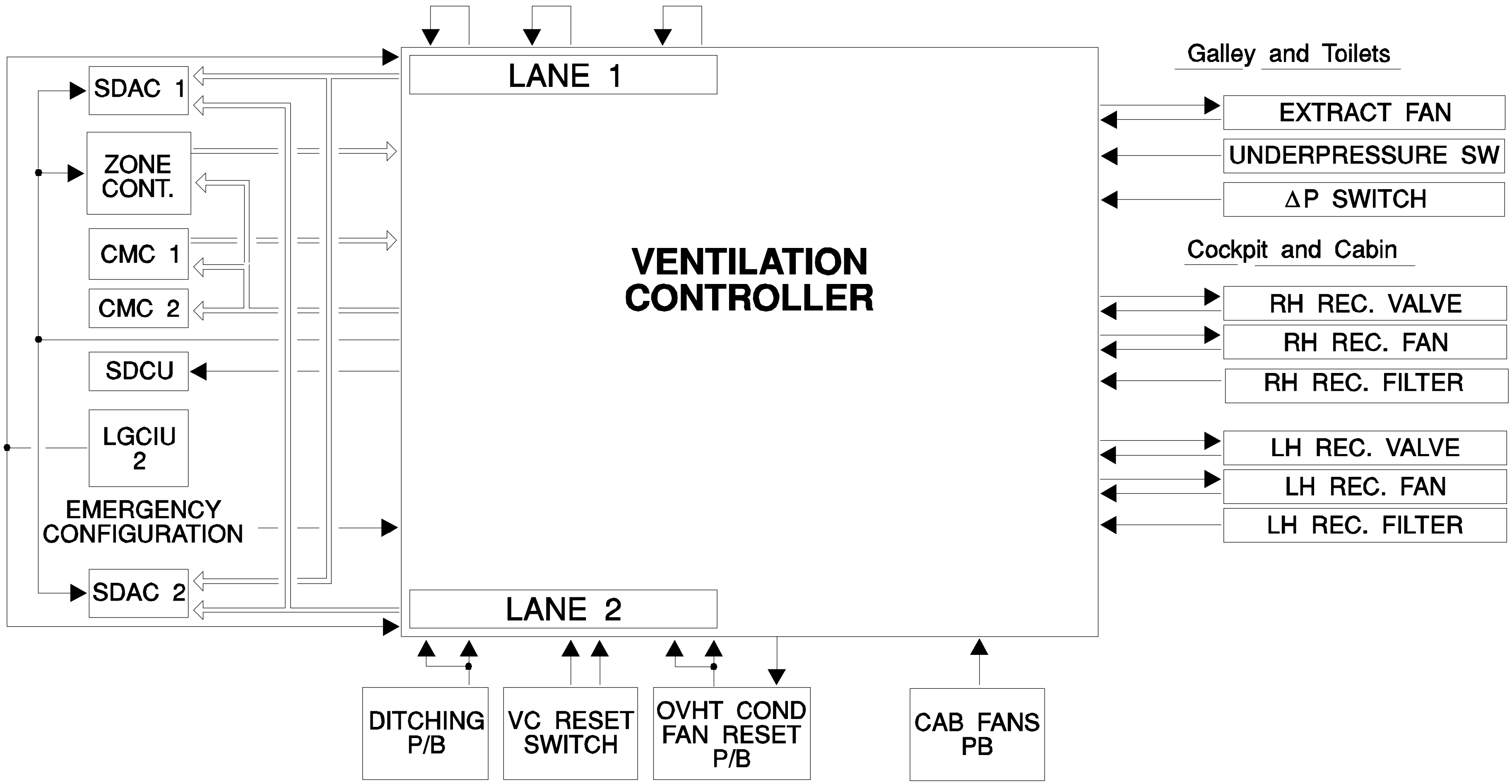
RECIRCULATION VALVES

Each recirculation valve sends the fully open and fully closed position signals to the ventilation controller for recirculation valve monitoring and recirculation system control.

RECIRCULATION FANS RECIRCULATION FILTERS

Each recirculation fan sends an overheat and a power feedback signal for fan monitoring and control purposes.

Clogging indicators of recirculation filters send signals to the ventilation controller to generate a maintenance information.



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EXTRACT FAN

The galley and toilets extraction fan sends an overheat and a power feedback signal for fan monitoring and control purposes.

UNDERPRESSURE SWITCH

A galley and toilets duct underpressure signal is sent if the negative differential pressure reaches 0.48 psi.

It is used to generate a maintenance message.

DIFFERENTIAL PRESSURE SWITCH

The differential pressure switch generates a signal if the difference between internal pressure and external pressure is above one psi.
It is used to stop the galley and toilets fan.

AFT GALLEY AREA HEATING SYSTEM PRESENTATION

GENERAL

The aft galley-area heating system increases the temperature of the air in the aft galley area.
The air comes from the cabin air supply area and flows through a heater located in the upper part of the aft galley.

POWER SUPPLY LOGIC

The heater is powered by the 115 VAC service bus.
The 115 VAC is available only if at least one air conditioning pack operates and galley power is "ON", provided the cargo loading is not operating.

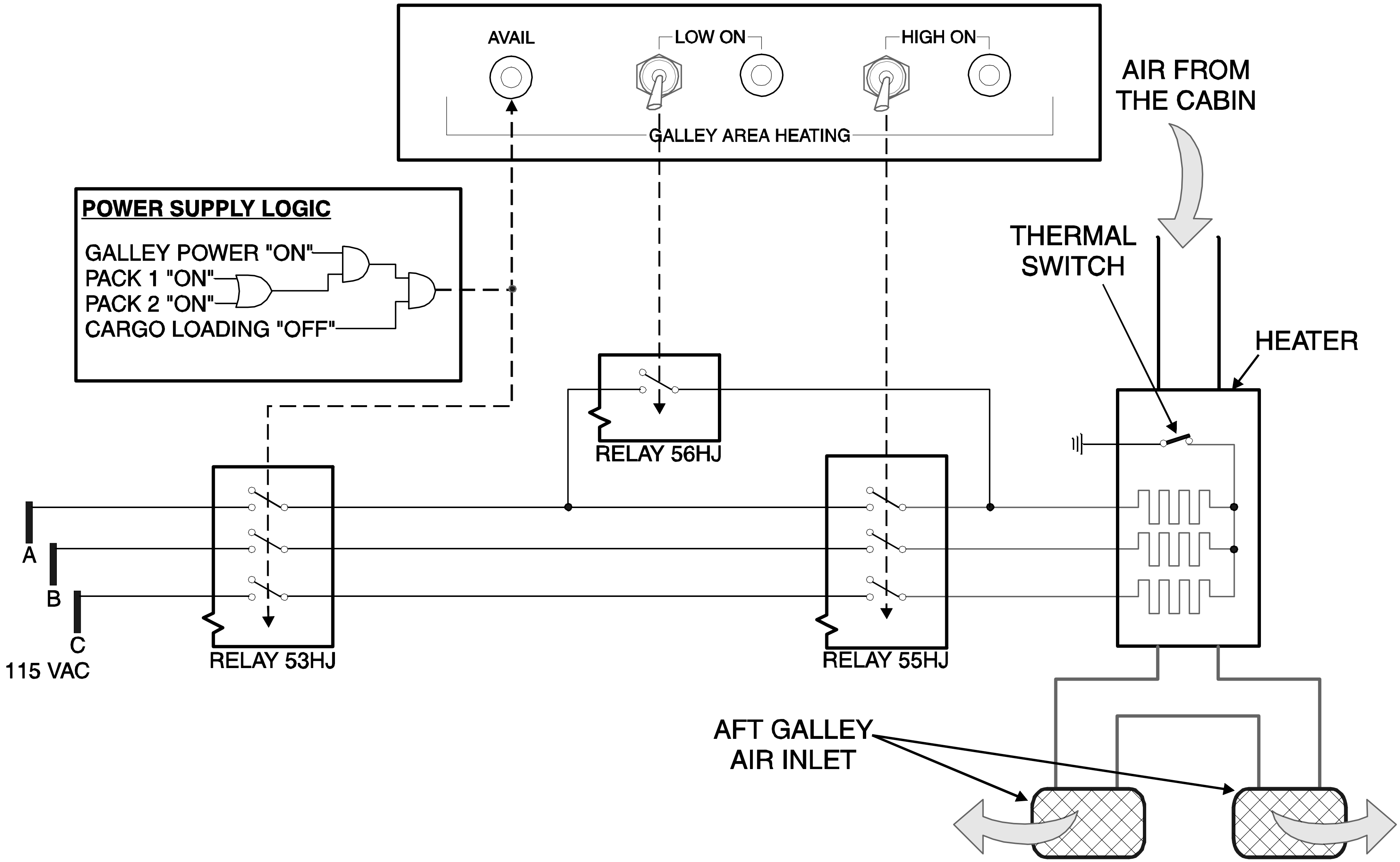
CONTROL AND INDICATING

As soon as all the heater supply initial conditions are fulfilled, the "AVAIL" indication illuminates on the aft GALLEY AREA HEATING panel meaning that the heater is available.

Two temperature settings (low or high) can be selected through two p/b switches located on the GALLEY AREA HEATING panel.
The "LOW ON" selection powers one heating element while the "HIGH ON" selection powers the three elements.

THERMAL PROTECTION

In case of heater overheat the thermal switch opens. This causes the heater supply to be interrupted.
The "AVAIL" indication on the GALLEY AREA HEATING panel will extinguish as long as the overheat exits.


AVAIL
LOW ON
HIGH ON
GALLEY AREA HEATING
AIR FROM
THE CABIN
POWER SUPPLY LOGIC
GALLEY POWER "ON"
PACK 1 "ON"
PACK 2 "ON"
CARGO LOADING "OFF"
THERMAL
SWITCH
HEATER
RELAY 56HJ
A
B
C
115 VAC
RELAY 53HJ
RELAY 55HJ
AFT GALLEY
AIR INLET

STUDENT NOTES

AFT GALLEY AREA HEATING: COMPONENTS

Heater

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HEATER

FIN/ZONE

FIN : 50HJ
ZONE : TBD

COMPONENT DESCRIPTION

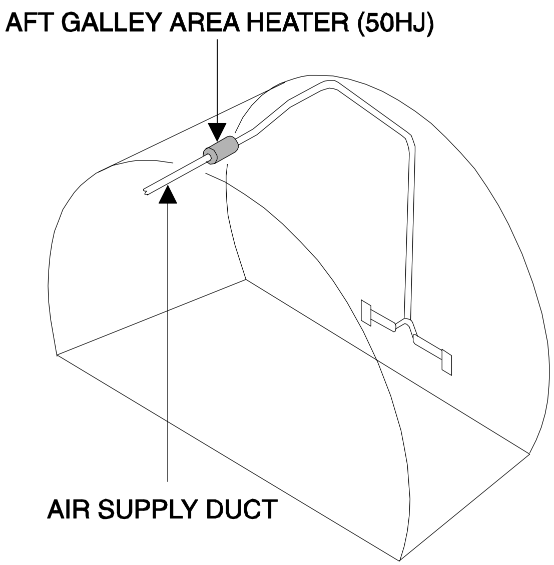
The heater is installed in the aft galley air supply duct.
It is an integrated unit electrically supplied by a 115VAC service BUS.
The heater has two different power heating settings and consists of three heating elements connected in parallel.
In case of overheat, the electrical power is automatically cut-off by means of a thermal switch.

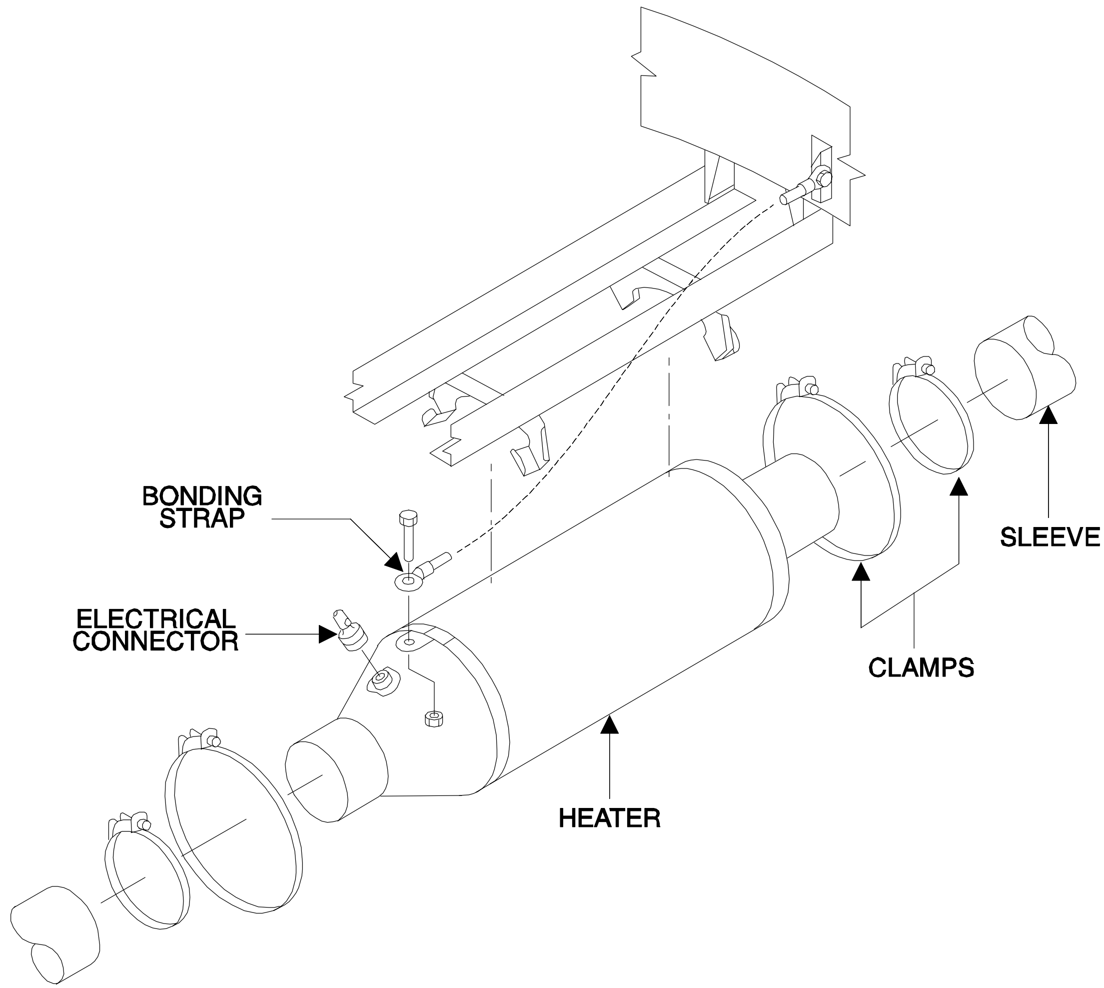
SAFETY PRECAUTIONS

Before removal:

- Make sure there is no bleed air supply from any sources,
- Make sure that both packs are off.

Do not touch the heater until it is sufficiently cool to prevent burns.





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STUDENT NOTES

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AVIONICS / AIR CONDITIONING BAY VENTILATION : SYSTEM PRESENTATION

INTERFACE

Recirculation System

AVIONICS VENTILATION SYSTEM

General
Ground Refrigeration System (OPTIONAL)
Extraction Fan
Overboard Valve
Underfloor Valve
Cooling Effect Detector (CED)
Pressure Switch

AIR CONDITIONING BAY VENTILATION SYSTEM

Turbofan and Supply Valve
Pressure Switch

INTERFACE

RECIRCULATION SYSTEM

The recirculation fans of the cockpit and cabin ventilation system are also used as blower fans for the avionics equipment ventilation.

The recirculation fans are controlled, via the ventilation controller, from the VENTILATION panel.

The recirculation valves are normally open.
They close when both packs are OFF to keep the avionics equipment sufficiently ventilated.

The valves are controlled and monitored by the ventilation controller.

AVIONICS VENTILATION SYSTEM

GENERAL

Vent air is supplied either from the recirculation system or from the packs.
Air is extracted by means of an extraction fan.
Air is discharged either overboard through the overboard valve or under the cargo floor through the underfloor valve.

When the overboard valve is open, the underfloor valve is closed and vice versa.
A ground horn sounds in case of abnormal operation on ground.

The cooling capacity is monitored by two sensors (Cooling Effect Detector and pressure switch).
All avionics ventilation system components are controlled and monitored by the Avionics Equipment Ventilation Computer (AEVC).

GROUND REFRIGERATION SYSTEM (OPTIONAL)

The ground refrigeration system cools the air of the avionics ventilation system.
The Ground Refrigeration Unit (GRU) is a freon gas closed-cycle refrigeration system which operates on a compression expansion principle. The GRU is designed to meet the new environmental requirements.

It operates when the aircraft is on ground with all engines and both packs stopped, ditching not selected, GND COOL pushbutton switch on AUTO and the recirculated air temperature higher than 27°C.

Control and monitoring are performed by the Avionics Equipment Ventilation Computer.

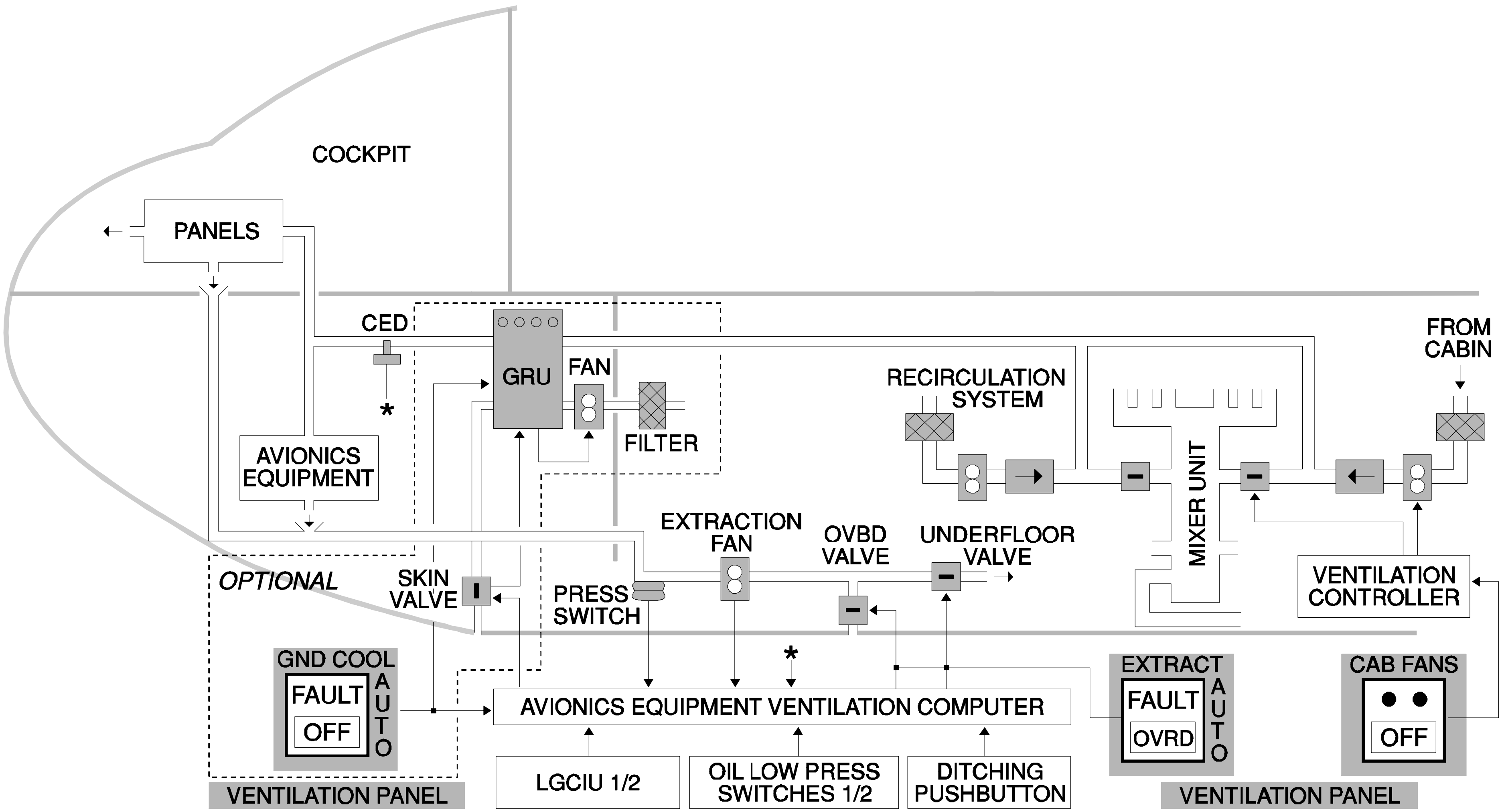
The ground/flight signal comes from LGCIU 1 and 2.
The engines 1 and 2 stopped signal comes from the oil low pressure switches (1 and 2). The ditching signal comes from the PRESS panel.

When the system operates, the fan runs and the heat accumulated in the condenser is extracted through the skin air valve.

EXTRACTION FAN

The extraction fan draws the air from the avionics equipment.
It is monitored by the Avionics Equipment Ventilation Computer.

It runs continuously whenever electrical power is available.



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OVERBOARD VALVE

In AUTO mode, air is extracted through the overboard valve provided the aircraft is on ground and engines 1 and 2 stopped.

The overboard valve will receive a signal to close if DITCHING is selected on the PRESS panel.

Manual OVRD selection on EXTRACT pushbutton switch controls partial opening of the overboard valve.
In flight it will ensure equipment ventilation by differential pressure.

This manual selection is done in case of low flow detection or avionics smoke procedure.

UNDERFLOOR VALVE

The underfloor valve is closed and the overboard valve is open, provided the EXTRACT pushbutton switch is in AUTO position, engines 1 and 2 stopped, and the aircraft on ground.

In flight, the extracted air is discharged below the forward cargo compartment floor via the underfloor valve, the overboard valve being closed.

If the OVRD position is selected, the underfloor valve closes to allow the air to be sent overboard via the overboard valve.

COOLING EFFECT DETECTOR (CED)

The Cooling Effect Detector provides a warning signal when the cooling capacity of the recirculated air is insufficient.

PRESSURE SWITCH

The Pressure Switch signals a low pressure to the Avionics Equipment Ventilation Computer in order to detect any low flow.

In case of low flow, the FAULT light on the EXTRACT pushbutton switch comes on and an electrical signal is sent to the ECAM and ground horn.

AIR CONDITIONING BAY VENTILATION

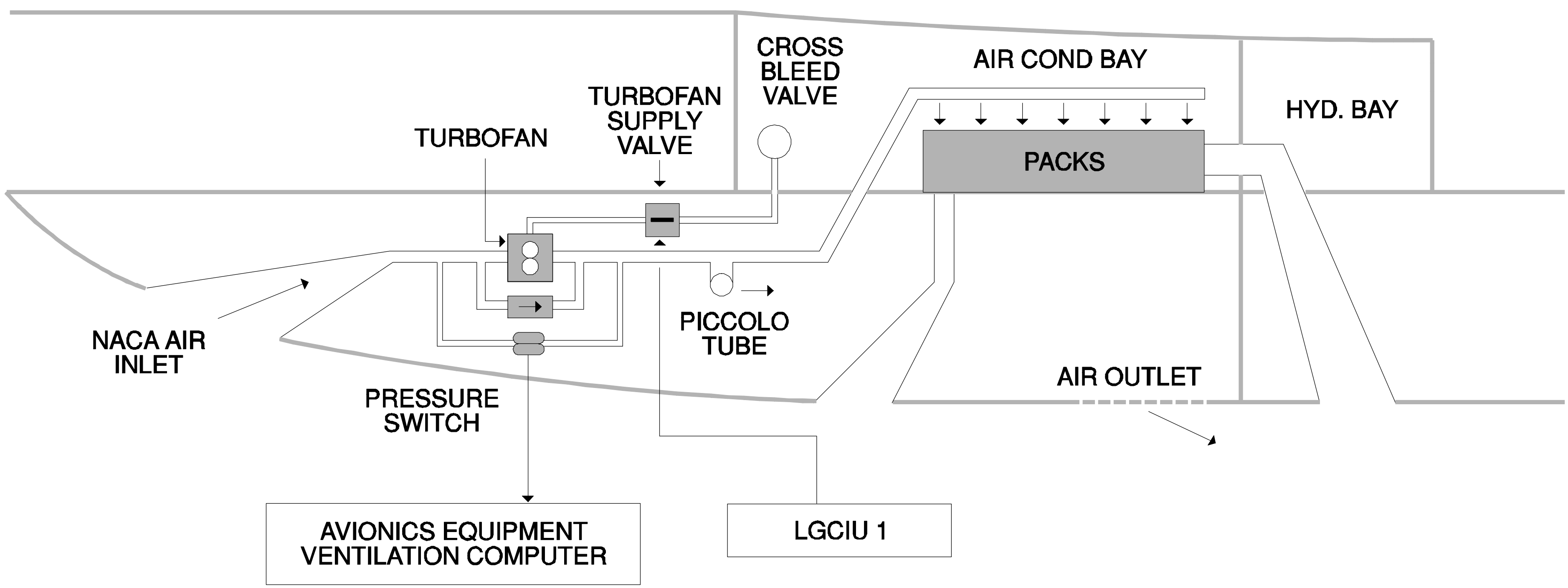
TURBOFAN AND SUPPLY VALVE

The air conditioning bay is ventilated by external air to prevent structural damage. With the aircraft on ground, the turbofan boosts air into the ventilation circuit.
The turbofan is driven as soon as it receives air from the cross bleed duct via the supply valve.

In flight, the supply valve being closed, ventilation is performed by ram air from NACA air inlet.
When the turbofan is in windmilling configuration, the overflow bypasses the turbofan through the check valve.

PRESSURE SWITCH

A pressure switch signals an abnormal ventilation to the Avionics Equipment Ventilation Computer.



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STUDENT NOTES:

AVIONICS / AIR CONDITIONING BAY VENTILATION : SYSTEM CONTROLS AND INDICATING

Extract P/B
OVBD Valve
Vent

EXTRACT P/B

The system is automatically controlled by the avionics equipment ventilation computer provided that the EXTRACT pushbutton switch is set to AUTO.
On ground, engine 2(1) and engine 3(2) not running, ditching not selected :
- underfloor valve closed,
- overboard valve fully open.

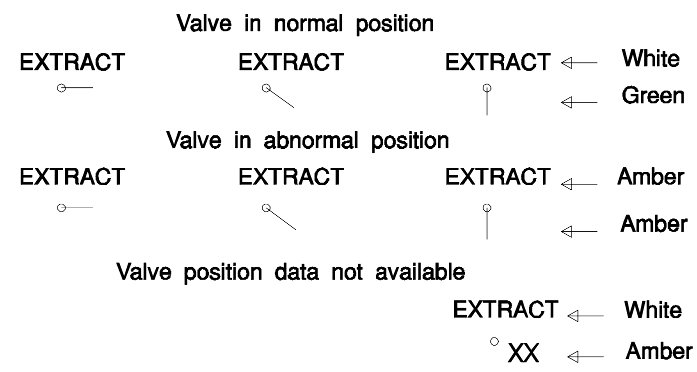
In flight or, on ground engine 2(1) or engine 3(2) running :
- underfloor valve open,
- overboard valve closed.

(*) : concerns the A330

In case of system malfunction, the FAULT light comes on amber and disappears when the EXTRACT pushbutton switch is set to OVRD.
When OVRD is selected, overboard and underfloor valves are set to a fixed position.
FAULT : in amber : The extract fan fails or the underfloor valve has failed closed.
OVRD : in white : The underfloor valve closes and the overboard valve partially opens provided ditching is not selected.

OVBD VALVE

The overboard valve position indication is normally green and the EXTRACT indication is normally white.
It becomes amber in case of abnormal position of the overboard valve.



VENT

The VENT indication is normally white and becomes amber if an extract low flow warning is triggered.
VENT : white : Normal operation.
VENT : amber : In case of extract low flow warning.

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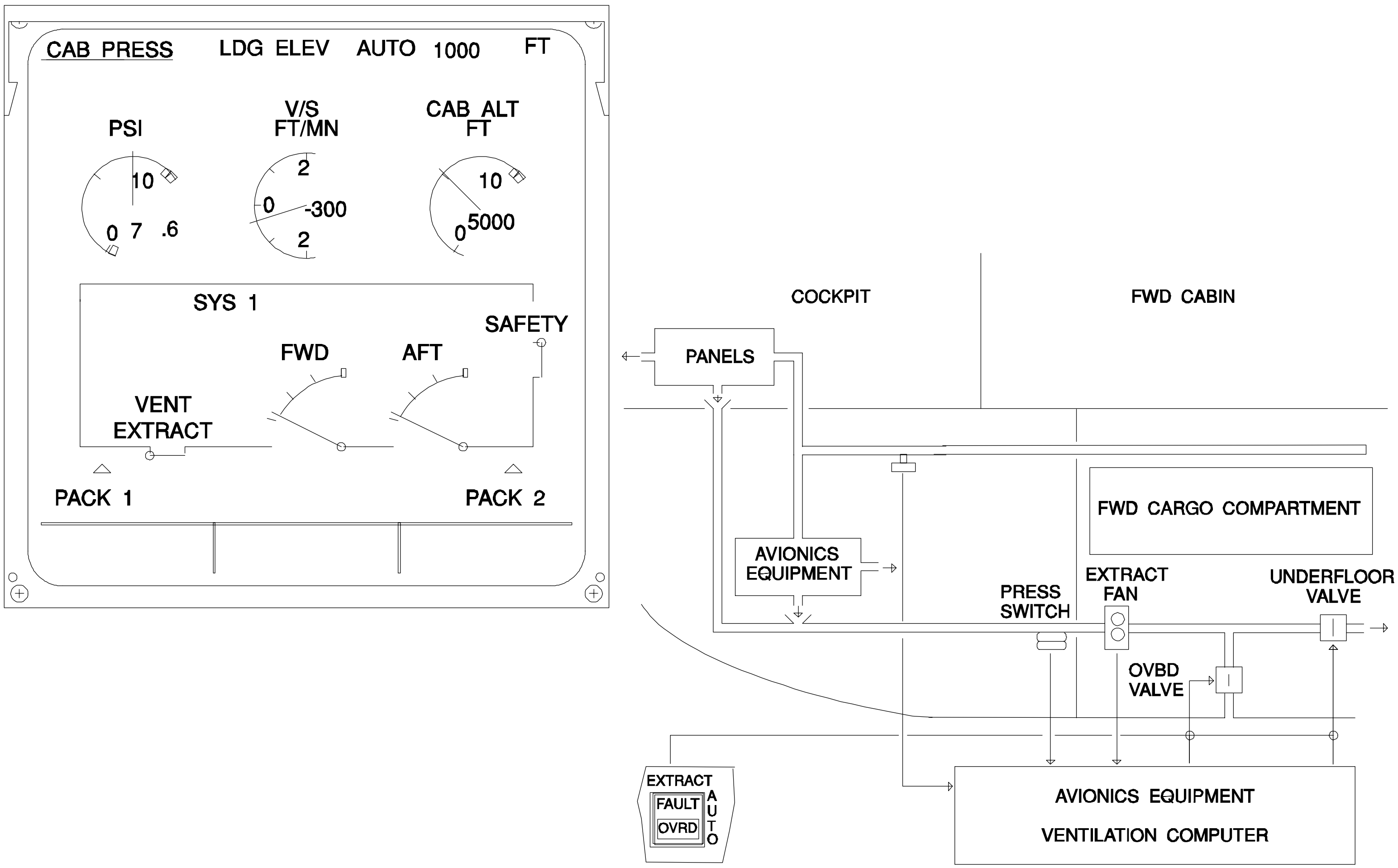

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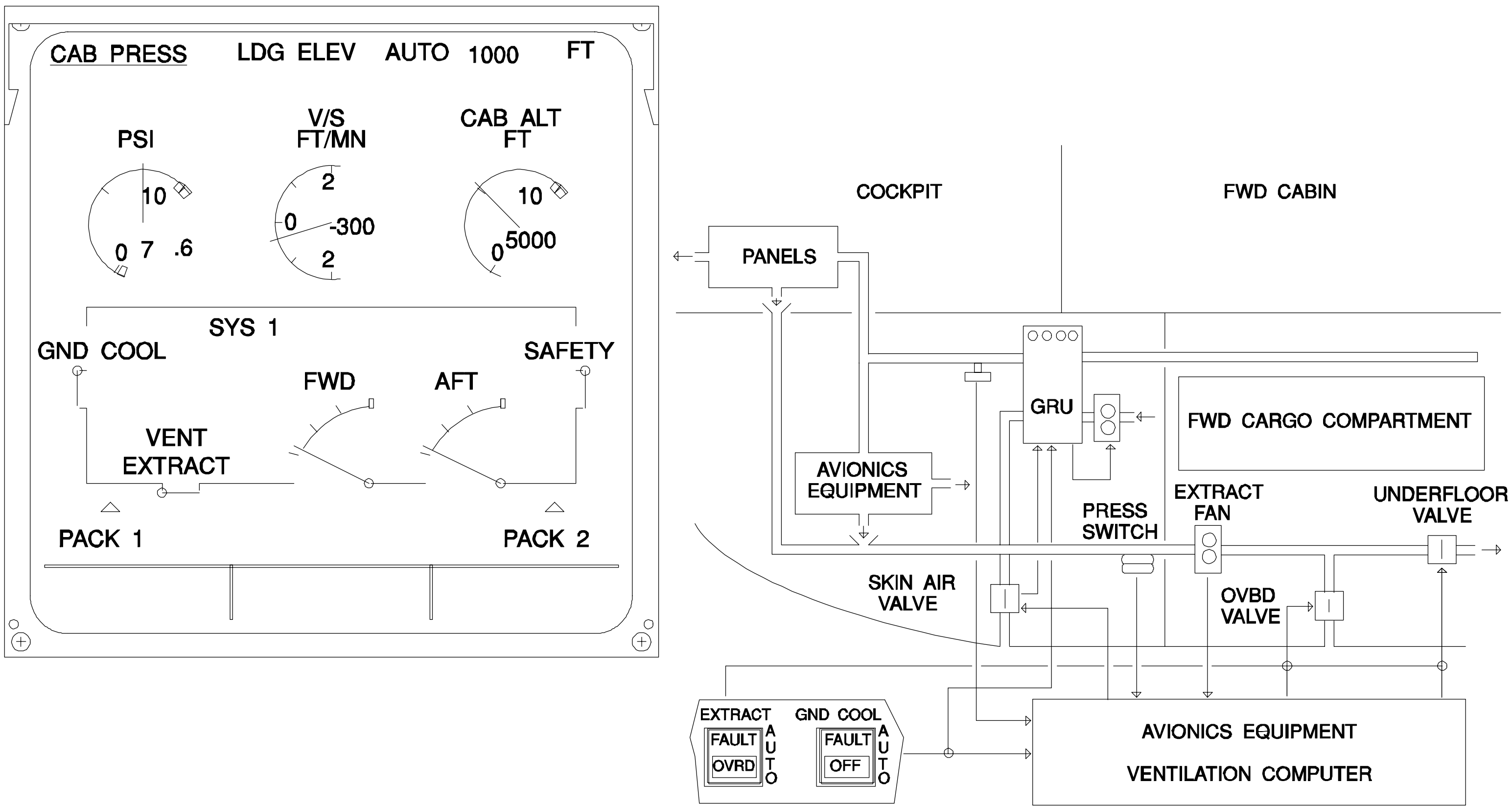
STUDENT NOTES

AVIONICS EQUIPMENT GROUND COOLING : SYSTEM CONTROLS AND INDICATING

Ground Cooling P/B
Skin Valve
Ground Cooling Indication

GROUND COOLING P/B

The ground cooling system is automatically controlled by the avionics equipment ventilation computer provided that the GROUND COOL pushbutton switch is set to AUTO.
In case of system malfunction, the GROUND COOL pushbutton switch must be set to OFF.
A/C on ground, engines stopped : Skin valve opens.
Skin valve open and recirculation air temperature >27°C (80°F): fan and compressor run.
FAULT : in amber : Ground Refrigeration Unit (GRU), fan or valve failure.
OFF : in white : the skin valve closes , the fan and the GRU stop.



GRU : GROUND REFRIGERATION UNIT

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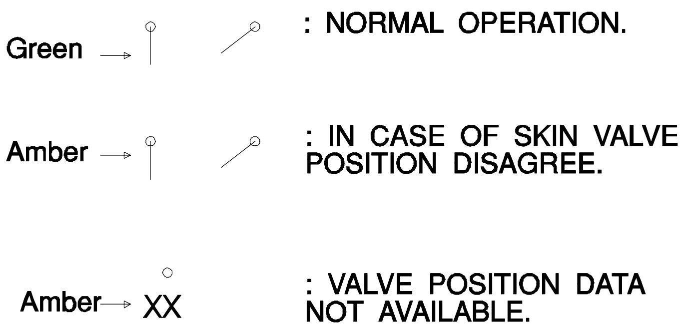
SKIN VALVE

The skin valve position indication is normally green. It becomes amber in case of abnormal position.



GROUND COOLING INDICATION

The GROUND COOL indication is normally white. It becomes amber when the skin valve position indication is displayed amber or when the ground cooling system is faulty.
GND COOL : white : Normal operation or when the ground cooling system status is not available.
GND COOL : amber : When the skin air valve is displayed amber or when the ground cooling system is faulty.

AVIONICS EQUIPMENT VENTILATION : SYSTEM DESCRIPTION AND OPERATION

GENERAL

The system ensures the ventilation of the avionics equipment in order to guarantee a high reliability level.
This is done in compliance with the ARINC 600 requirements.

The main items of equipment which are ventilated are :

- In the coockpit :
  - the display units,
  - the pedestal,
  - the overhead panel,
  - the cockpit temperature sensor.
- In the avionics compartment :
  - the electronics racks,
  - the weather radar shelf,
  - the AC/DC power center,
  - the forward shelf,
  - the ADIRUs,
  - the batteries.

The avionics equipment ventilation includes two sub-systems :

- the blowing sub-system,
- the extraction sub-system.

BLOWING SUB-SYSTEM

The required blowing airflow is bled from the cabin air recirculation system.

Under normal conditions the system enables the required airflow to be supplied by both cabin recirculation fans.

Permanent monitoring of the cooling capacity of blowing airflow is ensured by the Cooling Effect Detector.

The cooling capacity is sensed by measuring the cooling of a heating unit included in the Cooling Effect Detector.
The temperature and heating information is processed by an electronic circuit.

EXTRACT SUB-SYSTEM

DESCRIPTION

GENERAL

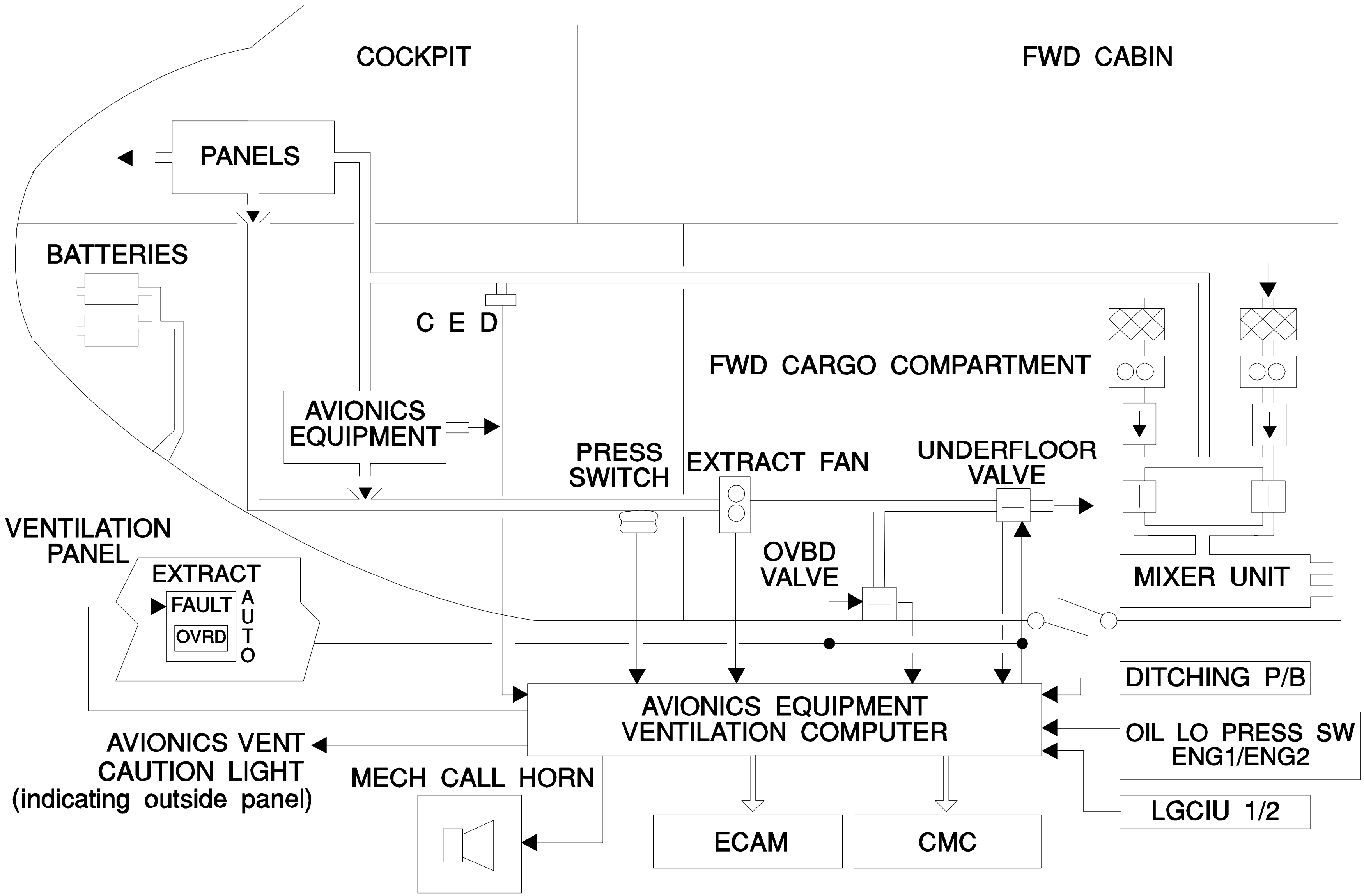
The air used for the avionics equipment ventilation is extracted by means of the extract fan.

The air is ducted either through the underfloor extract valve or the overboard extract valve.

AEVC

This system is under control of the Avionics Equipment Ventilation Computer.

The Avionics Equipment Ventilation Computer is a digital computer.



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EXTRACT FAN

The fan runs as soon as the electrical network of the aircraft is powered and remains on as long as electrical supply is available to the motor. The fan is of the one speed, three phase 115 VAC powered type.

OVBD VALVE

The overboard valve is of the skin mounted type.
The flap is controlled by an electric actuator.

Microswitches detect the three positions of the valve :

- fully open, partially open and fully closed.

A crank fitted on the valve is provided to manually operate the valve in the required position.

UNDERFLOOR VALVE

The valve is of the butterfly type, electrically controlled by an actuator. Two positions are available :

- fully open and fully closed.

Microswitches are provided to detect the positions of the valve.
A manual lever and visual indicator is provided to manually operate the valve in the required position.

PRESSURE SWITCH

The pressure switch serves to monitor the operation of the system.
It senses the differential pressure between the cabin and the extraction system.

OPERATION

On ground, with the aircraft electrically supplied, the fan starts to run, the overboard valve is fully open and the underfloor valve is fully closed.
Air is extracted overboard.

As soon as one engine is running, or in flight the overboard valve closes and the underfloor valve opens.
Air is extracted underneath the forward cargo floor compartment.

Note that the underfloor extract valve can close only when the overboard valve is fully open.

Control from the overhead panel permits the automatic operation of the system to be overridden.

When OVRD is selected :

- the overboard valve opens partially,
- the underfloor valve closes,
- the fan runs if serviceable.

This permits extraction of the air by differential pressure between cabin and outside in case of a malfunction in the system.

Malfunction cases :

- extract fan failure,
- dispatch of A/C with the overboard valve manually placed in partially open position if it is jammed closed in automatic mode
- it is also used for avionics smoke procedure.

ABNORMAL OPERATOIN

INSUFFICIENT COOLING

On ground, an insufficient cooling, detected by the Cooling Effect Detector signal activates the warnings :

- Mechanics call horn,
- AVIONICS ventilation caution light,
- ECAM.

During flight, in case of insufficient cooling, the Cooling Effect Detector sends a signal to the AEVC.
The AEVC sends a signal to the ECAM.

FAN FAILURE

In case of extract fan failure, the low airflow condition is detected by the pressure switch.
A signal is sent to the AEVC.
On ground with no engine running, the following warnings are activated :

- Mechanics call, horn,
- AVIONICS ventilation caution light (if no engine running),
- ECAM,
- CMC,
- FAULT legend on the EXTRACT P/B.

As soon as engine 1 or 2 is running, the following warnings are activated :

- FAULT legend on the EXTRACT P/B ;
- ECAM ;
- CMC.

In case of overheat in the electrical motor of the fan, thermal switches cut off electrical supply.

OVBD VALVE FAILURE

On ground, at engine 1 or 2 start, if the overboard valve is detected jammed in open position by the valve microswitches, warnings are activated :

- FAULT legend on EXTRACT P/B,
- Mechanics call horn,
- ECAM,
- CMC.

On ground, at engine 1 and 2 shutdown, if the overboard valve is detected jammed in closed position by the microswitches, warnings are activated :

- ECAM,
- CMC.

On ground, at engine 1 or 2 start and after an override selection if the overboard valve is detected jammed in closed position by the valve microswitches, warnings are activated :

- ECAM,
- CMC.

UNDERFLOOR VALVE FAILURE

At engine start, if the underfloor valve is detected jammed in closed position by the pressure switch and the valve microswitches, warnings are activated :

- FAULT legend on EXTRACT P/B,
- Mechanics call horn,
- ECAM,
- CMC.

At engine shutdown, if the underfloor valve is detected jammed in open position by the microswitches, warnings are activated :

- ECAM,
- CMC.

In case of valve positioning failure at engine start, the overboard valve can be partially opened and the underfloor valve closed by manual action.

BATTERIES VENTILATION

The batteries are ventilated by an independent sealed circuit.
The air extraction is provided by a venturi.
The ventilation is only effective with cabin differential pressure.

STUDENT NOTES:

STUDENT NOTES

AIR CONDITIONING BAY VENTILATION : SYSTEM DESCRIPTION AND OPERATION

GENERAL

The air conditioning compartment ventilation system ensures air recirculation in order to maintain, on ground or in flight, a temperature compatible with the structure constraints in the relevant area. The system comprises 3 piccolo tubes supplied by a turbofan on the ground and by a NACA air inlet in flight. The ventilation air is rejected out of the aircraft through an orifice in the lower part of the belly fairing.

DESCRIPTION

AEVC

The system is controlled by the Avionics Equipment Ventilation Computer. The AEVC is a digital computer which ensures warning and monitoring functions for the air conditioning bay ventilation and also for the avionics equipment ventilation.

TURBOFAN

The turbofan is a turbine driven fan of the pneumatic powered type. The turbofan is powered with a bleed air supply from the crossbleed duct through the supply valve.

SUPPLY VALVE

The turbofan supply valve is installed on the turbofan turbine air supply line and controls the air supply to the fan. The valve is pneumatically actuated and normally open. The valve is electrically controlled by means of a solenoid. Two microswitches detect the fully closed/open positions of the valve.

CHECK VALVE

The check valve is closed on ground and open during flight. It enables normal air conditioning of the compartment when the turbofan operates.

PRESSURE SWITCH

The pressure switch signals to the Avionics Equipment Ventilation Computer, the differential pressure between the upstream and downstream air flow of the turbofan. This enables monitoring of the system.

ACCESS DOORS

Two man access doors located on the belly fairing are provided for the maintenance of the system components. Accessible components :

- Turbofan ;
- Turbofan supply valve ;
- Check valve ;
- Pressure switch.

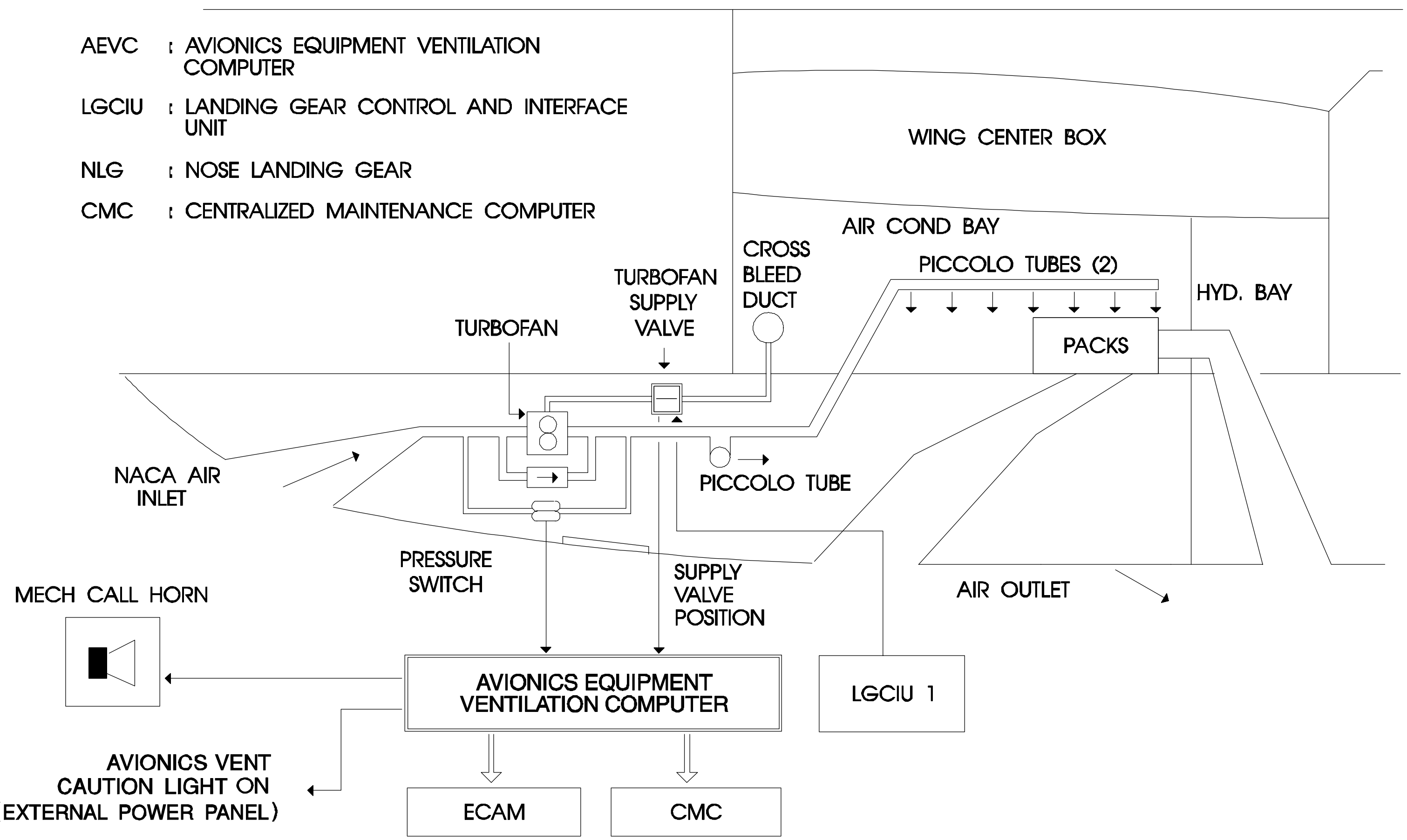
OPERATION

ON GROUND

During ground operation, the supply valve solenoid is de-energized by LGCIU 1. Provided there is pneumatic supply from the crossfeed duct, the supply valve opens and the turbofan provides the required ventilation airflow. The check valve is closed during operation and the turbine airflow is discharged into and mixed with the turbofan airflow.

IN FLIGHT

In flight, the solenoid of the supply valve is energized by the LGCIU 1 ; then the valve closes. The turbofan is in windmilling configuration and the check valve is open. This ensures normal air conditioning compartment ventilation. When the A/C altitude is above 15000 ft, an aneroid capsule installed on the valve maintains it in closed position by pneumatic action. This to prevent an inadvertent valve opening.



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ABNORMAL OPERATION

For maintenance action on ground, a blanking plug is fitted in the vicinity of the turbofan to blank the turbine supply line. This feature prevents :

- permanent hot air leakage on ground in case of turbofan failure ;
- excessive rotation speed of turbofan in flight in case of supply valve jammed in the open position.

NOTE : The turbofan is designed to withstand this last condition without bursting.

On ground, if the supply valve fails to open when one pack flow control valve at least is open , the warnings are activated.

WARNINGS :

- ECAM ;
- MECHANICS HORN ;
- AVIONICS VENT caution light;
- message on CMC.

Maintenance action : Deactivate packs on ground but can be recovered before Take-Off.

On ground, if the turbofan is detected jammed by the pressure switch when at least one flow control valve is open, the warnings are activated.

WARNINGS :

- ECAM ;
- MECHANICS HORN ;
- AVIONICS VENT caution light;
- message on CMC.

Maintenance action : Blank turbine turbofan supply line.

In flight, if supply valve is detected open by the Avionics Equipment Ventilation Computer, warnings are activated.

WARNINGS :

- ECAM ;
- message on CMC.

Maintenance action : Blankoff the turbine supply line.

A check valve stuck in the closed position cannot be detected. But the pressure switch enables a check valve in open position to be detected and the warnings to be activated.

WARNINGS :

- ECAM ;
- MECHANICS HORN ;
- AVIONICS VENT caution light;
- message on CMC.

Maintenance action :Deactivate packs on ground but can be recovered before Take-Off.

STUDENT NOTES:

STUDENT NOTES

AVIONICS EQUIPMENT GROUND COOLING : SYSTEM DESCRIPTION AND OPERATION

PRINCIPLE

On ground, reinforced cooling of the avionics equipment can be provided by an optional Ground Cooling System for operation in very hot conditions.
Air tapped from the recirculation system is cooled through a freon cycle Ground Refrigeration Unit (GRU) and ducted to the panels and avionics equipment. Air from the avionics bay is extracted by a fan through a filter and ducted to the GRU to cool the freon. This air is then rejected overboard through a skin valve.

SKIN VALVE

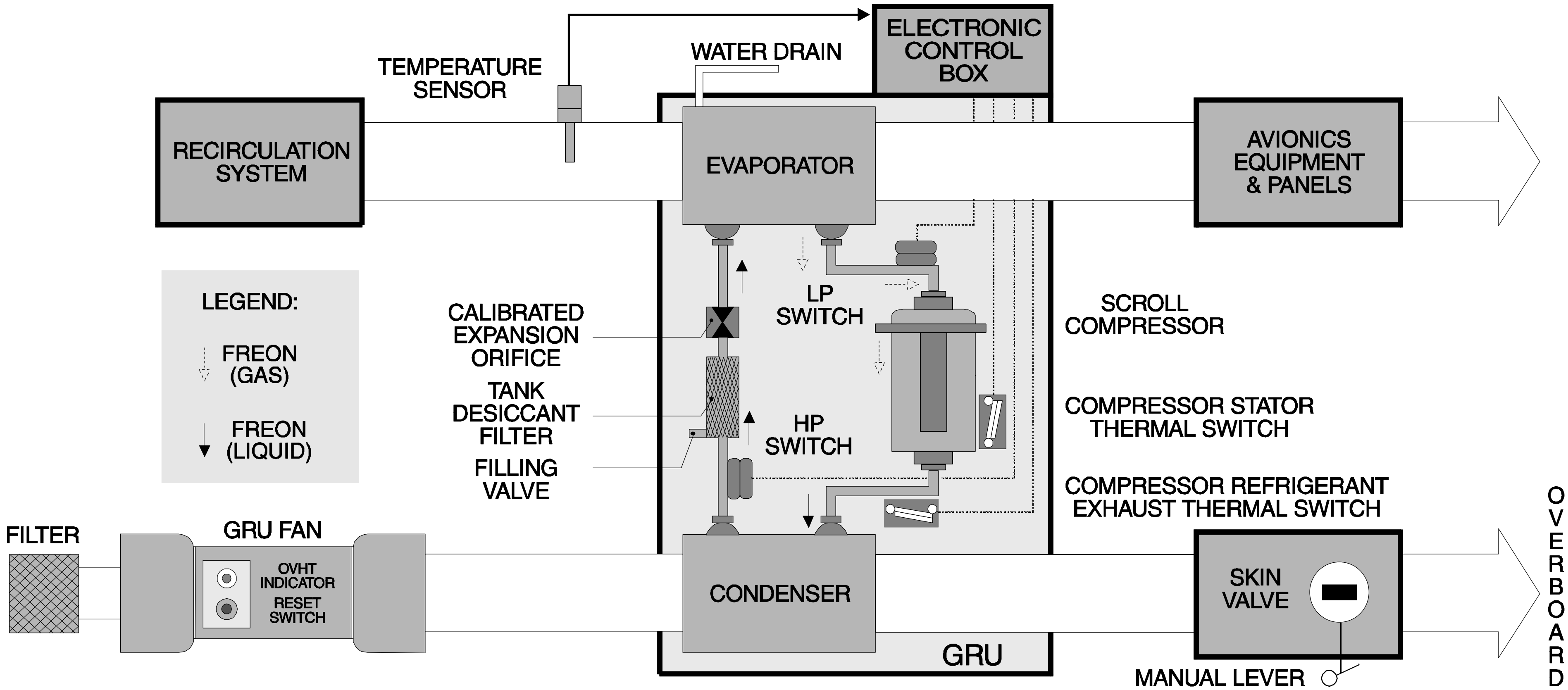
The valve is of the skin-mounted type and has two positions. The valve is actuated by a 28VDC electrical motor and controlled and monitored by the Avionics Equipment Ventilation Computer (AEVC).
In the event of electrical failure, an override manual mechanism enables valve operation from outside the aircraft (stowed hand-crank).

GRU

The GRU is a compact assembly and consists of a freon cycle system.
The refrigerant fluid in vapor state is compressed and transformed into liquid form by an electrical scroll compressor and cooled down through a condenser.
The freon, in liquid state, passes through a tank desiccant filter to remove water particules and impurities. Then it is expanded by leaving the tank filter through a calibrated expansion orifice in order to ensure sufficient sub-cooling.
The refrigerant fluid in liquid/vapor state is piped to the evaporator, where it is transformed into gazeous state by cooling down the air blown to the avionics. The condensation water formed in the evaporator is drained into the lower fuselage area.
The unit is controlled and monitored by an electronic control box located on the upper part of its structure. It is possible to test and reset the electronic control box through a specific connector. This connector is protected by a plug during GRU normal operation.
The GRU has a filling valve fitted to the tank filter inlet. It is protected by a threaded plug and is used for servicing purposes.

FAN

The fan is of the one speed design. It is directly controlled by the GRU electronic control box.
It simultaneously starts and stops with the GRU compressor.
A thermal switch is fitted on the fan motor to stop the fan in case of overheat.
There are an overheat indicator and a reset pushbutton on the fan flange.



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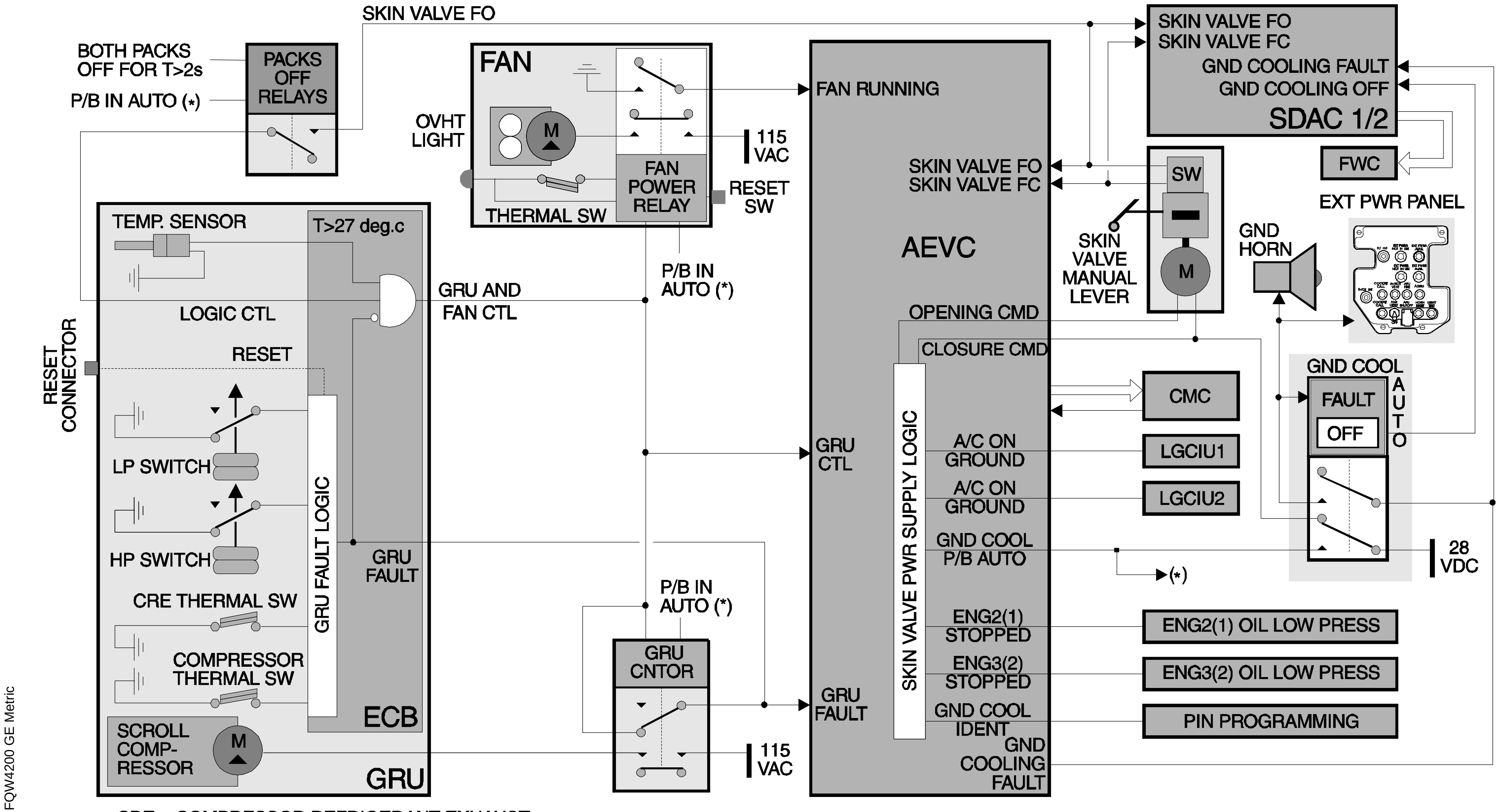
AUTO CONTROL

If the GND COOL pushbutton switch is set to AUTO, the skin valve power supply logic in the AEVC controls the skin valve opening, provided the aircraft is on ground, the AEVC is pin programmed and the engines are shutdown.
As soon as the skin valve has reached its fully open position, packs off relays send a logic control signal to the GRU electronic control box, provided both air conditioning packs are stopped for at least 2 minutes.
The automatic skin valve closure or at least one pack Flow control Valve opening lead to the fan and GRU shutdown.
The GRU is in stand-by mode provided no failure is detected by the electronic control box.
The fan and the GRU compressor are automatically powered through power relays when the temperature sensor senses a temperature higher than 27.5 °C.
The automatic shutdown occurs when the temperature goes below 26 °C.

MANUAL SHUTDOWN

When the GND COOL pushbutton switch is set to OFF, the skin valve is directly controlled to the closed position. It also cuts off the fan and GRU power supply through power relays control.



CRE = COMPRESSOR REFRIGERANT EXHAUST

VALVE JAMMING

If the skin valve is jammed in the open position at engine start, the crew must try to close the valve with the GND COOL pushbutton switch.
If it fails to close, manual closure from outside will be requested.

The skin valve jammed in the open position at engine start will lead to:
- illumination of the FAULT legend on the GND COOL pushbutton switch
- generation of warnings on the EWD (VENT GND COOL FAULT)
- display of amber skin valve indication on CAB PRESS page
- display of amber GND COOL indication on CAB PRESS page.

If the skin valve is jammed in the closed position at engine shutdown, the GND COOL pushbutton switch must remain in AUTO position and manual opening from outside is requested.

The skin valve jammed in the closed position at engine shutdown will lead to:
- illumination of the FAULT legend on the GND COOL pushbutton switch
- generation of warnings on the EWD (VENT GND COOL FAULT)
- display of amber skin valve indication on CAB PRESS page
- display of amber GND COOL indication on CAB PRESS page
- activation of the ground horn
- illumination of the AVNCS VENT CAUTion light on the external power panel.

VALVE DEACTIVATION/REACTIVATION

If manual operation is requested, a PUSH handle latch allows the handle to be folded out then deployed. Before turning the handle to close or open the valve, a deactivation switch must be set to the OFF position.
The deactivation switch must be set back to the ON position as soon as the problem is fixed in order to recover automatic control.

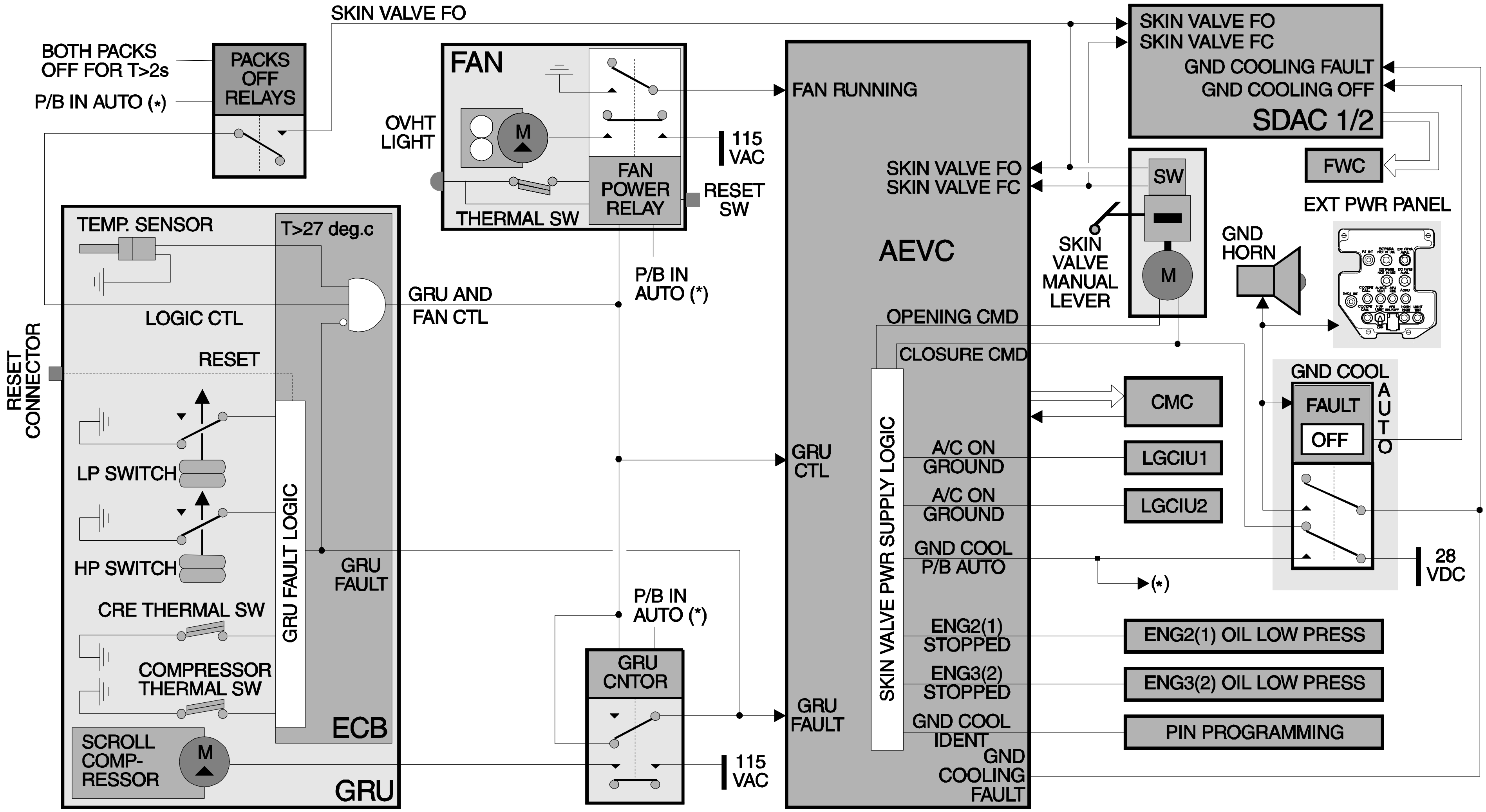
FAN OVERHEAT

If a fan overheat occurs, the overheat protection stops the fan power supply. The crew is requested to set the GND COOL pushbutton switch to the OFF position.

A fan overheat will lead to:
- illumination of the overheat light on the fan flange
- illumination of the FAULT legend on the GND COOL pushbutton switch
- generation of warnings on the EWD (VENT GND COOL FAULT)
- display of amber GND COOL indication on CAB PRESS page
- activation of the ground horn
- illumination of the AVNCS VENT CAUTion light on the external power panel.

FAN RESET

A fan reset must be performed after trouble shooting each time the overheat light comes on. The fan and the GRU will start again and the overheat light will go off, only if the overheat condition has disappeared.



CRE = COMPRESSOR REFRIGERANT EXHAUST

FQW4200 GE Metric

GRU FAILURE

If a fault occurs, a GRU fault logic in the electronic control box will automatically switch off the compressor motor and fan power supply.
The GRU failure may also come from the GRU contactor malfunction.
A GRU failure will also lead to:

- illumination of the FAULT legend on the GND COOL pushbutton switch
- generation of warnings on the EWD (VENT GND COOL FAULT)
- display of amber GND COOL indication on CAB PRESS page
- activation of the ground horn
- illumination of the AVNCS VENT CAUTion light on the external power panel.

The crew is requested to set the GND COOL pushbutton switch to the OFF position.

GRU RESET

If the reset of the GRU is carried out from the overhead panel, the GRU may restart but the fault is memorized by the electronic control box. It is only possible to reset it by means of a special fault control box connected to the GRU test and reset connector.

GRU TEST

If a failure occurs, it is possible to test the GRU by means of a special test control box connected to the GRU test and reset connector.
However, it is impossible to start up the GRU again as long as the causes of overheating, overpressure or underpressure have not been repaired.

AVIONICS / AIR CONDITIONING BAY VENTILATION : WARNINGS

PACK BAY VENT FAULT
BLOWING FAULT
EXTRACT FAULT
OVBD VALVE FAULT

If the aircraft is on ground with no engine running, the majority of failures trigger the ground horn and the Avionics VENT Caution light on the indicating outside panel.

PACK BAY VENT FAULT

The turbo supply valve or turbofan are lost. There is a risk of overheat in the air conditioning bay.

BLOWING FAULT

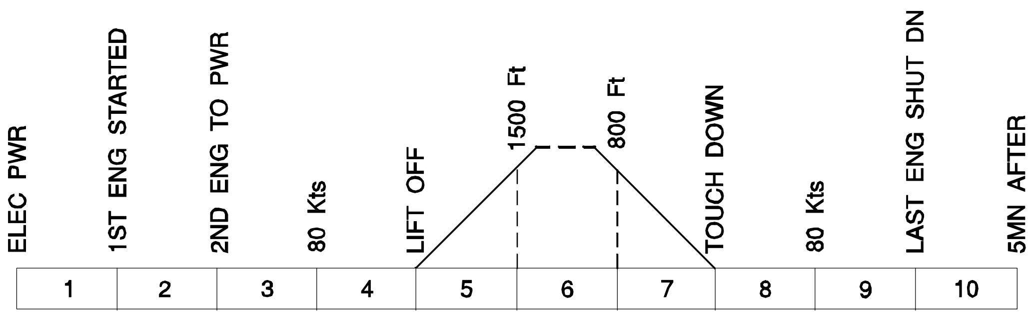
The cooling capacity (flow and temperature) of the blown air in the avionics is abnormal. The procedure will tell you: how to increase the air flow and decrease cabin temperature. If the failure persists after 5 min, flight time is limited to 5 hours.

EXTRACT FAULT

Low extract flow is detected. VENT indication becomes amber on ECAM. FAULT light comes on amber on the EXTRACT pushbutton.

OVBD VALVE FAULT

On ground,with at least one engine running, the OVBD valve remains open whereas it should be closed. EXTRACT indication is shown amber on ECAM. FAULT light comes on amber on the EXTRACT pushbutton.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
PACK BAY VENT. FAULT	SINGLE CHIME	MASTER CAUT	NIL	NIL	3 to 8
BLOWING FAULT	SINGLE CHIME	MASTER CAUT	NIL	NIL	4, 5, 7 8
EXTRACT FAULT	SINGLE CHIME	MASTER CAUT	CAB PRESS	EXTRACT FAULT LIGHT	3, 4, 5, 7, 8
OVBD VALVE FAULT	SINGLE CHIME	MASTER CAUT	CAB PRESS	EXTRACT FAULT LIGHT	3, 4, 5, 7, 8

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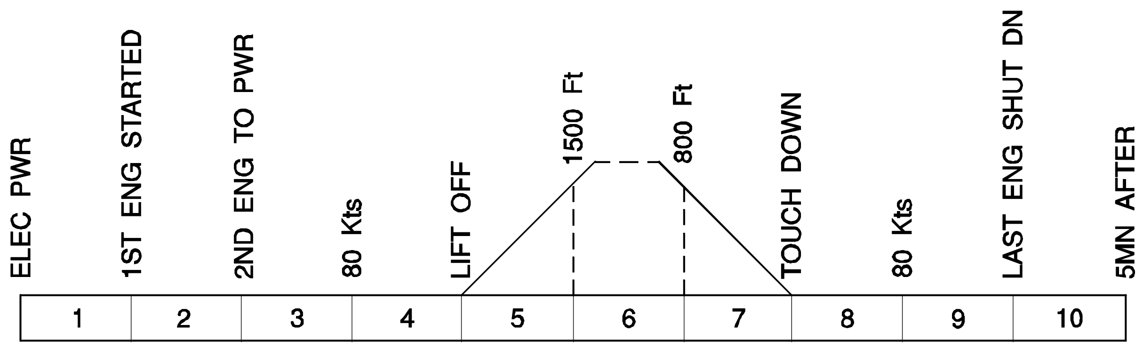
STUDENT NOTES

AVIONICS EQUIPMENT GROUND COOLING : SYSTEM WARNINGS

GND COOL FAULT

GROUND COOL FAULT

The avionics ground cooling system is faulty. The GND COOL valve indication is displayed amber on ECAM. The FAULT light comes on amber on the GND COOL pushbutton and the ground horn is triggered.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
GND COOL FAULT	SINGLE CHIME	MASTER CAUT	CAB PRESS	GND COOL FAULT LIGHT	3, 4, 5, 7, 8, 9,

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STUDENT NOTES

AVIONICS / AIR CONDITIONING BAY VENTILATION : COMPONENTS/1

SAFETY PRECAUTIONS

Make sure that air is not supplied to the air conditioning system from the main engines, the APU or a ground source.
Hot compressed air can cause injury to personnel.

STUDENT NOTES

OVERBOARD EXTRACT VALVE

FIN / ZONE

FIN : 13HQ
ZONE : 133

COMPONENT DESCRIPTION

The valve is of the skin mounted type. An electric actuator (28 VDC) controls a main flap and an auxiliary flap.
Three microswitches detect the following positions :
fully / not fully open
fully / not fully closed
partially / not partially open
Both flaps open to the fully open position, however only the auxiliary flap can remain open in the partially open position.
In case of loss of automatic control (AEVC or OVRD selection on the VENTILATION/EXTRACT pushbutton switch), a manual device fitted on the valve enables the maintenance crew to manually set it in the required position.

DEACTIVATION

Comply with the safety precautions.
(1) Push the PUSH latch to release the handle.
(2) Slightly pull the handle but do not engage the mechanism.
(3) Set the deactivation switch to OFF.
(4) Pull the handle to engage the mechanism.
(5) Fold out the handle.
(6a) Turn the handle clockwise to fully open the main flap of the valve.
(6b) Turn the handle counterclockwise to fully close the main flap of the valve. The auxiliary flap must stay open.
(7) Fold and latch the handle.

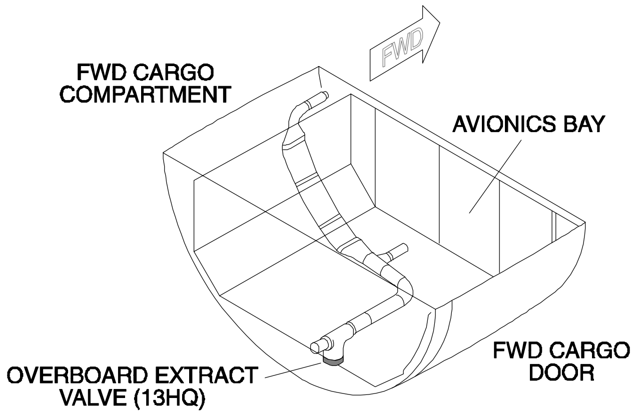
6a : valve deactivation in fully open position.
6b : valve deactivation in partially open position.

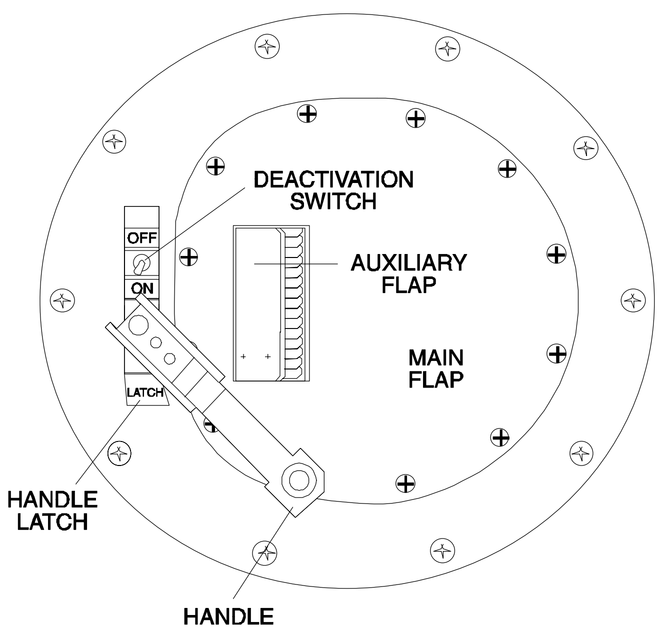
REMOVAL / INSTALLATION

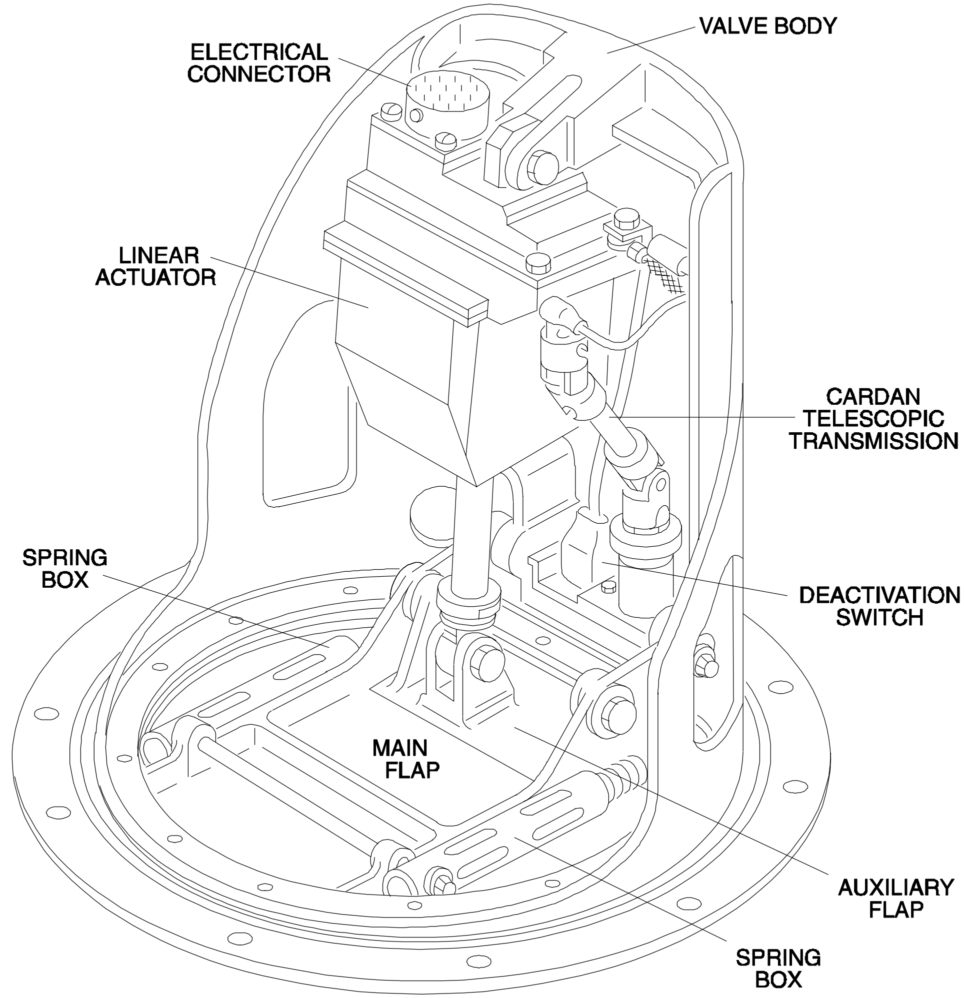
Comply with the safety precautions.
- get access to the valve.
- remove the screws and hold the overboard extract valve.
- disconnect the electrical connector.
- remove the valve and discard the O-ring
The operational test of the avionics equipment ventilation system has to be performed to complete the valve installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.
Open, safety and tag the circuit breakers listed in the AMM.







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UNDERFLOOR EXTRACT VALVE

FIN / ZONE

FIN : 12HQ
ZONE : 134

COMPONENT DESCRIPTION

The valve is of the butterfly type and electrically controlled by a 28VDC actuator.
Two microswitches are provided to detect the fully open and fully closed positions.
A manual lever and a visual indicator are provided to manually operate the valve in the required position.

DEACTIVATION

Comply with the safety precautions.
(1) On the valve (12HQ):
(a) Disconnect the electrical connector.
(b) Put blanking caps on the connectors.
(c) Turn the manual lever counterclockwise to fully close the valve (the visual indicator must show C).
(2) On the VENTILATION section of the panel 212VU:
Release the EXTRACT pushbutton switch (OVRD legend on)
(3) On the CAB PRESS page of the System Display :
The symbol of the overboard extract valve shows that the valve is not fully open.
(4) The overboard extract valve (13HQ) is not fully open.

REMOVAL / INSTALLATION

Comply with the safety precautions.
- get access to the valve.
- disconnect the electrical connector.
- hold the valve and remove the V-clamp.
- Remove the valve and discard the O-ring.
The operational test of the avionics equipment ventilation system has to be performed to complete the valve installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.
Open, safety and tag the circuit breakers listed in the AMM.

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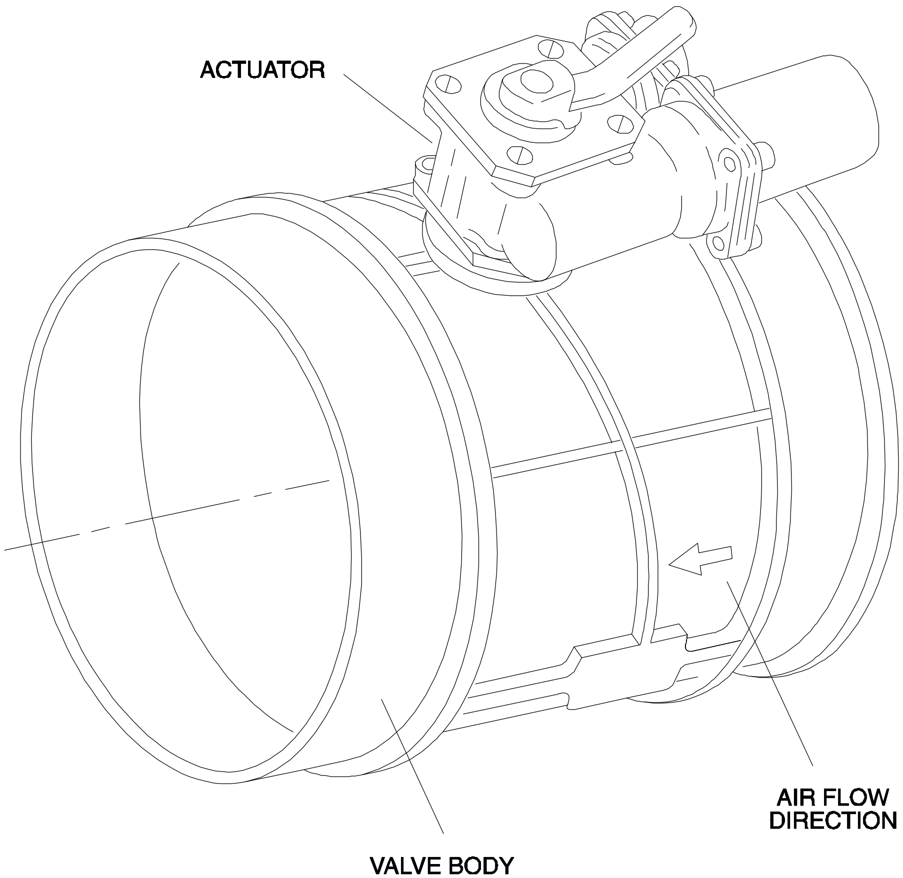
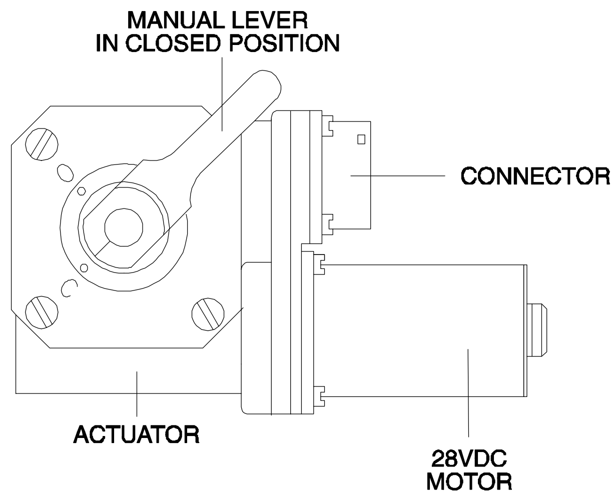
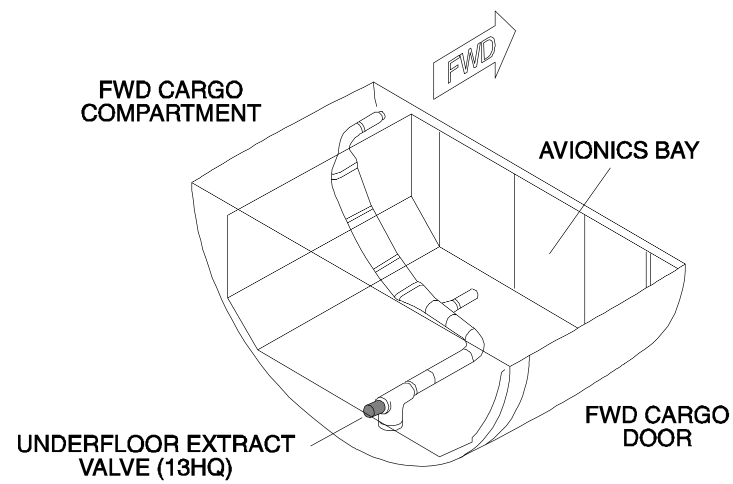






FQW4200 GE Metric

EXTRACT FAN

FIN / ZONE

FIN : 7HQ
ZONE : 134

COMPONENT DESCRIPTION

The fan is one speed designed (200 V, 400 Hz, three phase) and incorporates power switches.
These power switches are closed 5 seconds after the A/C is energized and the fan starts to turn.
If there is a motor overheat, then a thermal switch fitted on the motor cuts off the power supply.

SPECIAL DESIGN

In case of overheat, a fault light located on the fan flange comes on. After trouble shooting, a reset pushbutton also located on the fan flange enables the maintenance staff to reset the fan. When the reset pushbutton is pressed in, the fault light goes off and the fan starts to turn 5 seconds later.

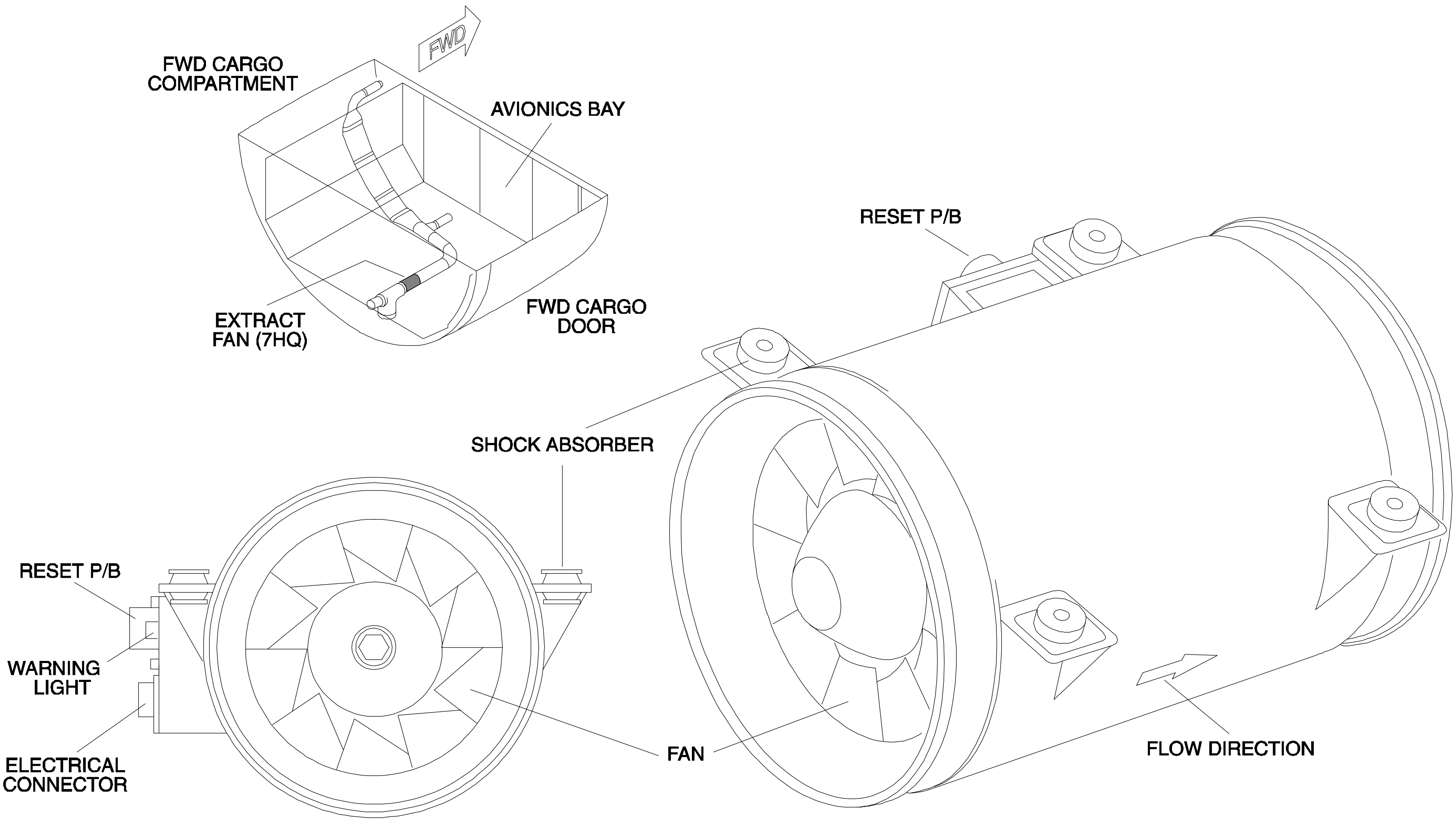
REMOVAL / INSTALLATION

Comply with the safety precautions.
- get access to the extract valve.
- disconnect the elctrical connector.
- loosen the clamps then hold the fan to remove the screws and washers.

The operational test of the avionics equipment ventilation system has to be performed to complete the fan installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.
Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

TURBOFAN

FIN / ZONE

FIN : 6250HG
ZONE : 192

COMPONENT DESCRIPTION

The turbofan is a turbine driven fan of the pneumatic powered type. It consists of a vane axial fan with a turbine mounted at the periphery. The fan impeller and the turbine wheel form a single assembly.

DEACTIVATION

Comply with the safety precautions.
(1) Remove the blanking plug from the dummy connection.
(2) Disconnect the turbofan supply line from the turbofan.
(3) Connect the turbofan supply line to the dummy connection on the aircraft structure.
(4) Put blanking plugs on the disconnected line ends.

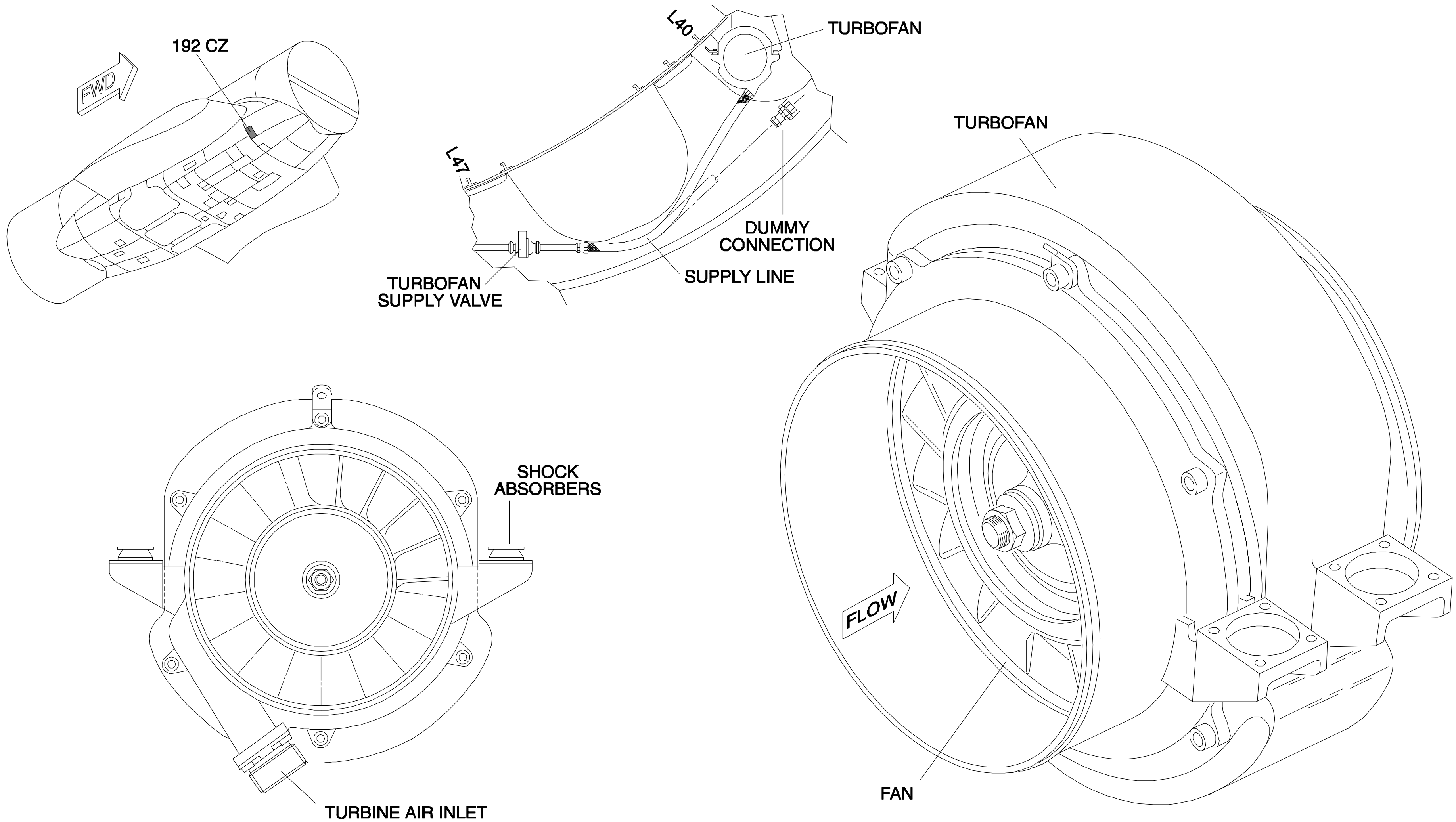
REMOVAL / INSTALLATION

Comply with the safety precautions.
- get access to the turbofan.
- disconnect the sense line.
- remove the 2 clamps, 4 bolts and washers.
- move the bellows away from the turbofan.
- disengage and remove the turbofan from the bellows.

The operational test of the air conditioning compartment ventilation system has to be performed to complete the turbofan installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.
On the HP ground connectors, put warning notices to tell persons not to supply the ground air source.
Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

STUDENT NOTES

AVIONICS / AIR CONDITIONING BAY VENTILATION : COMPONENTS/2

Safety Precautions
AEVC
Cooling Effect Detector
Pressure Switch
Turbofan Supply Valve
Pressure Switch
Check Valve

SAFETY PRECAUTIONS

Make sure that air is not supplied to the air conditioning system from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel.

STUDENTS NOTES

AEVC

FIN/ZONE

FIN : 2HQ

Zone : 122

COMPONENT DESCRIPTION

The Avionics Equipment Ventilation Computer is a digital computer which ensures control and monitoring functions:

- for the air conditioning compartment ventilation system.
- for the avionics equipement ventilation system.
- or the avionics equipment ground cooling system (optional system).

REMOVAL INSTALLATION

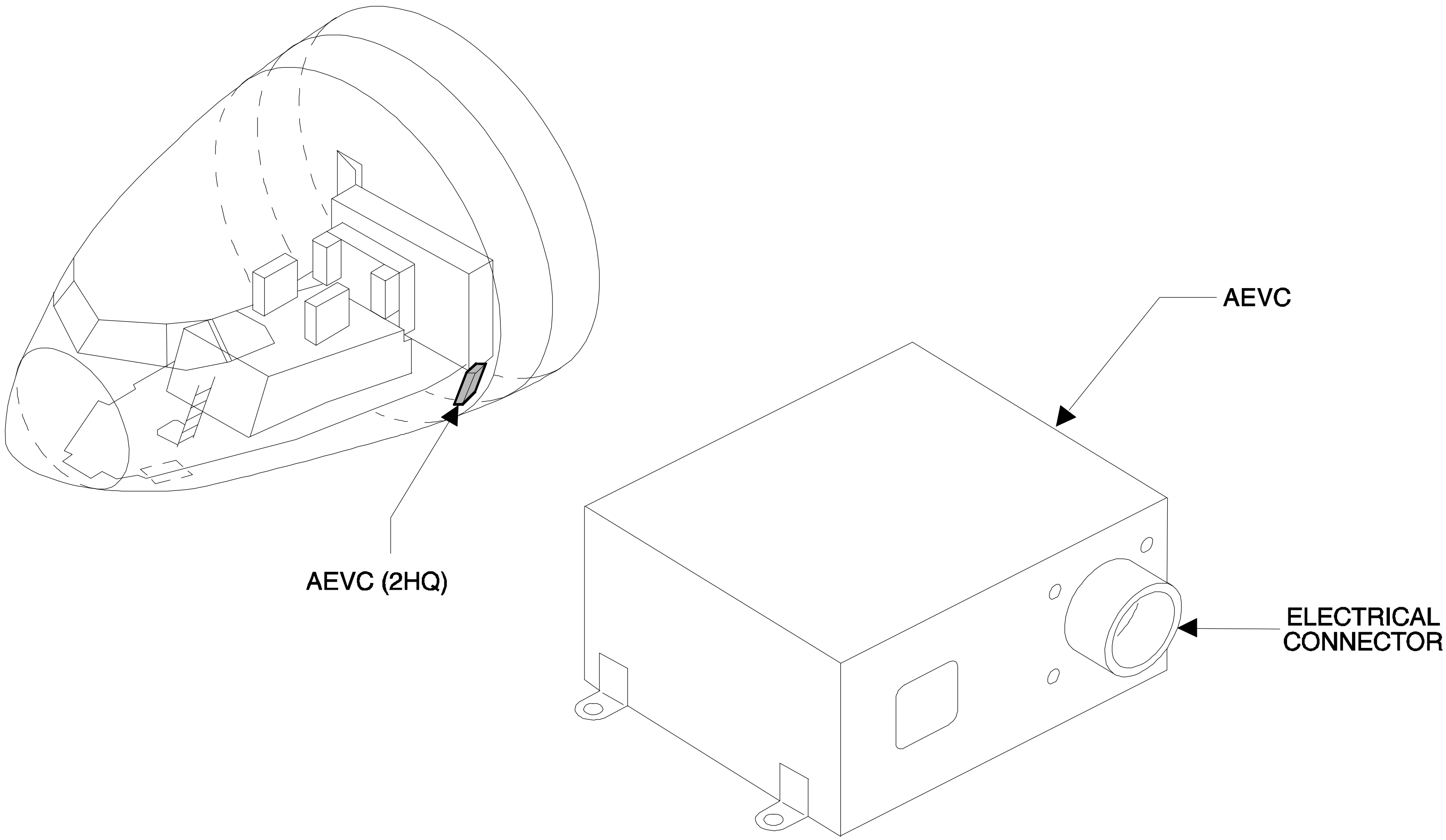
Comply with the safety precautions.

- get access to the avionics compartment.
- remove the screws, washers and then the chip pan from the rack.
- disconnect the electrical connector from the AEVC.
- remove the screws, washers and then the AEVC.

The operational test of the avionics equipment ventilation system has to be performed to complete the AEVC installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out. Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

COOLING EFFECT DETECTOR

FIN/ZONE

FIN : 5HQ

Zone : 121

COMPONENT DESCRIPTION

The cooling effect detector (CED) is a duct type detector.

It ensures permanent monitoring of the cooling capacity of the blowing airflow by measuring the cooling of a heating unit. Measurement and heating are ensured by a thermistor and resistors.

REMOVAL INSTALLATION

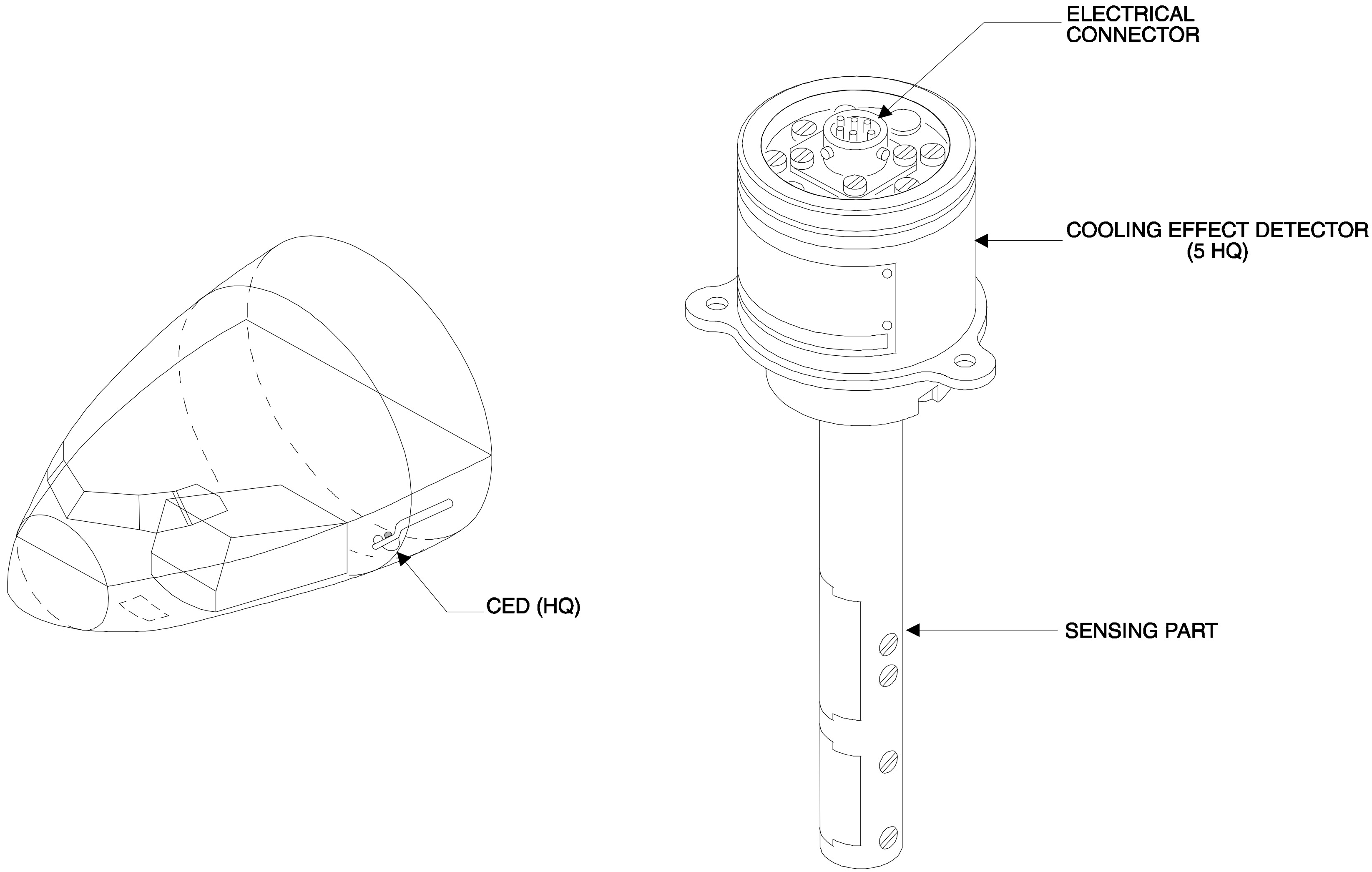
Comply with the safety precautions.

- get access to the CED.
- disconnect the electrical connector from the CED.
- remove the screws, washers and finally the CED from the duct.

The operational test of the avionics equipment ventilation system has to be performed to complete the CED installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out. Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

PRESSURE SWITCH

FIN/ZONE

FIN : 11HQ

Zone : 134

COMPONENT DESCRIPTION

The pressure switch is of the flexible membrane type.

The membrane, when submitted to a differential pressure P1/P2, operates an internal spring loaded piston linked to an electrical switch.

A low flow condition due to an extraction system failure provides an abnormal differential pressure which generates an electrical signal.

REMOVAL INSTALLATION

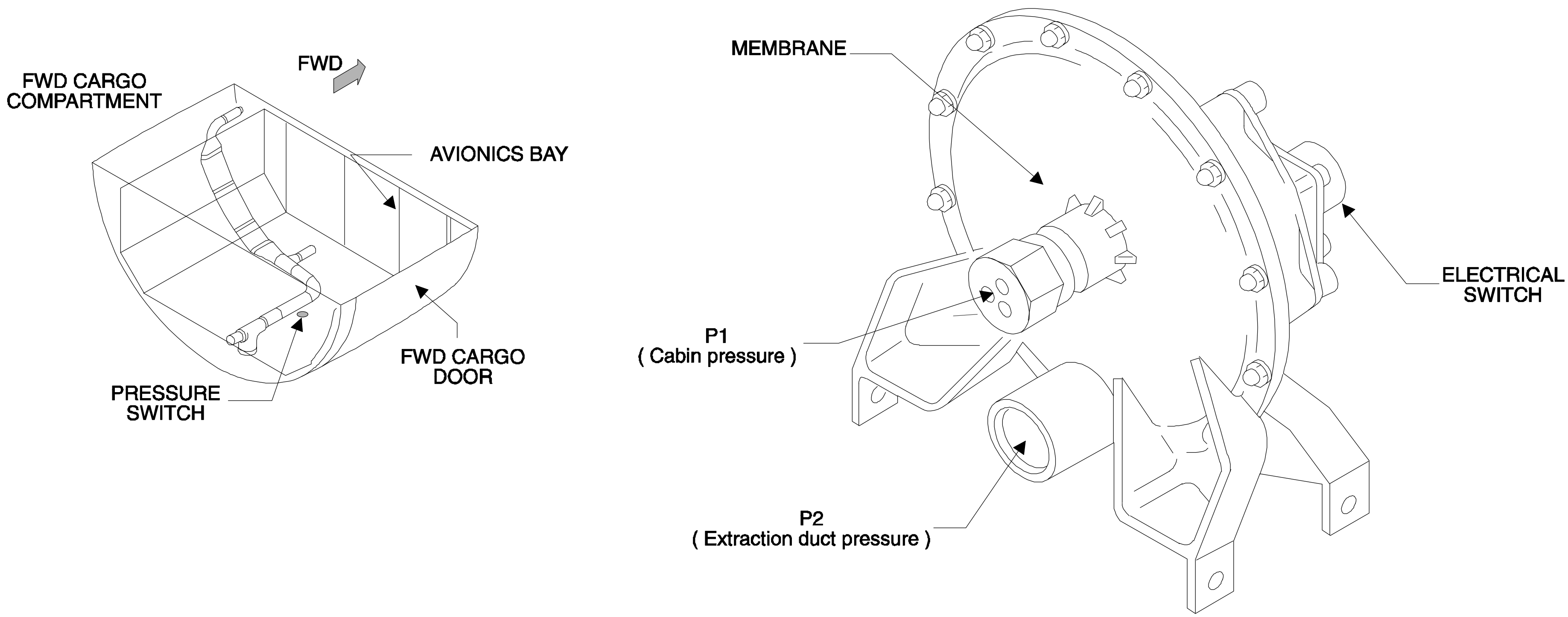
Comply with the safety precautions.

- get access to the pressure switch.
- disconnect the electrical connector and the sense line.
- remove the nuts, screws and finally the pressure switch.

The operational test of the avionics equipment ventilation system has to be performed to complete the fan installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out. Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

TURBOFAN SUPPLY VALVE

FIN/ZONE

FIN : 1HR

Zone : 191

COMPONENT DESCRIPTION

The turbofan supply valve is an in line valve with an internal piston which is pneumatically actuated and spring loaded closed.

A solenoid valve controls the piston internal pressure and then enables the valve opening (on ground) and closure (in flight).

The valve position is detected by two microswitches which provide the fully closed and fully open positions to the AEVC.

An aneroid capsule prevents inadvertent valve opening when the aircraft altitude exceeds 15000 ft.

DEACTIVATION

Comply with the safety precautions

(1) Remove the blanking plug from the dummy connection

(2) Disconnect the turbofan supply line from the turbofan 6250HG

(3) Connect the turbofan supply line to the dummy connection on the aircraft structure.

(4) Put blanking plugs on the disconnected line ends.

REMOVAL INSTALLATION

Comply with the safety precautions.

-get access to the turbofan supply valve

-disconnect the electrical connector

-remove the two bolts and washers

-do not remove the clamps.

-disengage and remove the turbofan supply valve

-remove and discard the 2 O-rings and put blanking plugs on the disconnected line ends.

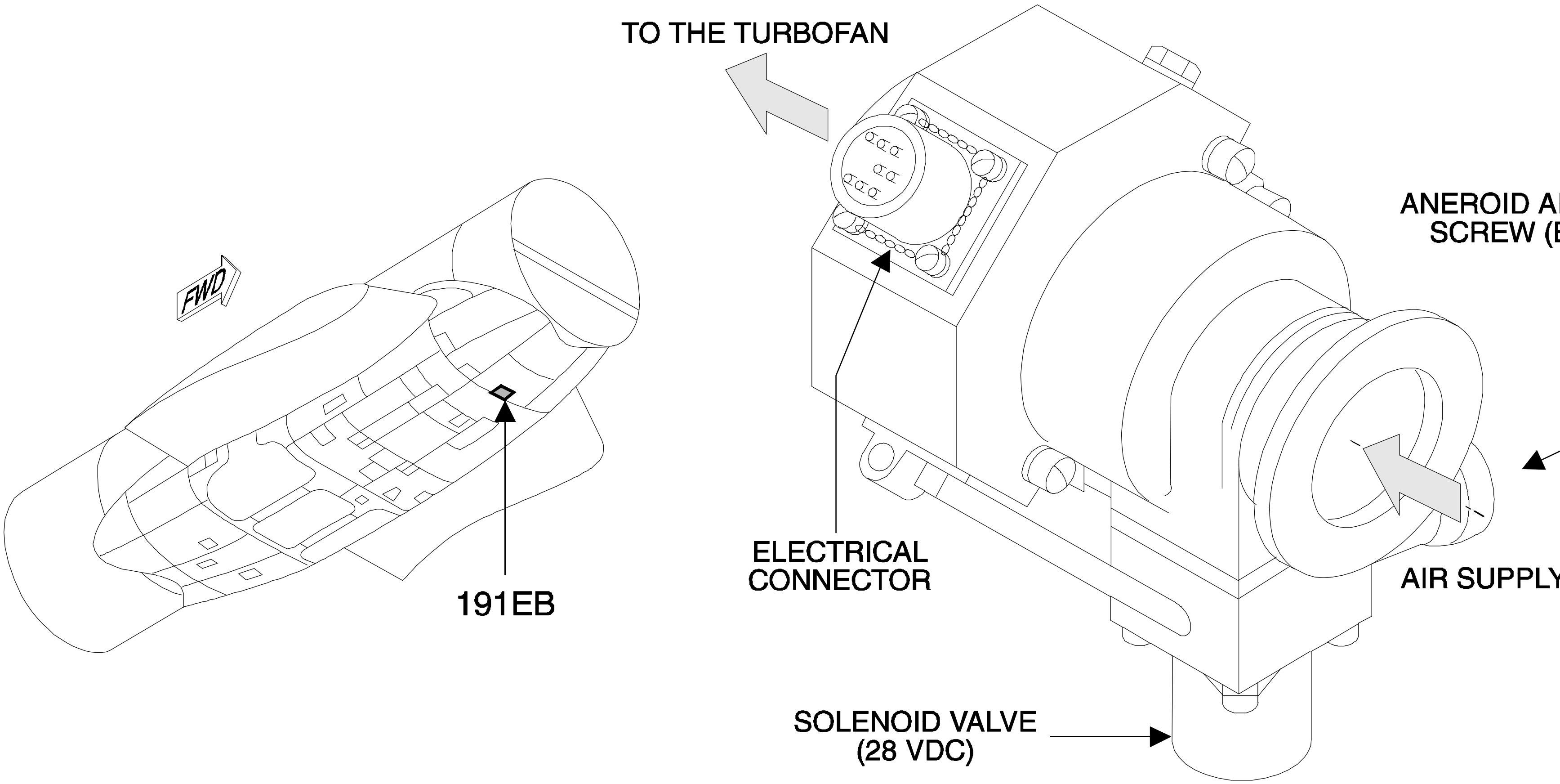
The operational test of the air conditioning compartment ventilation system has to be performed to complete the turbofan installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.

On the HP ground connectors, put warning notices to tell people not to supply the ground air source.

Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

PRESSURE SWITCH

FIN/ZONE

FIN : 2HR

Zone : 192

COMPONENT DESCRIPTION

The pressure switch is of the flexible membrane type.

The membrane, when submitted to a differential pressure P1/P2, operates an internal spring loaded piston linked to an electrical switch.

The pressure switch is connected to the upstream and downstream turbofan pressure ports (P1 and P2).

This enables the monitoring of the air conditioning compartment ventilation on ground.

In flight, the pressure switch withstands overpressure conditions.

REMOVAL/INSTAL

Comply with the safety precautions.

- get access to the pressure switch.
- disconnect the electrical connector.
- put blanking caps on the disconnected electrical connectors.
- disconnect the sense lines.
- remove the coupling and discard the packing
- put blanking plugs on the disconnected line ends.
- remove the four bolts, washers and finally the pressure switch.

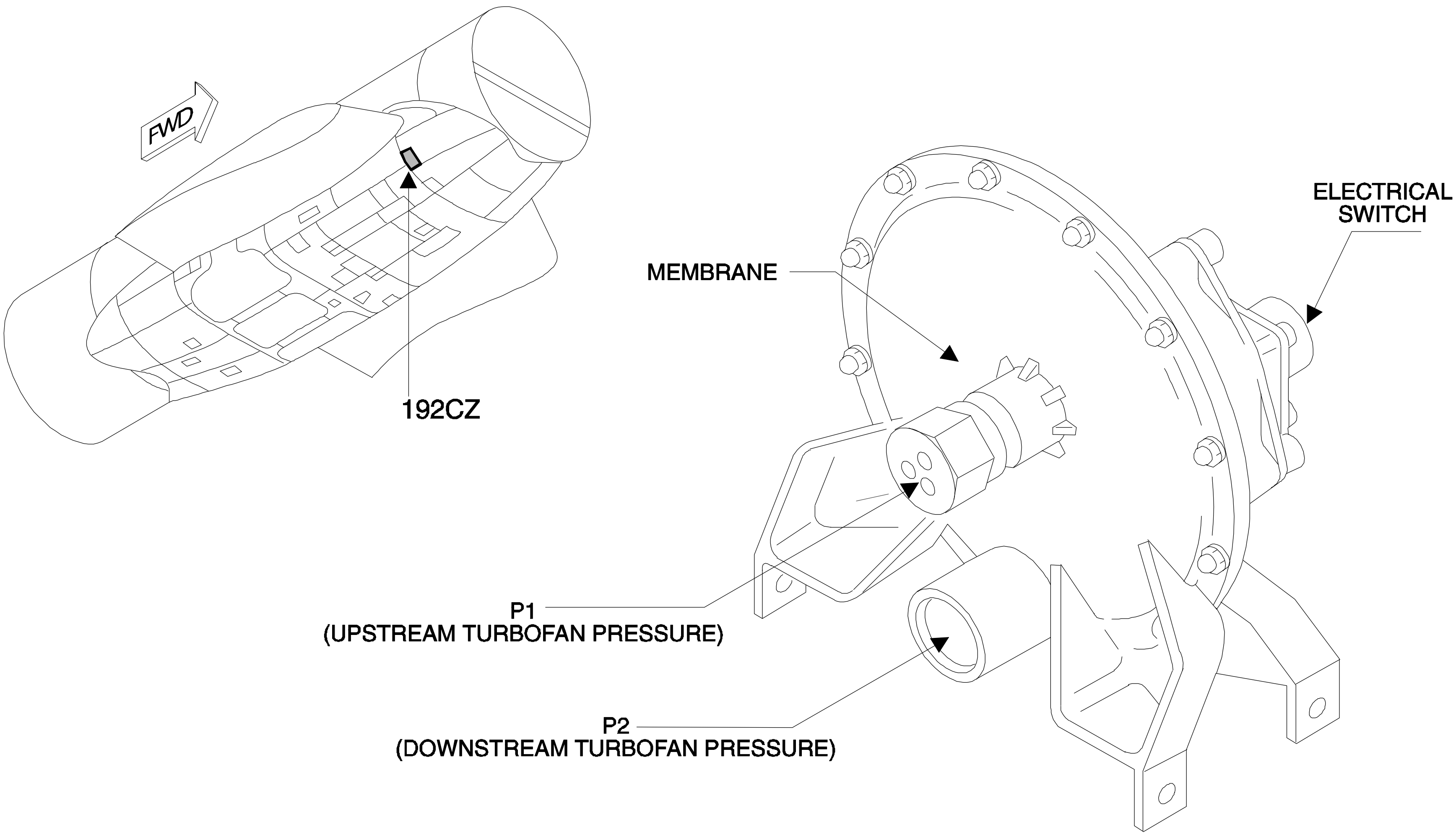
The operational test of the air conditioning compartment ventilation system has to be performed to complete the pressure switch installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.

On the HP ground connectors, put warning notices to tell people not to supply the ground air source.

Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

CHECK VALVE

FIN/ZONE

FIN : 6252HG

Zone : 192

COMPONENT DESCRIPTION

The check valve has a housing with two semicircular flaps installed on a hinge bar.

The flaps can open in one direction only (in flight) and springs hold them in the closed position (on ground).

REMOVAL INSTALLATION

Comply with the safety precautions.

-get access to the check valve

-remove the clamps and move the flexible sleeve along the duct to disengage the duct.

-disengage and remove the duct, then remove the check valve.

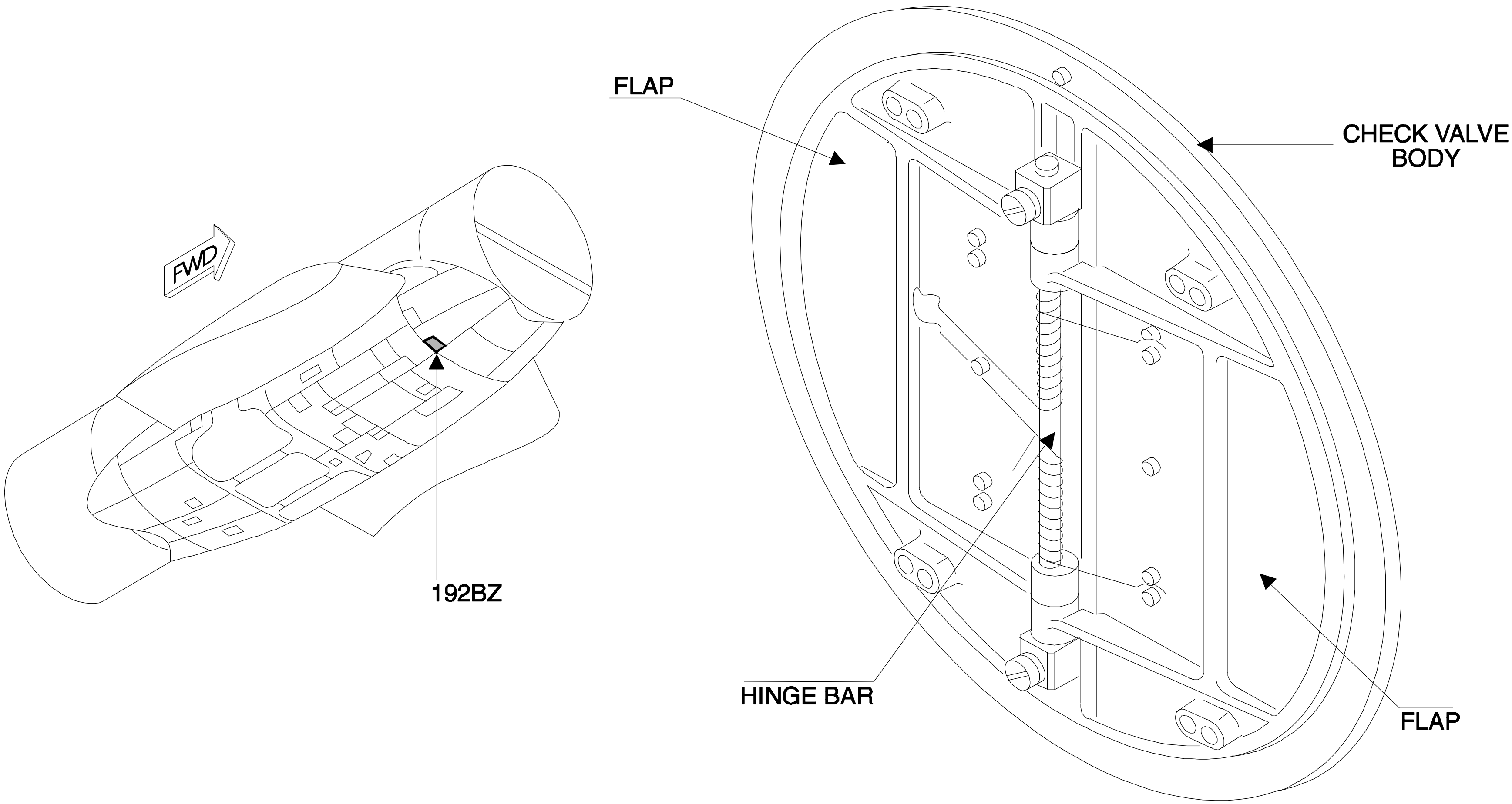
The operational test of the air conditioning compartment ventilation system has to be performed to complete the check valve installation.

SAFETY PRECAUTIONS

Make sure that the APU BLEED, the ENG BLEED and the PACK pushbutton switches are released out.

On the HP ground connectors, put warning notices to tell people not to supply the ground air source.

Open, safety and tag the circuit breakers listed in the AMM.



FQW4200 GE Metric

STUDENT NOTES

AVIONICS EQUIPMENT GROUND COOLING SYSTEM: COMPONENTS

Safety Precautions
GRU
GRU Fan
Skin Valve

SAFETY PRECAUTIONS

Before any component removal, open, safety and tag the circuit breakers listed in the AMM..

Concerning the GRU :

(1) Make sure that the PACK 1 and PACK 2 pushbutton switches are set to OFF.

(2) Make sure that the GND COOL and CAB FANS pushbutton switches are set to OFF.

Put a warning notice to tell persons not to operate them.

(3) Put a warning notice on the LP and HP ground connectors to tell persons not to supply the A/C with ground air.

STUDENT NOTES

GRU

FIN / ZONE

FIN : 6HD

ZONE : 121

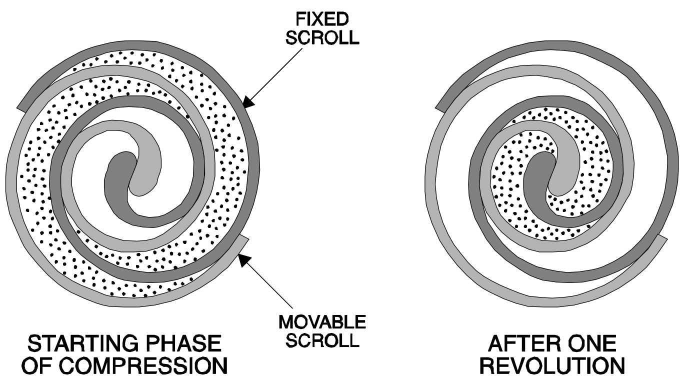
COMPONENT DESCRIPTION

The Ground Refrigeration Unit forms a compact assembly and consists of:

- a scroll compressor with a 115VAC/400Hz three phase motor,
- an air/freon condenser,
- an air/freon evaporator,
- a tank filter,
- a hose system
- an electronic control box,
- a structure with two antivibration mountings,
- a protective cover.

SPECIAL DESIGN

The scroll compressor is mainly made up of two parts in the shape of a scroll: a fixed scroll and a movable scroll. The movable scroll is installed in the fixed scroll and has an orbital movement.



SHOP MAINTENANCE

A tank desiccant filter removes water and impurities in order to avoid the formation of acid substances in the circuit. This filter is made of sheet metal and includes a valve used for filling. This valve is protected by a threaded plug.

The GRU has a special connector used for testing and resetting the electronic control box and GRU main circuits. Only specific tooling, recommended by the manufacturer, must be used with this connector. This connector is protected by a plug during GRU normal operation.

REMOVAL / INSTALLATION

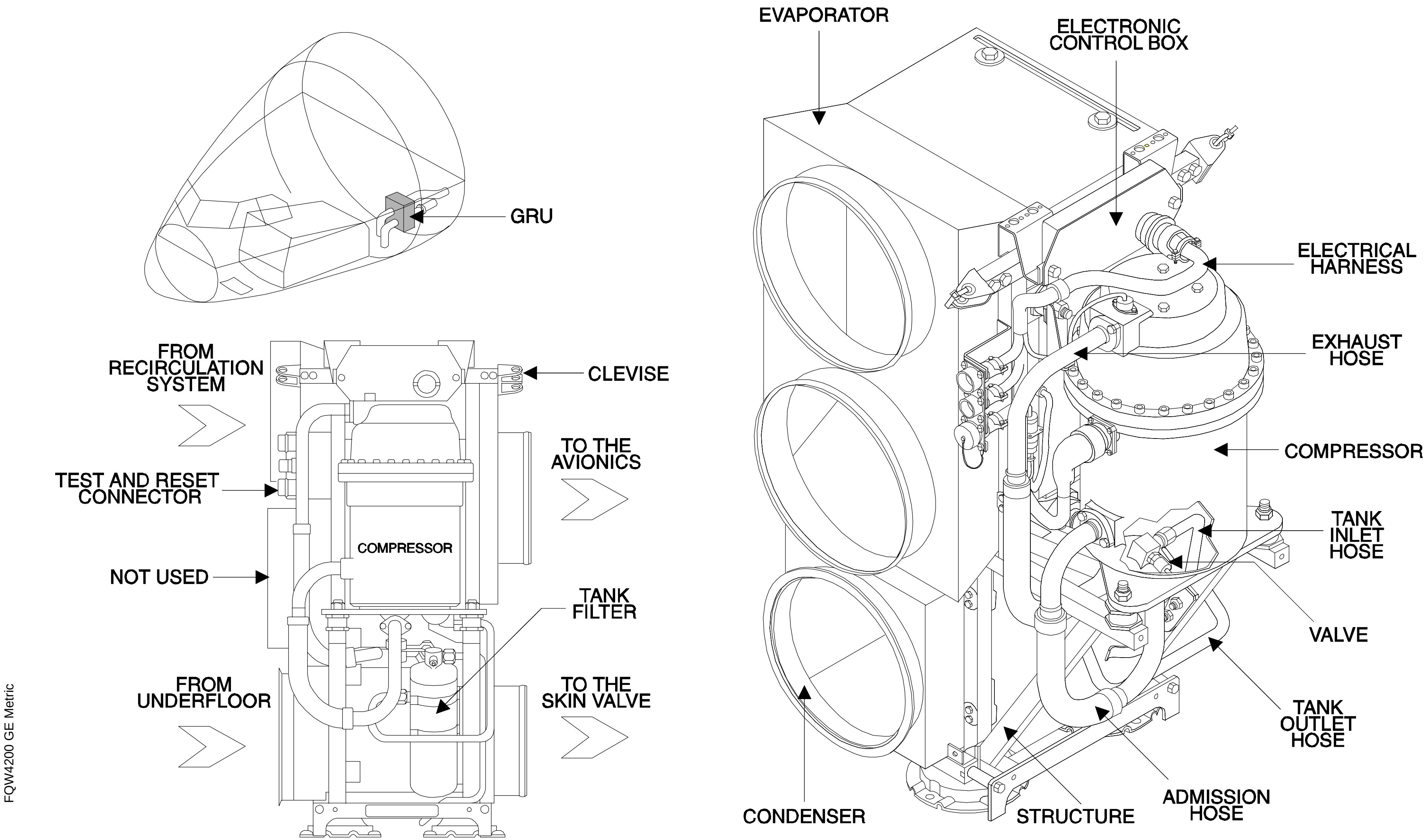
The GRU is connected to the ducts with clamps and attached to the structure with two clevises. Respect the torque values, install the bonding strap for the GRU installation. Do the operational test from the MCDU of the fault warning of the avionics equipment ground cooling to complete the installation. Obey the position instructions shown on the GRU identification plate when it is put into storage.

SAFETY PRECAUTIONS

WARNING: Move the GRU carefully to prevent injury to people and damage to the GRU. Two people are necessary to hold the GRU as the unit is very heavy.

WARNING: During GRU operation, the compressor must IMPERATIVELY be held in the upright position.

WARNING: In case of GRU damage, beware of jets of refrigerant fluid. They can cause severe injuries.


GRU
FROM RECIRCULATION SYSTEM
CLEVISE
TO THE AVIONICS
TEST AND RESET CONNECTOR
COMPRESSOR
NOT USED
TANK FILTER
FROM UNDERFLOOR
TO THE SKIN VALVE
FQW4200 GE Metric
EVAPORATOR
ELECTRONIC CONTROL BOX
ELECTRICAL HARNESS
EXHAUST HOSE
COMPRESSOR
TANK INLET HOSE
VALVE
TANK OUTLET HOSE
ADMISSION HOSE
STRUCTURE
CONDENSER

GRU FAN

FIN / ZONE

FIN : 7HD

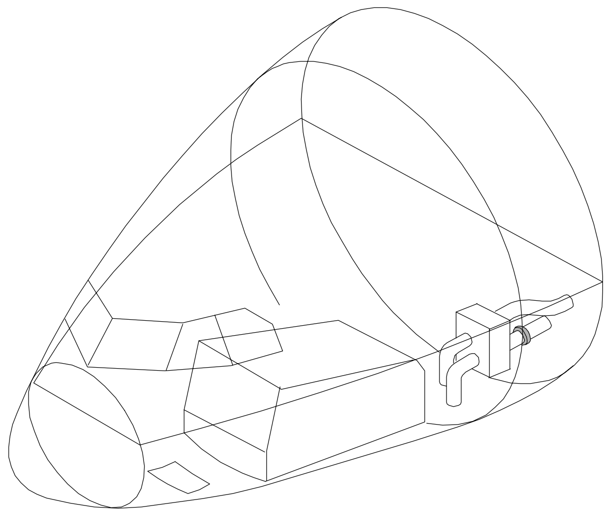
ZONE : 121

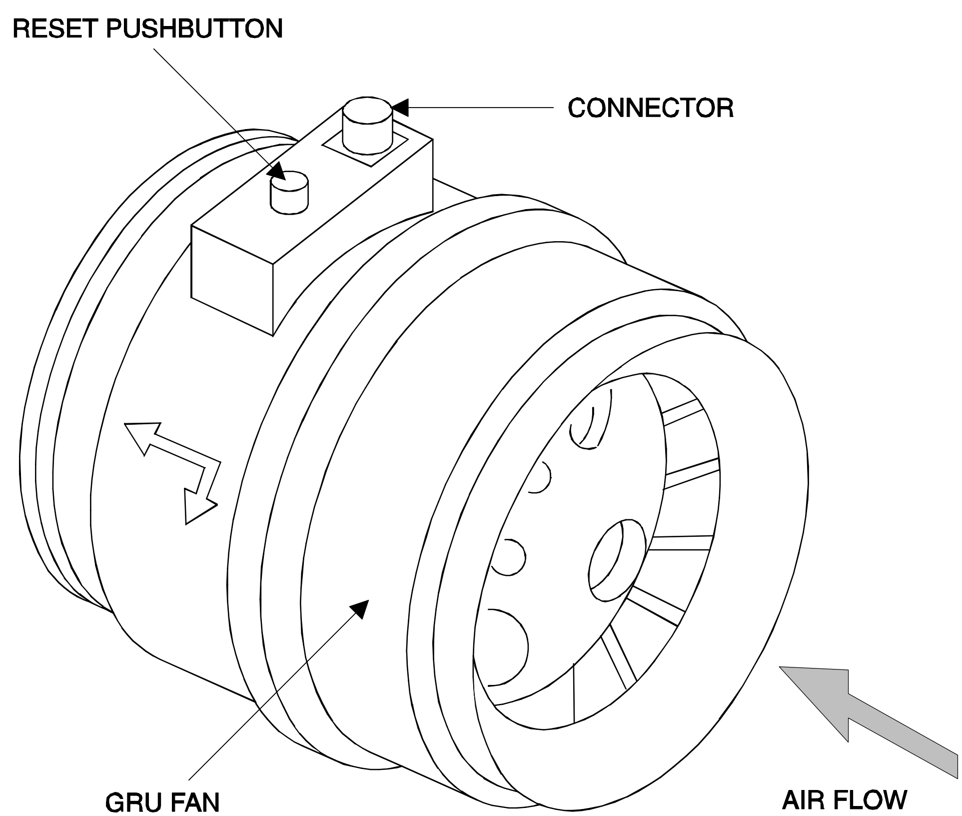
COMPONENT DESCRIPTION

The fan is one speed designed (3 phase/ 115/200VAC). The power switches are incorporated to the fan. Thermal switches fitted in the fan motor stop the fan in case of overheat. After trouble shooting the fan can be restarted with the reset P/Bsw fitted on the fan housing.

REMOVAL / INSTALLATION

- open the access door 811,
- remove the different clamps, sleeve and o-ring,
- clean the component interface and/or the adjacent area and use a new o-ring for the installation,
- do the operational test of the fault warning of the avionics equipment ground cooling from the MCDU.





FQW4200 GE Metric

SKIN VALVE

FIN / ZONE

FIN : 8HD

ZONE : 121

COMPONENT DESCRIPTION

The valve is of the skin-mounted type. It has an electrical motor (28VDC) which actuates a linear actuator. The actuator is fitted with two end of travel microswitches. The fully open and fully closed positions are detected by 2 other microswitches, for indication purposes. An override manual mechanism makes valve operation from outside possible.

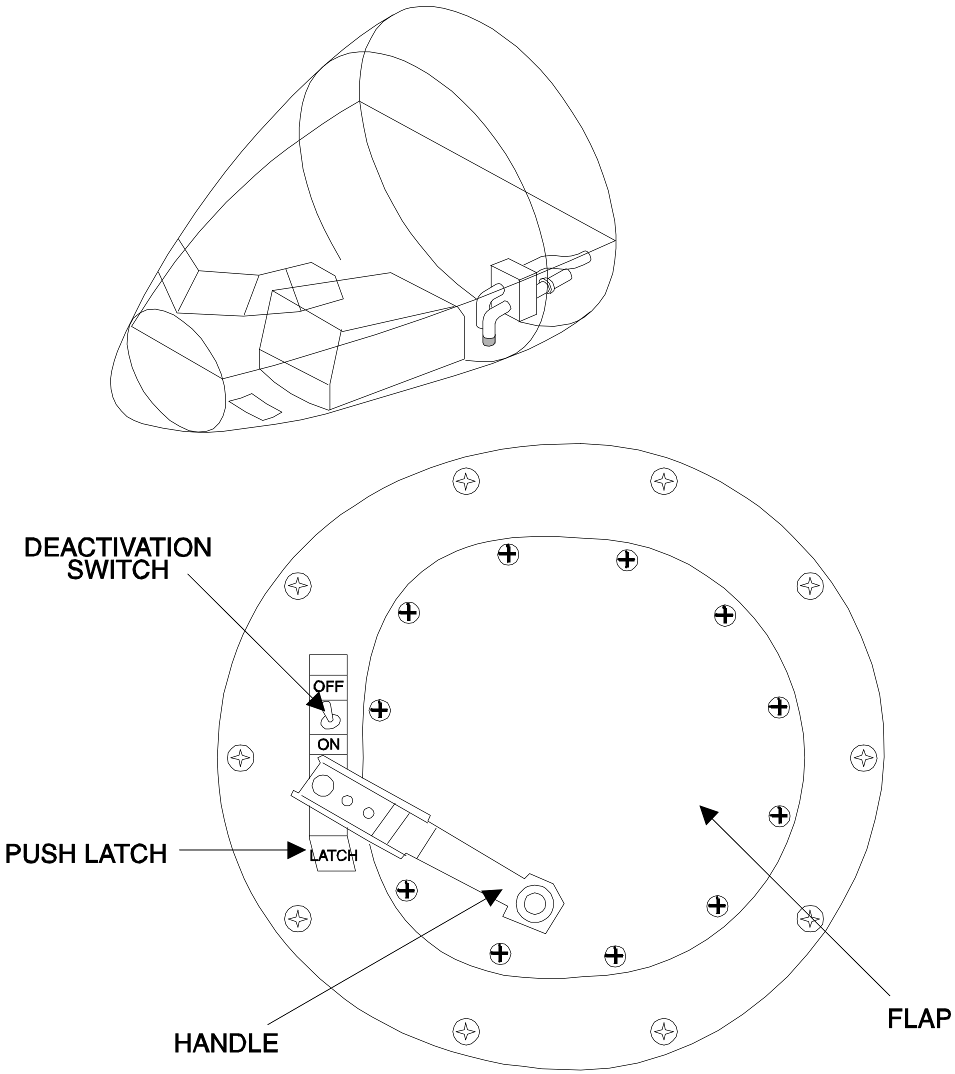
VALVE DEACTIVATION

Make sure the GND COOL P/Bsw is set to OFF.

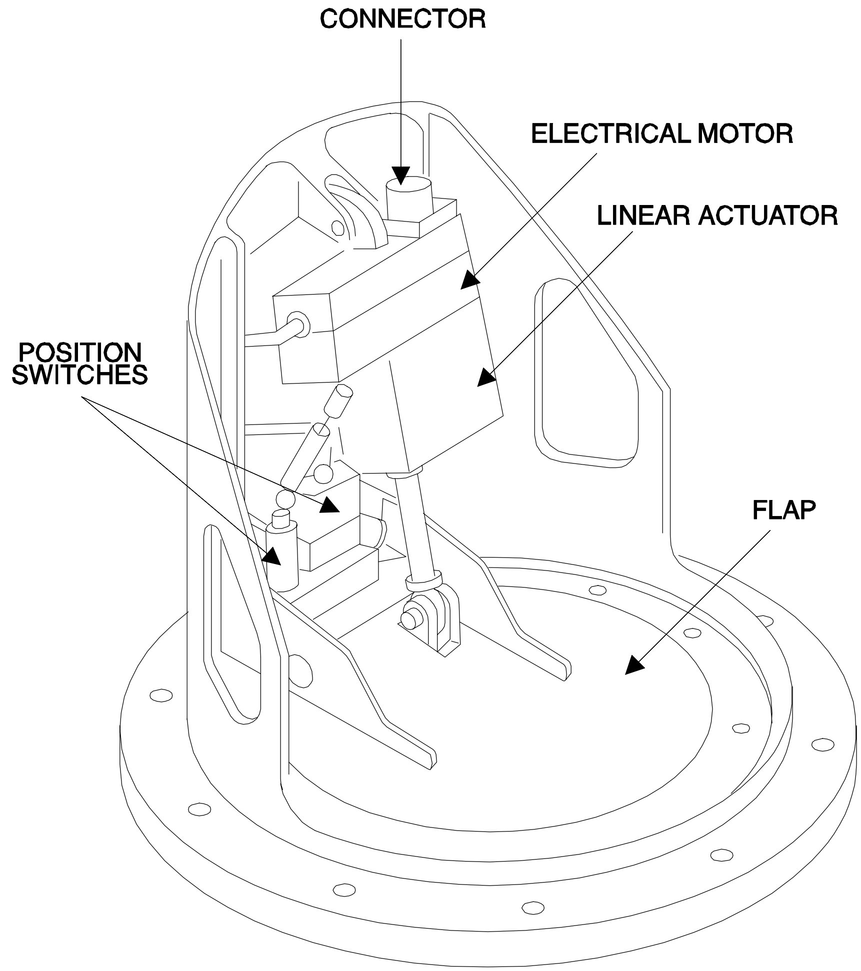
(1) Push the PUSH latch to release the handle,
(2) Pull the handle to engage the mechanism,
(3) Fold out the handle,
(4) Set the deactivation switch to OFF,
(5) Turn the handle counterclockwise to fully close the flap,
(6) Fold the handle and latch it.

REMOVAL / INSTALLATION

- remove the 10 bolts and make a mark to show their positions.
- prior any valve installation, remove the sealant from the valve and the structure and clean the areas with cleaning agents.
- install a new o-ring and apply sealants.
- do the Op/test of the fault warning of the avionics equipment ground cooling.



EXTERNAL VIEW



FQW4200 GE Metric

STUDENT NOTES

AVIONICS EQUIPMENT VENTILATION : SYSTEM INTERFACES

Centralized Maintenance Computer (CMC) 1, 2
Pin Programming
Landing Gear Control and Interface Unit (LGCIU) 1, 2
Engine (ENG) Switches
Cooling Effect Detector (CED)
Ground (GND) Horn
Pressure Switch
System Data Acquisition Concentrator (SDAC) 1, 2
Extract Pushbutton Switch (P/BSW)
Ditching Pushbutton Switch (P/BSW)
Reset Switch (SW)
Underfloor Valve
Overboard Valve
Extract Fan

CENTRALIZED MAINTENANCE COMPUTER (CMC) 1, 2

The Centralized Maintenance Computers are connected to the Avionics Equipment Ventilation Computer for system monitoring.
The Avionics Equipment Ventilation Computer (AEVC) is a type 2 system.

PIN PROGRAMMING

Two ground (GND) cool identification inputs enable the optional ground cooling system to be activated.

LANDING GEAR CONTROL AND INTERFACE UNIT (LGCIU) 1, 2

Landing Gear Control Interface Units 1 and 2 send ground and flight signals to the AEVC for valves control.

In addition, LGCIU 2 sends a validity signal.

ENGINE (ENG) SWITCHES

The AEVC receives engine 1 and 2 oil low press signals from engine systems for valves control.

COOLING EFFECT DETECTOR (CED)

The Cooling Effect Detector provides a warning signal to the AEVC, both System Data Acquisition Concentrator (SDAC)s and the ground horn when the blown air cooling capacity is abnormal.

The CED incorporates a monitoring test initiated from the AEVC.
The CED is activated whenever electrical power supply is available.

GROUND (GND) HORN

The ground horn receives an electronic insufficient cooling signal from the CED, low pressure signal from the pressure switch, and an extract warning signal from the AEVC.

These signals are used to trigger the ground horn and the Avionics (AVNCS) VENT light if the aircraft is on ground, and engine 1 and 2 stopped.

PRESSURE SWITCH

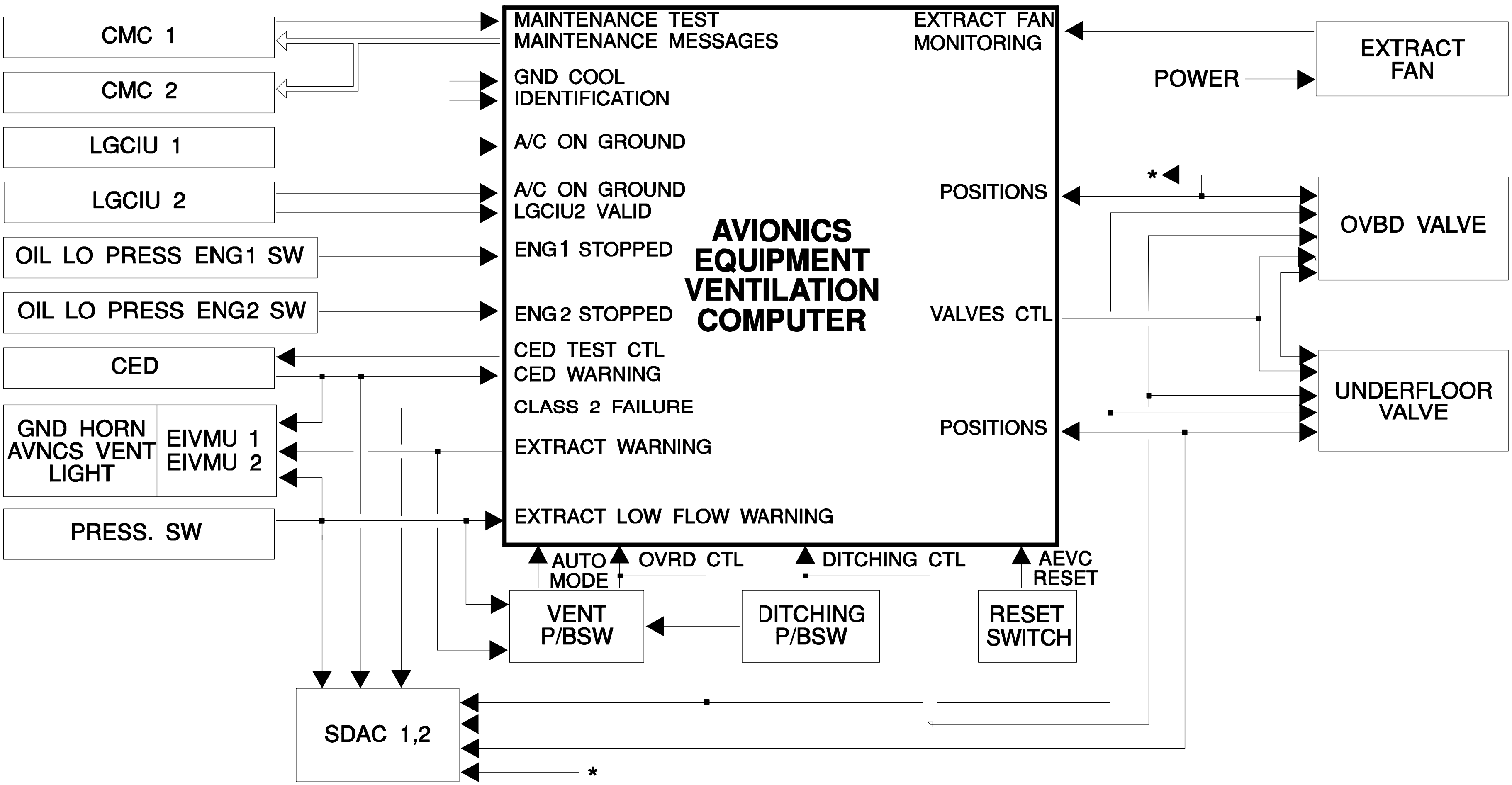
The pressure switch provides a warning signal to both SDACs, the ground horn, avionincs vent light, and the EXTRACT pushbutton FAULT light if any abnormal pressure is detected.

This signal is also sent to the AEVC for monitoring purposes.

SYSTEM DATA ACQUISITION CONCENTRATOR (SDAC) 1, 2

System Data Acquisition Units 1 and 2 receive the valves position, warnings triggered by the CED and the pressure switch to generate system fault signals and display information.

Both SDACs also receive class 2 failure signals from the AEVC, and ditching and override configuration information from the respective pushbutton.


CMC 1
CMC 2
LGCIU 1
LGCIU 2
OIL LO PRESS ENG1 SW
OIL LO PRESS ENG2 SW
CED
GND HORN
AVNCS VENT
LIGHT
EIVMU 1
EIVMU 2
PRESS. SW
MAINTENANCE TEST
MAINTENANCE MESSAGES
GND COOL
IDENTIFICATION
A/C ON GROUND
A/C ON GROUND
LGCIU2 VALID
ENG1 STOPPED
ENG2 STOPPED
CED TEST CTL
CED WARNING
CLASS 2 FAILURE
EXTRACT WARNING
EXTRACT LOW FLOW WARNING
AVIONICS
EQUIPMENT
VENTILATION
COMPUTER
EXTRACT FAN
MONITORING
POSITIONS
VALVES CTL
POSITIONS
EXTRACT
FAN
POWER
*
OVBD VALVE
UNDERFLOOR
VALVE
AUTO
MODE
OVRD CTL
DITCHING CTL
AEVC
RESET
VENT
P/BSW
DITCHING
P/BSW
RESET
SWITCH
SDAC 1,2
*

EXTRACT PUSHBUTTON SWITCH (P/BSW)

The EXTRACT pushbutton switch sends an overboard valve power supply signal to the AEVC in AUTO mode.
It is used to control the valves according to the aircraft configuration.

The EXTRACT pushbutton switch also sends an override signal in OVRD mode to the AEVC for monitoring, and to the valves for direct control.

DITCHING PUSHBUTTON SWITCH (P/BSW)

When ditching is selected, the extract pushbutton is overstepped and a direct signal is sent to the valves for closure and to the AEVC for monitoring.

RESET SWITCH (SW)

One reset discrete is sent to the AEVC, in order to reset it.

UNDERFLOOR VALVE

The underfloor valve sends its position signals to the AEVC and the close position signal to both SDACs for monitoring.

OVERBOARD VALVE

The overboard valve sends its position signals to the AEVC and both SDACs for monitoring.

EXTRACT FAN

The extract fan sends a fan on signal to the AEVC for monitoring.
The extract fan is activated whenever electrical power is available.

AIR CONDITIONING BAY VENTILATION : SYSTEM INTERFACES

LGCIU 1, 2
Centralized Maintenance Computers (CMC) 1, 2
System Data Acquisition Concentrator (SDAC) 1, 2
Flow Control Valve (FCV) 1, 2
Ground Horn
Pressure Switch
Turbofan Supply Valve

LGCIU 1,2

LGCIU 1 controls the turbofan supply valve.

The LGCIU 2 ground/flight signal is used to trigger or inhibit the signal sent to the ground horn and the AVNCS VENT light.

CENTRALIZED MAINTENANCE COMPUTERS (CMC) 1,2

The Centralized Maintenance Computers are connected to the AEVC for system monitoring.

The AEVC is a type 2 system.

SYSTEM DATA ACQUISITION CONCENTRATOR (SDAC) 1,2

The AEVC and the pressure switch send a discrete signal to the System Data Acquisition Units to generate a system fault signal and display information.

FLOW CONTROL VALVE (FCV) 1,2

The not fully closed signal from the flow control valve is used to enable warnings if any abnormal pressure is detected.

The signals are also sent to the AEVC for class 2 warning activation..

GROUND HORN

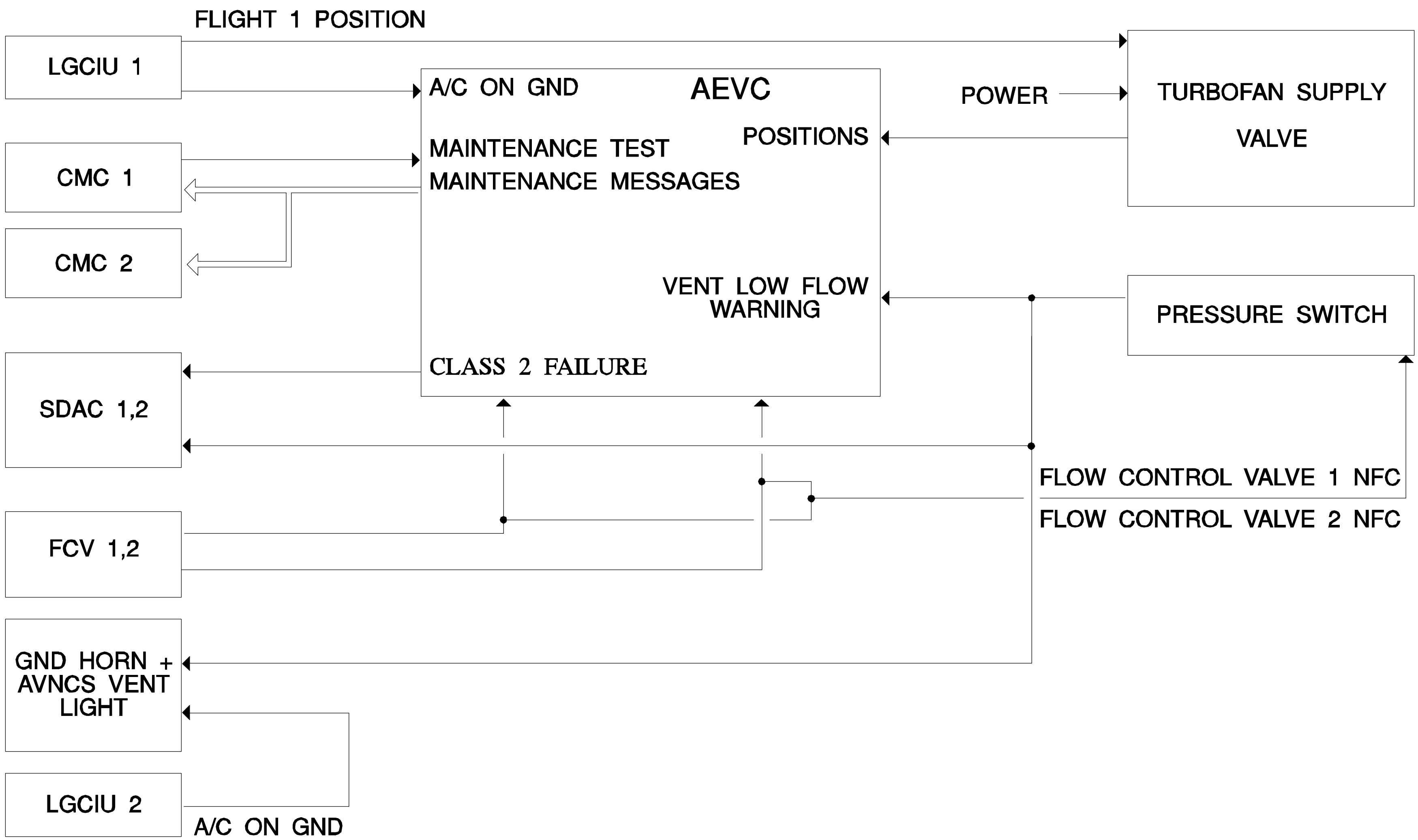
On ground, with at least one pack flow control valve open, the ground horn and the avionics vent light are activated if any abnormal pressure is detected.

PRESSURE SWITCH

On ground with at least one pack flow control valve open, the pressure switch sends a warning signal to the AEVC, to SDAC 1 and 2, to the ground horn and to the avionics VENT light if any abnormal pressure is detected.

TURBOFAN SUPPLY VALVE

The turbofan supply valve sends the valve position signal to the AEVC for monitoring.



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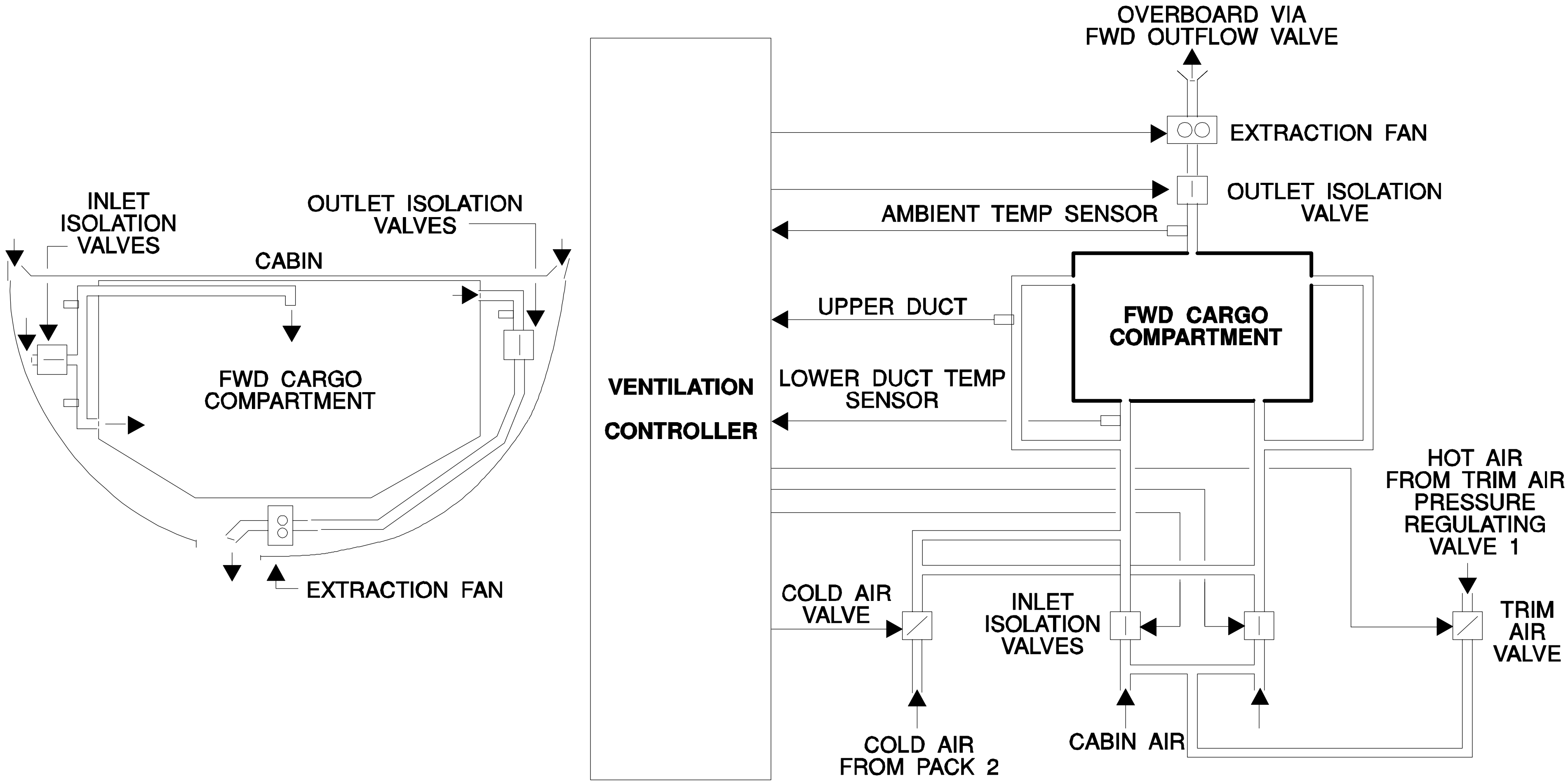
STUDENT NOTES

FORWARD CARGO COMPARTMENT VENTILATION / TEMPERATURE CONTROL : SYSTEM PRESENTATION

GENERAL

The forward cargo compartment is ventilated by cabin air, cooled by cold air from pack 2 and heated by hot air from trim air pressure regulating valve 1.



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INLET ISOLATION VALVES

The inlet isolation valves allow cabin air, from openings in the cabin floor, to enter the compartment.
Control is achieved, via the ventilation controller, by the ISOL VALVES pushbutton switch.

To isolate the cargo compartment, they close if DITCHING is selected or if smoke is detected in the Forward cargo compartment.

TRIM AIR VALVE

Heating regulation is achieved by a trim air valve which allows hot air to be mixed with cabin air.
The trim air valve is controlled by the ventilation controller through a stepper motor according to cockpit control selection.

The trim air valve closes in case of Forward cargo compartment door open Proximity Switch Control Unit (PSCU), extraction fan inoperative, duct overheat detection, forward smoke warning Smoke Detector and Control Unit (SDCU), isolation valves closed, or no hot air supply when trim air pressure regulating valve 1 and trim air shut-off valve closed (Zone Controller).

COLD AIR VALVE

Cooling regulation is achieved by a cold air valve which allows cold air to be mixed with cabin air.
The cold air valve is controlled by the ventilation controller according to the cockpit cooling selector position.

The valve closes in case of ISOL VALVES or COOLING OFF selection, DITCHING configuration, both flow control valves closed, Forward cargo smoke warning, extraction fan inoperative, or one isolation valve closed. When NORM or MAX is selected, the zone controller receives signals to increase the flow delivered by the pack flow control valves.

OUTLET ISOLATION VALVE

The outlet isolation valve allows air to be sent overboard via the forward outflow valve. Control is achieved, via the ventilation controller, by the ISOL VALVES pushbutton switch.

To isolate the cargo compartment, it closes if DITCHING is selected or if smoke is detected in the forward cargo compartment.

EXTRACTION FAN

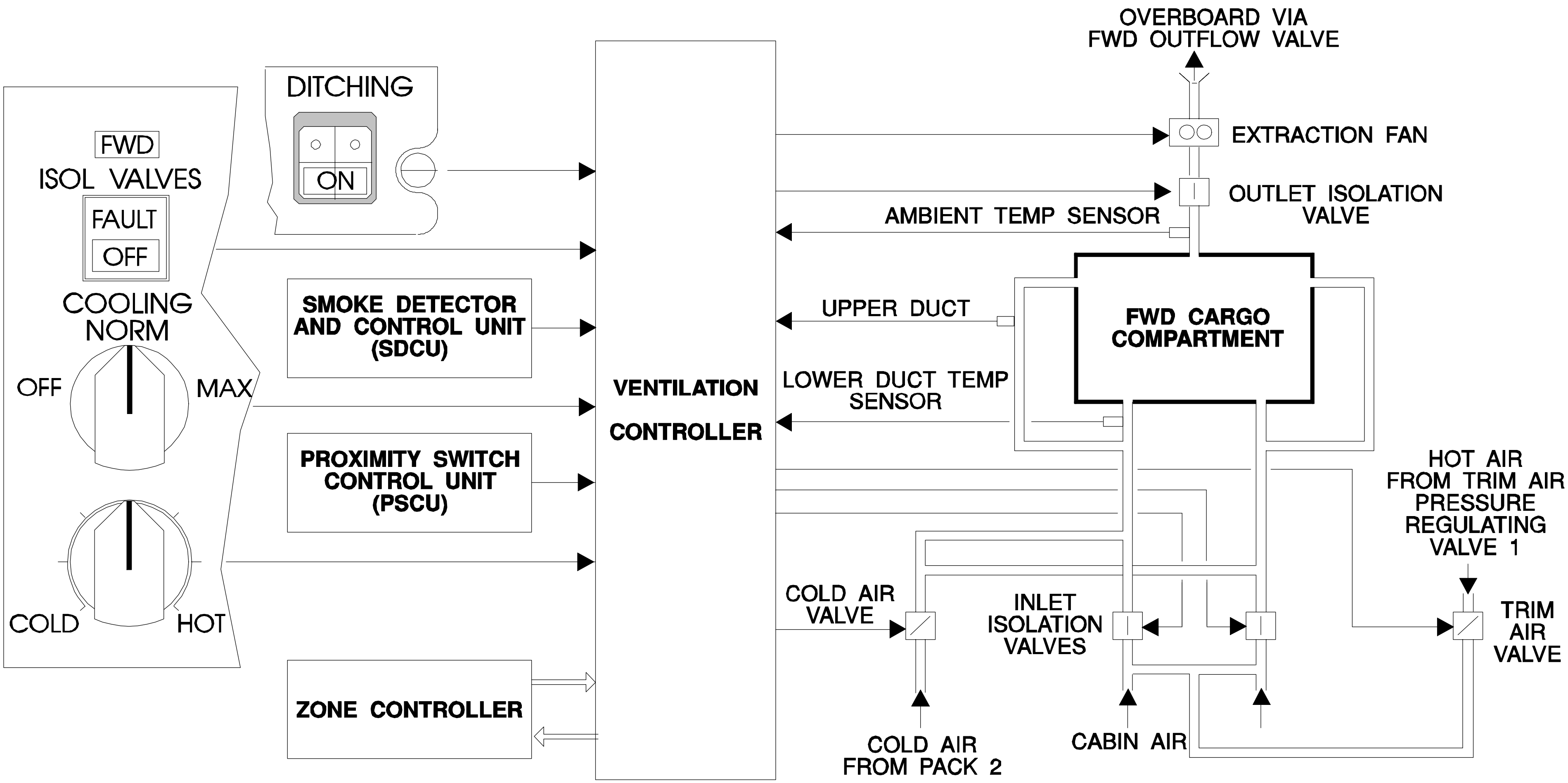
The two speed extraction fan extracts the Forward cargo compartment air. It operates provided normal or max cooling is selected and both flow control and isolation valves are open.

High speed is only used when NORM or MAX cooling is selected, and both pack flow control valves and isolation valves are open.

TEMP SENSORS

Two double duct temperature sensors and one double compartment temperature sensor send temperature signals to the ventilation controller for temperature control and duct overheat detection.

The ventilation controller sends a FWD cargo duct OVHT signal to the zone controller in order to close trim air pressure regulating valve 1 and the trim air shut-off valve, if open.



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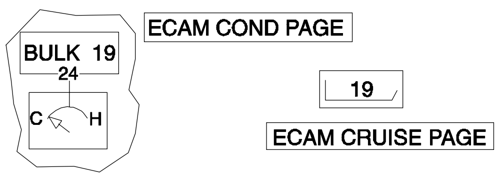
STUDENT NOTES:

FORWARD CARGO COMPARTMENT VENTILATION / TEMPERATURE CONTROL : SYSTEM CONTROLS AND INDICATING

Isolation Valves P/B
Cooling Selector
Temperature Selector
Fan Reset P/B
Trim Air Valve
Cold Air
Cold Air Valve
Duct Temperature
Compartment Temperature

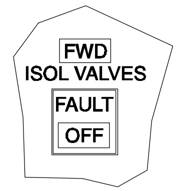
As these systems are optional, the indications concerning the FWD cargo compartment temperature control system are displayed on the ECAM COND and CRUISE pages only if the option is fitted on the aircraft and the ventilation controller pinprogrammed.

These indications are displayed on ECAM only if the BULK CARGO HEATING system is installed.



ISOLATION VALVES P/B

When the isolation valves pushbutton switch is pressed in, the isolation valves open and the extraction fan runs provided there is no smoke detection in the FWD cargo compartment.



FAULT comes on associated with an ECAM caution when either the inlet or outlet isolation valve is not in agreement with the selected position.

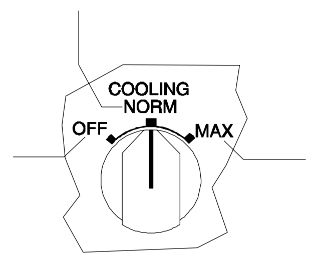
The pushbutton is released out. The valves close and the extraction fan stops.

COOLING SELECTOR

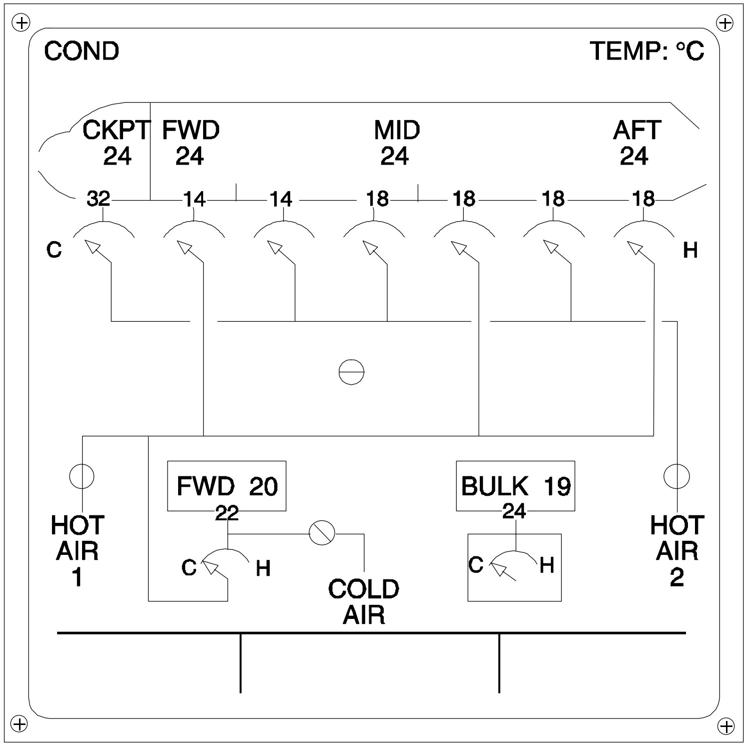
The COOLING selector controls the cold air valve via the ventilation controller to adjust the quantity of cold air supplied by the mixer unit. The COOLING selector has three positions.

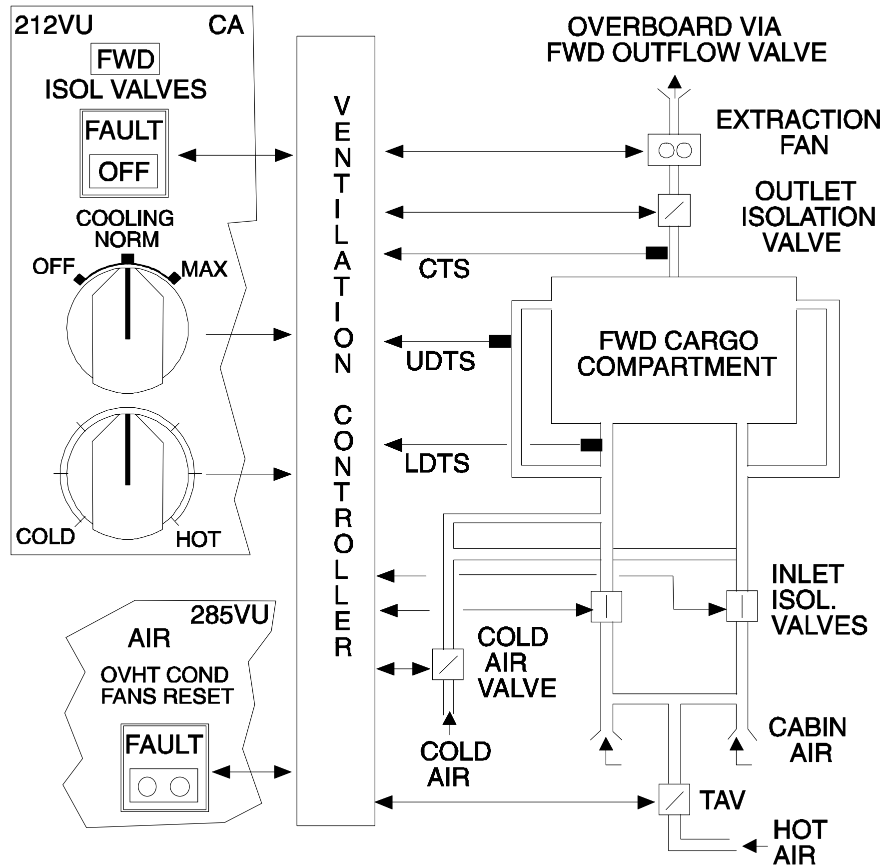
Cold air valve partially open.

Cold air valve fully closed.



Cold air valve fully open.





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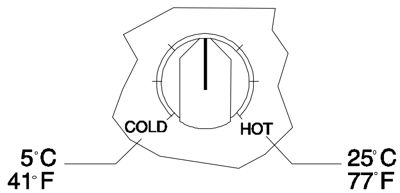
TEMPERATURE SELECTOR

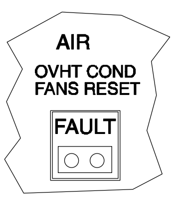
The forward cargo compartment temperature can be adjusted with the temperature rotary selector.



The temperature regulation is performed by changing the FWD cargo Trim Air Valve position.

FAN RESET P/B

The Fan Reset pushbutton indicates an overheat of at least one fan controlled by the ventilation controller and enables the crew to reset it.

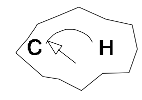


There is an extraction fan overheat.

When the P/B is pressed, the fan restarts and the fault light goes off provided the overheat condition has disappeared.

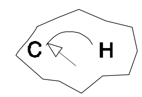
TRIM AIR VALVE

The forward cargo trim air valve indication is normally displayed in green on the ECAM COND page.



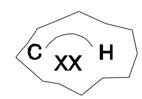
GREEN NEEDLE

Normal operation.
C (COLD) = Valve closed.
H (HOT) = Valve open.



AMBER NEEDLE

The trim air valve has failed.

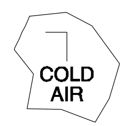


AMBER CROSSES

The trim air valve position data is not available.

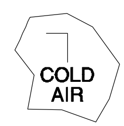
COLD AIR

The cold air duct indication is normally displayed in green on the ECAM COND page.



GREEN NEEDLE

The duct is green when the two flow control valves are not fully closed or when their position is not available.



AMBER NEEDLE

It becomes amber when one of the two flow control valves are fully closed.

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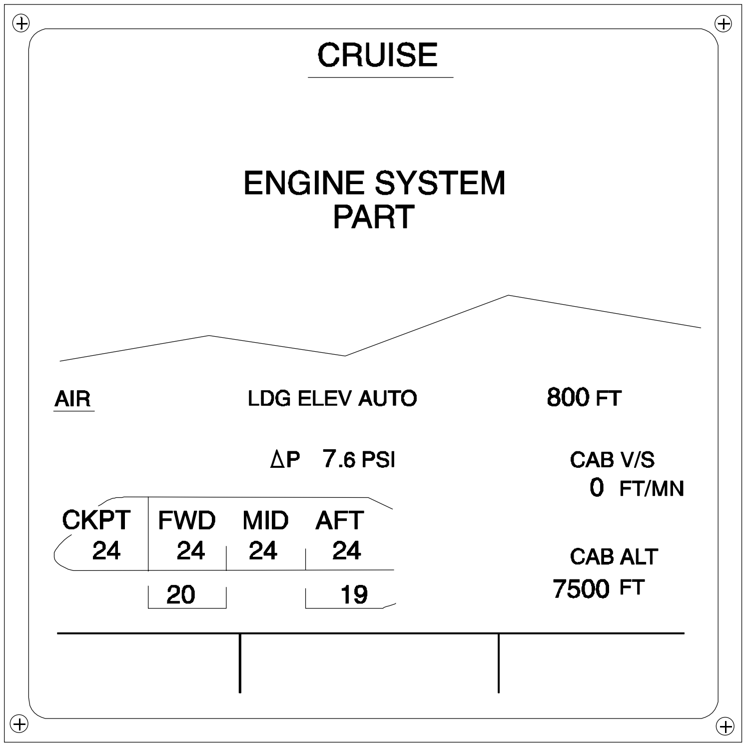

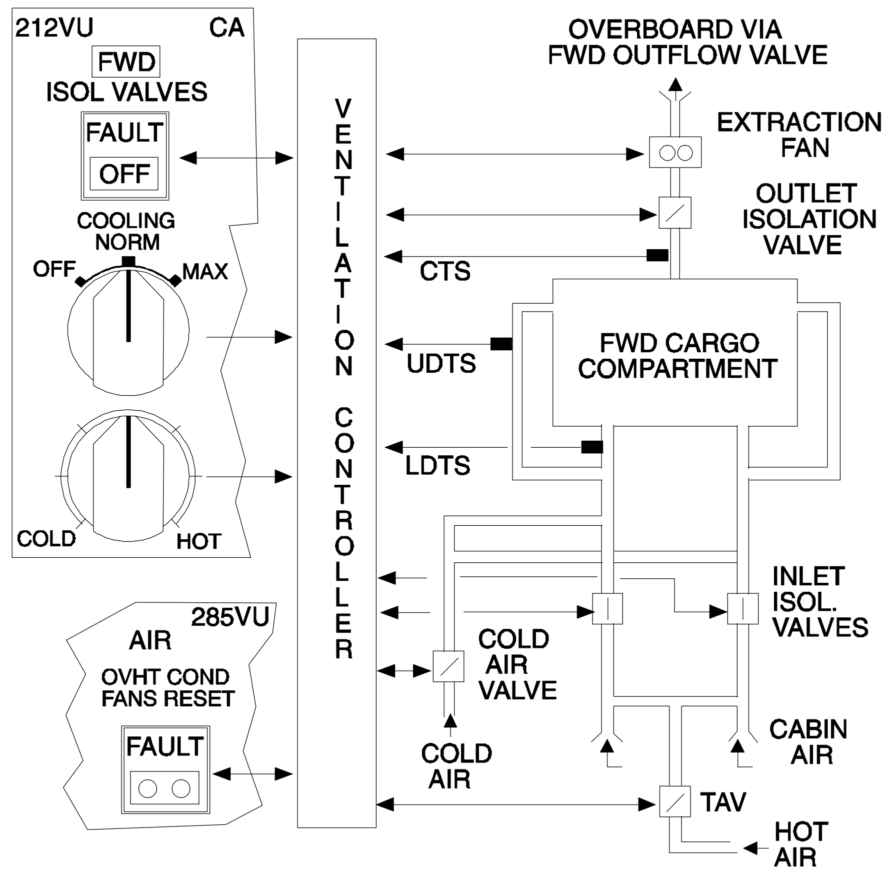

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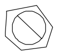
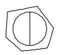
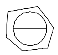
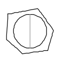
COLD AIR VALVE

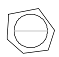
The cold air valve indication is normally displayed in green on the ECAM COND page.

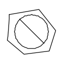
GREEN  Valve partially open.

GREEN  Valve fully closed.

GREEN  Valve fully open.

AMBER  Valve abnormal fully closed.

AMBER  Valve abnormally fully open.

AMBER  Valve abnormally partially open or in transit position.

GREEN AND AMBER CROSSES 

Valve position data not available.

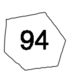
DUCT TEMPERATURE

The forward cargo duct temperature is normally displayed in green on the ECAM COND page.

UDTS = Upper Duct Temp. Sensor
LDTS = Lower Duct Temp. Sensor

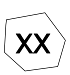
GREEN

The duct temperature is lower than 88°C (190°F).



AMBER

The duct temperature is greater than 88°C (190°F).



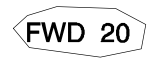
AMBER

The duct temperature data is not available.

COMPARTMENT TEMPERATURE

The forward cargo compartment temperature is always displayed in green on the ECAM COND page.

CTS = Compartment Temp. Sensor



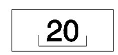
WHITE LETTERS
GREEN NUMBER

Normal configuration.
Temperature varies by steps of 1°C (2°F).

WHITE LETTERS
AMBER CROSSES

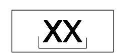
The FWD cargo compartment temperature data is not available.

The FWD cargo compartment temperature is also displayed in green on the ECAM CRUISE page.



GREEN

Normal configuration.
Temperature varies by steps of 1°C (2°F).



AMBER

The FWD cargo compartment temperature data is not available.

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FWD CARGO COMPARTMENT VENTILATION / TEMPERATURE CONTROL : WARNINGS

FWD CRG VENT FAULT
FWD CRG ISOL FAULT
FWD CRG COOL FAULT
FWD CRG HEAT FAULT

These warnings can be triggered only if the FWD cargo compartment ventilation system is installed.

FWD CRG VENT FAULT

The forward cargo ventilation extract fan is faulty.

FWD CRG ISOL FAULT

The ventilation is lost in the affected compartment. FAULT light is amber on the respective "ISOL VALVES" pushbutton.

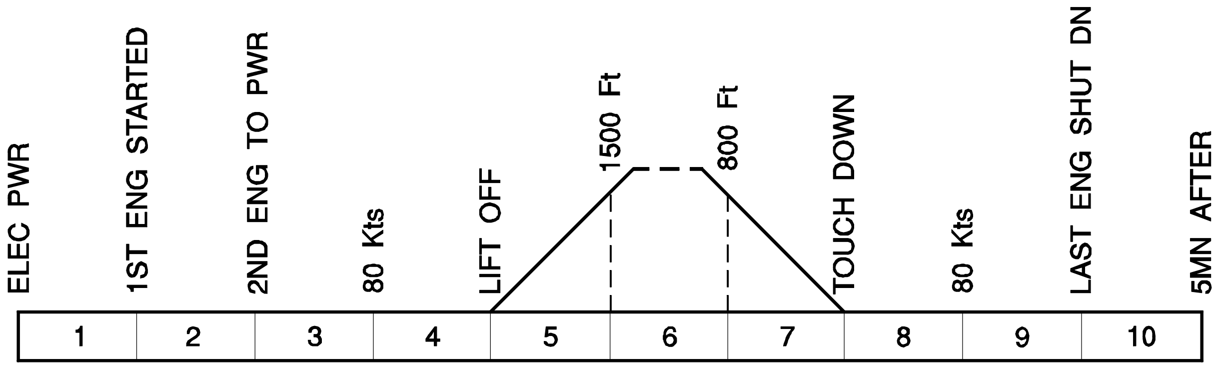
These warnings can be triggered only if the FWD cargo compartment temperature control system is installed.

FWD CRG COOL FAULT

The forward cargo cooling is lost.

FWD CRG HEAT FAULT

The forward cargo Trim Air Valve is inoperative.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
FWD CRG VENT. FAULT	NIL	NIL	NIL	FAN FAULT LIGHT	3, 4, 5, 7, 8
FWD CRG ISOL. FAULT	NIL	NIL	NIL	ISOL. VALVE FAULT lt	3, 4, 5, 7, 8
FWD CRG COOL FAULT	NIL	NIL	COND	NIL	3, 4, 5, 7, 8
FWD CRG HEAT FAULT	NIL	NIL	COND	NIL	3, 4, 5, 7, 8

STUDENT NOTES

FWD CARGO COMPARTMENT VENTILATION / TEMPERATURE CONTROL : COMPONENTS/1

Safety Precautions
Isolation valves
Cold air valve
Trim air valve

SAFETY PRECAUTIONS

Make sure that the air conditioning system is not supplied with air from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel.

STUDENT NOTES

ISOLATION VALVES

FIN / ZONE

INLET ISOLATION VALVES
FIN : 287 HN, 289 HN
Zone : 131
OUTLET ISOLATION VALVE
FIN : 286 HN
Zone : 132

COMPONENT DESCRIPTION

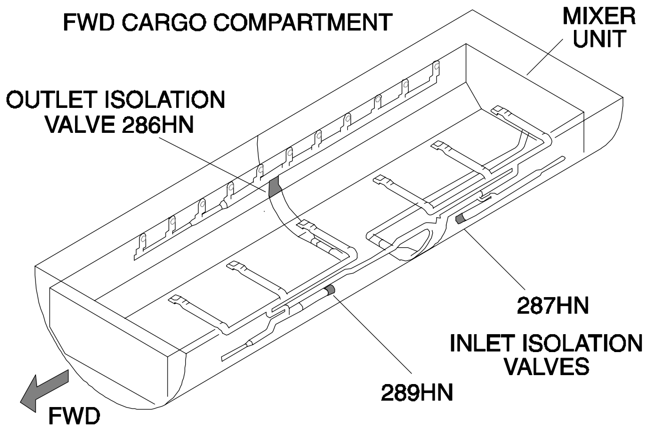
Each of the 3 isolation valves has a 28VDC electrical motor, an actuator and a butterfly valve. The motor drives the actuator to open or close the butterfly valve. The isolation valves have 2 positions (open or closed) which are detected by means of 2 microswitches.
A manual lever shows the valve position and makes manual overriding possible.

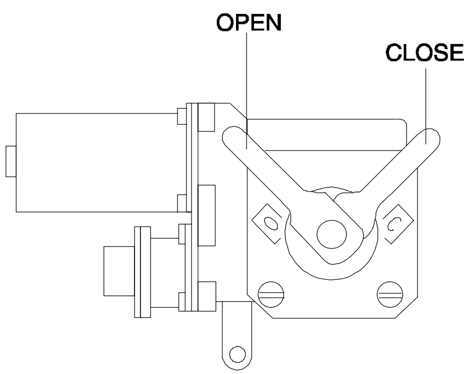
REMOVAL INSTALLATION

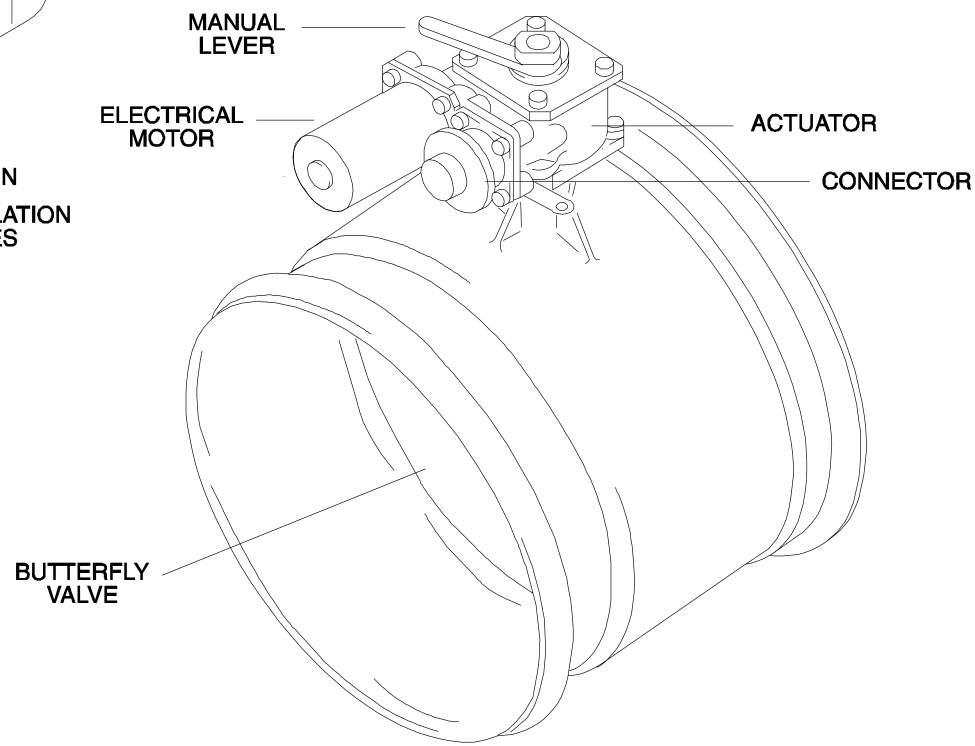
All of the isolation valves of the lower deck cargo are interchangable.
- remove the access panel 132UW for 286HN, 131WW for 287HN and 131QW for 289HN.
- The valve is attached to the ducts by means of clamps and sleeves.
- perform the operational test of the FWD cargo compartment to complete the valve(s) installation.

VALVE DEACTIVATION

(1) comply with the safety precautions and then push and release the FWD ISOL VALVES pushbutton switch to OFF.
(2) disconnect the electrical connector.
(3) close the isolation valve with the manual lever.
(4) put a blanking cap on the electrical connector.
(5) put a warning notice in the cockpit to tell the flight crew the FWD CC isolation valve(s) is(are) deactivated and secured closed.







FQW4200 GE Metric

COLD AIR VALVE

FIN / ZONE

FIN : 290 HN
Zone : 138

COMPONENT DESCRIPTION

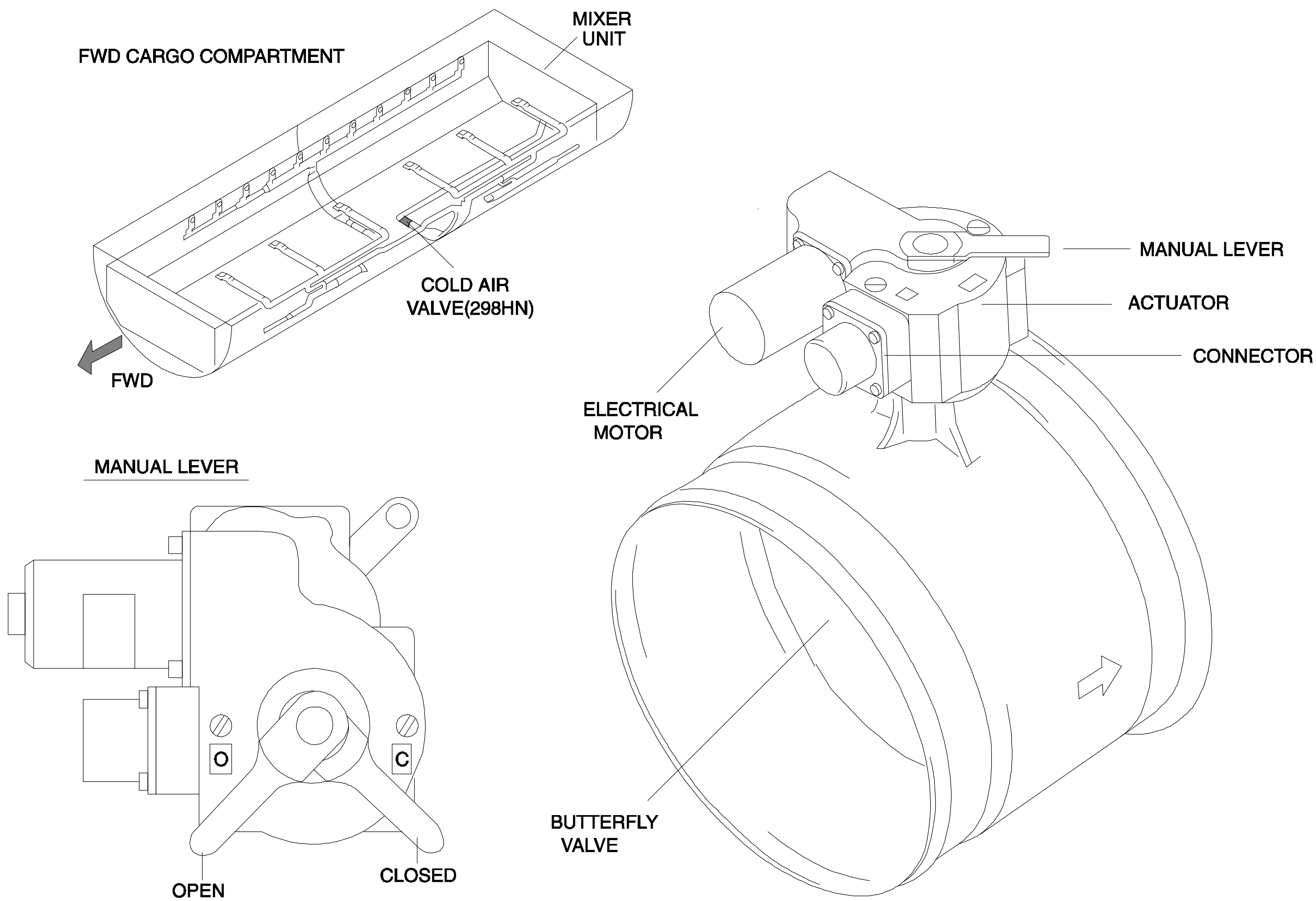
The cold air valve has a 28VDC electrical motor, an electrically actuated clutch, a manual lever, an actuator and a butterfly valve.
The manual lever shows the valve position and makes manual overriding possible. The valve is spring loaded closed and has three positions (fully closed, partially open and fully open).

REMOVAL INSTALLATION

- Before removing the cold air valve, set PACK 1 and PACK 2 P/B to the OFF position and deactivate the Flow Control Valve 2.
- The valve is attached to the ducts by means of clamps and sleeves.
- Perform the operational test of the FWD cargo comp ventilation and the test of the flow control and indicating system to complete the installation.

VALVE DEACTIVATION

(1) comply with the safety precautions, then select the FWD COOLING selector to the OFF position.
(2) disconnect the electrical connector.
(3) close the cold air valve with the manual lever.
(4) put a blanking cap on the electrical connector.
(5) put a warning notice in the cockpit to tell the flight crew the cold air valve is deactivated and secured closed.



FQW4200 GE Metric

TRIM AIR VALVE

FIN / ZONE

FIN : 438 HC
Zone : 137

COMPONENT DESCRIPTION

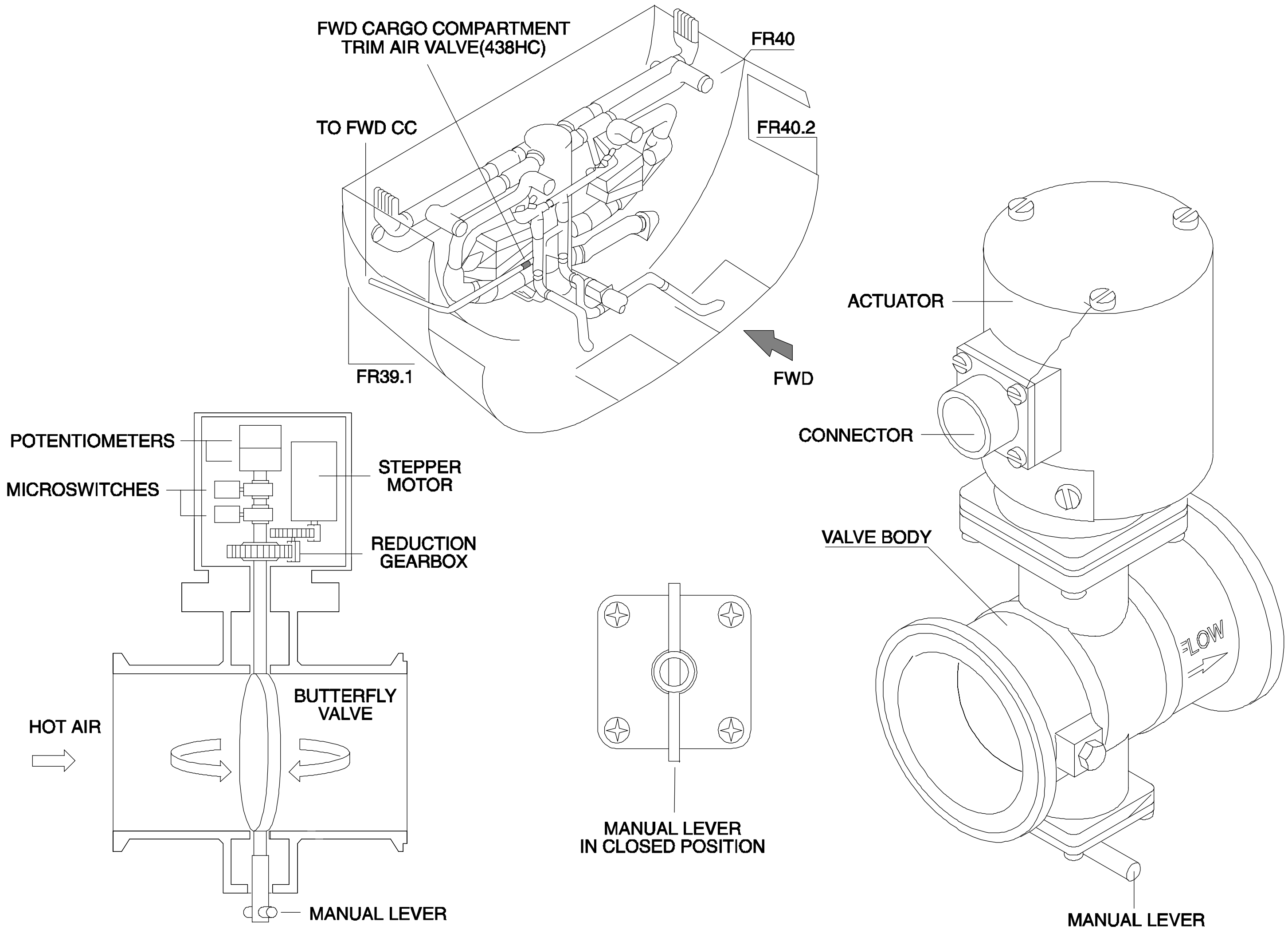
The FWD cargo compartment Trim Air Valve has an actuator and a valve body. The actuator has a stepper motor, a reduction gearbox with 2 mechanical end stops used to limit the rotation of the gear shaft in both directions and two microswitches to indicate the fully open and fully closed positions. 2 Potentiometers installed on the end of the shaft send analog signals to the zone controller for the valve position monitoring and control. A manual lever shows the valve position and makes manual overriding possible.

VALVE DEACTIVATION

(1) comply with the safety precautions :
(a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.
(b) make sure that the LP and HP ground connectors are not supplied and are tagged with a warning notice telling people not to supply the ground air sources.
(2) close the FWD CC Trim Air Valve with the manual lever.
(3) disconnect the electrical connector.
(4) put a blanking cap on the electrical connector.
(5) put a warning notice in the cockpit to tell the flight crew the FWD CC Trim Air Valve is deactivated.

REMOVAL INSTALLATION

WARNING : Do not touch the valve until it is cool enough to prevent burns
- remove the access panel 131CX.
- open, safety and tag the circuit breakers listed in the AMM.
- comply with the safety precautions :
(a) make sure that the APU BLEED, all ENG BLEED and the PACK 1(2) P/Bsw are released and tagged.
(b) make sure that the LP and HP ground connectors are not supplied.
- the valve is attached to the ducts by means of clamps.
- perform the operational test of the FWD CC temperature regulation.



FQW4200 GE Metric

STUDENT NOTES

FWD CARGO COMPARTMENT VENTILATION / TEMPERATURE CONTROL : COMPONENTS/2

Safety precautions
Fwd Cargo compart. Extract fan
Fwd Cargo compart. Temp. Sensors and Duct Temp. Sensors

SAFETY PRECAUTIONS

WARNING : Make sure that air is not supplied to the air conditioning system from the main engines, the APU or a ground source. Hot compressed air can cause injury to personnel.

STUDENT NOTES

FWD CARGO COMPT. EXTRACT FAN

FIN / ZONE

FIN : 285 HN
ZONE : 132

COMPONENT DESCRIPTION

The extract fan has a two speed three phase induction motor (115/200 VAC) and a fan wheel with high efficiency blades in a housing.
The induction motor drives the fan wheel. Thermal switches are installed for the OVHT protection. The fan housing is attached to the A/C structure by means of four brackets with vibration dampers.
Arrows on the housing show the direction of the airflow through the extraction fan and the rotation direction of the fan wheel.

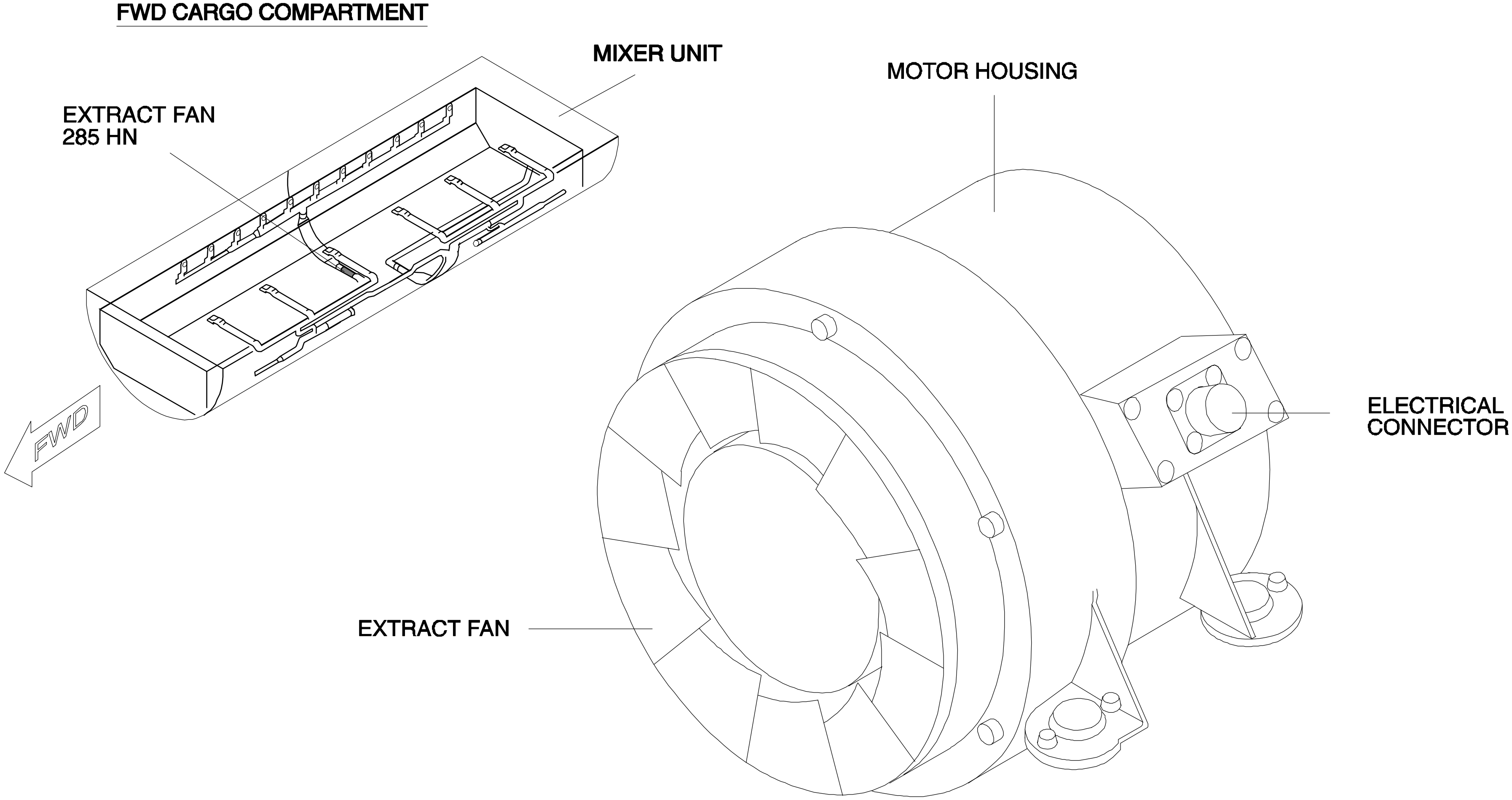
REMOVAL / INSTALLATION

- Get access to the fan and remove the access panel 132 HF.
- Release the fan from the ducts and then from the A/C structure to remove it.

To complete the installation, the operational test of the FWD cargo compartment ventilation system has to be performed.

SAFETY PRECAUTIONS

Open, safety and tag these circuit breakers
EXTC FAN FWD CRG 11 HN
CRG VENT CTL LZ 2 HN
CRG VENT CTL LZ 1 HN



FQW4200 GE Metric

FWD CARGO COMPT. TEMP. SENSORS AND DUCT TEMP. SENSORS

FIN / ZONE

FWD CARGO COMPT. TEMP. SENSORS AND DUCT TEMP. SENSORS

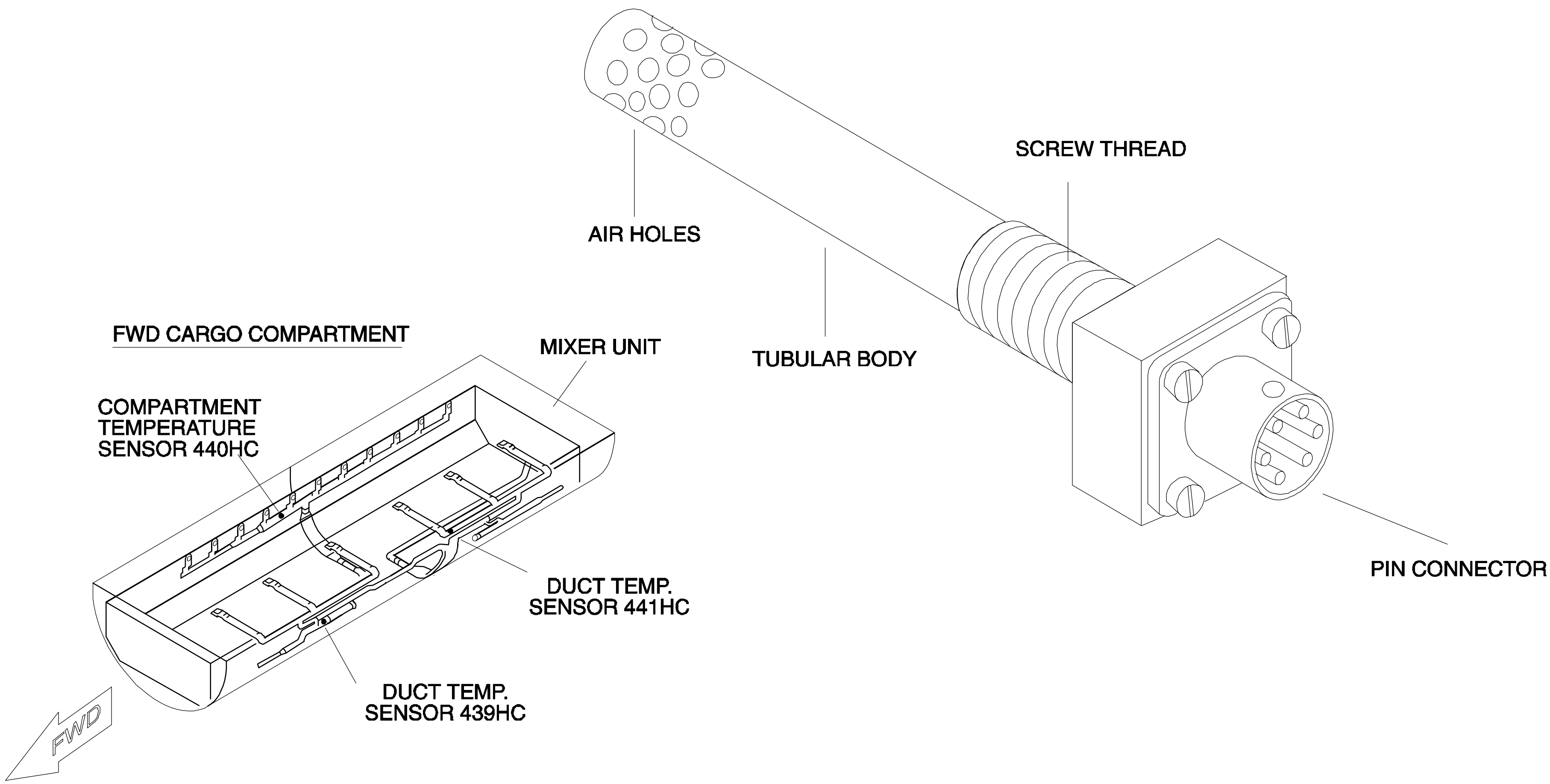
FIN : 440HC
ZONE : 132
FIN : 439HC ; 441HC
ZONE : 131

COMPONENT DESCRIPTION

The FWD Cargo Compartment Temperature Sensors have two thermistors in a tubular body.
One thermistor is dedicated to one of the two lanes of the ventilation Controller.
The body has holes to permit air to flow through a screw thread for installation and a pin connector for electrical connection.

SAFETY PRECAUTIONS

Open, safety and tag these circuits breakers
CARGO VENT CTL L1 2 HN
CARGO VENT CTL L2 1 HN



FQW4200 GE Metric

STUDENT NOTES

FWD CARGO COMPARTMENT VENTILATION / TEMPERATURE CONTROL : INTERFACES

System Data Acquisition Concentrator
Zone Controller
Centralized Maintenance Computer
Proximity Switch Control Unit
Smoke Detection and Control Unit
Aircraft Emergency Config.
Ditching Pushbutton
Ventilation Controller Reset Switch
Fan Reset Pushbutton
Cargo Air Cond Panel
Pin Programming
Sensors
Isolation Valves
Trim Air Valve and Cold Air Valve
Extract Fan

SYSTEM DATA ACQUISITION CONCENTRATOR

The ventilation controller provides SDAC 1 and SDAC 2 with temperature indications, valve positions and warning messages through two ARINC buses.

A ventilation controller fault discrete signal is also sent to both SDACs.

ZONE CONTROLLER

The zone controller provides the ventilation controller with Trim Air Pressure Regulating Valve 2, Trim Air Shut-off Valve and Flow Control Valve positions through an ARINC bus.

These positions are used to control the FWD cargo compartment trim air valve and cold air valve.

CENTRALIZED MAINTENANCE COMPUTER

The ventilation controller is a type 1 system and provides both CMCs with failure and maintenance information.

CMC 1 sends flight information and BITE commands.

PROXIMITY SWITCH CONTROL UNIT

The Proximity Switch Control Unit transmits the fwd cargo door position to the ventilation controller, in order to control the forward cargo Trim Air Valve.

SMOKE DETECTION AND CONTROL UNIT

The Smoke Detection and Control Unit transmits fwd smoke and smoke test discrete signals to the ventilation controller.

These two signals are used to control :

- the isolation valves
- the trim air valve
- the extract fan
- the cold air valve

AIRCRAFT EMERGENCY CONFIG.

Two electrical aircraft emergency configuration discrete signals coming from a relay logic are used to stop the extract fan, the heating and cooling systems.

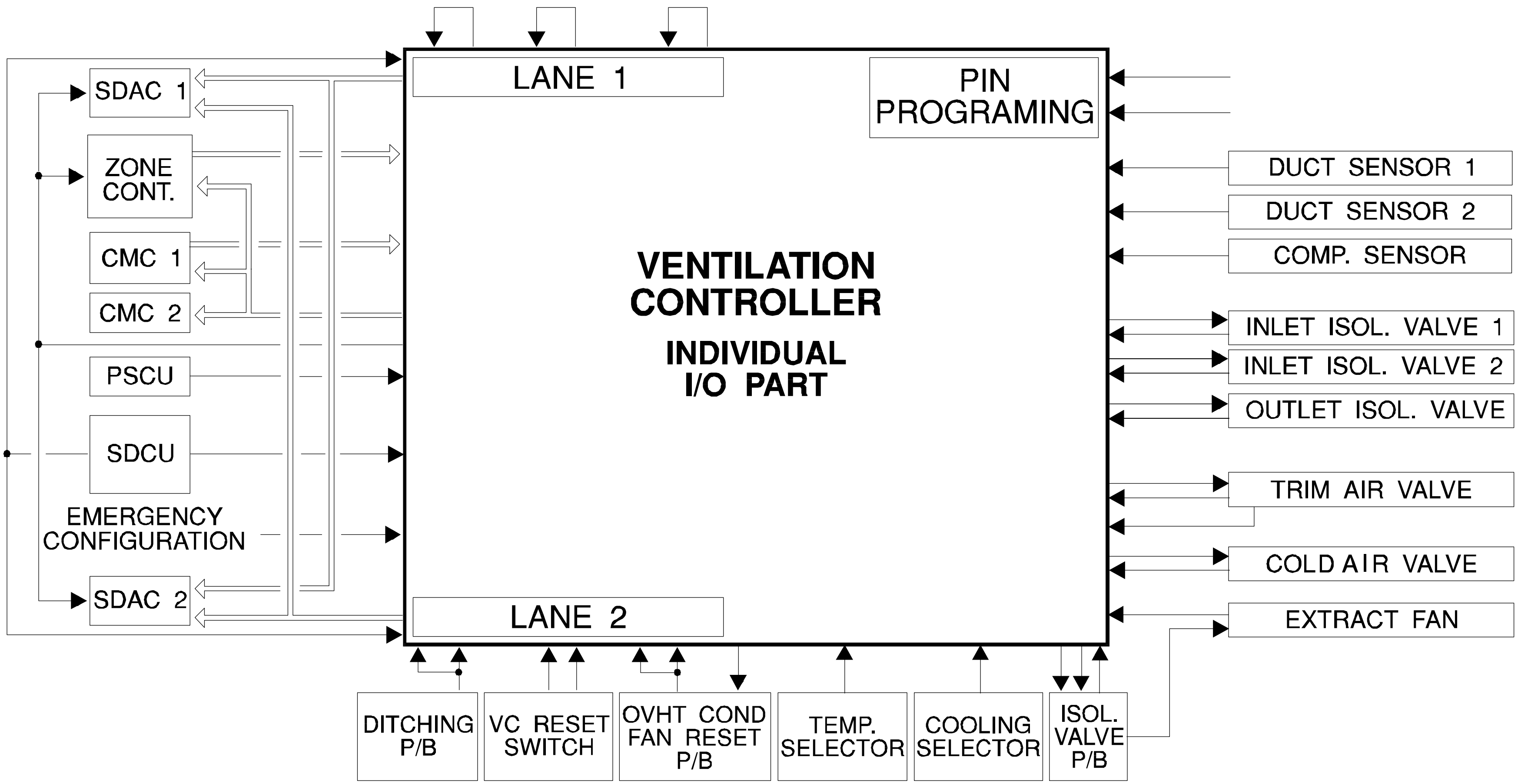
DITCHING PUSHBUTTON

The ditching discrete signal is used to close the cold air valve and the isolation valves.

The trim air valve also closes as a consequence of the isolation valves closure.

VENTILATION CONTROLLER RESET SWITCH

One reset discrete signal is sent to each ventilation controller lane, in order to reset it.



FQW4200 GE Metric

FAN RESET PUSHBUTTON

A fan reset signal is sent to the ventilation controller, in order to reset the extract fan.

CARGO AIR COND PANEL

The temperature selector sends three analog signals to the ventilation controller, for the fwd cargo Trim Air Valve control.
The cooling selector sends three discrete signals to the ventilation controller for the cold air valve control.

In case of ISOL. VALVE position disagree, FAULT signal comes to the P/B.
When the P/B is pressed in, EXTRACT FAN receives PWR CMD according to logic.
If released out, the P/B sends a FWD VENT OFF CMD to the ventilation controller.

PIN PROGRAMMING

Two pin inputs allow optional heating and ventilation functions to be activated.

SENSORS

Each sensor sends two analog signals for temperature control and monitoring.

ISOLATION VALVES

Each isolation valve sends the fully open and fully closed position signals to the ventilation controller for monitoring and ventilation system control.

TRIM AIR VALVE AND COLD AIR VALVE

The Trim Air Valve sends its positions to the ventilation controller for the Trim Air Valve monitoring and heating system control.

The cold air valve sends the fully open, partially open and fully closed position signals to the ventilation controller for cold air valve monitoring and cooling system control.

EXTRACT FAN

The extract fan sends two power feedback signals and an OVERHEAT signal, for monitoring and control purposes.

The extract fan is controlled from the ventilation controller through the ISOLATION VALVES pushbutton.

AFT CARGO COMPARTMENT VENTILATION : SYSTEM PRESENTATION

GENERAL

The aft cargo compartment is ventilated with cabin air.

INLET ISOLATION VALVES

The inlet isolation valves allow cabin air, from openings in the cabin floor, to enter the compartment.
Control is achieved, via the ventilation controller, by the ISOL VALVES pushbutton switch.

To isolate the cargo compartment, they close if DITCHING is selected or if smoke is detected in the AFT or Bulk cargo compartment.

EXTRACTION FAN

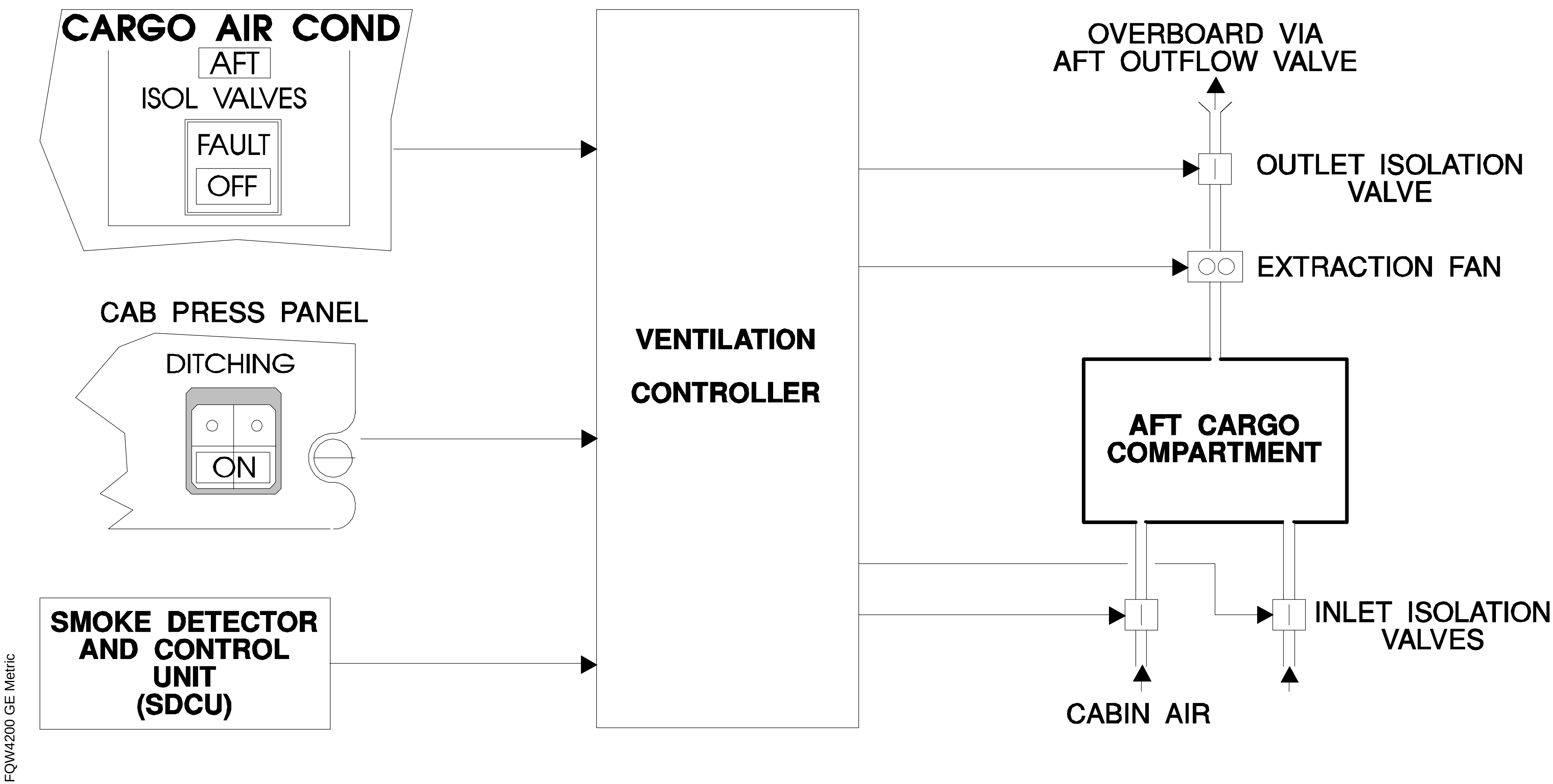
The extraction fan extracts the air from the cargo compartment.

The extraction fan operates provided at least one inlet isolation valve is open and the outlet isolation valve is open.
It stops if smoke is detected in the AFT or Bulk cargo compartment.

OUTLET ISOLATION VALVE

The outlet isolation valve allows the air to be ducted overboard through the AFT outflow valve.
Control is achieved, via the ventilation controller, by the ISOL VALVES pushbutton switch.

To isolate the cargo compartment, it closes if DITCHING is selected or if smoke is detected in the AFT or Bulk cargo compartment.


CARGO AIR COND
AFT
ISOL VALVES
FAULT
OFF
CAB PRESS PANEL
DITCHING
ON
SMOKE DETECTOR AND CONTROL UNIT (SDCU)
VENTILATION CONTROLLER
OVERBOARD VIA AFT OUTFLOW VALVE
OUTLET ISOLATION VALVE
EXTRACTION FAN
AFT CARGO COMPARTMENT
INLET ISOLATION VALVES
CABIN AIR
FQW4200 GE Metric

STUDENT NOTES:

AFT CARGO COMPARTMENT VENTILATION : SYSTEM CONTROLS AND INDICATING

Isolation Valves p/b
Fans Reset p/b

ISOLATION VALVES P/B

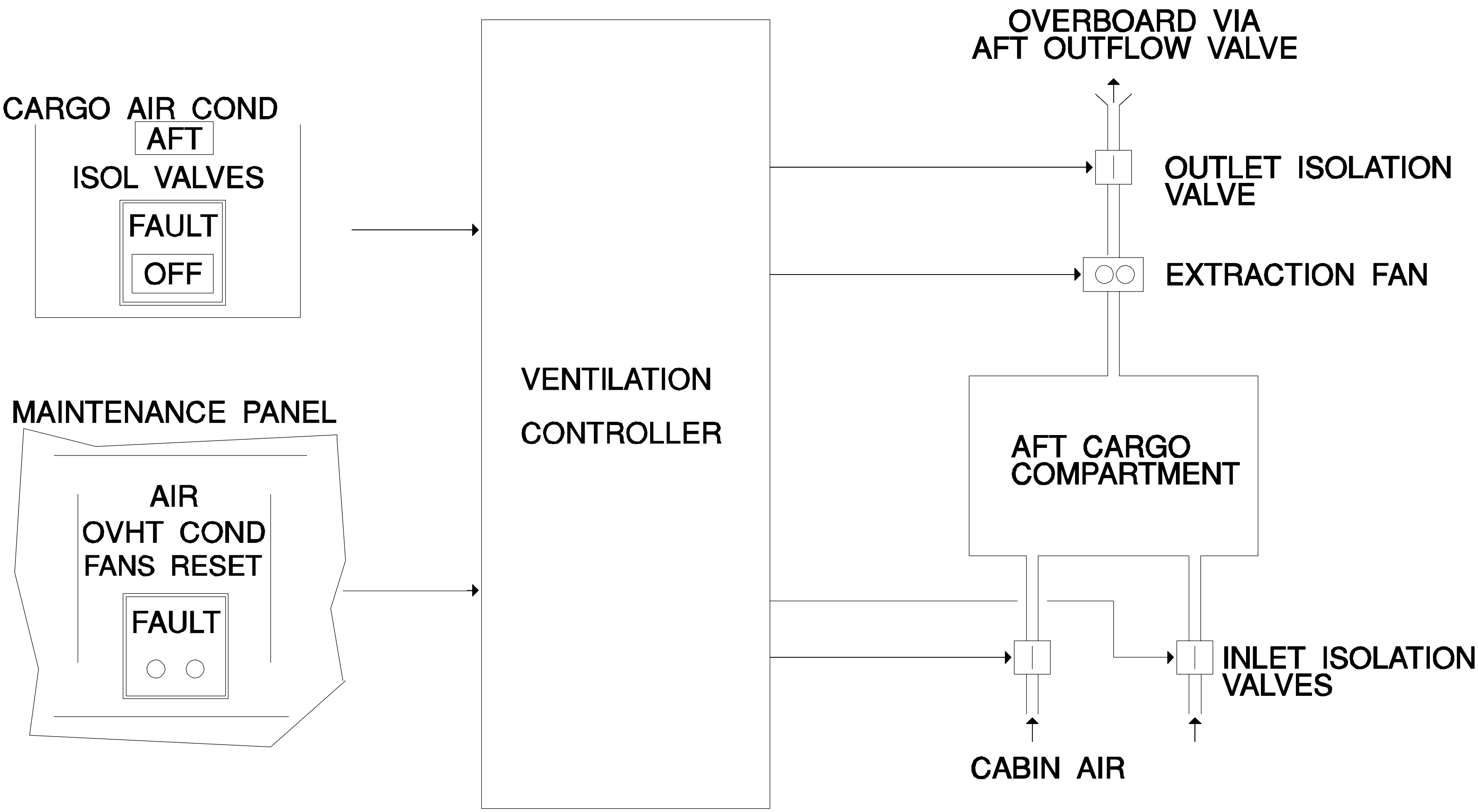
When the isolation valve pushbutton switch is pressed, the isolation valves open and the extraction fan runs provided there is no smoke detection in the aft cargo compartment.

FAULT (in amber) : comes on associated with ECAM caution when either inlet or outlet valve is not in agreement with the selected position.

OFF (in white) : the isolation valves pushbutton switch released out, the valves close and the extraction fan stops.

FANS RESET P/B

The FAN RESET pushbutton switch indicates an overheat of at least one fan of the air conditioning system and enables the crew to reset it.
If there is a fan overheat, a FAULT light (in amber) on the OVHT COND FANS RESET pushbutton switch comes on and the extraction fan stops.
When this reset pushbutton switch is pressed, the extraction fan is reset by means of the ventilation controller and the fault light goes off.



FQW4200 GE Metric

STUDENT NOTES :

AFT CARGO COMPARTMENT VENTILATION : WARNINGS

AFT CRG VENT FAULT
AFT CRG ISOL FAULT

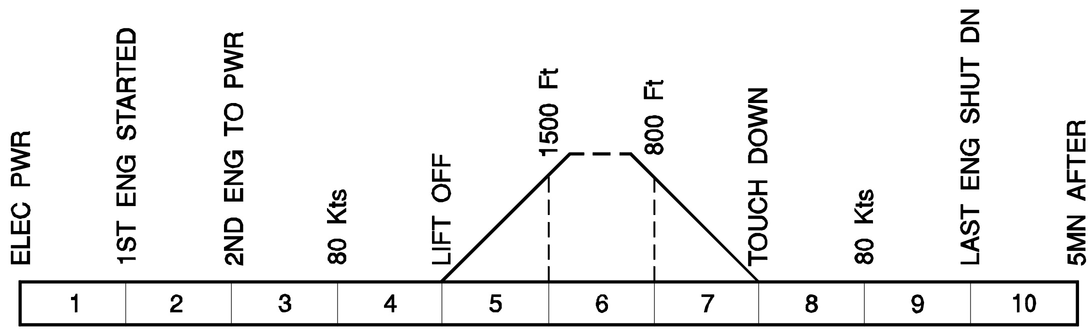
These warnings can only be triggered if the aft cargo compartment ventilation system is installed.

AFT CRG VENT FAULT

The aft cargo ventilation extract fan is faulty.

AFT CRG ISOL FAULT

The ventilation is lost in the affected compartment. FAULT light is amber on the respective "ISOL VALVES" pushbutton.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
AFT CRG VENT FAULT	NIL	NIL	NIL	FAN FAULT LIGHT	3, 4, 5, 7, 8
AFT CRG ISOL FAULT	NIL	NIL	NIL	ISOL VALVE FAULT lt.	3, 4, 5, 7, 8

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STUDENT NOTES

AFT CARGO COMPARTMENT VENTILATION : COMPONENTS/1

Safety Precautions
Aft Cargo Comp Isolation Valves

SAFETY PRECAUTIONS

Before any isolation valve removal, please make sure that these circuit breakers are open, safetied, and tagged.

EXTC FAN AFT CRG 8HN
CRG VENT CTL L1 2HN
CRG VENT CTL L2 1HN

STUDENT NOTES

AFT CARGO COMP ISOLATION VALVES

FIN / ZONE

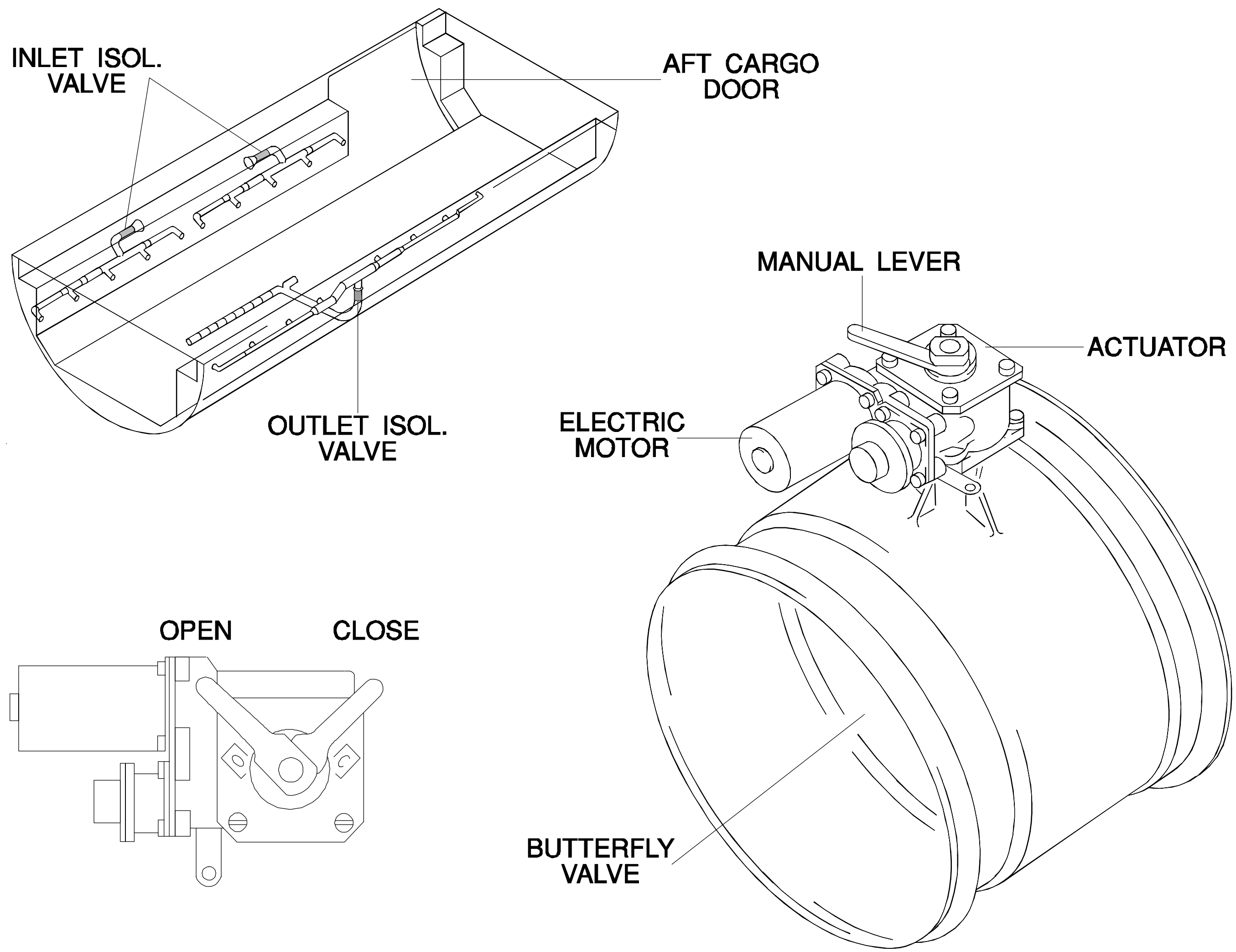
INLET ISOLATION VALVE
FIN : 292HN, 294HN
ZONE : 152
OUTLET ISOLATION VALVE
FIN : 293HN
ZONE : 151

COMPONENT DESCRIPTION

Each of the 3 isolation valves has an electrical motor, an actuator and a butterfly valve. The motor drives the actuator to open or close the butterfly valve. The isolation valves have 2 positions (open or close). The manual lever enables the maintenance staff to see the valve position and to manually change it.

REMOVAL / INSTALLATION

- remove the access panel 152GW for 292HN and 151RW for 293HN and 152LW for 294HN.
- torque the clamps within the limits requested in the AMM and make sure the sleeves are properly installed.
- do the operational test of the aft cargo compartment ventilation system to complete the installation.


INLET ISOL. VALVE
AFT CARGO DOOR
OUTLET ISOL. VALVE
MANUAL LEVER
ACTUATOR
ELECTRIC MOTOR
OPEN
CLOSE
BUTTERFLY VALVE

STUDENT NOTES

AFT CARGO COMPARTMENT VENTILATION : COMPONENTS/2

Safety Precautions
Aft Cargo Comp extraction fan

SAFETY PRECAUTIONS

Before any extraction fan removal, please make sure that these circuit breakers are open, safetied, and tagged.

EXTC FAN AFT CRG 8HN
CRG VENT CTL L1 2HN
CRG VENT CTL L2 1HN

STUDENT NOTES

AFT CARGO COMP EXTRACTION FAN

FIN / ZONE

FIN : 291HN

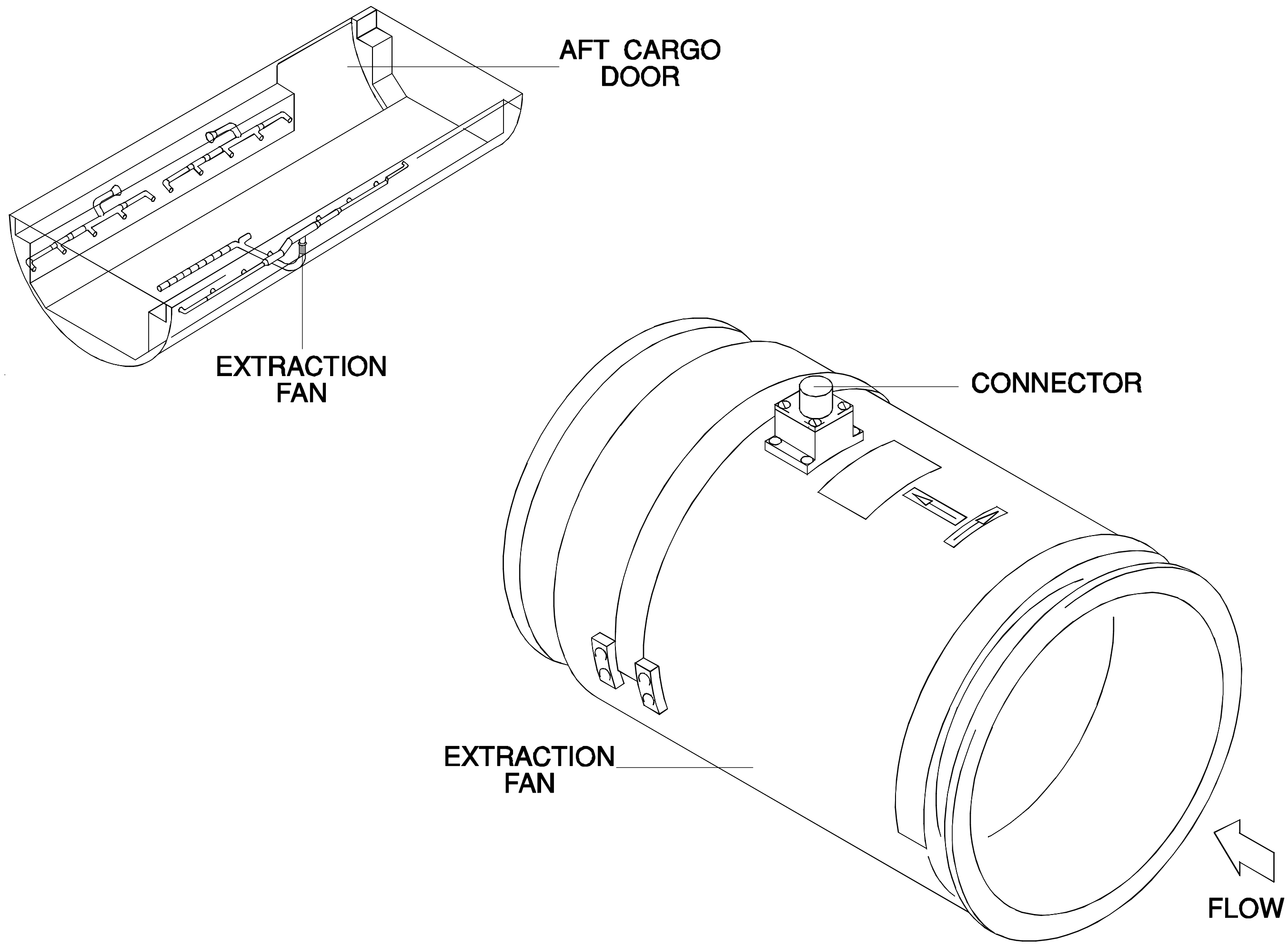
ZONE : 151

COMPONENT DESCRIPTION

The extraction fan has a 3 phase induction motor (115vAC) and a fan wheel with high efficiency blades in a housing. The induction motor drives the fan wheel. Two thermal switches stop the fan if its temperature reaches 140.C. The fan is reset from the cockpit by the OVHT COND FANS RESET P/B (3HN). Arrows on the housing show the airflow direction and the fan wheel rotation direction.

REMOVAL / INSTALLATION

- remove the sidewall panel 151JW.
- respect the gap between the fan and the isol. valve.
- torque the clamps within the limits requested in the AMM and make sure the sleeve is properly installed.
- do the operational test of the aft cargo compartment ventilation system to complete the installation.



FQW4200 GE Metric

STUDENT NOTES

AFT CARGO COMPARTMENT VENTILATION : INTERFACES

System Data Acquisition Concentrator
Centralized Maintenance Computer
Smoke Detection and Control Unit
Aircraft Emergency Configuration
Ditching Pushbutton
Ventilation Controller Reset Switch
Fan Reset Pushbutton
Cargo Air Cond Panel
Pin Programming
Isolation Valves
Extract Fan

SYSTEM DATA ACQUISITION CONCENTRATOR

The ventilation controller provides SDAC 1 and SDAC 2 with temperature indications, valve positions and warning messages through two ARINC buses.

A ventilation controller fault discrete signal is also sent to both SDACs.

CENTRALIZED MAINTENANCE COMPUTER

The ventilation controller is a type 1 system and provides both CMCs with failure and maintenance information.

CMC 1 sends flight information and BITE commands.

SMOKE DETECTION AND CONTROL UNIT

The Smoke Detection and Control Unit transmits aft/bulk smoke and smoke test discrete signals to the ventilation controller.

These two signals are used to control the isolation valves.

AIRCRAFT EMERGENCY CONFIGURATION

Two electrical aircraft emergency configuration signals coming from a relay logic, are used to stop the extract fan, the heating and cooling systems.

DITCHING PUSHBUTTON

The ditching discrete signal is used to close the isolation valves.

VENTILATION CONTROLLER RESET SWITCH

One reset discrete signal is sent to each ventilation controller lane, in order to reset it.

FAN RESET PUSHBUTTON

A fan reset signal is sent to the ventilation controller, in order to reset the extract fan.

CARGO AIR COND PANEL

In case of isolation valve position disagree, the FAULT legend on the isolation valve pushbutton comes on.
When the pushbutton is pressed in, the extract fan receives a power command depending on the relay logic.

If released out, the pushbutton sends an AFT VENT OFF command to the ventilation controller.

PIN PROGRAMMING

One pin input allows the optional aft cargo ventilation system to be activated.

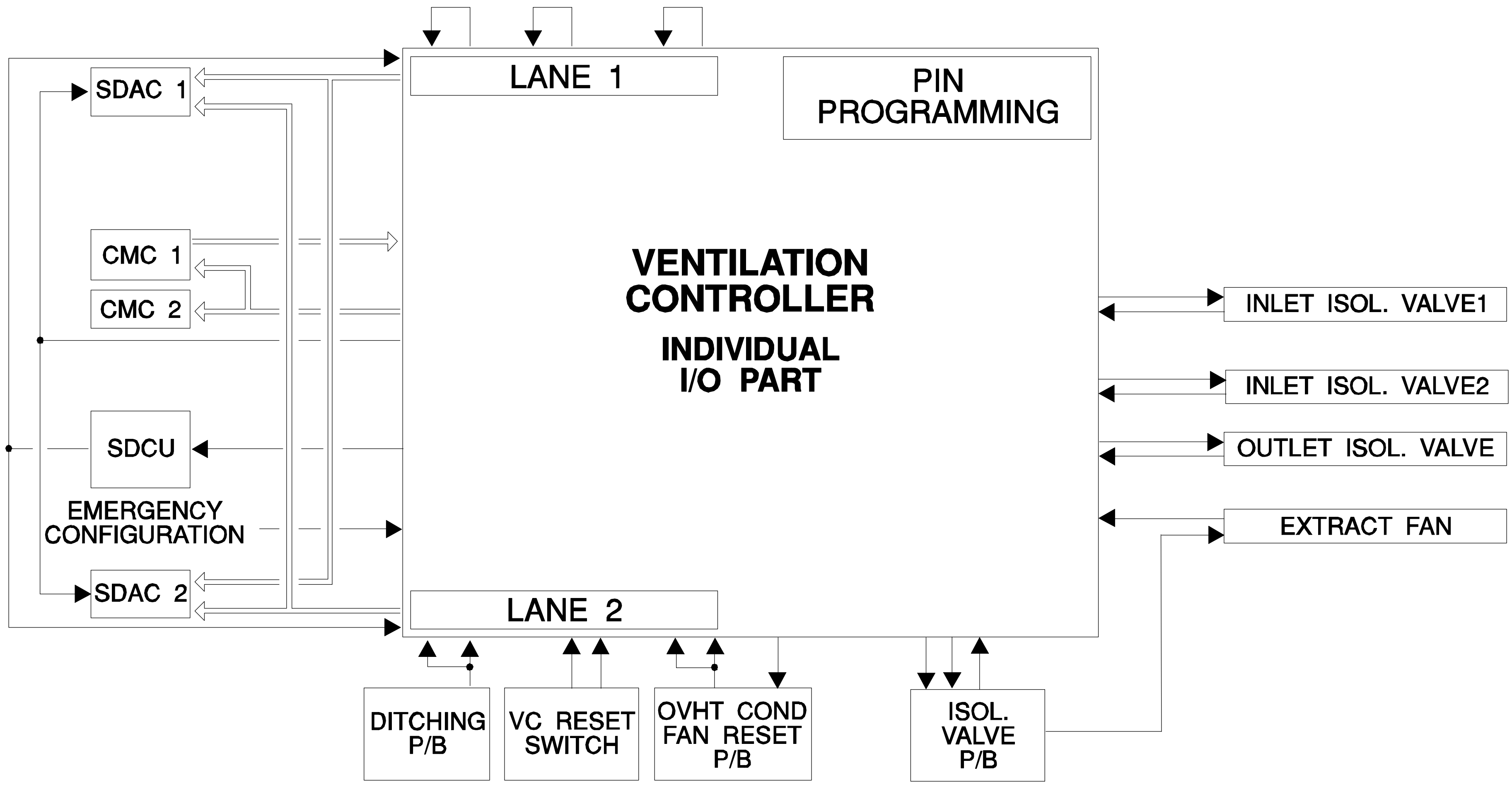
ISOLATION VALVES

Each isolation valve sends the fully open and the fully closed position signals to the ventilation controller for monitoring and control purposes.

EXTRACT FAN

The extract fan sends one power feedback signal and an OVERHEAT signal for monitoring and control purposes.

The extract fan is controlled from the ventilation controller through the ISOLATION VALVE pushbutton.



FQW4200 GE Metric

SUDENT NOTES

FQW4200 GE Metric

BULK CARGO COMPARTMENT VENTILATION / HEATING : SYSTEM PRESENTATION

General
Inlet Isolation Valve
Extraction Fan
Outlet Isolation Valve
Fan Heater (Optional)
Duct and Compartment Temperature Sensors (Optional)

GENERAL

The bulk cargo compartment is ventilated with cabin air by means of an extraction fan. An optional heating system may be fitted on the aircraft.
Heating is then performed by an electrical fan heater.

INLET ISOLATION VALVE

The inlet isolation valve allows cabin air to enter the Bulk cargo compartment through an elbow duct . Control is achieved, via the ventilation controller, by the ISOL VALVES pushbutton switch.
To isolate the cargo compartment, it closes if DITCHING is selected or if smoke is detected in the Bulk or AFT cargo compartment.

EXTRACTION FAN

The extraction fan extracts the compartment air.
The extraction fan operates provided the isolation valves are open.
It stops if smoke is detected in the Bulk or AFT cargo compartment.

OUTLET ISOLATION VALVE

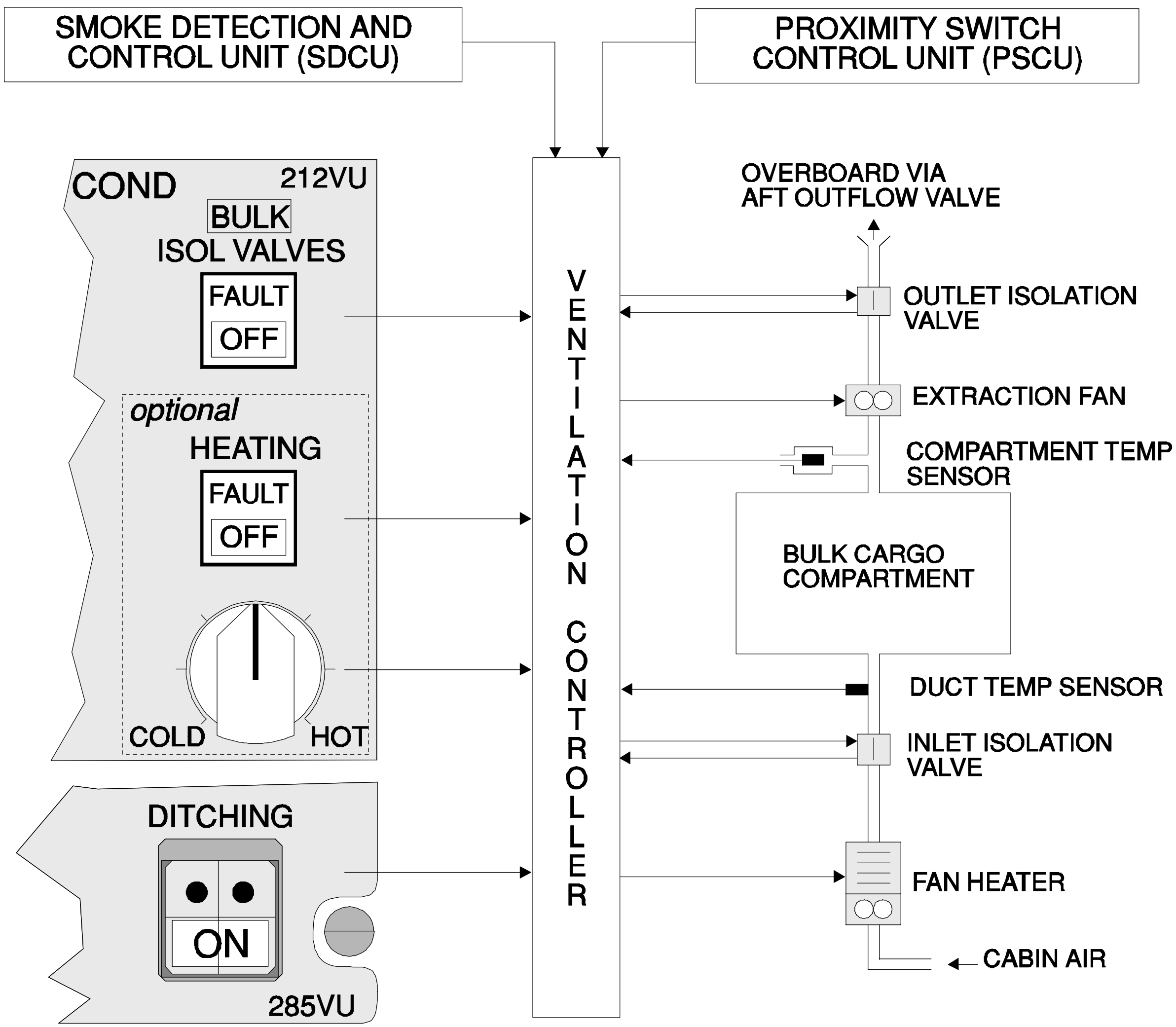
The outlet isolation valve allows air to be sent overboard through the AFT outflow valve. Control is achieved, via the ventilation controller, by the ISOL VALVES pushbutton switch.
To isolate the cargo compartment, it closes if ditching is selected or if smoke is detected in the Bulk or AFT cargo compartment.

FAN HEATER (OPTIONAL)

The optional fan heater is controlled by the Ventilation Controller according to the cockpit panel selection. It operates provided the inlet and the outlet isolation valves are open.
It automatically stops in case of Bulk cargo door open (PSCU), smoke detected in the AFT or Bulk cargo compartment (SDCU) or duct or fan overheat detection.

DUCT AND COMPARTMENT TEMPERATURE SENSORS (OPTIONAL)

If the optional heating system is fitted on the aircraft, temperature sensors are installed for temperature control and duct temperature overheat detection.



The two sensors and the fan heater are optional.

FQW4200 GE Metric

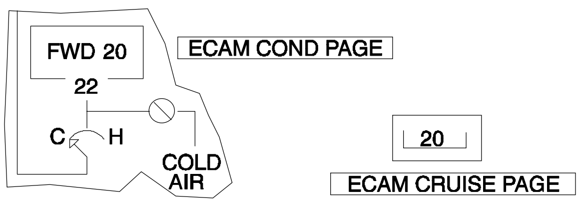
STUDENT NOTES:

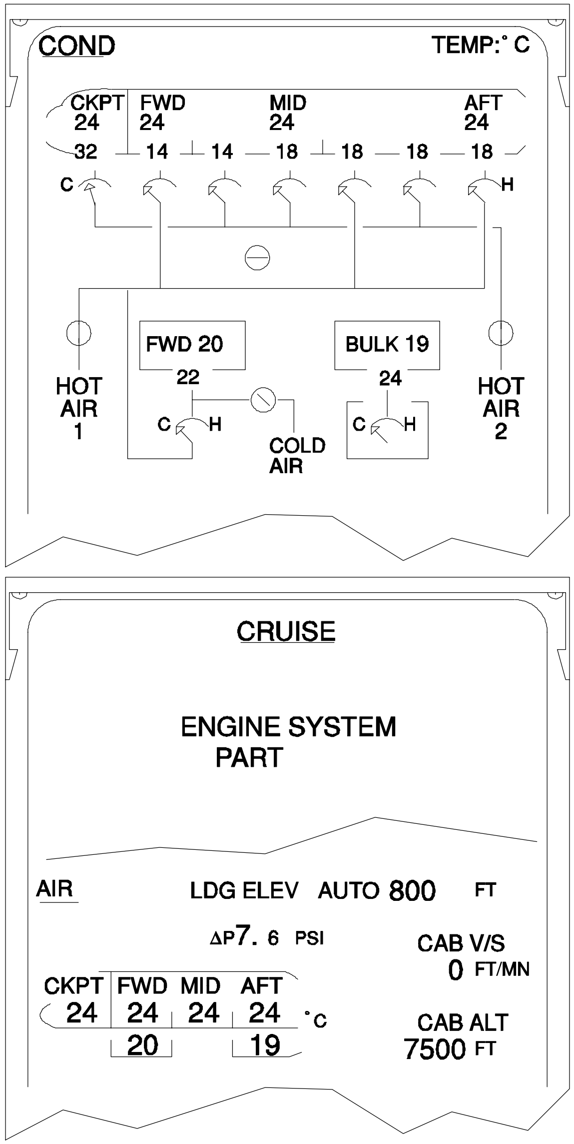
BULK CARGO COMPARTMENT VENTILATION / HEATING : SYSTEM CONTROLS AND INDICATING

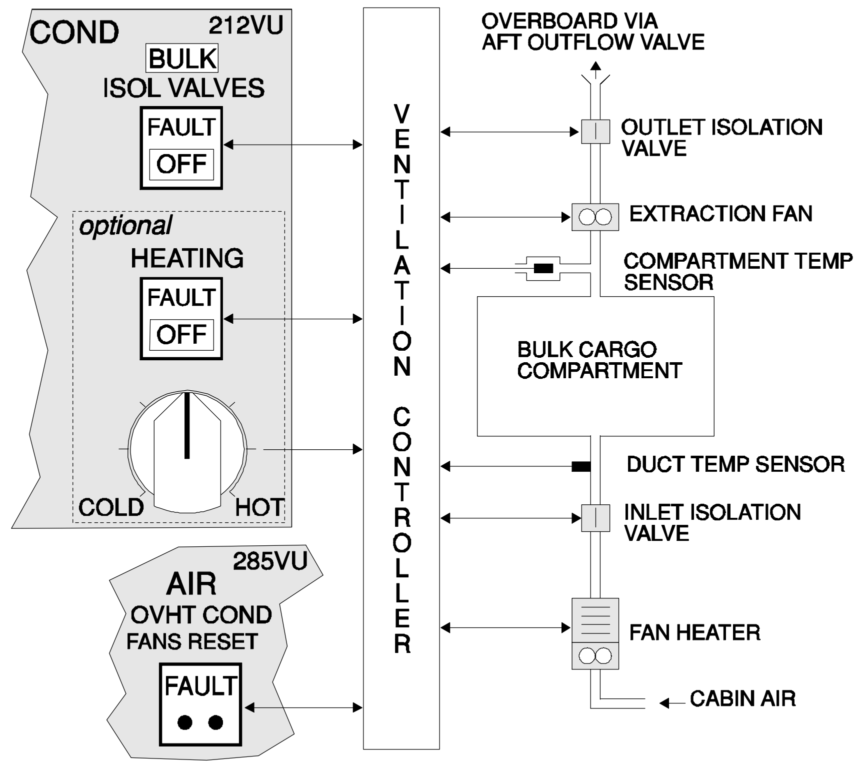
Isol Valves Pushbutton
Fans Reset Pushbutton
Heating P/B
Temperature Selector
Fan Heater Indication
Duct Temperature
Zone Temperature

The indications concerning the bulk cargo compartment temperature control system are displayed on the ECAM COND and CRUISE pages only if the option is fitted on the aircraft and the ventilation controller pinprogrammed.

These indications are displayed on ECAM only if the FWD CARGO TEMP CONTROL is installed.





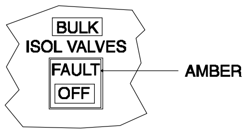


The two sensors and the fan heater are optional.

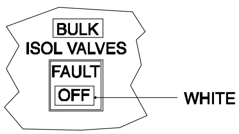
FQW4200 GE Metric

ISOL VALVES PUSHBUTTON

When the isolation valves pushbutton switch is pressed in, the isolation valves open and the extraction fan runs provided there is no smoke detection in the bulk cargo compartment.



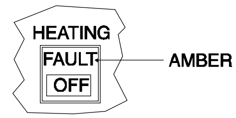
FAULT comes on associated with an ECAM caution when either the inlet or outlet isolation valve is not in agreement with the selected position.



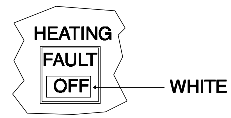
The pushbutton is released out. The valves close and the extraction fan stops.

HEATING P/B

When the heating pushbutton switch is pressed in, the fan heater is activated provided the isolation valves are open.



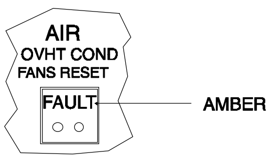
The duct temperature is greater than 88°C (190°F). The overheat condition can be reset provided the duct temperature is lower than 70°C (158°F).



The heating pushbutton is released out and the fan heater stopped.

FANS RESET PUSHBUTTON

The Fan Reset pushbutton indicates an overheat of at least one fan controlled by the ventilation controller and enables the crew to reset it.

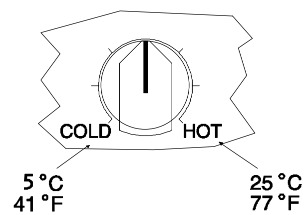


There is an extraction fan or fan heater fan part overheat.

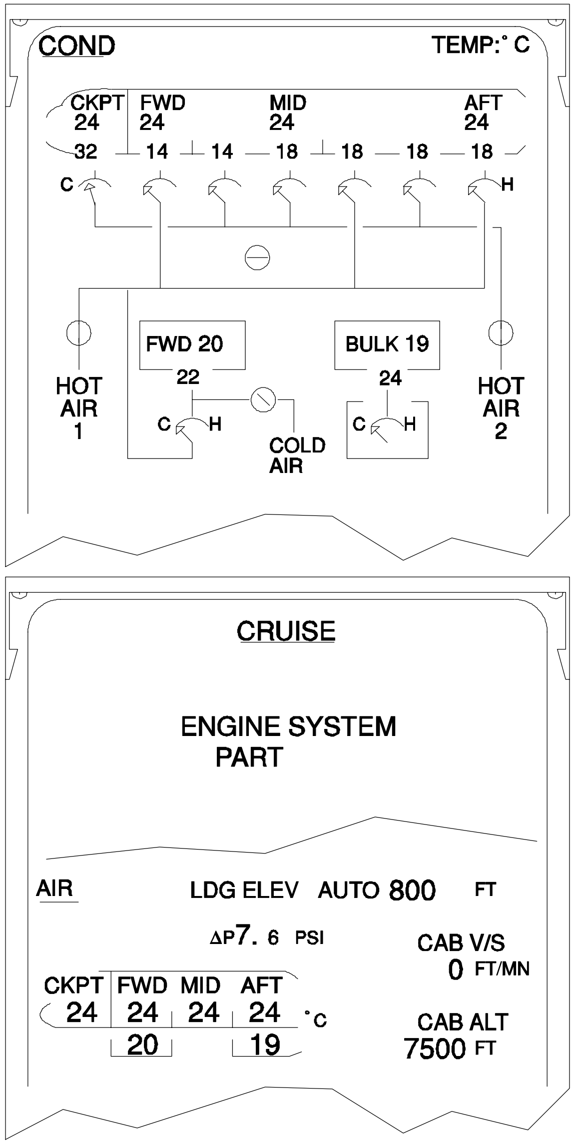
When the P/B is pressed, the fan restarts and the fault light goes off provided the overheat condition has disappeared.

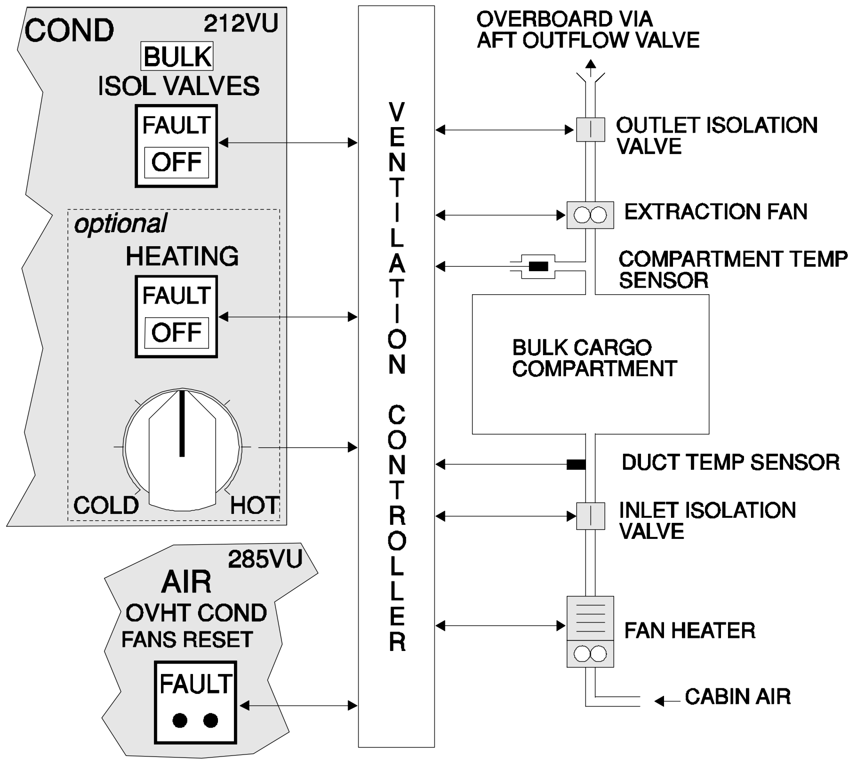
TEMPERATURE SELECTOR

The bulk cargo compartment temperature can be adjusted with the temperature rotary selector.



The temperature regulation is performed by changing the fan heater power supply controlled by the ventilator controller.



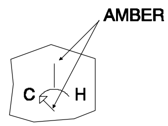


The two sensors and the fan heater are optional.

FQW4200 GE Metric

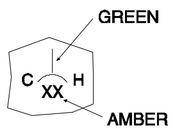
FAN HEATER INDICATION

The arrow representing the bulk cargo fan heater performance is normally displayed in green on the ECAM COND page.



C (COLD) = minimum performance.
H (HOT) = maximum performance.

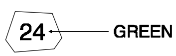
The fan heater has failed.



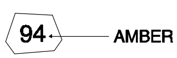
The fan heater performance data is not available.

DUCT TEMPERATURE

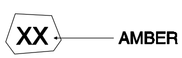
The bulk cargo duct temperature is normally displayed in green on the ECAM COND page.



The duct temperature is lower than 88°C (190°F).



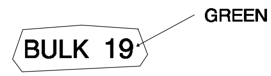
The duct temperature is greater than 88°C (190°F).



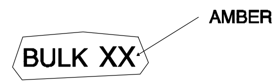
The duct temperature data is not available.

ZONE TEMPERATURE

The bulk cargo compartment temperature is always displayed in green on the ECAM COND page.

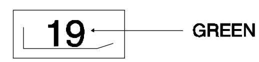


Normal configuration. Temperature varies by steps of 1°C (2°F).

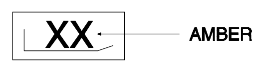


The bulk cargo compartment temperature data is not available.

The bulk cargo compartment temperature is also displayed in green on the ECAM CRUISE page.



Normal configuration. Temperature varies by steps of 1°C (2°F).



The bulk cargo compartment temperature data is not available.

BULK CARGO COMPARTMENT VENTILATION / HEATING : WARNINGS

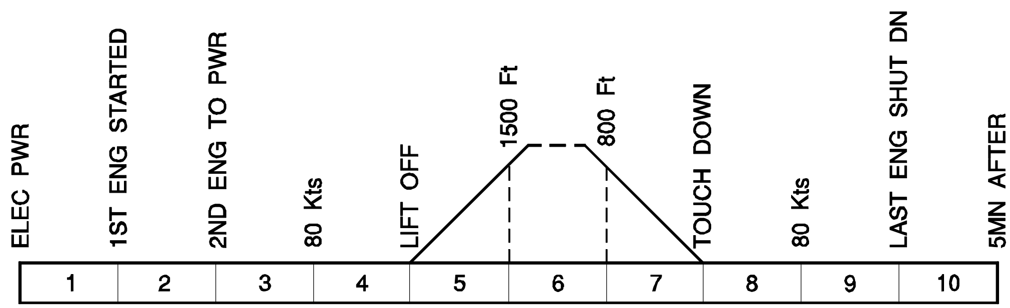
BULK CRG VENT. FAULT
BULK CRG ISOL. FAULT
BULK CRG HEAT FAULT
BULK CRG DUCT OVHT

BULK CRG VENT FAULT

The bulk cargo ventilation extract fan is faulty.

BULK CRG ISOL FAULT

The ventilation is lost in the affected compartment. FAULT light is amber on the respective "ISOL VALVES" pushbutton.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
BULK CRG VENT FAULT	NIL	NIL	NIL	FAN FAULT LIGHT	3, 4, 5, 7, 8
BULK CRG ISOL FAULT	NIL	NIL	NIL	BULK ISOL. VALVE FAULT lt.	3, 4, 5, 7, 8

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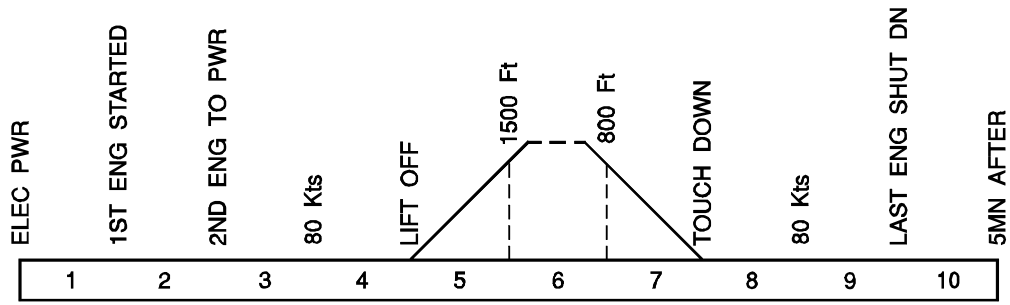
These warnings can only be triggered if the BULK cargo compartment heating system is installed.

BULK CRG HEAT FAULT

The bulk cargo fanheater is inoperative.

BULK CRG DUCT OVHT

When bulk temperature is lower than 70°C, BULK CARGO HOT AIR pushbutton must be set to OFF then ON to reset the system.



E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
BULK CRG HEAT FAULT	NIL	NIL	COND	NIL	3, 4, 5, 7, 8
BULK CRG DUCT OVHT	SINGLE CHIME	MASTER CAUTION	COND	HOT AIR FAULT lt.	3, 4, 5, 7, 8,

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STUDENT NOTES

BULK CARGO COMPARTMENT : VENTILATION SYSTEM COMPONENTS

SAFETY PRECAUTIONS

Before any isolation valve or extract fan removal, please make sure that these circuit breakers are open, safetied, and tagged.

BULK FAN	1HC
EXTC FAN BULK CRG	5HN
CRG VENT CTL L1	2HN
CRG VENT CTL L2	1HN

STUDENT NOTES

BULK CARGO COMPT. ISOLATION VALVES

FIN / ZONE

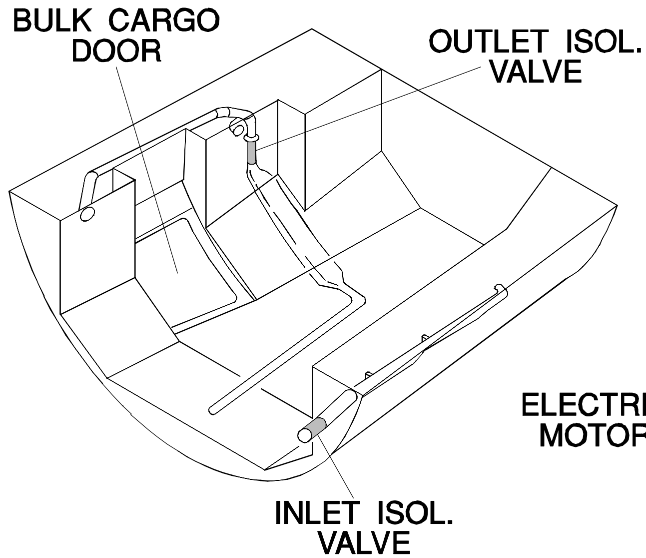
INLET ISOLATION VALVE
FIN : 283HN
ZONE : 161
OUTLET ISOLATION VALVE
FIN : 284HN
ZONE : 162

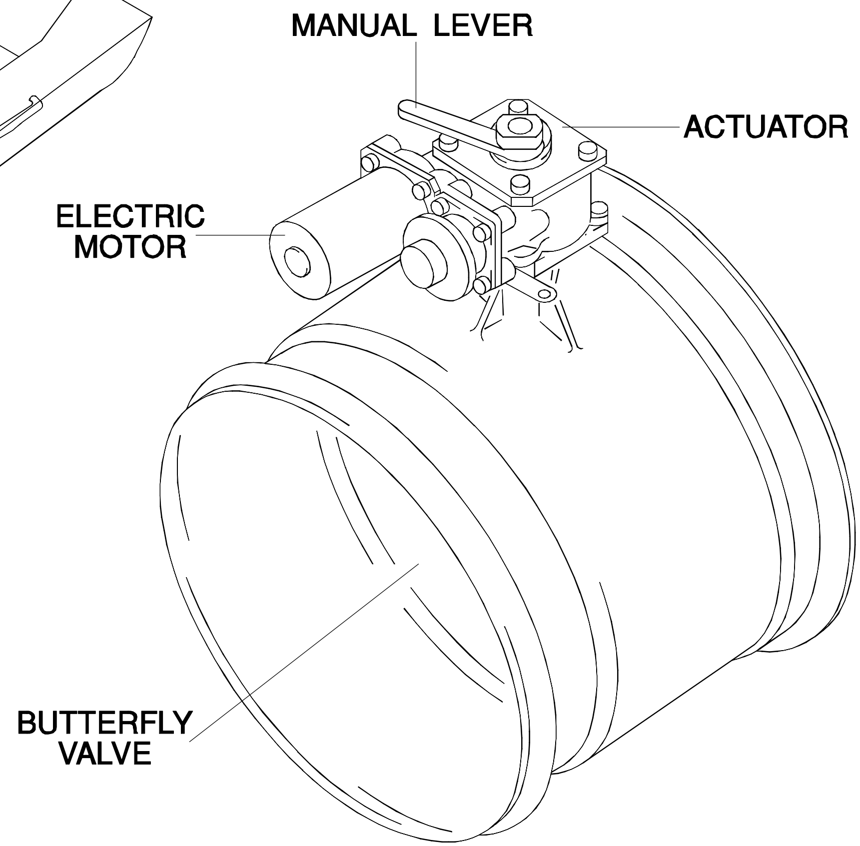
COMPONENT DESCRIPTION

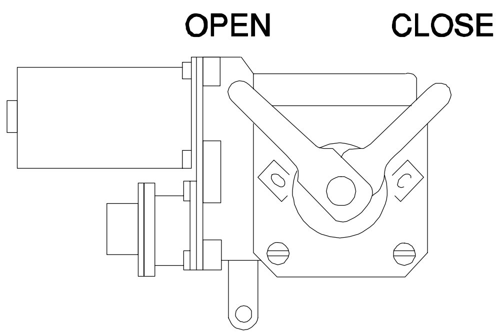
Each of the 2 isolation valves has an electrical motor, an actuator and a butterfly valve. The motor drives the actuator to open or close the butterfly valve. The isolation valves have 2 positions (open or close). The manual lever enables the maintenance staff to see the valve position and to manually change it.

REMOVAL / INSTALLATION

All the isolation valves of the lower deck cargos are interchangeable.
- remove the access panel 151TW for 283HN and 162RW for 284HN.
- torque the clamps within the limits requested in the AMM and make sure the sleeves are properly installed.
- do the operational test of the bulk cargo compartment ventilation system to complete the installation.







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BULK CARGO COMPT. EXTRACT FAN

FIN / ZONE

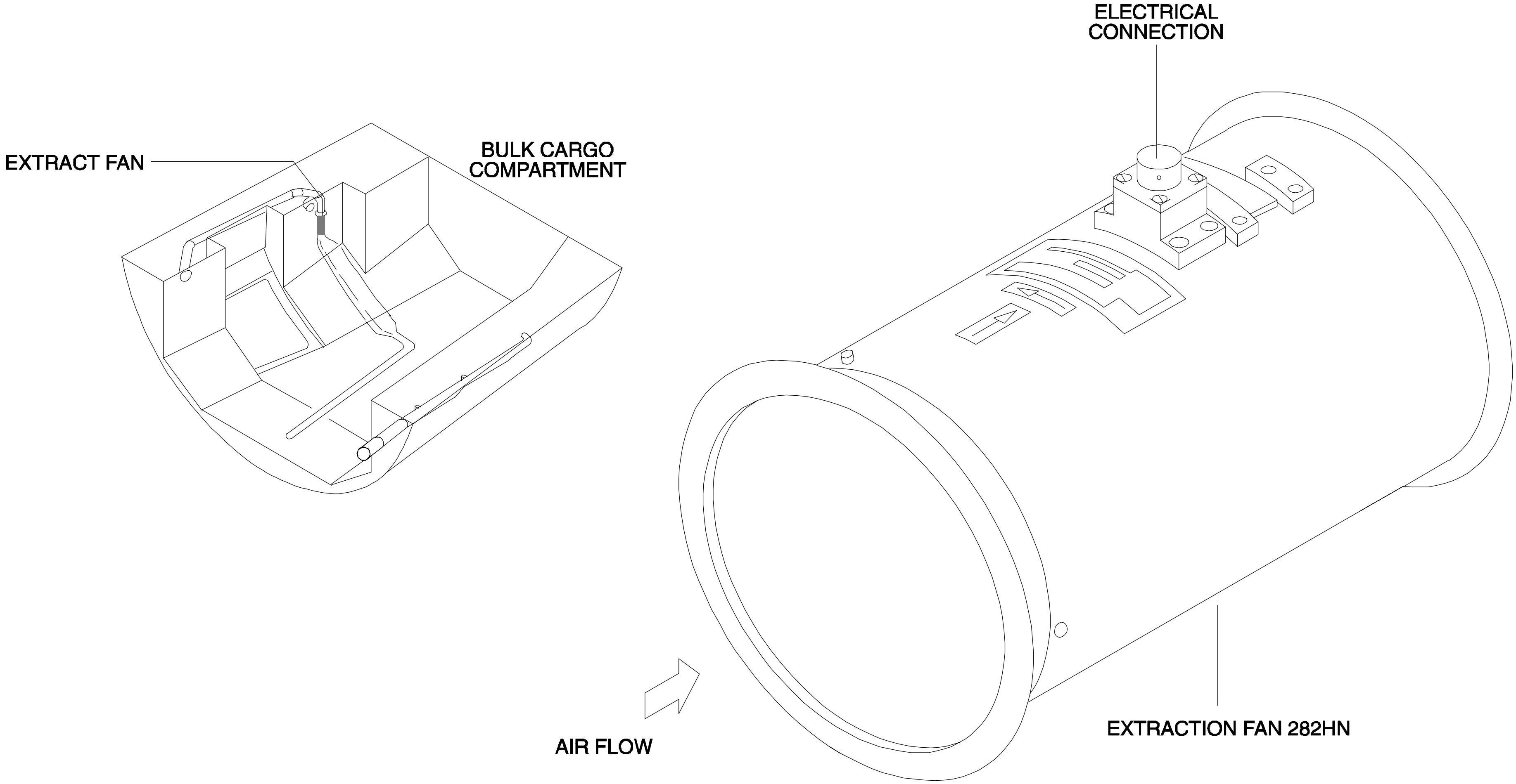
FIN : 282HN
Zone : 162

COMPONENT DESCRIPTION

The extract fan has a 3 phase induction motor (115/200VAC) and a fan wheel with high efficiency blades in a housing. The induction motor drives the fan wheel. Thermal switches are installed for overheat protection and reset is ensured from the cockpit by the OVHT COND FANS RESET P/B. Arrows on the housing show the direction of airflow through the extract fan and the rotation direction of the fan wheel. If the fan wheel breaks, the housing is sufficiently strong to contain the broken pieces.

REMOVAL / INSTALLATION

- Get access to the bulk cargo compartment.
- Remove the access panel 162RW.
- Disconnect the electrical connector.
- Loosen the clamp and move the sleeve from the extract fan.
- Remove the V-clamp.
- Hold the extract fan and remove the support clamp.
- Remove the extract fan.
- Do the operational test of the lower cargo compartment ventilation to complete the installation.



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STUDENT NOTES

BULK CARGO COMPARTMENT : HEATING SYSTEM COMPONENTS

SAFETY PRECAUTIONS

Open safety and tag these circuit breakers :

BULK TEMP SENSORS

-722 VU CRG VENT CTL L1	2HN
-742 VU CRG VENT CTL L2	1HN

BULK CRG FAN HEATER

-718 VU BULK FAN	1HC
-722 VU CRG VENT CTL L1	2HN
-742 VU CRG VENT CTL L2	1HN

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STUDENT NOTES

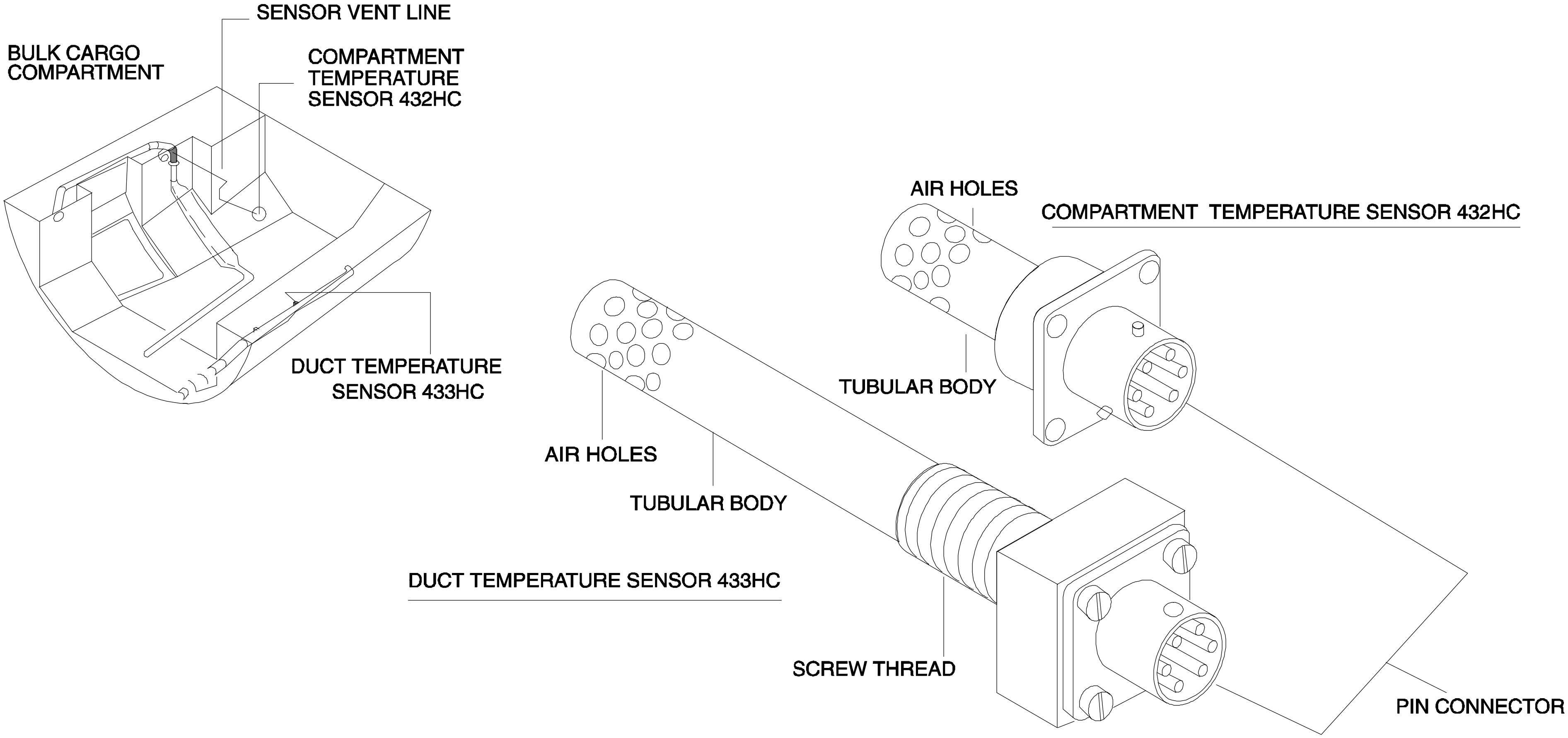
BULK CC TEMP SENSORS

FIN / ZONE

	COMPARTMENT	DUCT
FIN :	432HC	433HC
Zone :	162	161

COMPONENT DESCRIPTION

There are two temperature sensors in the bulk cargo compartment. Each sensor has two thermistors in a tubular body and each thermistor is dedicated to one of the two lanes of the ventilation controller.
Each sensor body has holes to enable air to flow through. The bulk CC compartment temperature sensor is ventilated by the extract fan for a better accuracy of measurements.



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BULK CC FAN HEATER

FIN / ZONE

FIN : 431HC
Zone : 161

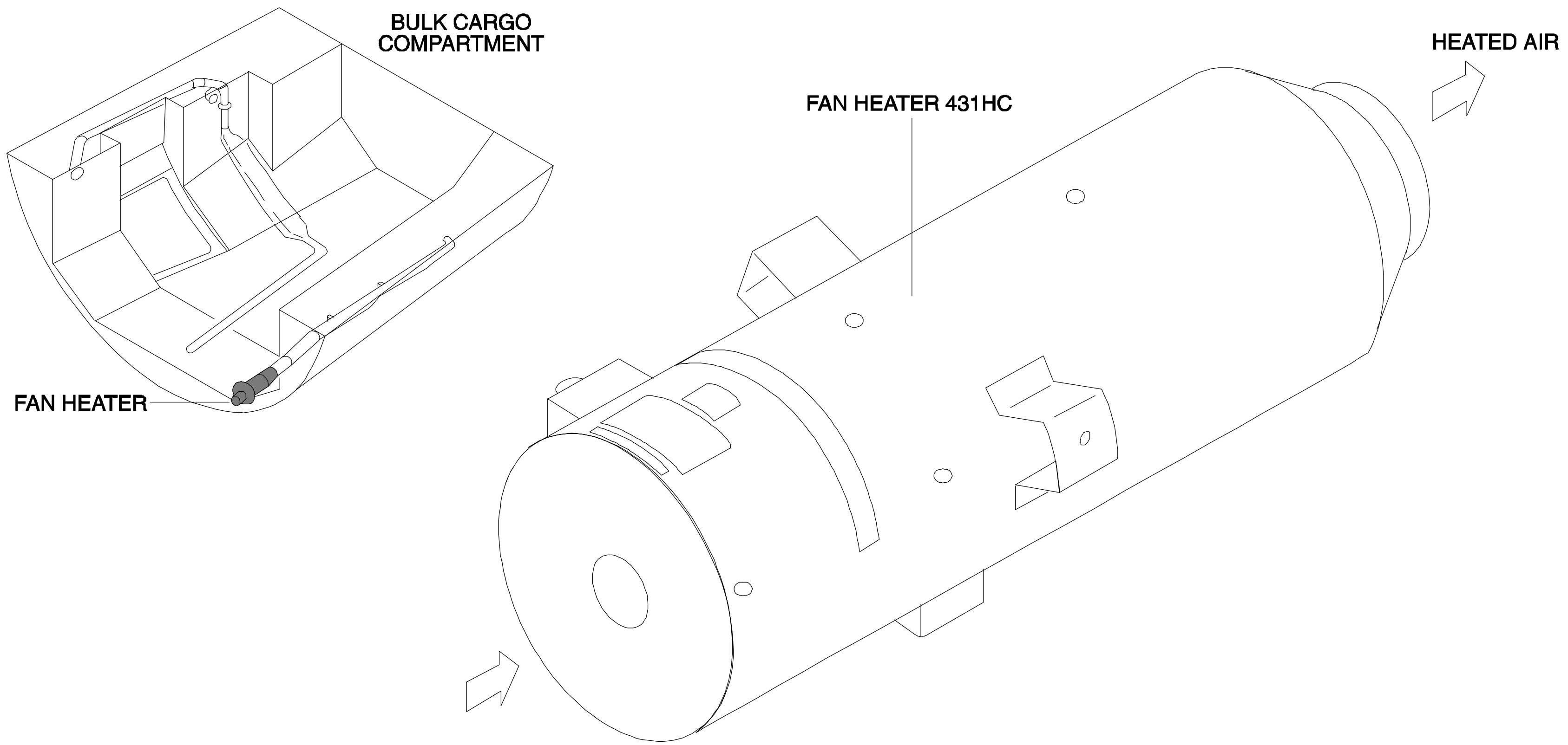
COMPONENT DESCRIPTION

The fan heater is supplied with electrical power when the safety relay is energized. The heater power and the fan power are switched via solid state relays which are located inside the fan heater.
The heater is built up of two seperate groups of heating elements
One group of heating elements has a variable heating performance up to 3KW. The other group has a fixed heating performance of 3KW. This satisfies all ranges of temperature demands in this compartment. The fan heater PWR fan switches off 120 sec. after the fan PWR heater is switched off. In case of fan part or heater part OVHT, thermal switches cut off the total fan heater power. Both parts are switched off simultaneously and reset is ensured from the cockpit by the OVHT COND FANS RESET P/B.

REMOVAL / INSTALLATION

- Get access to the bulk cargo compartment.
- Remove the access panel 151TW.
- Disconnect the electrical connector.
- Remove the bonding strap.
- Loosen the clamp.
- Hold the fan heater and remove the screws and washers.
- Remove the fan heater from the housing.

Do the operational test of the bulk cargo heating system after the fan heater installation is completed.



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STUDENT NOTES

BULK CARGO COMPARTMENT VENTILATION / HEATING : INTERFACES

System Data Acquisition Concentrator (SDAC)
Centralized Maintenance Computer (CMC)
Proximity Switch Control Unit (PSCU)
Smoke Detection Control Unit (SDCU)
Aircraft Emergency Configuration
Ditching Pushbutton
Ventilation Controller (VC) Reset Switch
Fan Reset Pushbutton
Cargo Air Conditioning Panel
Pin Programming
Sensors (optional)
Isolation Valves
Fan Heater (optional)
Extract Fan

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SYSTEM DATA ACQUISITION CONCENTRATOR (SDAC)

The ventilation controller provides SDAC 1 and SDAC 2 with temperature indications, valve positions and warning messages through two ARINC buses.

A ventilation controller fault discrete signal is also sent to both SDACs.

CENTRALIZED MAINTENANCE COMPUTER (CMC)

The ventilation controller is a type 1 system and provides both CMCs with failure and maintenance information.

CMC 1 sends flight information and BITE commands.

PROXIMITY SWITCH CONTROL UNIT (PSCU)

The Proximity Switch Control Unit transmits the bulk cargo door position to the ventilation controller, in order to control the fan optional heater.

SMOKE DETECTION CONTROL UNIT (SDCU)

The Smoke Detection and Control Unit transmits bulk compartment smoke test discrete signals to the ventilation controller.

These two signals are used to control :

- the isolation valves
- the optional fan heater
- the extract fan

AIRCRAFT EMERGENCY CONFIGURATION

Two electrical aircraft emergency configuration signals coming from a relay logic are used to stop the extract fan, and the optional fan heater.

DITCHING PUSHBUTTON

The ditching discrete signal is used to close the isolation valves.

VENTILATION CONTROLLER (VC) RESET SWITCH

One reset discrete signal is sent to each ventilation controller lane, in order to reset it.

FAN RESET PUSHBUTTON

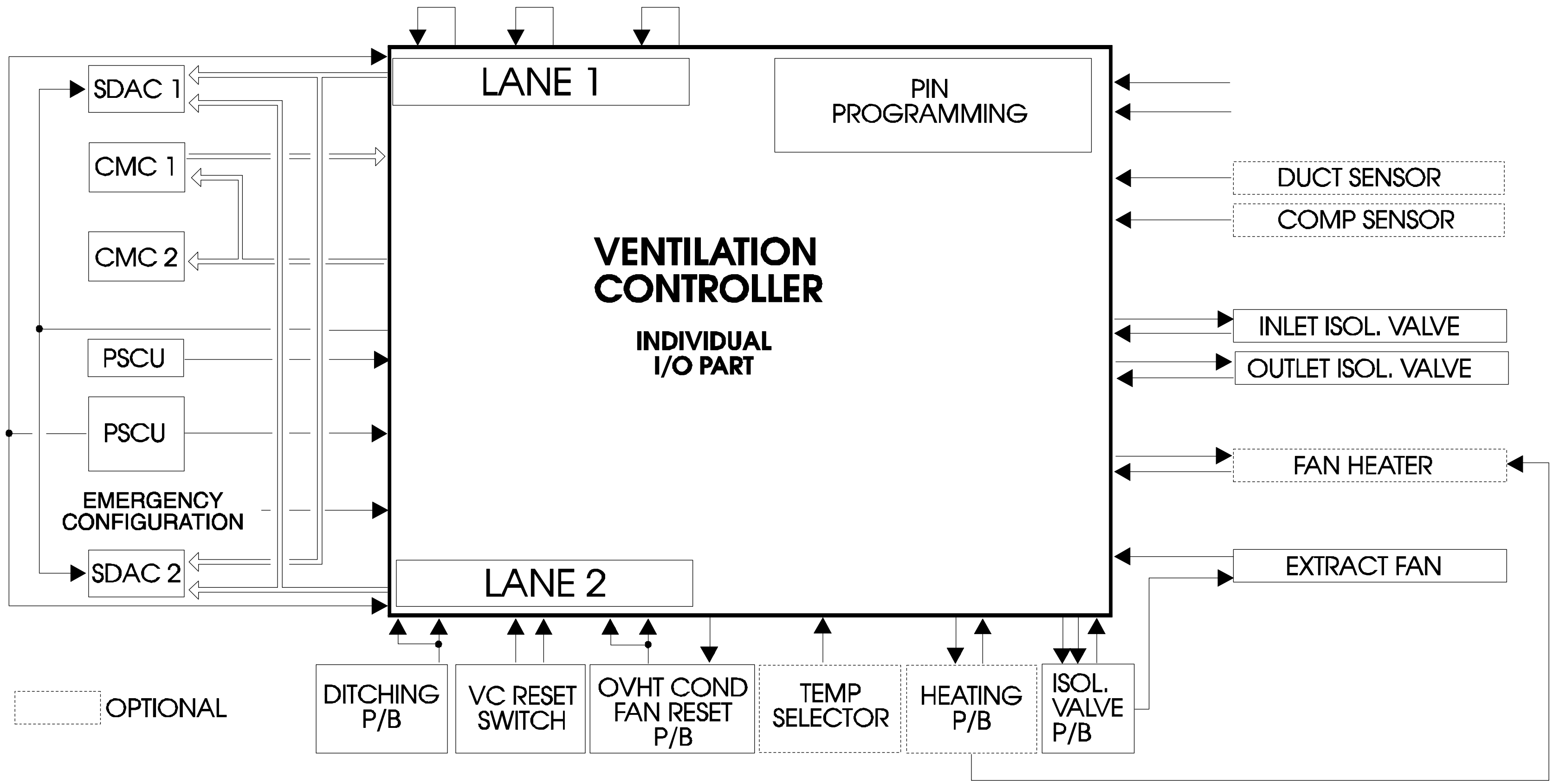
A fan reset signal is sent to the ventilation controller, in order to reset the extract fan and the fan part of the optional fan heater.

CARGO AIR CONDITIONING PANEL

In case of ISOLATION VALVE position disagree, a FAULT signal is sent to the pushbutton.
When the pushbutton is pressed in, the EXTRACT FAN receives a power command according to the logic.
If released out, the P/B sends a BULK VENT OFF command to the ventilation controller.
In addition, if the optional bulk cargo compartment heating system is fitted on the aircraft, a temperature selector sends three analog signals to the ventilation controller for the fan heater control.
A heating pushbutton switch receives a duct overheat signal and sends a discrete signal to deactivate or reset the fan heater.

PIN PROGRAMMING

Two pin inputs allow the basic bulk ventilation system and the optional bulk heating system to be activated.



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SENSORS (OPTIONAL)

Each sensor sends two analog signals for temperature control and monitoring.

ISOLATION VALVES

Each isolation valve sends the fully open and fully closed position information to the ventilation controller for monitoring and ventilation system control.

FAN HEATER (OPTIONAL)

The fan heater sends overheat, power feedback and rotation signals for fan heater control and monitoring.

The fan heater is energized from the ventilation controller through the heating pushbutton and is directly controlled from the ventilation controller.

EXTRACT FAN

The Extract Fan sends a power feedback signal and an OVERHEAT signal, for monitoring and control purposes.

The extract fan is controlled from the ventilation controller through the ISOLATION VALVE pushbutton.

PRESSURIZATION :
SYSTEM DESIGN PHILOSOPHY

GENERAL

The pressurization system ensures a cabin altitude safe and compatible with crew and passenger comfort.
Pressurization is performed by controlling the amount of air discharged overboard through two outflow valves.

DESIGN PHILOSOPHY

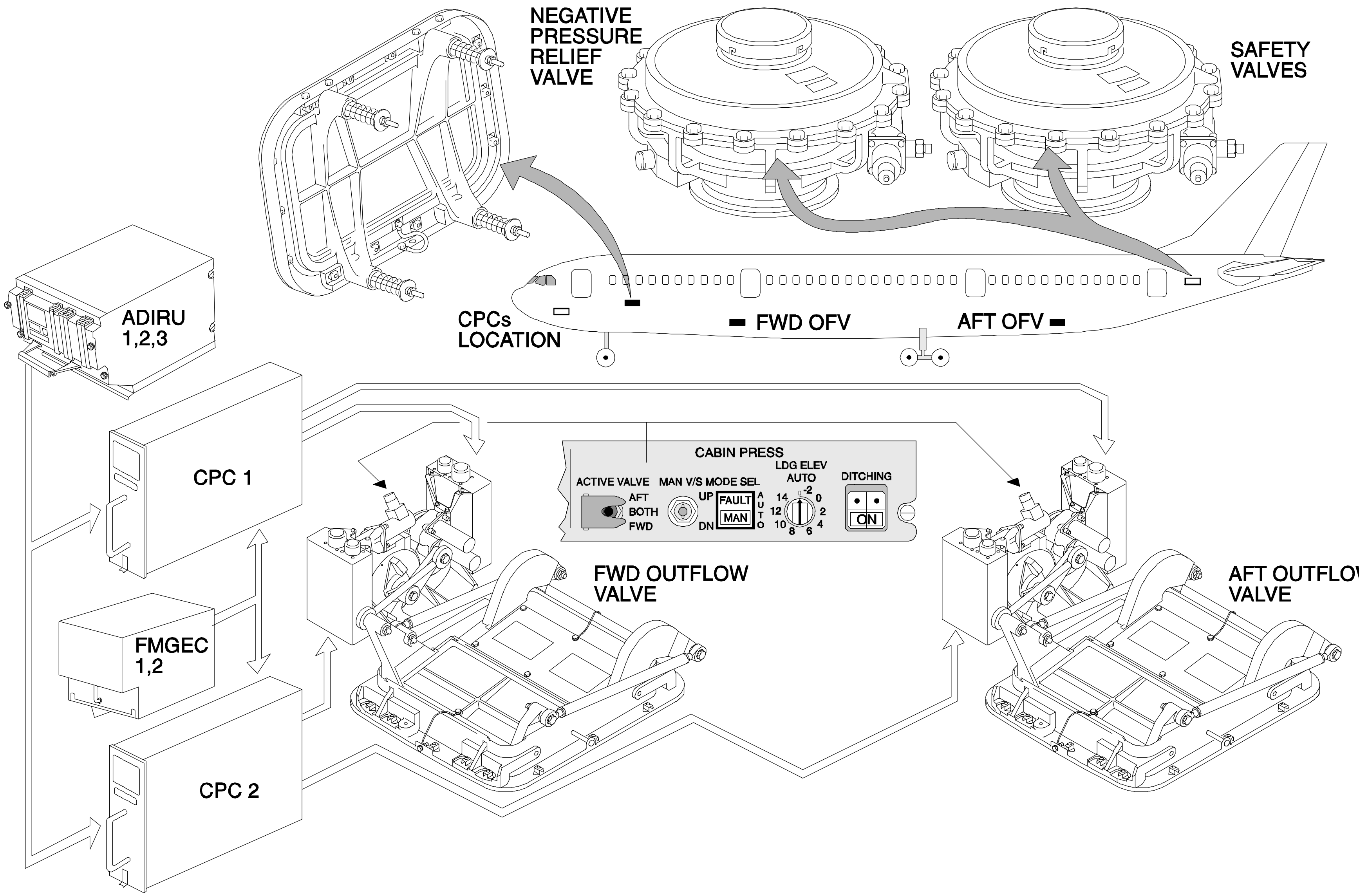
The system has two identical and independent automatic controllers.
Only one controller operates at a time, the other is in active stand-by.

In normal condition, the system operation is fully automatic.
The operation of the automatic cabin pressure control depends on pre-programmed control laws and information from the ADIRUs.
The automatic cabin pressure control is achieved from internal schedules, or external schedules if the FMGES inputs are available, such as top of climb.

The CABIN PRESS panel enables manual cabin pressure control in case of failure of both automatic systems. The FWD and AFT valves may be simultaneously or independently manually controlled.

A mixed mode is available mainly in case of cabin compartment smoke evacuation. In mixed mode, one outflow valve may be manually controlled whereas the other one remains under automatic control (active cabin pressure controller).

Two safety valves are installed on the aft pressure bulkhead to prevent excessive positive or negative differential pressure.
Due to the large volume of the fuselage, a negative pressure relief valve assists the safety valves to prevent negative differential pressure.



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STUDENT NOTES:

PRESSURIZATION : SYSTEM PRESENTATION

Cabin Pressure Controllers
Outflow Valves
Safety Valves
Negative Pressure Relief Valve
Cabin Pressure Altitude Envelope

CABIN PRESSURE CONTROLLERS

There are two interchangeable controllers which are identified as CPC 1 and CPC 2 by means of a pin programming.

Each controller has an automatic and manual part which are functionally and electronically independent of each other.

One controller operates the system at a time according to flight profile data and aircraft configurations.
The second controller is in active stand-by with automatic change over after each flight or in case of failure of the active one.

CPC inputs :

- flight profile data
(FMGES, ADIRU, OMS).
- aircraft configurations
(EIVMU, LGCIU, PSCU, ECS).

CPC outputs :

- for indicating and monitoring
(ECAM, ECS, OMS).

When manual mode is used, controller 1 manual part operates only as a back up indication circuit processing outputs for indicating and monitoring.

CPC 1 manual part outputs :

-for monitoring and indicating
(ECAM, ECS, OMS).

CPC 2 manual part is not used.

OUTFLOW VALVES

In automatic mode, both outflow valves are controlled by the operating controller.

The two outflow valves are of double flap and motor driven type.

In automatic operation, each outflow valve is operated by electrical motor 1 or motor 2 depending on operating controller.

Motor 1 is controlled by controller 1.
Motor 2 is controlled by controller 2.

Two electronic actuators ensure the interface with controllers.

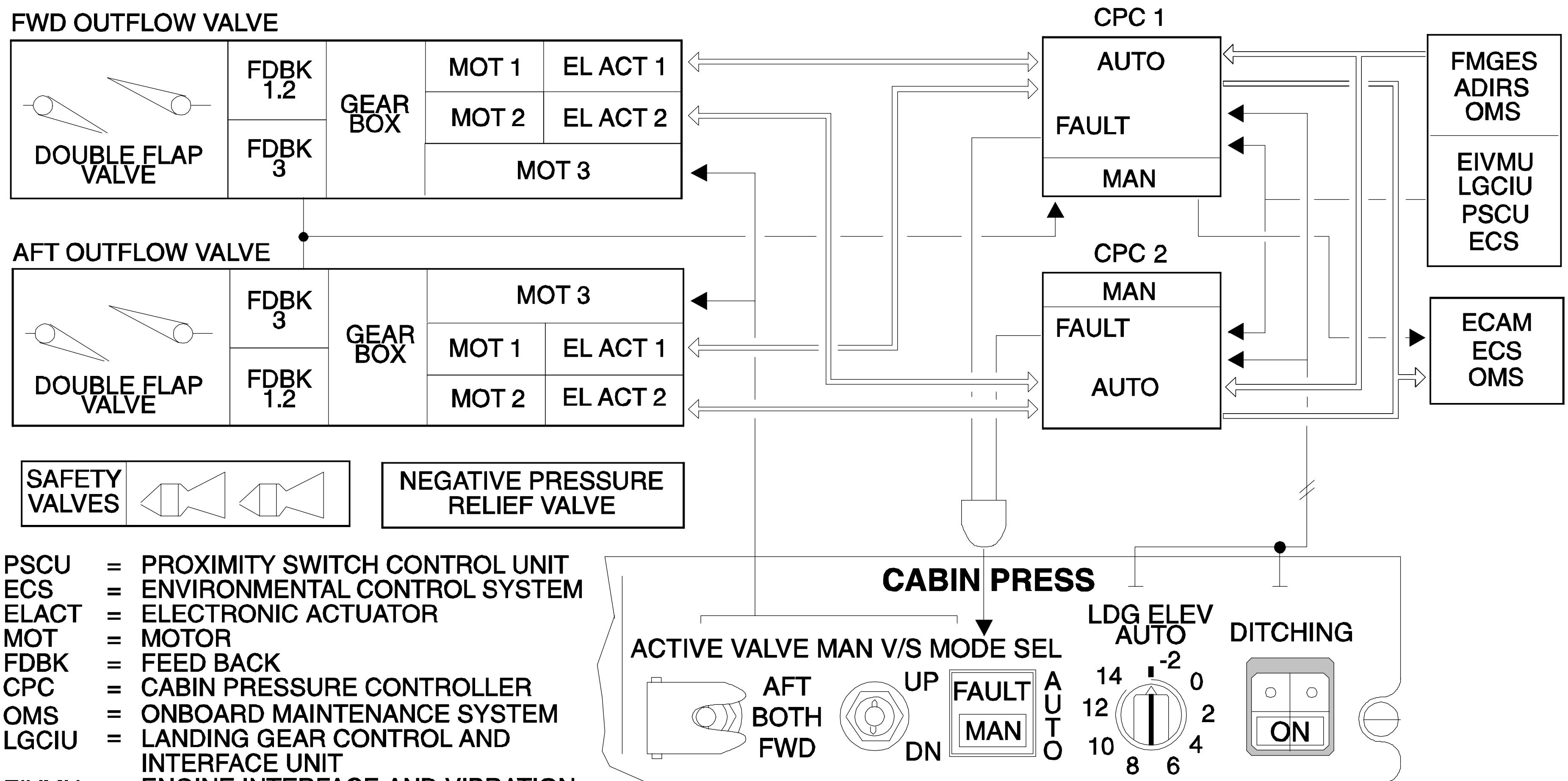
A pressure switch which operates independently from the automatic operation, is installed in each electronic actuator.
It closes the applicable outflow valve in case of cabin altitude above 15000 Ft.

Motor 3 is controlled from the cabin pressure panel by the MAN V/S toggle switch when MANUAL mode is selected on the MODE SEL pushbutton.

Both valves may be independently or simultaneously selected by use of the ACTIVE VALVE selector.
If only one outflow valve is manually selected, the other one remains under the active CPC control (mixed mode).

Automatic mode signals are used by the corresponding electronic actuator.

Manual mode feedback (N°3) signal is directly sent to controller 1 manual part for outflow valve position indication.
Controller 2 manual part is not used.



PSCU = PROXIMITY SWITCH CONTROL UNIT
ECS = ENVIRONMENTAL CONTROL SYSTEM
ELACT = ELECTRONIC ACTUATOR
MOT = MOTOR
FDBK = FEED BACK
CPC = CABIN PRESSURE CONTROLLER
OMS = ONBOARD MAINTENANCE SYSTEM
LGCIU = LANDING GEAR CONTROL AND INTERFACE UNIT
EIVMU = ENGINE INTERFACE AND VIBRATION MONITORING UNIT
FMGES = FLIGHT MANAGEMENT GUIDANCE AND ENVELOPE SYSTEM

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SAFETY VALVES

The safety valves prevent excessive positive or negative differential pressure in the fuselage. They open when the differential pressure exceeds 8.85 PSI or goes below -1 PSI.
They are installed on the rear pressure bulkhead above the aircraft flotation line.

NEGATIVE PRESSURE RELIEF VALVE

The negative pressure relief valve assists the safety valves to prevent negative differential pressure in the cabin. It shall start to open between -0.26 and -0.36 PSI.
It is installed below the floor level aft of left door number 1, above the floating line.

CABIN PRESSURE ALTITUDE ENVELOPE

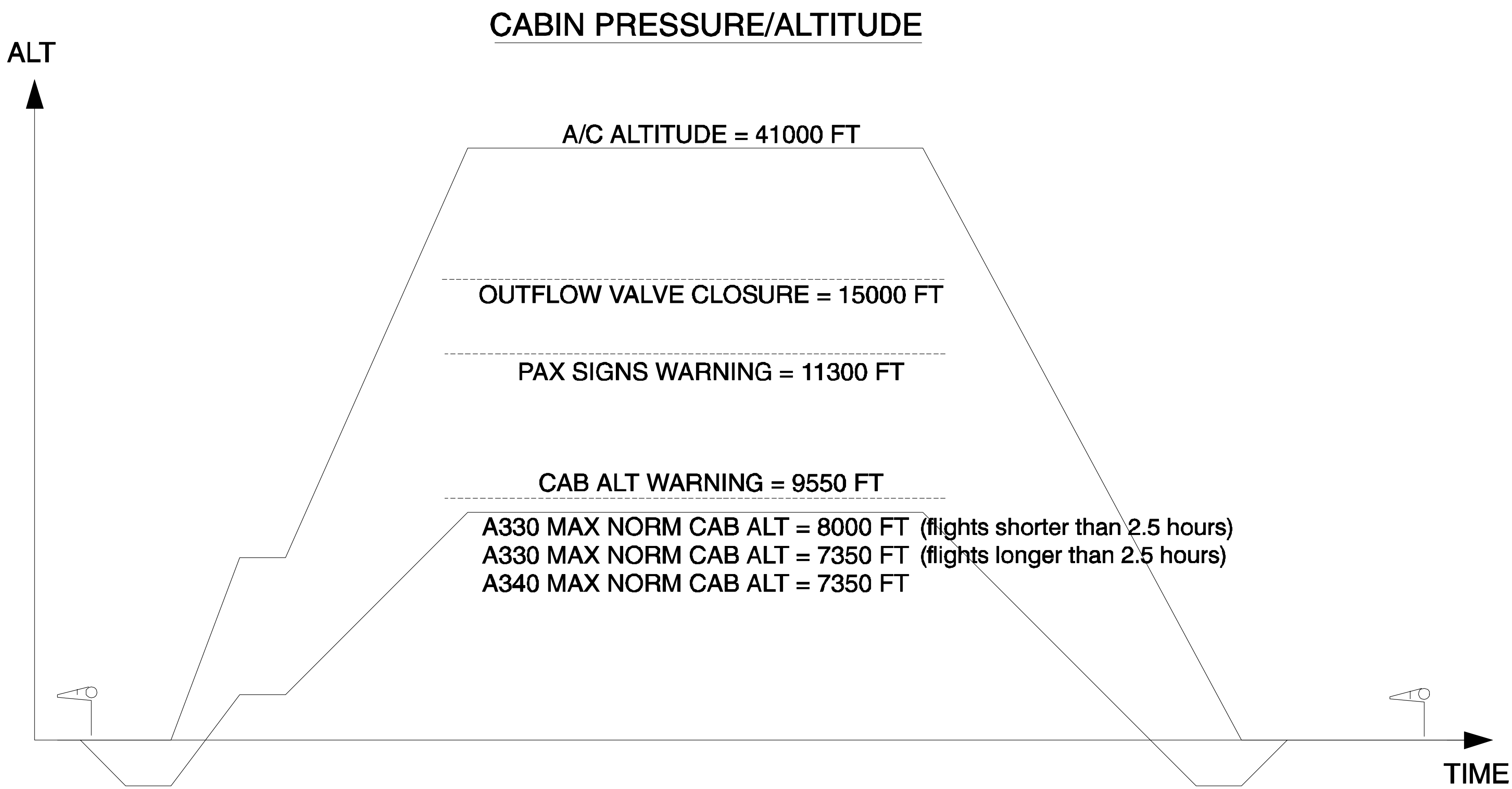
The A340 normal cabin altitude is limited to 7350 feet with a differential pressure of 8.60 psi for an aircraft altitude of 41000 feet.

The A330 normal cabin altitude depends on the flight duration.
It is limited for an aircraft altitude of 41000 feet to :

- 8000 Feet, whith a differencial pressure of 8.32 psi for flights shorter than 2.5 hours,
- 7350 Feet, whith a differencial pressure of 8.60 psi for flights longer than 2.5 hours.

If cabin altitude reaches 9550 Ft, the master warning comes on, and at 11300 Ft, passenger signs are activated.

In each outflow valve, a safety device closes the valve when the cabin altitude reaches 15000 Ft.



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STUDENT NOTES:

PRESSURIZATION :
SYSTEM CONTROLS AND INDICATING

Active Valve Selector
MAN V/S Toggle Switch
MODE SEL P/B Switch
Landing Field Elevation Selector
Ditching P/B Switch
CPC Reset Switches

ACTIVE VALVE SELECTOR

The ACTIVE VALVE selector allows the FWD or AFT outflow valves to be independently or simultaneously controlled in manual mode.

BOTH: Normal and guarded position. Both valves are controlled.
FWD: The FWD outflow valve is manually controlled whereas the AFT outflow valve remains under automatic control.
AFT: The AFT outflow valve is manually controlled whereas the FWD outflow valve remains under automatic control.

MAN V/S TOGGLE SWITCH

The MAN V/S toggle switch, spring loaded to neutral, allows the selected active valve to be manually operated.

UP: Cabin altitude increases, the valve(s) opens.
DN: Cabin altitude decreases, the valve(s) closes.

MODE SEL P/B SWITCH

The MODE SEL pushbutton switch is used to select manual or automatic operation. When it is released out, the outflow valves are automatically controlled by the active system.
The FAULT light comes on amber, associated with an ECAM caution when both systems are faulty.
When the MODE SEL pushbutton switch is pressed in, the MAN legend comes on white and the FAULT light goes off.
The outflow valve(s) can be manually operated using the MAN V/S toggle switch.

LANDING FIELD ELEVATION SELECTOR

The landing field elevation selector enables the flight crew to choose either the Flight Management Guidance and Envelope Computer as the source of landing field elevation by selecting AUTO position, or to manually set it by selecting one of the other positions.
The landing field elevation must be manually set in case of FMGEC failure.
The selectable value varies from -2000 to 14000 feet.

DITCHING P/B SWITCH

When the DITCHING pushbutton is pressed in, the active CPC sends a closure signal to the outflow valves. However it has no effect if the outflow valves are manually controlled. It is possible to select DITCHING on ground.
In ditching configuration, the following valves close:

- the emergency ram air inlet
- the overboard valve
- the BULK cargo compartment isolation valves
- the Flow Control Valves.

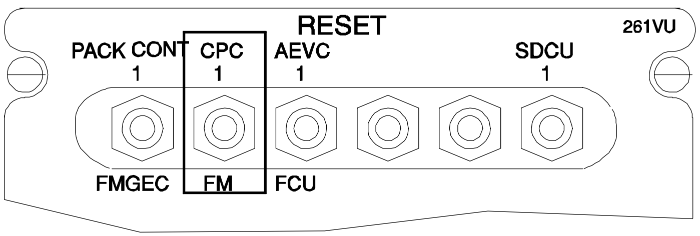
The recirculation fans stop also.

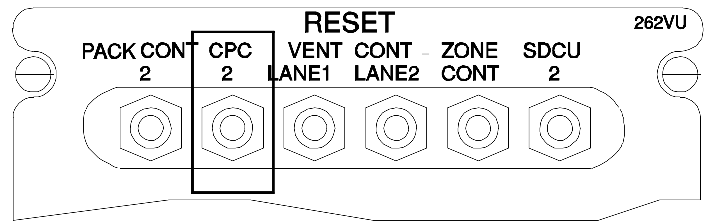
Additionally some optional valves shall close if fitted on the aircraft.

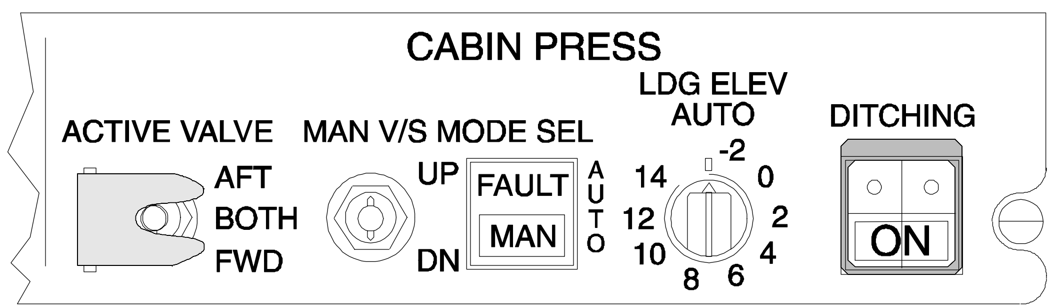
- the skin valve (avionics ground cooling system)
- the FWD cargo compartment isolation valves
- the cold air valve (FWD cargo compartment temperature control system)
- the AFT cargo compartment isolation valves.

CPC RESET SWITCHES

A reset switch is provided for each controller.
Reset is performed by pulling and pushing the corresponding CPC reset switch.







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STUDENT NOTES

PRESSURIZATION: FLIGHT PROFILE

Ground
Take-off
Climb
Cruise
Descent
Ground

Landing field elevation (LFE) to AUTO, controller 1 active.
Take off altitude=500 ft(QNH).
Landing altitude=800 ft.

Note: to display the LFE on the ECAM when the Landing Field Elevation Selector (LFES) is set to AUTO, LFE must be received from the Flight Management Guidance and Envelope Computers.

GROUND

On ground, the outflow valves are fully open to ensure that the cabin is depressurized.

Ground signals:
Landing gear 1 or 2 compressed.

The Avionics Equipment Ventilation Computer closes the overboard valve and the optional skin valve, when engine 1 or 2 is running.

TAKE-OFF

The cabin is prepressurized as soon as power is set to take off to prevent a pressure surge during rotation.

Prepressurization authorization signals:
- Engine 1 and 2 set to take off power
- Main shock absorber 1 or 2 compressed
- Doors closed.

The active Cabin Pressure Controller controls the outflow valves to regulate a fixed cabin rate of descent.

The cabin Vertical Speed is 500 feet per minute down until the differential pressure reaches 0.1 psi.

CLIMB

The pressurization is initiated at take-off.
The CPC always switches to CLIMB INTERNAL mode for about 30 seconds to allow FMGEC data validation before going to CLIMB EXTERNAL mode.

During this data validation, the FMGEC sends, among other things, the remaining flight time to destination to the CPC.
This flight duration is computed from the flight plan entered by the crew and used for the maximum normal cabin differential pressure set-up.

Climb Internal switching:
- Engine 1 or 2 set to Take Off power and Main shock absorbers extended.

After 30 seconds, if FMGEC data is validated, the CPC switches to CLIMB EXTERNAL mode.

Pressure control is based on the FMGES inputs taking into account top of climb and planned aircraft cruise altitude.

During climb the cabin altitude increases at a constant rate, up to the top of climb.

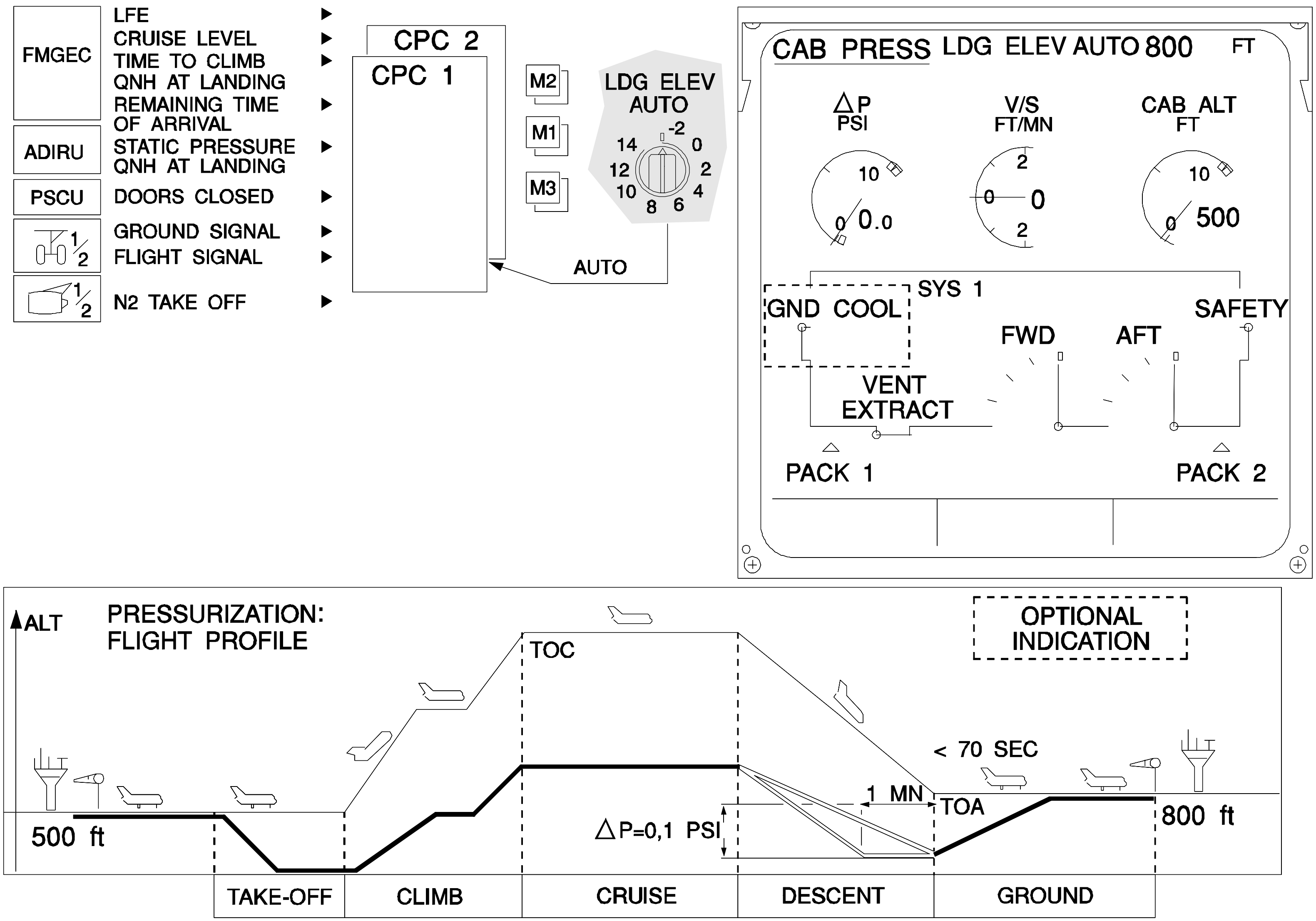
Cabin vertical speed is limited to 1000 ft/mn.

In case of long level off, the system reverts to CLIMB INTERNAL mode.

Note: ABORT mode is selected below A/C altitude of 8000 ft if descent rate is >2000 ft/mn for 30 seconds. The CPC processes an Internal schedule in order to land with a ΔP of 0.1 psi.

If FMGEC data is not validated, the system will remain in CLIMB INTERNAL mode.

This requires the landing elevation to be set manually.



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In CLIMB INTERNAL mode, the cabin pressure will follow the ambient pressure evolution according to a proportional schedule.

Note: ABORT mode is selected below A/C altitude of 8000 ft if descent rate is >2000 ft/mn for 30 seconds.
The CPC processes an Internal schedule in order to land with a ΔP of 0.1 psi.

Internal scheduling also ensures that the max cabin differential pressure is not encountered during climb.

The cabin vertical speed is limited to 1000 ft/mn.

CRUISE

The cabin cruise altitude will correspond to the highest value computed from aircraft planned altitude or actual aircraft altitude.

Note: the landing field elevation selection takes over from the computed cruise cabin altitude if the landing field elevation is higher.

DESCENT

The CPC always switches to DESCENT INTERNAL mode for about 30 seconds to allow the FMGEC data validation before going to DESCENT EXTERNAL mode.

The CPC switches to the EXTERNAL mode after 30 seconds, if the FMGEC data is validated.

The cabin pressurization profile is computed according to the aircraft descent speed, landing altitude, field baro setting and remaining time of arrival.

The cabin vertical speed is limited to -750 ft/mn.

The CPC computes an ideal constant cabin rate in order to reach an altitude lower than the Landing Field Elevation, before landing.

The cabin altitude descends below the Landing Field Elevation. Then the cabin altitude remains constant with a differential pressure of 0.1 psi.

However, the system will remain in DESCENT INTERNAL mode if the FMGEC data is not validated at the top of descent.

This requires the landing field elevation to be set manually.

The cabin pressurization profile is computed according to the ambient pressure, aircraft descent speed, manually selected landing field elevation and landing field baro setting.

The cabin vertical speed is limited to -750 ft/mn.

The cabin rate is adjusted, so that the cabin altitude reaches the selected landing field elevation plus an offset of 0.1 psi prior to landing. The offset ensures a pressurized landing.

GROUND

We are now entering into the depressurization phase.

Depressurization authorization signal:
- Landing gear 1 or 2 compressed.

The cabin is depressurized at a fixed rate until the differential pressure reaches 0 psi.

The rate limiter is overridden and the outflow valves are driven fully open, 70 seconds after touchdown to ensure that the cabin is fully depressurized.

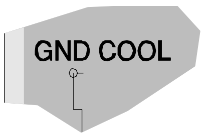
At the same time, a controller change over occurs automatically.

STUDENT NOTES:

STUDENT NOTES

PRESSURIZATION:
ECAM PAGE PRESENTATION

Packs
Outflow Valves
Safety Valves
Active System
Man
LFE Selection Mode
LFE Value
Cabin ΔP
Cabin V/S
Cabin Altitude



: These indications are displayed on ECAM only if the optional ground cooling system is fitted on the aircraft.

ECAM CAB PRESS PAGE
WHITE LETTERS
GREEN NEEDLE

: These indications are displayed on ECAM only if the optional FWD and BULK cargo temperature control systems are fitted on the aircraft.

ECAM CRUISE PAGE
GREEN LETTERS

PACKS

The Pack indication gives the respective flow control valve status.

: The respective flow control valve is not fully closed.

GREEN TRIANGLE

: The respective flow control valve is fully closed.

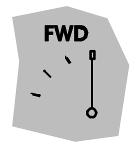
AMBER TRIANGLE
AND LETTERS

: The respective flow control valve position data is not available.

AMBER CROSSES
WHITE LETTERS

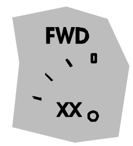
OUTFLOW VALVES

The Outflow Valve indication gives the respective outflow valve position. The needle is normally green and the FWD and AFT indications white.



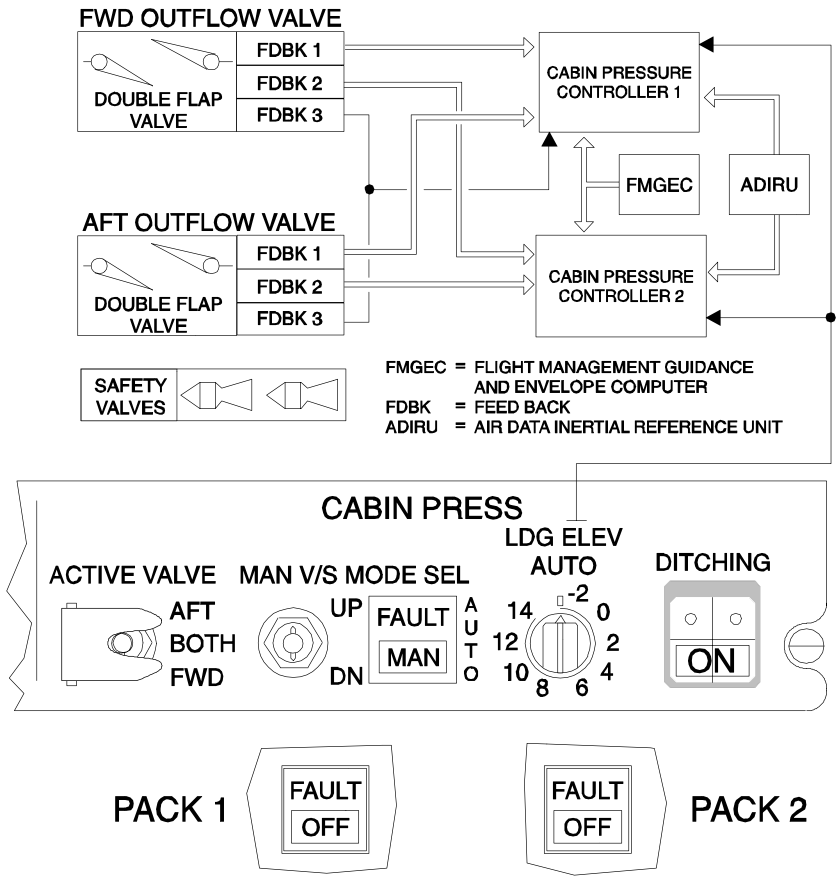
: The valve is opened more than 95% during flight or it is determined faulty (only in auto press mode).

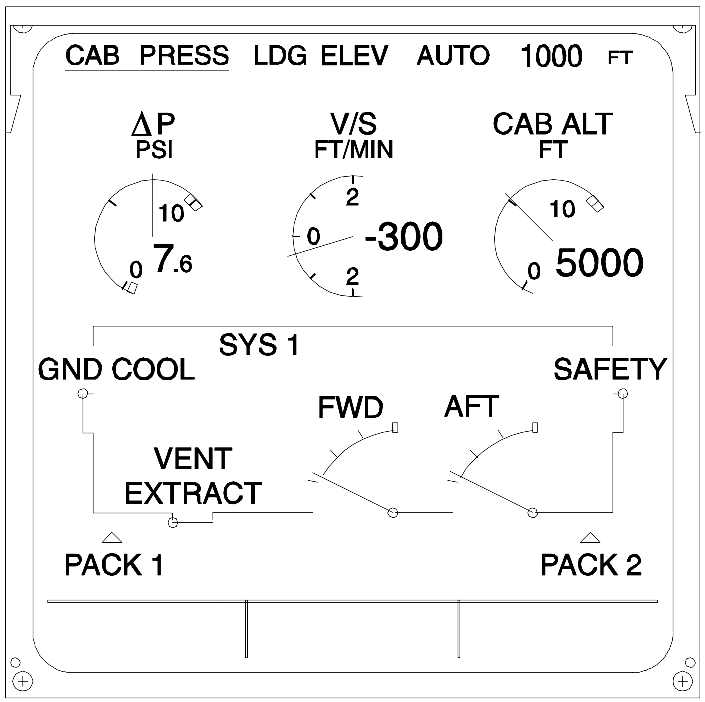
AMBER LETTERS
AND NEEDLE



: The valve position data is not available.

WHITE LETTERS
AMBER CROSSES





FQW4200 GE Metric

SAFETY VALVES

The safety valve indication gives the safety valve status. The position signals are provided to the SDAC by a discrete signal from the valves sensor.

: Both safety valves are fully closed.

GREEN NEEDLE
WHITE LETTERS

: At least one of the safety valves is not fully closed.

AMBER LETTERS
AND NEEDLE

: Both safety valves position data are not available or one is not available and the other valve is closed.

WHITE LETTERS
AMBER CROSSES

ACTIVE SYSTEM

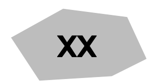
It indicates which system is active and what is the system status.
Only one system is active at a time.
When both systems are faulty, the "FAULT" light on the MODE SEL pushbutton comes on.

GREEN

: System 1 is active and not faulty.

AMBER

: System 1 is faulty.



AMBER

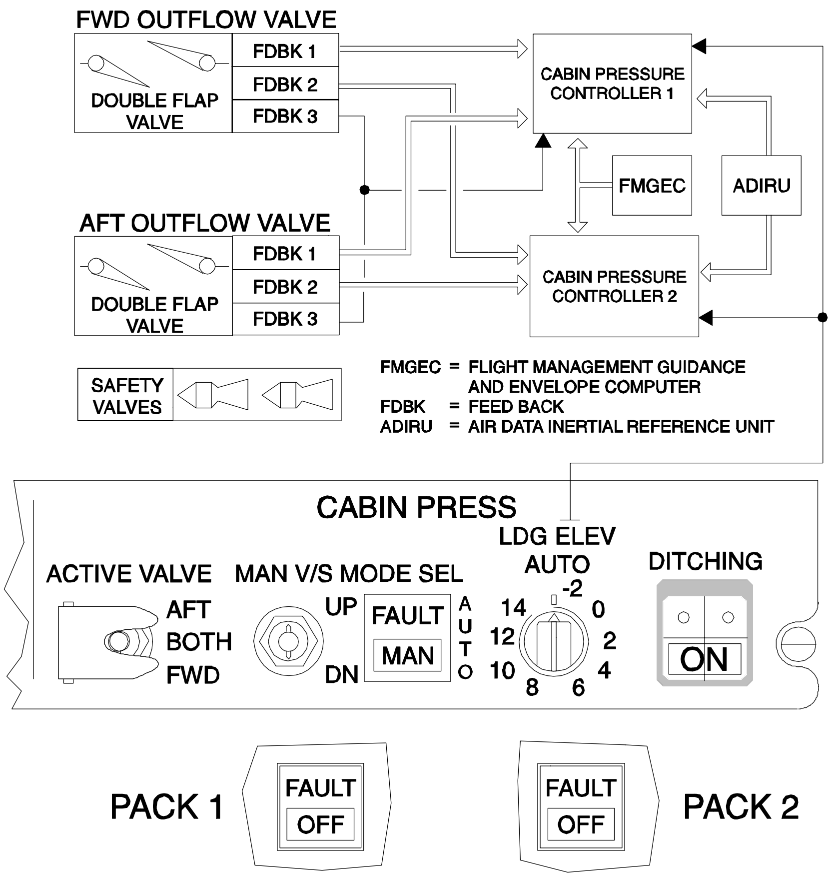
: System status data is not available.

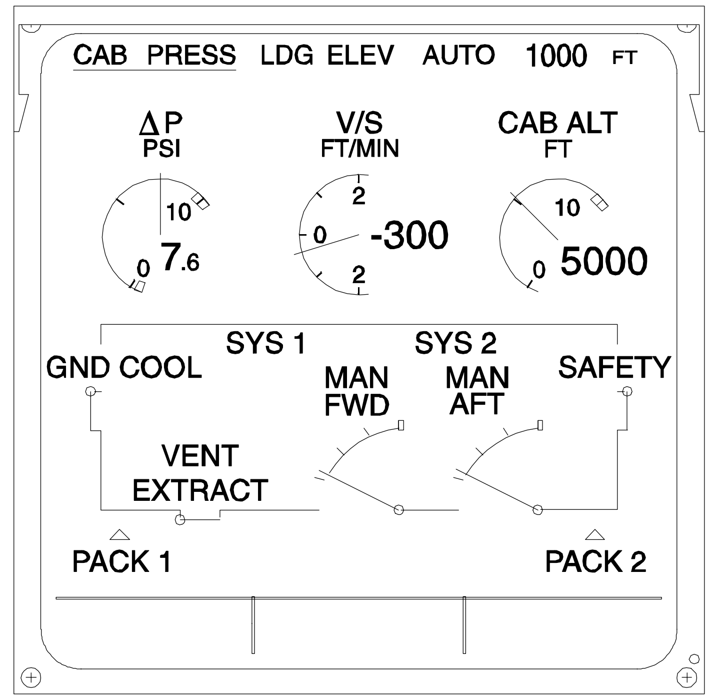
MAN

The MAN indication appears in green above the outflow valve indication when its corresponding valve is manually controlled.
MAN indication is not displayed otherwise.

GREEN

: The corresponding outflow valve is manually controlled.





FQW4200 GE Metric

LFE SELECTION MODE

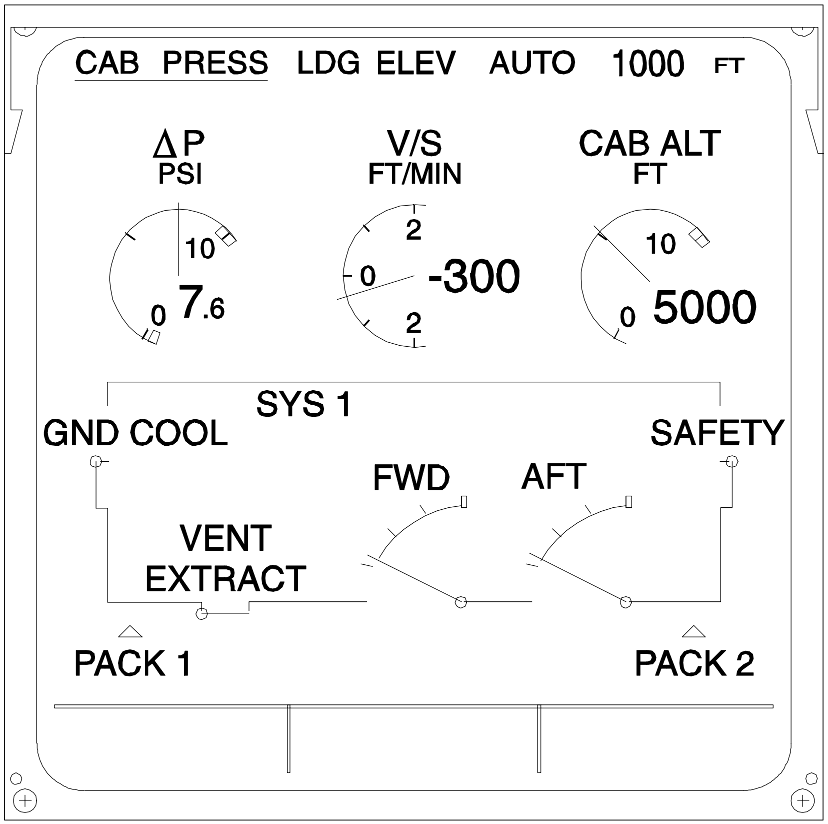
It indicates if the Landing Field Elevation data comes either from the FMGES or the landing elevation selector. It also provides the LFE source status.
Nothing is displayed when the LDG ELEV selector is completely faulty or during manual pressure regulation.
The LFE selection indication is also displayed on the CRUISE ECAM page.

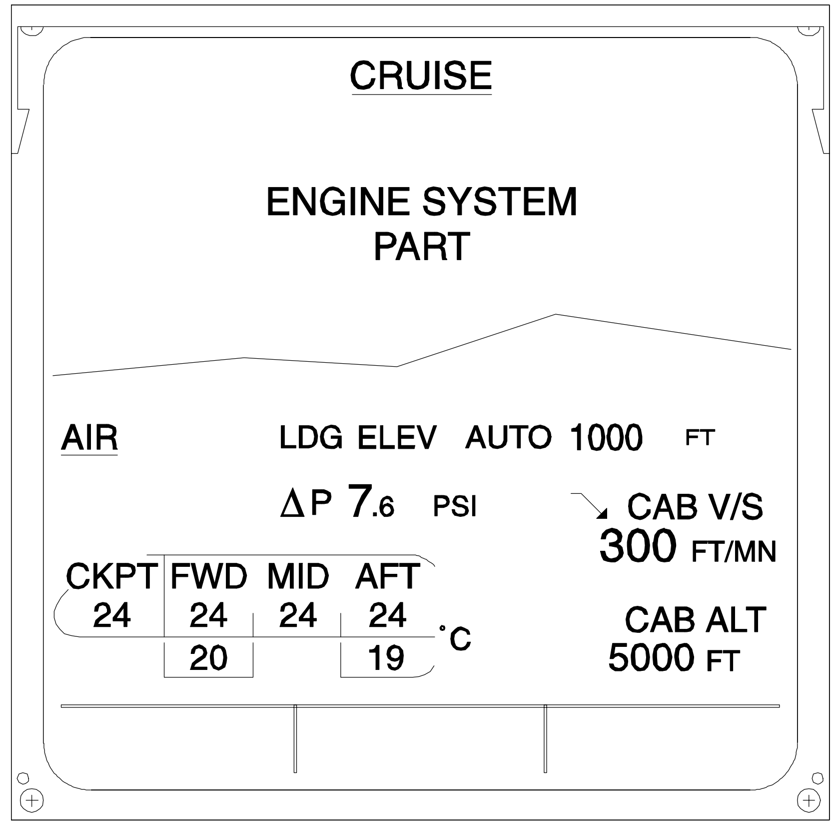
AUTO	GREEN	: LFE data from FMGES is valid and LDG ELEV selector set to AUTO.
AUTO	AMBER	: LFE data from FMGES invalid and LDG ELEV selector set to AUTO.
MAN	GREEN	: LDG ELEV selector set to a value
XX	AMBER	: At least one parameter from CPCs automatic part is not available.

LFE VALUE

The Landing Field Elevation value is provided by the FMGES in normal condition.
Nothing is displayed in manual pressure regulation.
The LFE value indication is also displayed on the CRUISE ECAM page.

1000	GREEN	: LFE data is available. (From FMGES or LDG ELEV selector).
XX	AMBER	: LFE data is not available.
0 FT	GREEN ZERO AND CYAN LETTERS	: LFE from FMGES is invalid, (AUTO in amber) or LDG ELEV selector is completely faulty.

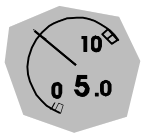




FQW4200 GE Metric

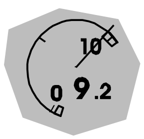
CABIN ΔP

The needle and the cabin differential pressure value are normally displayed in green. The ΔP value can vary from -9.9 to 31.9 by steps of 0.1 PSI, but the needle can only vary from -0.5 to 10.5 PSI.



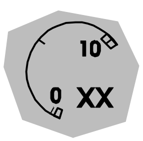
GREEN NEEDLE

: -0.2 ≤ ΔP ≤ 8.85 PSI
During final approach, the ΔP value and the needle pulse in green if 1.5 < ΔP < 8.85 PSI.
The pulsing stops when the ΔP drops below 1 PSI.



AMBER NEEDLE
AND VALUE

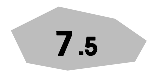
: ΔP < -0.2 PSI or
ΔP > 8.85 PSI.



AMBER
CROSSES

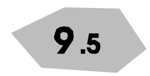
: ΔP data is not available.

The cabin differential pressure is also displayed on the CRUISE ECAM page.



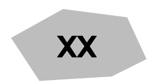
GREEN

: -0.2 ≤ ΔP ≤ 8.85 PSI
During final approach, the ΔP value and the needle pulse in green if 1.5 < ΔP < 8.85 PSI.
The pulsing stops when the ΔP drops below 1 PSI.



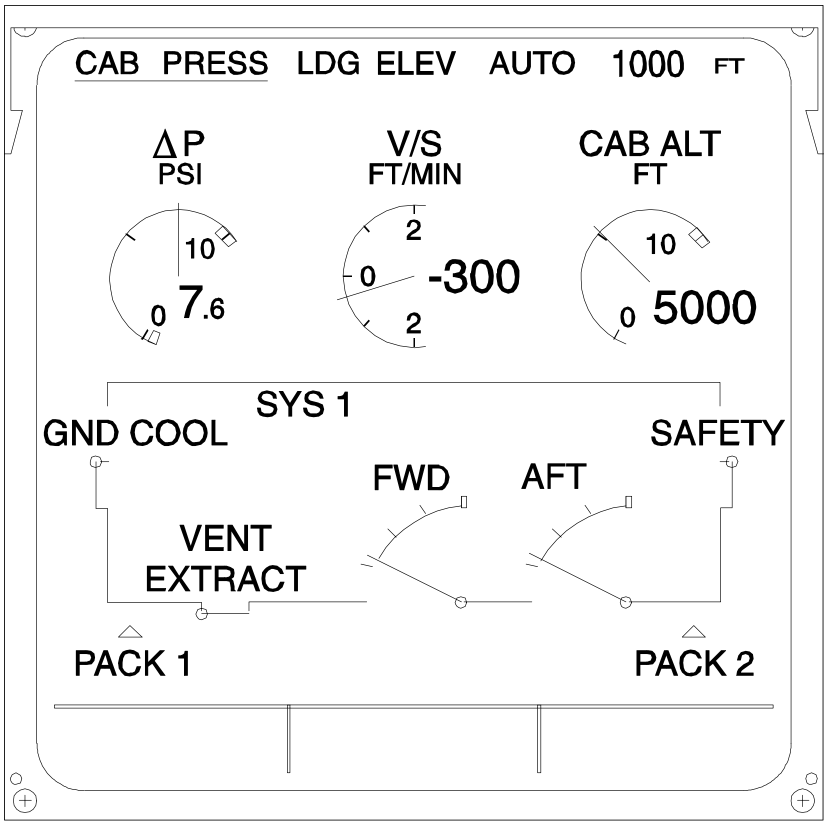
AMBER

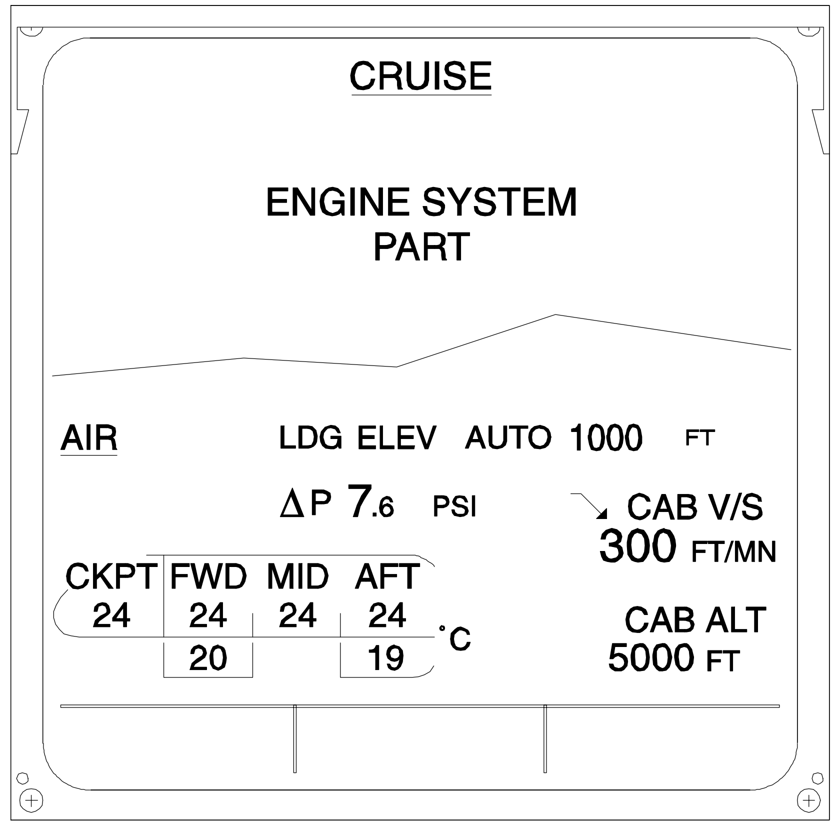
: ΔP < -0.2 PSI or
ΔP > 8.85 PSI.



AMBER

: ΔP data is not available.



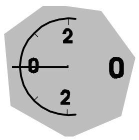


FQW4200 GE Metric

CABIN V/S

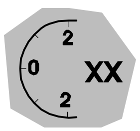
<u>on CAB PRESS ECAM page and CRUISE ECAM page during manual press regulation</u>

The needle and the cabin vertical speed value are normally displayed in green. The CAB V/S value can vary from -6350 to 6350 by steps of 50 ft/mn. The needle can only vary from -2250 to 2250 ft/mn. The needle disappears and the cabin vertical speed value is replaced by amber crosses when the cabin vertical speed data is not available.



GREEN NEEDLE

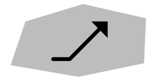
: The CAB V/S value and the needle pulse in green if CAB V/S < -1800 ft/mn or CAB V/S > 1800 ft/mn. The pulsing stops when the value drops below 1600 ft/mn or goes above -1600 ft/mn.



AMBER CROSSES

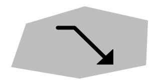
: CAB V/S data is not available

<u>on DOOR/OXY ECAM page and CRUISE ECAM page during auto press regulation</u>



GREEN

: 25 ≤ CAB V/S ≤ 1800 ft/mn.
It pulses green when CAB V/S > 1800 ft/mn.
It stops pulsing when the CAB V/S value drops below 1600 ft/mn.



GREEN

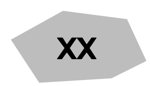
: -1800 ≤ CAB V/S ≤ -25 ft/mn.
It pulses green when CAB V/S < -1800 ft/mn.
It stops pulsing when the CAB V/S value goes above -1600 ft/mn.

Nothing is displayed when -25 < CAB V/S < 25 ft/mn or the CAB V/S data is not available.

The cabin vertical speed value is normally displayed in green. It can vary from 0 to 6350 by steps of 50 ft/mn.

GREEN

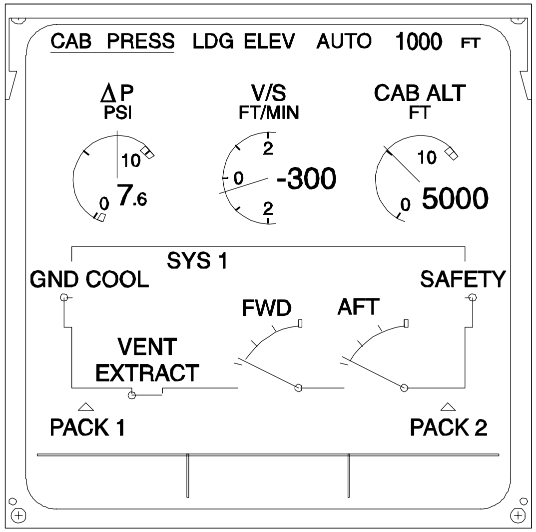
: The CAB V/S value pulses in green when CAB V/S < -1800 ft/mn or CAB V/S > 1800 ft/mn. It stops pulsing when the value drops below 1600 ft/mn or goes above -1600 ft/mn.

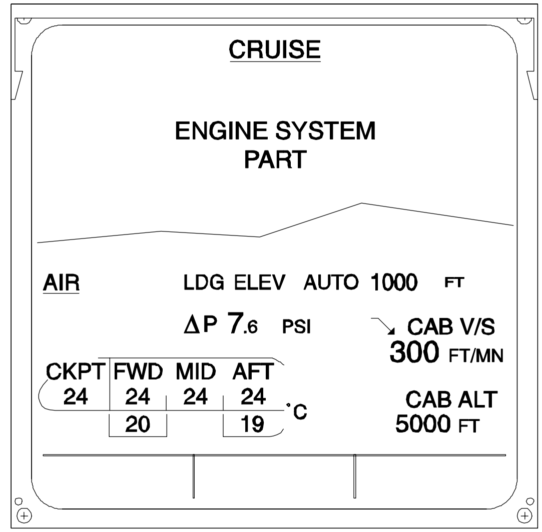


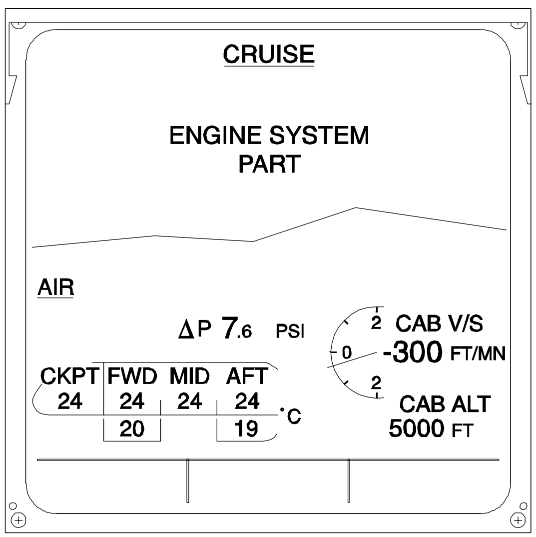
AMBER

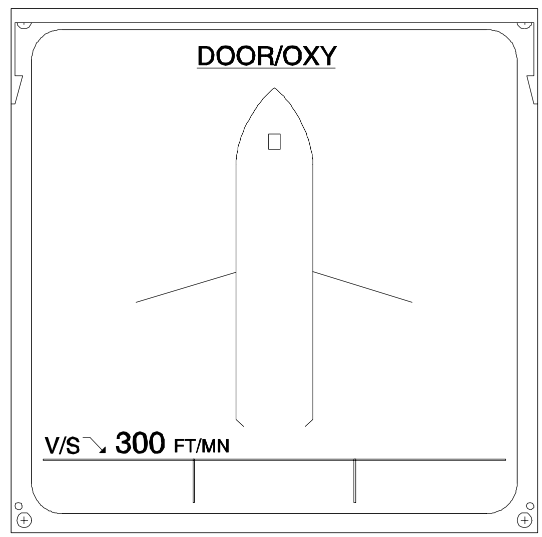
: CAB V/S data is not available.

The cabin vertical speed indication on the DOOR/OXY ECAM page is displayed in flight from lift up to touch down only.









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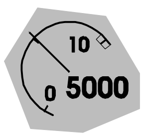
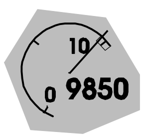
CABIN ALTITUDE

The needle and the altitude value are normally displayed in green.



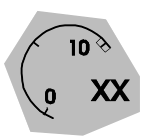
GREEN NEEDLE
AND VALUE

: cabin altitude < 9550 ft
The cabin altitude value and the needle pulse in green when
8800 < CAB ALT < 9550 ft.



RED NEEDLE
AND VALUE

: Cabin altitude ≥ 9550 Ft



AMBER
CROSSES

: Cabin altitude data is not available

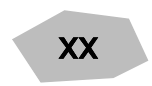
The cabin altitude indications are also displayed on the CRUISE ECAM page.

GREEN

: cabin altitude < 9550 ft
The cabin altitude value pulses in green when
8800 < CAB ALT < 9550 ft.
The pulsing stops when the value
drops below 8600 ft.

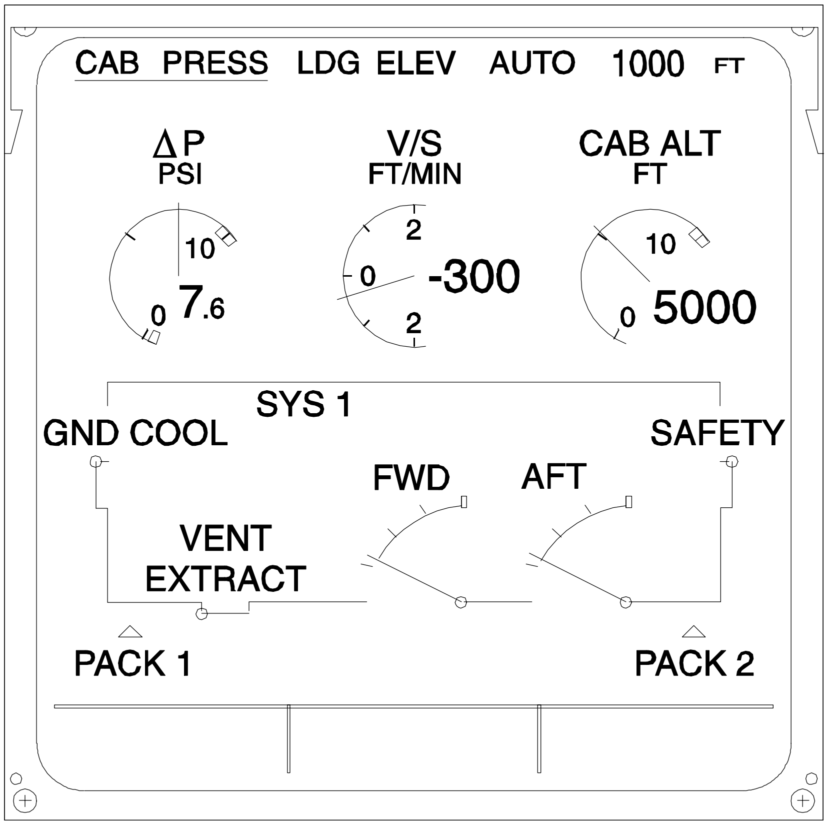
RED

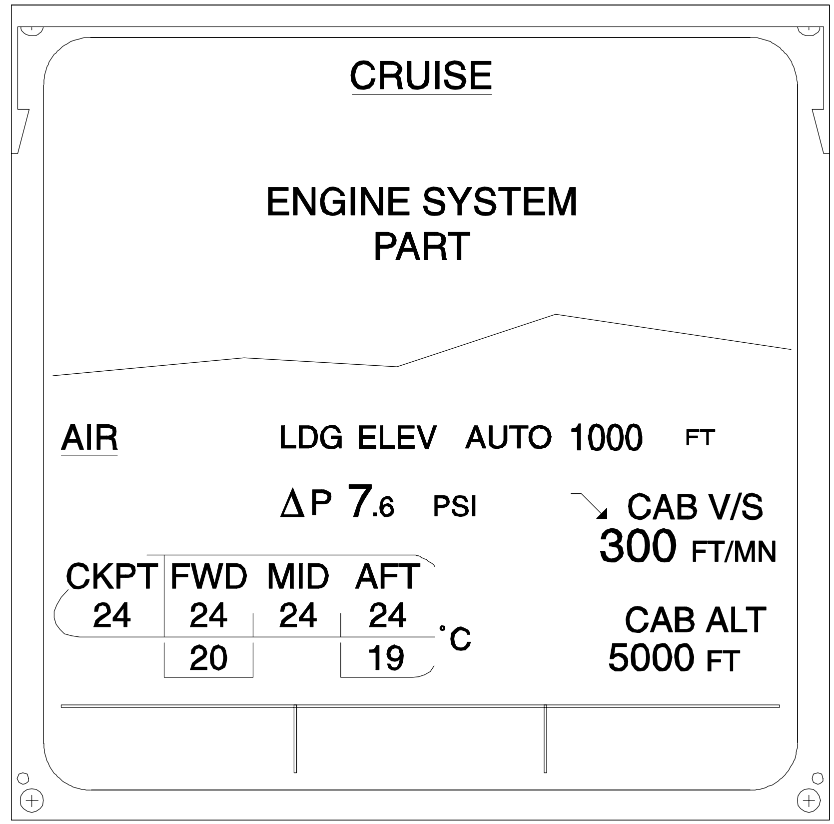
: Cabin Altitude ≥ 9550 ft.



AMBER

: Cabin Altitude data is not available.





FQW4200 GE Metric

STUDENT NOTES

PRESSURIZATION : WARNINGS AND OPERATING LIMITATIONS

EXCESS CAB ALT
SYS 1+2 FAULT
LO DIFF PR
FWD OR AFT OFV NOT OPEN
LDG ELEV FAULT
Operating Limitations

EXCESS CAB ALT

- Cabin altitude is above 9550 +/- 350 Ft.

- An emergency descent must be initiated.
This failure is also displayed on the CRUISE page.

SYS 1+2 FAULT

Both Cabin Pressure Controllers (CPC) are faulty. The FAULT light of the MODE SEL pushbutton switch comes on amber.
The cabin altitude must be controlled by the V/S control switch in manual operating mode.

LO DIFF PR

This message can appear in descent when the descent profile is not followed.
Expect high cabin rate. Aircraft V/S must be reduced.

FWD OR AFT OFV NOT OPEN

The FWD outflow valve is not open on ground. The valve must be opened manually, using the MAN V/S CTL toggle switch.

LDG ELEV FAULT

No data available with the LDG ELEV selector set to AUTO.
LDG ELEV must be manually selected using LDG ELEV rotary selector.
This failure is also displayed on CRUISE page.

OPERATING LIMITATIONS

- Safety valves operation :
  positive : 8.85 psi,
  negative : -1 psi.
- Negative pressure relief valve operation :
  starts to open between -0.26 and - 0.36 psi.
- Maximum normal cabin altitude :
  7350 ft (A340),
  7350 ft (A330; flight longer than 2.5 hours),
  8000 ft (A330; flight shorter than 2.5 hours).
- Maximum normal differential pressure :
  8.60 psi (A340),
  8.60 psi (A330; flight longer than 2.5 hours),
  8.32 psi (A330; flight shorter than 2.5 hours).

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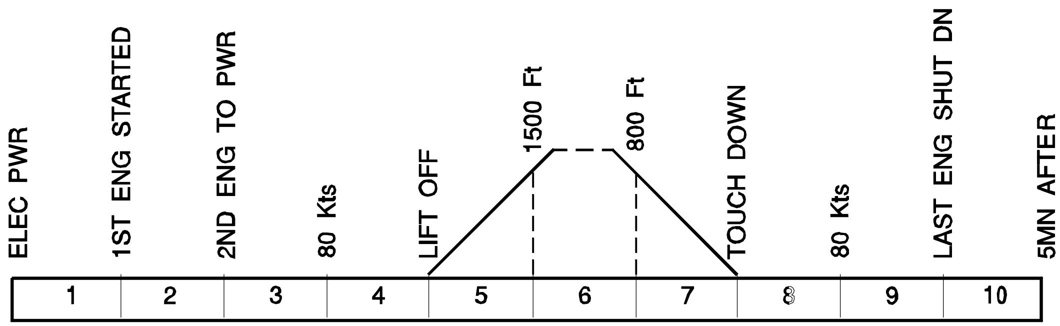


E/WD : FAILURE TITLE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
EXCESS CAB ALT	CRC	MASTER WARN	CAB PRESS	NIL	1 to 5 7 to 10
SYS 1 + 2 FAULT	SINGLE CHIME	MASTER CAUT	CAB PRESS	MODE SEL FAULT lt	4, 5 7, 8
LO DIFF PR	SINGLE CHIME	MASTER CAUT	CAB PRESS	NIL	1 to 5 7 to 10
FWD OR AFT OFV NOT OPEN	SINGLE CHIME	MASTER CAUT	CAB PRESS	NIL	3 to 8
LDG ELEV FAULT	SINGLE CHIME	MASTER CAUT	CAB PRESS	NIL	1, 3, 4, 5 7 to 10

FQW4200 GE Metric

STUDENT NOTES:

PRESSURIZATION: COMPONENTS

SAFETY PRECAUTIONS

Before any component removal, open, safety and tag the circuit breakers listed in the AMM.

Concerning the outflow and safety valves :

- Make sure that air is not supplied to the air conditioning system from the engines, the APU or a ground source. Hot compressed air can cause injury to personnel.

Concerning the outflow valves :

- Make sure that the FWD avionics access door 811 is open with a warning placard attached to it. The warning notice must tell persons not to close the door. This prevents accidental pressurization of the A/C.
- Keep away from the moving and energized parts of the OFV when you operate or test the valve. These can cause injury to persons.
- Make sure that the travel ranges of the OFVs are clear.

STUDENT NOTES

CABIN PRESSURE CONTROLLER

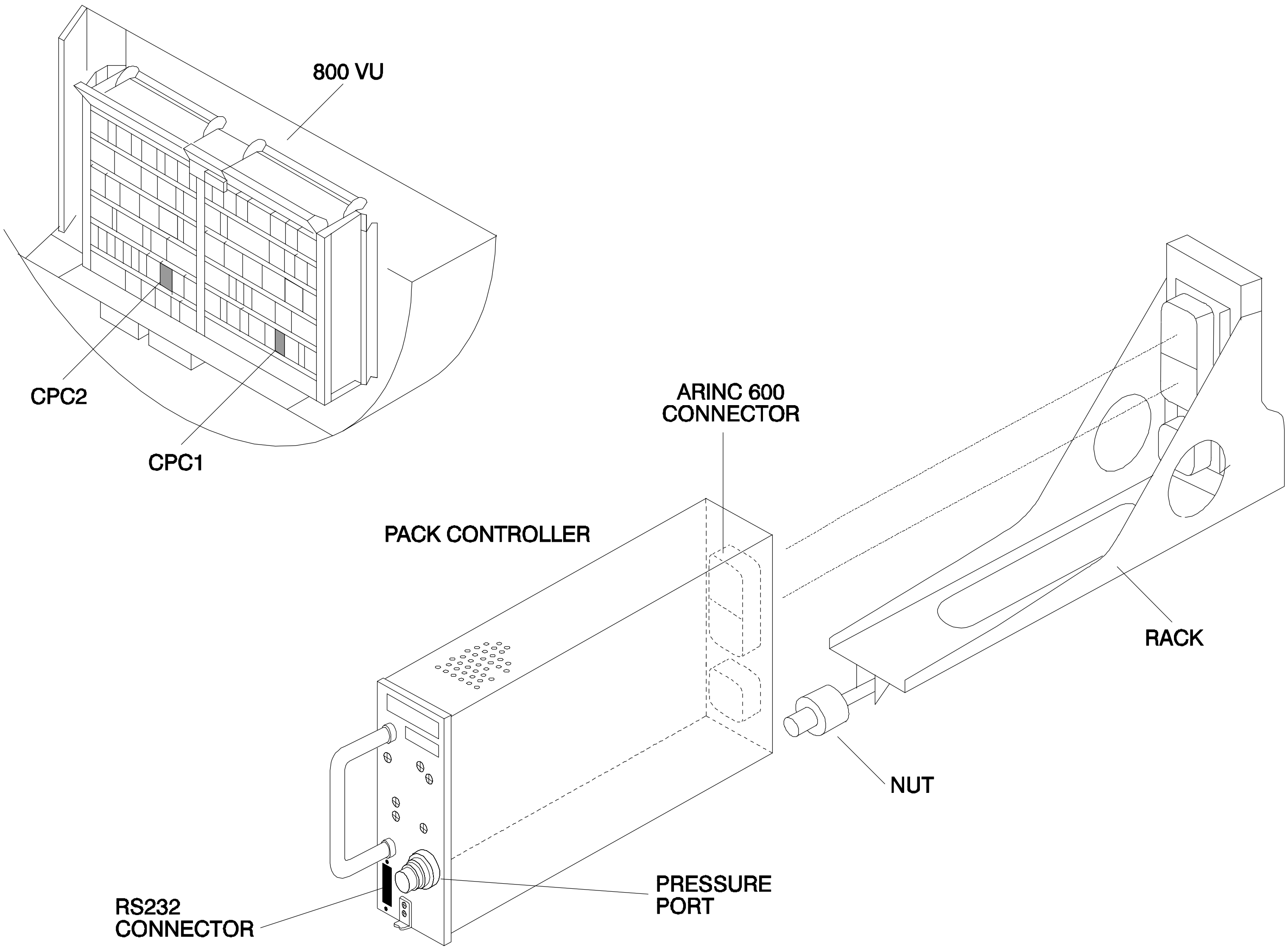
FIN / ZONE

CPC1
FIN : 311HL
ZONE : 121
CPC2
FIN : 312HL
ZONE: 122

COMPONENT DESCRIPTION

Each CPC has two parts which operate independently of each other but use the same pressure port.
- an automatic part (microprocessor) with a DMS cabin pressure sensor module (of the piezo-ceramic element type).
- a manual back-up part (analog circuit) with a cabin pressure sensor of the thin film type.

A covered RS232 test equipment connector is on the front.



FQW4200 GE Metric

FWD AND AFT OUTFLOW VALVES

FIN / ZONE

FWD OUTFLOW VALVE
FIN : 313HL
ZONE: 131
AFT OUTFLOW VALVE
FIN : 315HL
ZONE: 153

OFV

Both outflow valves are the same. They are of motor driven type and the housing assembly is cast from aluminum alloy.
Each valve has :
- two electronic actuators
- two automatic motors
- a manual motor
- an outflow valve body
- a gearbox and feedback assembly

All these sub-components are LRUs

ELECTRONIC ACTUATORS AND MOTORS

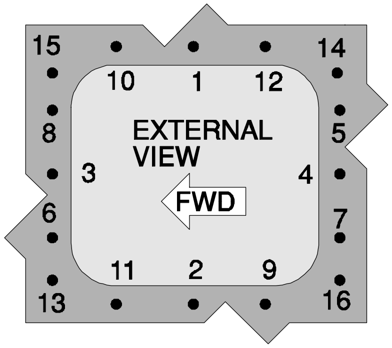
The electronic actuators send and receive signals to and from the CPCs. A pressure switch is installed in each electronic actuator. It operates independently from the automatic operation. It closes the applicable outflow valve if the pressure in the A/C is less than the atmospheric press at 15000 ft.
The automatic motors are of the DC brushless type.
The manual motors is of the DC brush type.

GEARBOX AND FEEDBACK ASSEMBLY AND GATES

The outflow valve body has two gates with an anti-noise duct integrated in the aft one.
The forward gate opens outwards whereas the aft gate opens inwards.
The aft gate is mechanically connected to the forward one and the gearbox.
The gearbox is a gear train fitted with an electromecanical brake.
A triple position-monitoring device of the potentiometer type is fitted to the gearbox output shaft.
Two out of the three potentiometers are dedicated to automatic operation. They send position data to the CPCs through the electronic actuators.
The third potentiometer directly sends position data to the CPC1 manual back up.

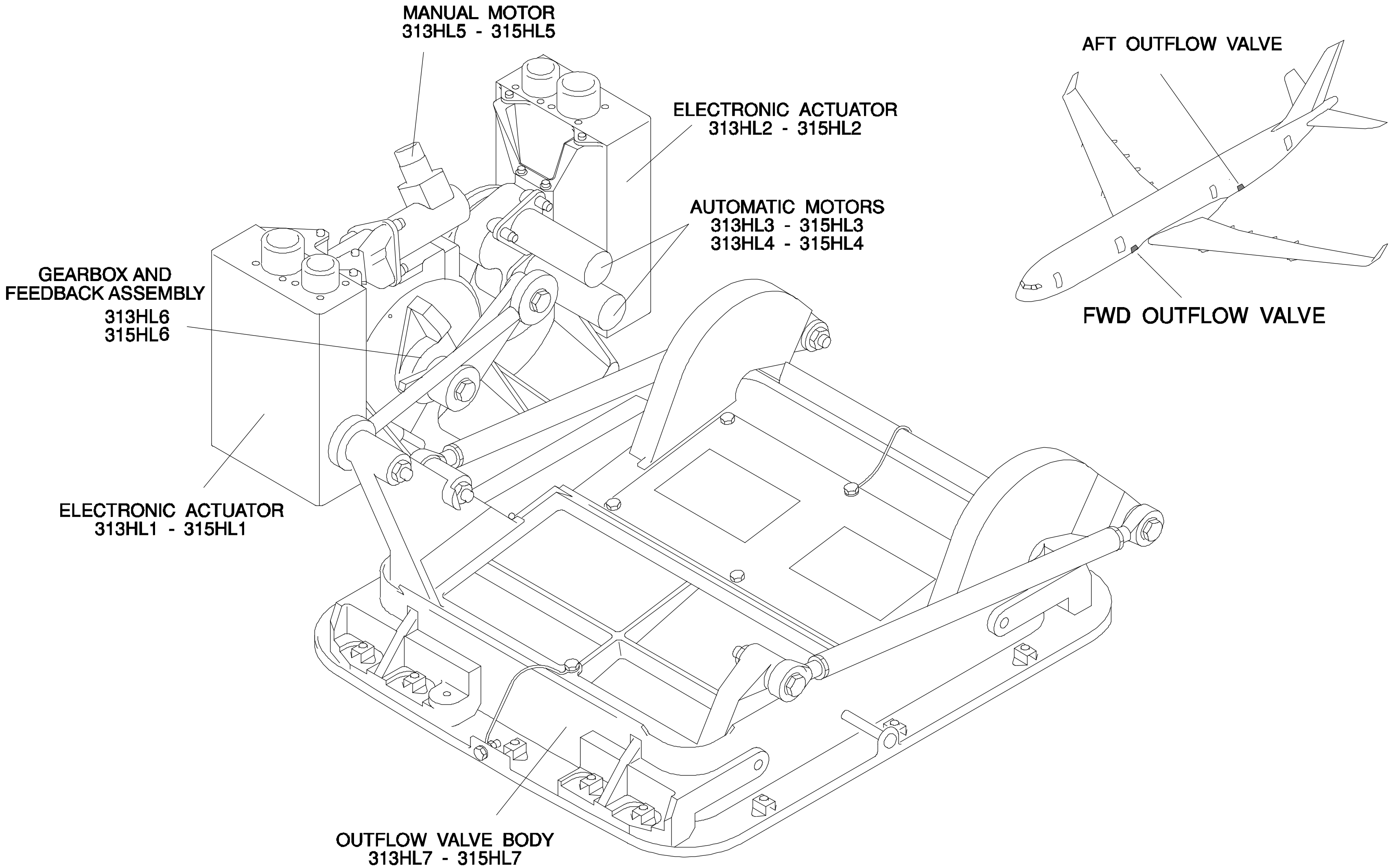
REMOVAL / INSTALLATION FROM INSIDE

Get access ; then from outside remove and identify the 16 screws. Disconnect the electrical connectors. Remove the valve carefully from the inner side. The valve is heavy (12.5 Kg). Torque the screws in sequence order to the requested torque value.



REMOVAL / INSTALLATION FROM OUTSIDE

Get access ; then disconnect the electrical connectors. Remove and identify the 16 screws. Connect the electrical connector 313(5)HL5-A. Respect the safety precautions. From the cockpit, close the applicable OFV with the manual system (two people are recommended to do it). Disconnect the electrical connector then remove the valve. The valve is heavy (12.5 kg). Respect the torque and the sequence order when you install the 16 screws.



FQW4200 GE Metric

SAFETY VALVES

FIN / ZONE

RIGHT SAFETY VALVE
FIN : 316HL
ZONE: 271
LEFT SAFETY VALVE
FIN : 317HL
ZONE: 272

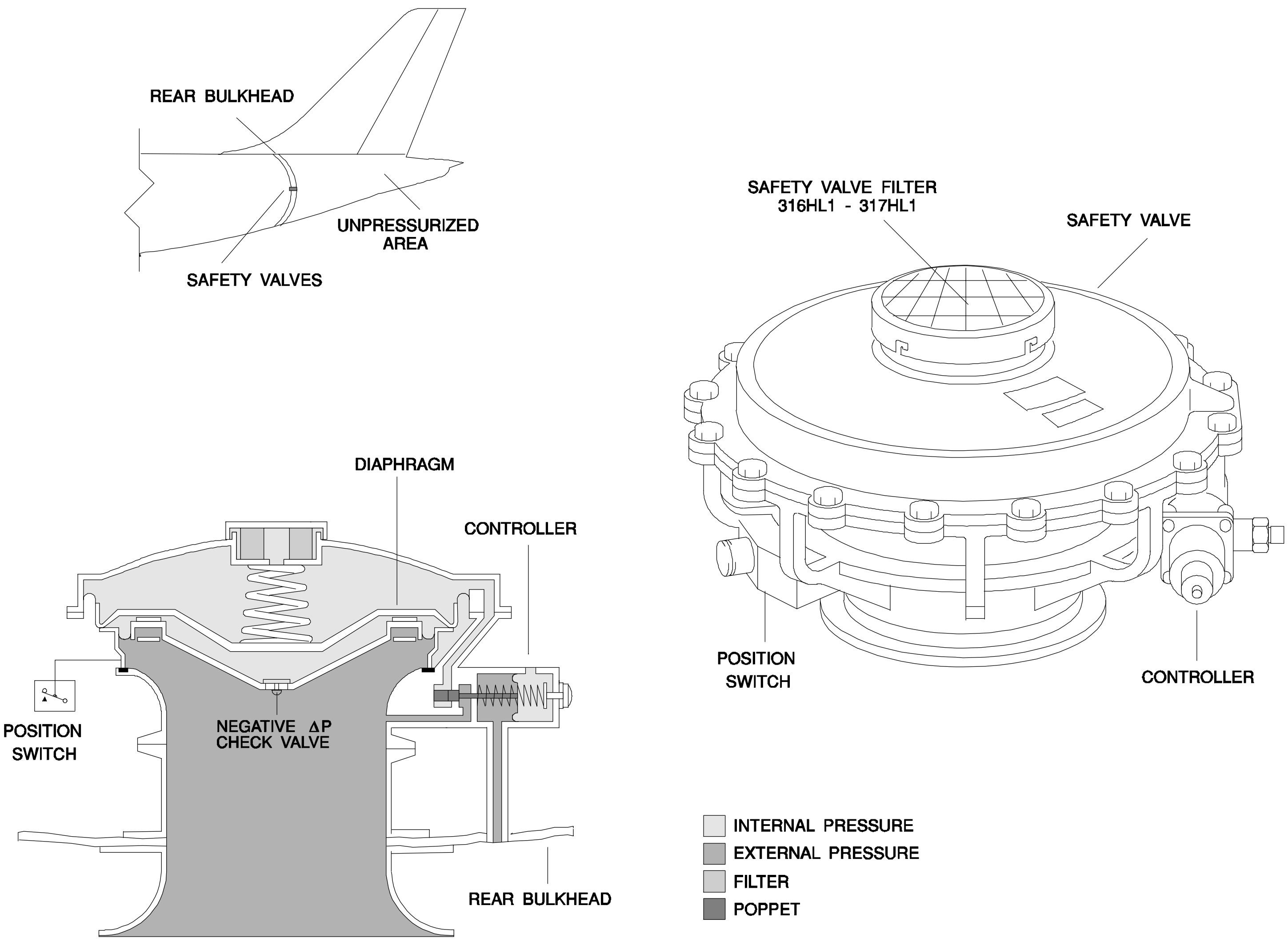
COMPONENT DESCRIPTION

Both safety valves are of poppet type and pneumatic. Each valve has a valve part and a control part. The valve part consists of a cap with a filter, a diaphragm, a bellmouth and a pedestal. The control part has a position switch, a negative delta-p check valve and a controller.

The negative ΔP check valve opens if the external pressure is higher than the internal pressure. The controller has a poppet which gives accurate limit control.

REMOVAL / INSTALLATION

Get access to the safety valve.
Disconnect the electrical connector.
Remove the nut, washers, screws and disconnect the bonding strap and the ambient pressure sensor line.
Remove the V-clamp which connects the safety valve to the mounting flange. Remove the valve and discard the o-ring.
Put a new o-ring and make sure the clamp bolt points to the centerline of the A/C. Respect the torques.



FQW4200 GE Metric

NEGATIVE PRESSURE RELIEF VALVE

FIN / ZONE

FIN : 5139HL

ZONE : 131

COMPONENT DESCRIPTION

It is a rectangular mechanical valve. Four springs hold it in position on four spring rods. A seal is installed to prevent air leaks when the valve is closed. There are also mechanical stops to prevent damage to the seal. If the internal pressure is less than the external pressure, the valve opens and the air flows in. If not, the ΔP maintains it closed.

REMOVAL / INSTALLATION

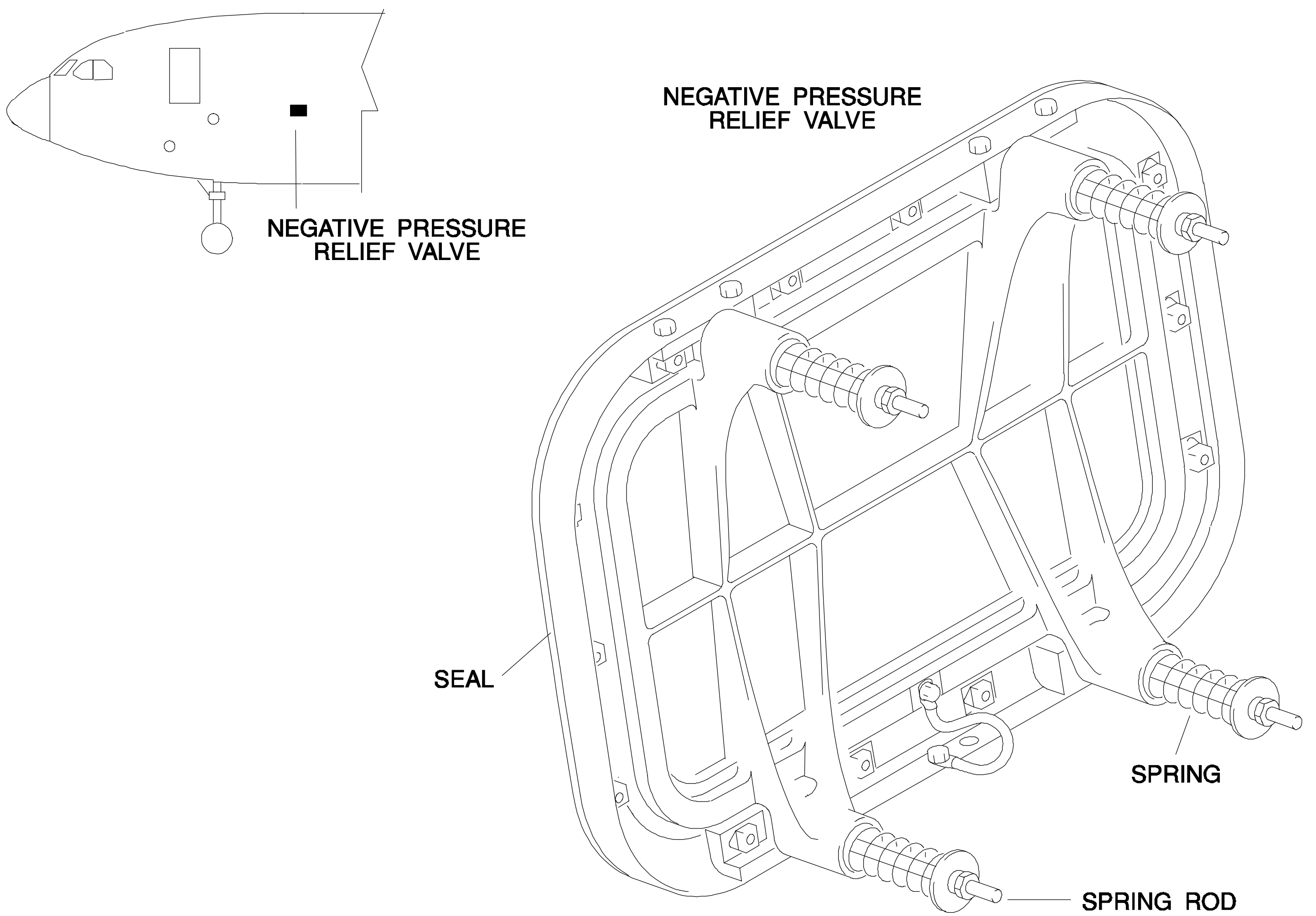
Remove the sidewall panel 131KW.

Remove the washers, nut and bonding strap from inside.

Remove the screws from outside.

Make sure you do not damage the gasket during the valve removal.

Make sure that the negative pressure relief valve moves freely.



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STUDENT NOTES

PRESSURIZATION: EXTERNAL INTERFACES

ADIRU 1,2,3
FMGEC 1,2
CMC 1,2
Zone Controller
DMU (OPTION)
DMC & FWC
SDAC 1,2
CIDS 1,2
LGCIU 1,2
EIVMU 1,2
PSCU 1,2
FCV 1,2
Ram Air Pushbutton

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ADIRU 1,2,3

Each Air Data Inertial Reference Unit mainly sends pressure information for pressurization control.

Signal : static pressure
Used for : calculation of cabin pressure

Signal : barometric correction from FCU (Flight Control Unit)
Used for : indication of cabin altitude and calculation of landing field pressure when FMGEC baro correction can't be used.

Signal : Total Air Temperature and Mach number.
Used for : information to the Zone Controller for pack heat exchanger monitoring.

FMGEC 1,2

The Flight Management Guidance and Envelope Computers send fixed data and time to both controllers for the optimized pressurization schedule.

Signal : Remaining flight time to destination from the flight plan entered by the crew before engine start.
Used for : differential pressure switching.

Signal : Top of climb time, cruise flight level, final cruise flight level, time of arrival, landing field elevation.
Used for : optimization of pressurization schedule.

Signal : Actual FMGEC valid and mastered, autopilot engaged.
Used for : External mode setting.

Signal : Type of baro correction signal (QNH, QFE, STD), baro correction, top of descent time.
Used for: temp. control loop and press. scheduling logic.

CMC 1,2

Centralized Maintenance Computer 1 is connected to both controllers for system monitoring.

Signal : flight information and BITE command.
Used for : BITE demand.

Centralized Maintenance Computers 1 and 2 receive BITE information from the Cabin Pressure Controllers 1 and 2.

Signal: pressurization system BITE data.
Used for : system monitoring.

ZONE CONTROLLER

Controller 1 sends signals to the zone controller for temperature correction control and heat exchanger monitoring.

Signal : cabin altitude, top of climb time, top of descent time, cruise configuration.
Used for : temperature correction.

Signal : Mach number, total air temperature.
Used for : heat exchanger monitoring and RAM air doors control.

DMU (OPTION)

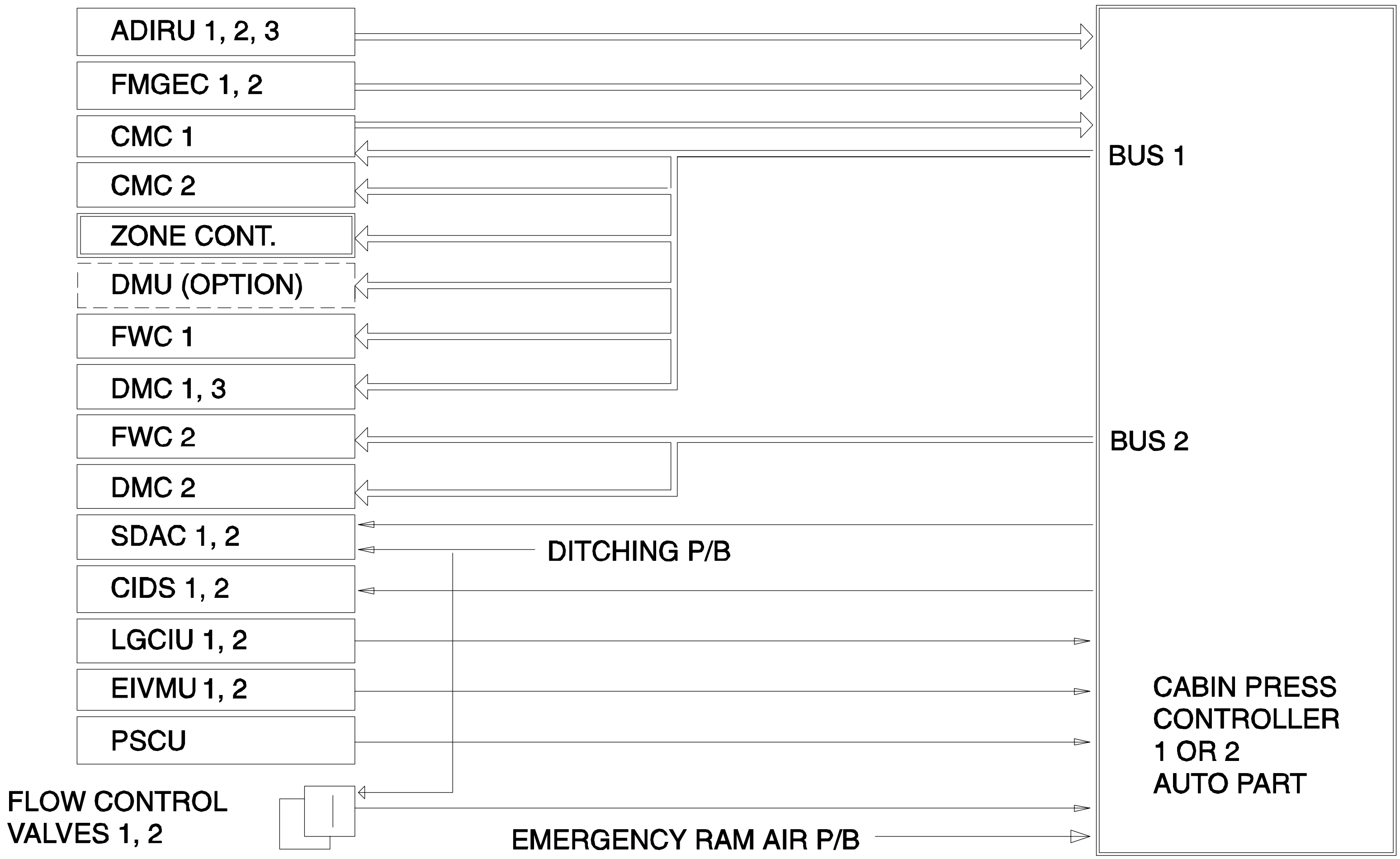
Both controllers send pressure system data to the optional Data Management Unit for Aircraft Centralized Monitoring system.

DMC & FWC

Both controllers send data to the Flight Warning Computers and to the Display Management Computers for the display of warnings on the ECAM.

SDAC 1,2

Both controllers send a system fault discrete signal to the System Data Acquisition Concentrators to generate a system fault warning and display indication. Both SDACs also receive a ditching signal.



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CIDS 1,2

Each controller provides a discrete signal to Cabin Intercommunication Data Systems 1 and 2 to automatically switch on "Fasten seat belt”, and “no smoking" signs when the cabin altitude exceeds 11300 feet.

LGCIU 1,2

Each Landing Gear Control Interface Unit sends a ground/flight signal to both controllers to initiate the ground prepressurization, pressurization and depressurization sequences.

EIVMU 1,2

Engine Interface and Vibration Monitoring Units 1 and 2 send an engine throttle take-off power signal to initiate the prepressurization and the pressurization sequences.

PSCU 1,2

Proximity Switch Control Unit channels 1 and 2 send a door not closed signal to both controllers to inhibit aircraft pressurization.

FCV 1,2

The pack flow control valves closed position signals are sent to both controllers to optimize the fuselage ventilation by variable control of the outflow valves opening in conjunction with air supply.
If one or two packs are off and delta P>= 4 psi, the aft outflow valve closes and the cabin pressure is controlled by the FWD outflow valve. The pack flow control valves receive a signal to close in ditching configuration.

RAM AIR PUSHBUTTON

Both controllers receive a RAM AIR pushbutton ON selection signal from the AIR panel to increase the fuselage ventilation by driving the outflow valves to the half open position.

STUDENT NOTES:

STUDENT NOTES

PRESSURIZATION: MANUAL PART INTERFACES

Cabin Press Panel
SDAC1,2
FWC 1,2
Feedback Unit

CABIN PRESS PANEL

When the MODE SEL pushbutton is set to MAN, the vertical speed control toggle switch associated with the VALVE SEL SWITCH gives manual control of the forward, aft, or both outflow valves.

SDAC1,2

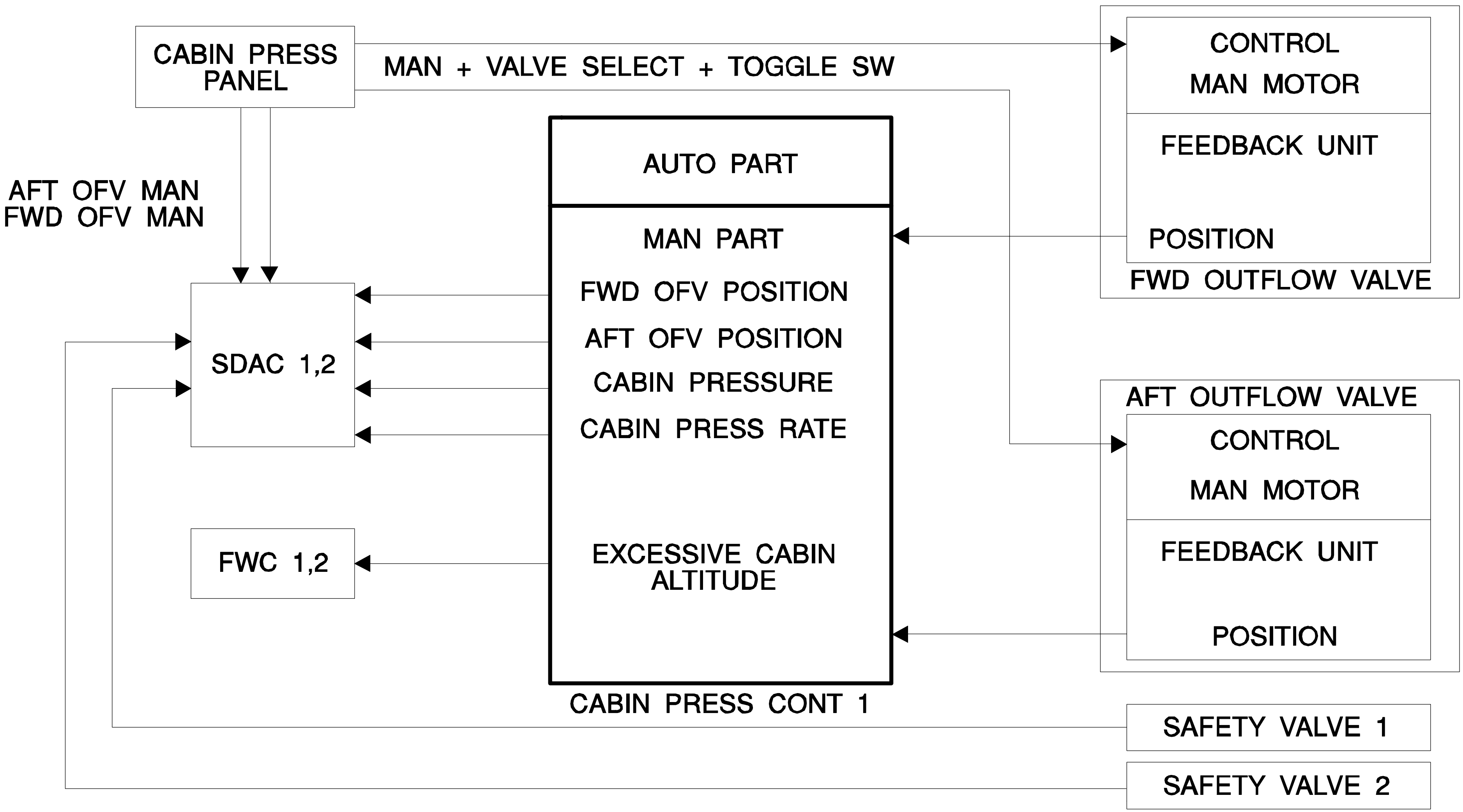
The manual part of controller 1 generates back-up information signals to System Data Acquisition Units 1 and 2 for ECAM display.
The SDACs use this information only if MAN is selected.
The SDACs also receive AFT OFV and FWD OFV selection in MAN mode for ECAM display.
The closed position signals of the safety valves are sent to both SDACs for ECAM dislay.

FWC 1,2

In case of excessive cabin altitude in manual mode, the manual part of controller 1 sends a discrete signal to both flight warning computers for ECAM warning.

FEEDBACK UNIT

A potentiometer installed in the feedback unit sends the outflow valve position to the manual part of controller.



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STUDENT NOTES:

GENERAL LAYOUT

INTRODUCTION

The air conditioning system maintains the air in the pressurized fuselage compartments at the correct level of pressure, temperature and freshness.

AIR SUPPLY

Air is delivered by the pneumatic system at a regulated pressure and temperature.

TEMPERATURE CONTROL

The temperature control system provides temperature controlled air to the cockpit and the three passenger cabin zones. The system is controlled and monitored by the zone and pack controllers.

VENTILATION

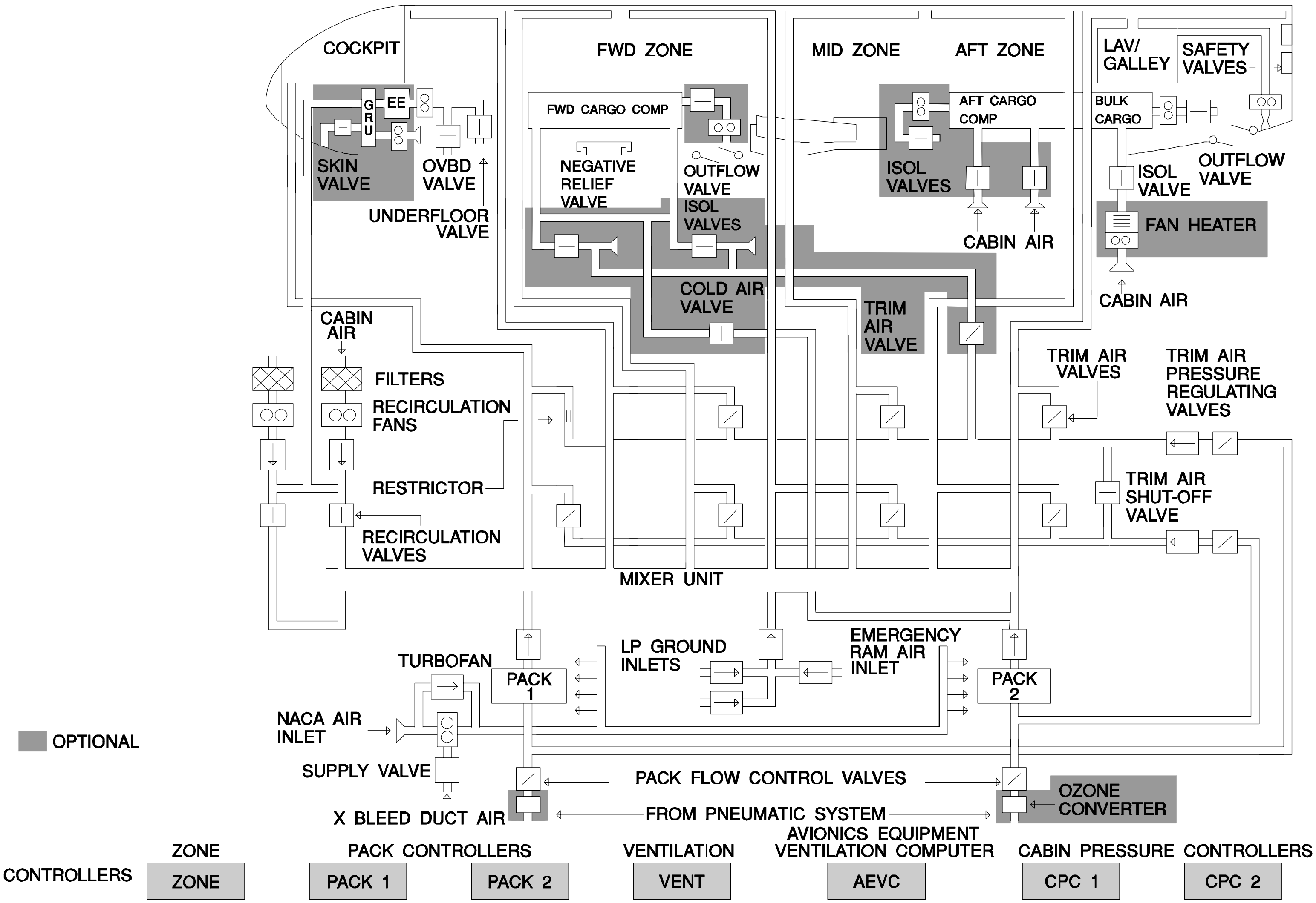
The cockpit and cabin ventilation system ensures a proper ventilation for each of the four zones. The system is controlled and monitored by the Ventilation Controller.
The lavatory and galley ventilation system prevents unpleasant odors entering the cabin. The system is controlled and monitored by the Ventilation Controller.
The avionics equipment ventilation system which may be fitted with an optional ground cooling system ensures a proper ventilation of avionics equipment. The system is controlled and monitored by the Avionics Equipment Ventilation Computer.
A ventilation system prevents structural damage in the air conditioning bay. The system is controlled and monitored by the Avionics Equipment Ventilation Computer.

CARGO VENTILATION AND TEMPERATURE CONTROL (OPTIONAL)

The forward cargo compartment may be fitted with optional ventilation and temperature control systems. These systems are controlled and monitored by the ventilation controller.
The aft cargo compartment may be fitted with an optional ventilation system. This system is controlled and monitored by the ventilation controller.
The bulk cargo compartment is basically equipped with a ventilation system and may be fitted with an optional temperature control system. Both systems are controlled and monitored by the ventilation controller.

PRESSURIZATION

The pressurization system ensures a suitable cabin altitude pressure for crew and passenger comfort. The system is controlled and monitored by two Cabin Pressure Controllers.



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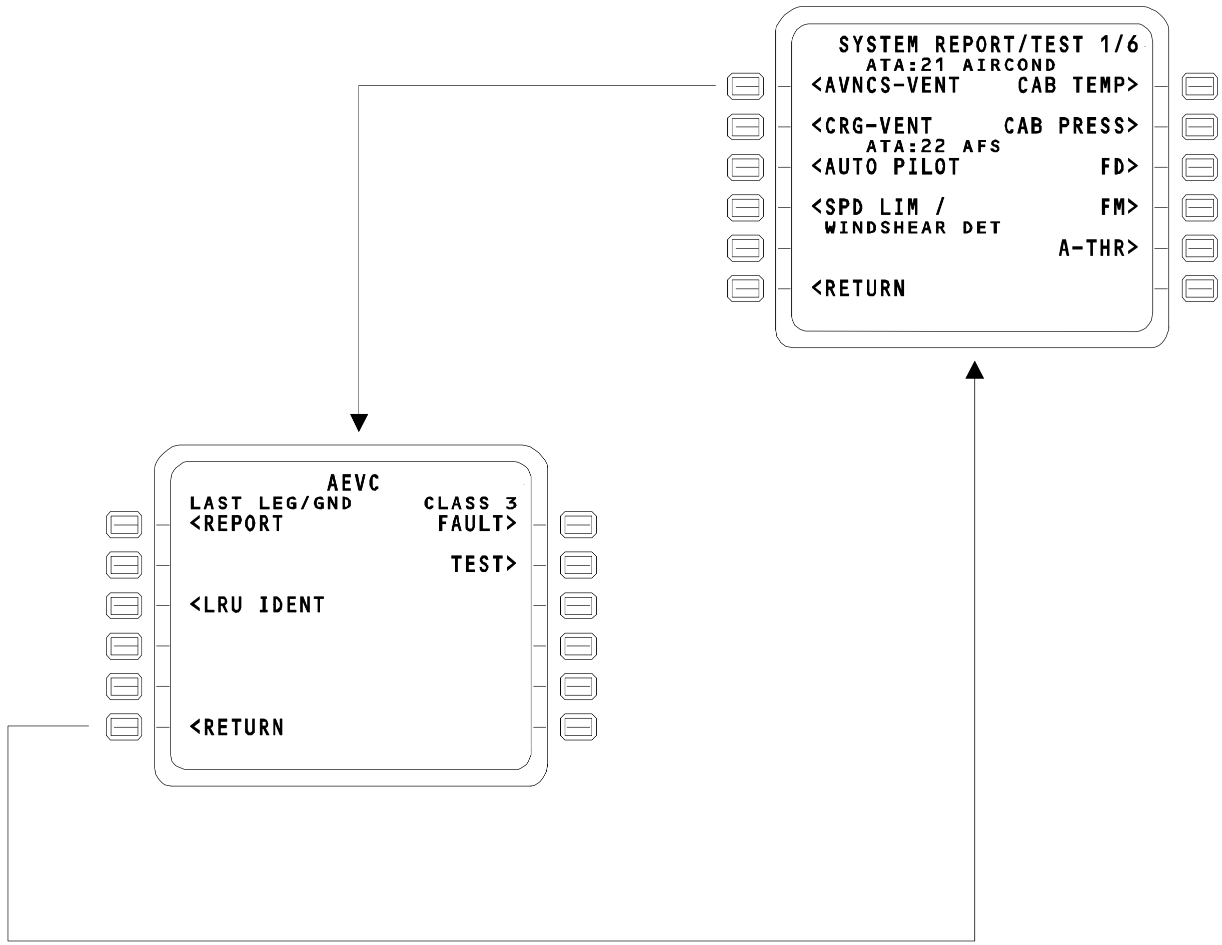
STUDENT NOTES:

CMS SPECIFIC PAGES PRESENTATION

AVNCS-VENT
CRG-VENT
CAB TEMP
CAB PRESS

AVNCS-VENT

The AEVC main menu is standard.



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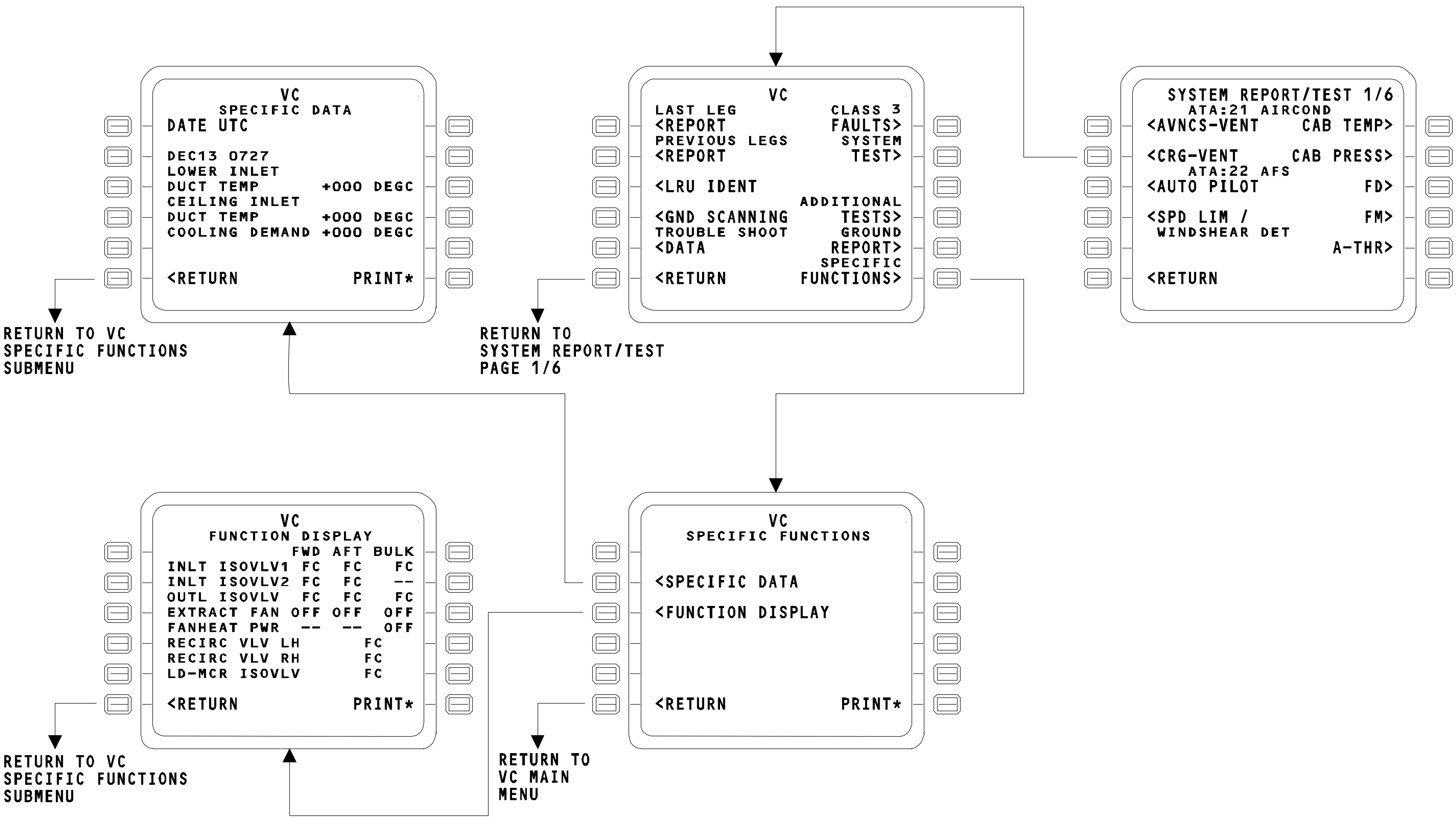
CRG-VENT

The VC main menu has a SPECIFIC FUNCTIONS item.

The selection of the corresponding line key leads to the VC SPECIFIC FUNCTIONS submenu. This submenu has a FUNCTION DISPLAY item and a SPECIFIC DATA item which is only displayed and available if the FWD cargo temperature control option is installed and pin programmed.

The VC SPECIFIC DATA page shows more information concerning the FWD cargo temperature control.

The VC FUNCTION DISPLAY page shows the actual condition of the systems monitored by the Ventilation Controller. This page needs to be displayed while the system test of the SDCU is started from an other MCDU in interactive mode.
Only the information concerning the BULK cargo compartment ventilation system and the recirculation system is basic. The information concerning the optional systems is displayed and available only if the systems are installed and pin programmed.



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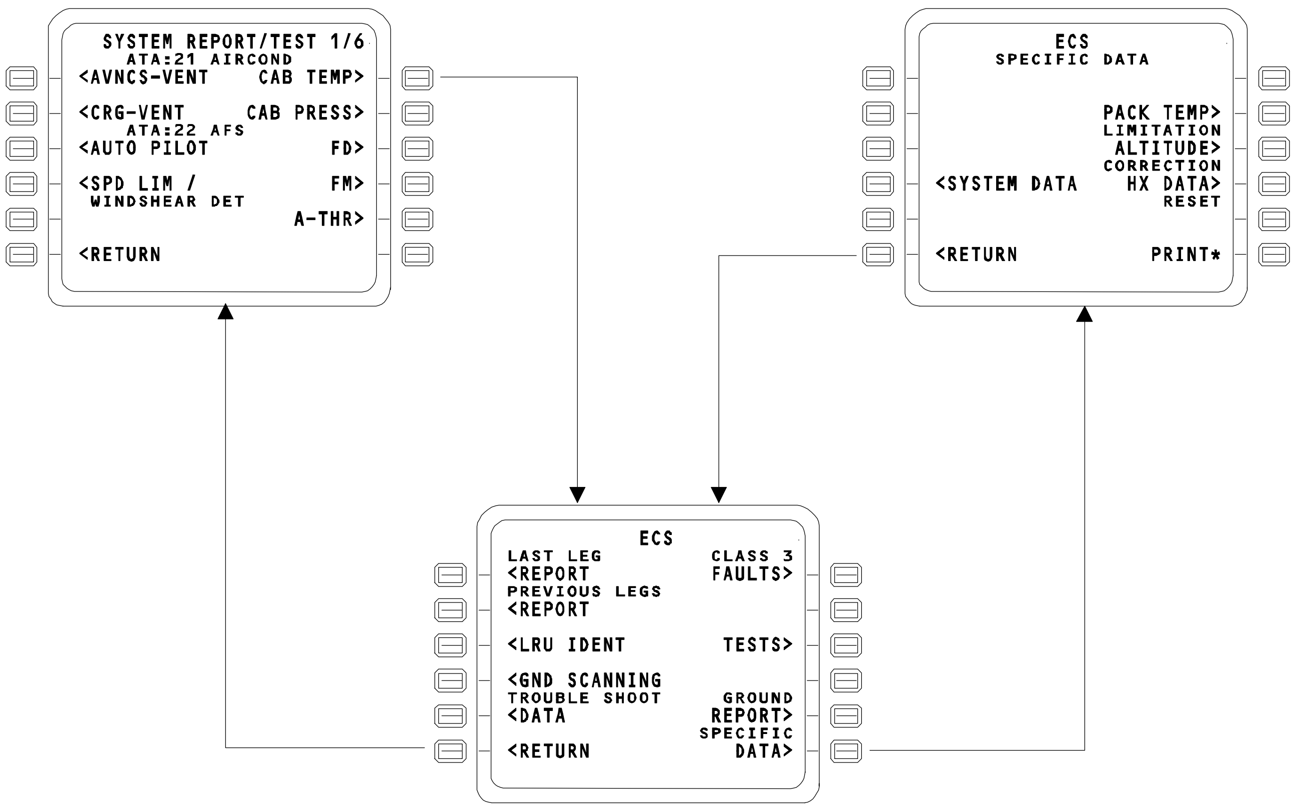
CAB TEMP

The ECS main menu has a SPECIFIC DATA item.

The selection of the corresponding line key leads to the ECS SPECIFIC DATA submenu. This submenu has four different items.



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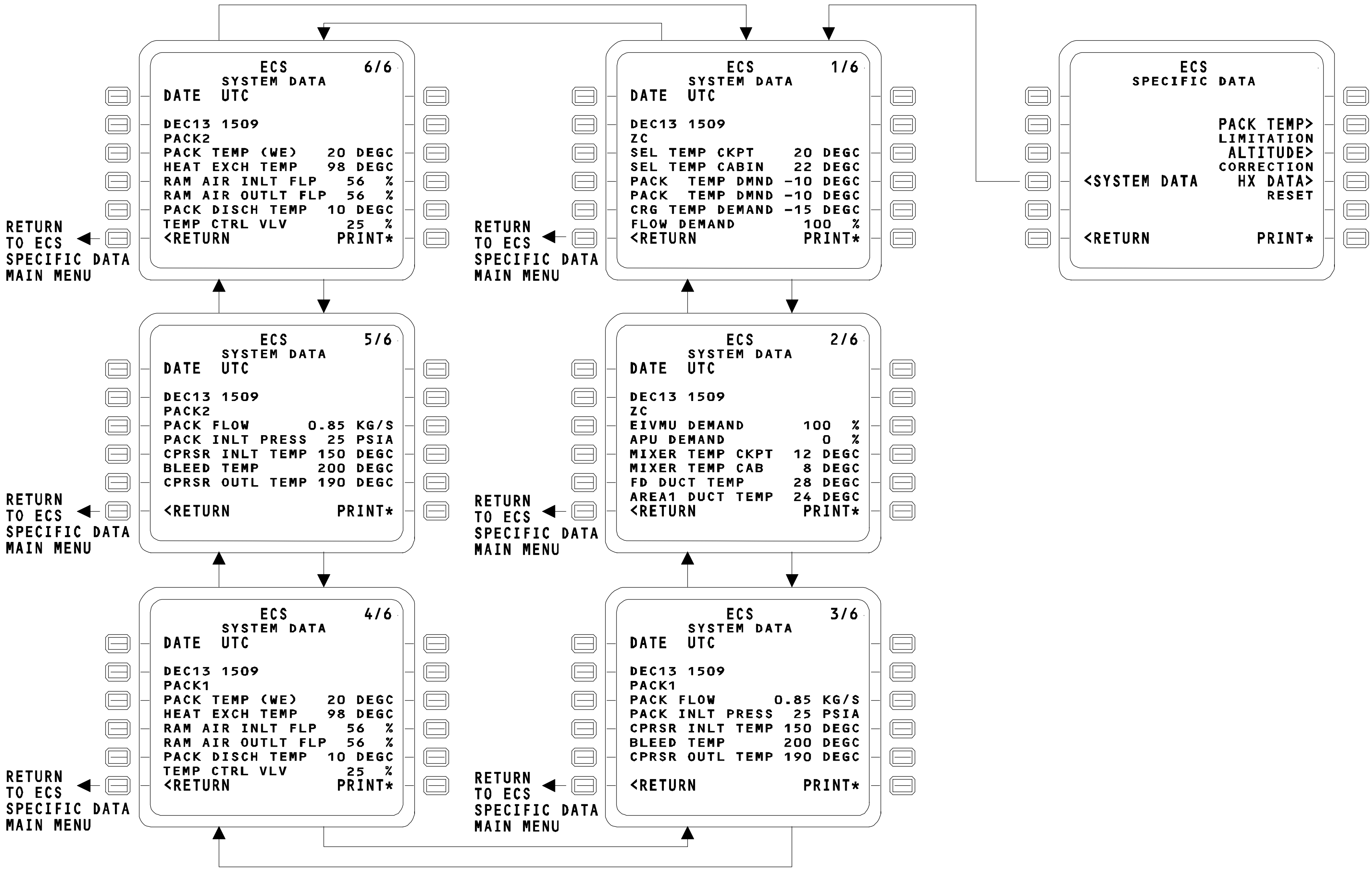
CAB TEMP

The selection of the SYSTEM DATA line key leads to the display of the ECS SYSTEM DATA 1/6. The UP and DOWN arrows are used to go through the other pages.

This indication is only displayed if the FWD cargo temperature control option is installed and pin programmed.



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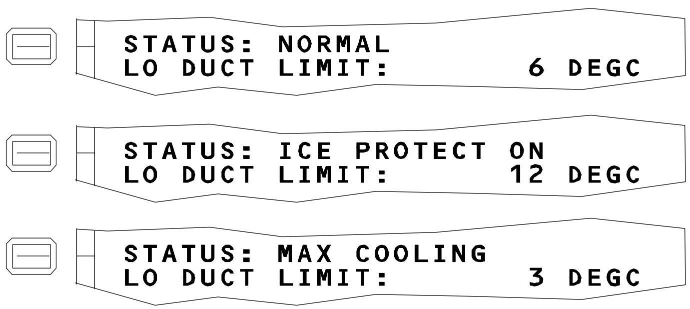
CAB TEMP

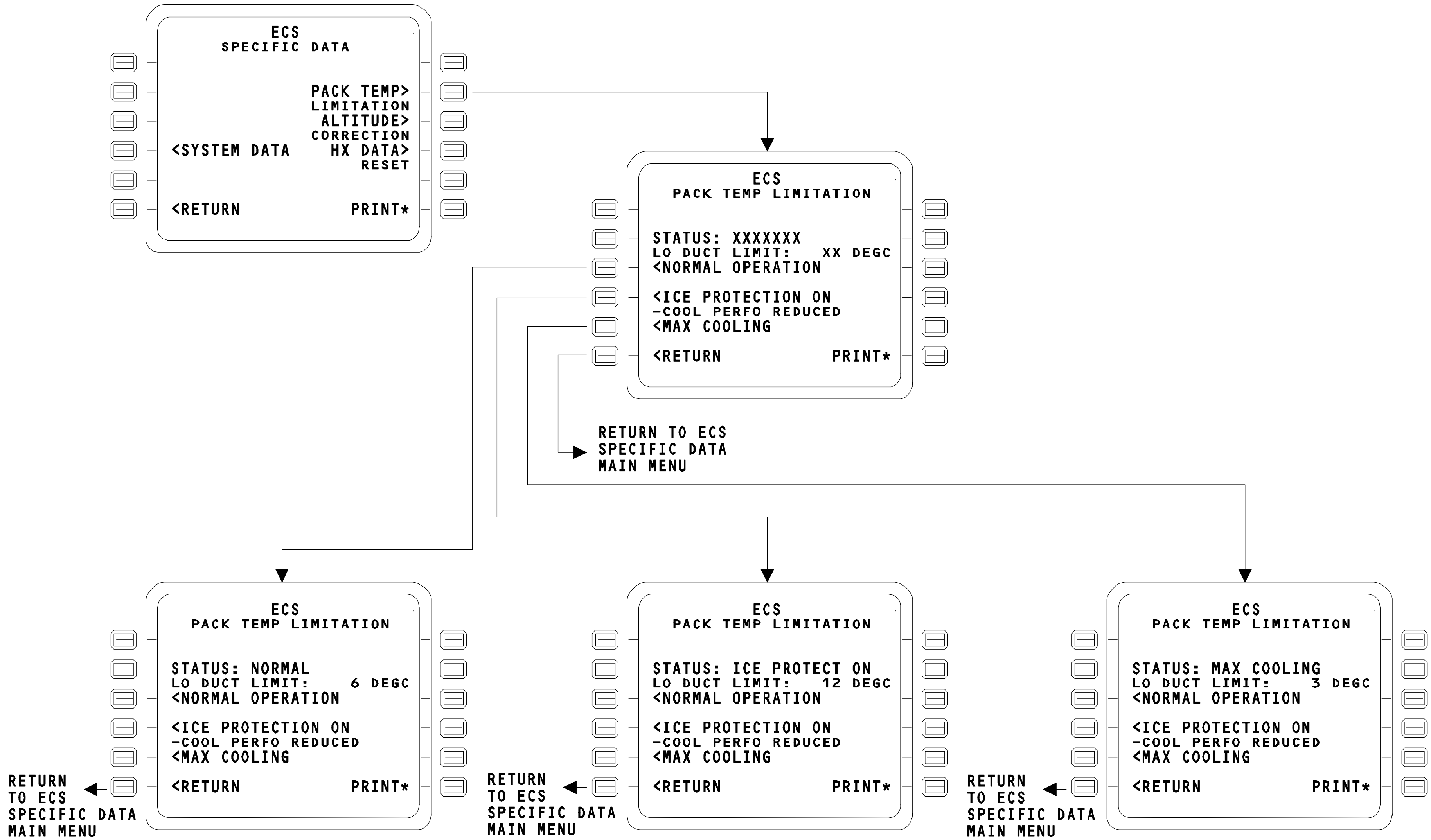
The selection of the PACK TEMP LIMITATION line key leads to the display of the ECS PACK TEMP LIMITATION submenu.
This page contains three items and displays the limitation status. The status depends on which limitation was previously selected.
The three possible statuses are :



The selection of the NORMAL OPERATION line key resets the system to the normal operation.

The selection of the ICE PROTECTION ON line key ensures ice reduction in the air ducts but reduces the packs cooling performance.

The selection of the MAX COOLING line key allows a more rapid cabin temperature stabilization in such conditions as in a cold or heat soaked aircraft with no passengers on board.



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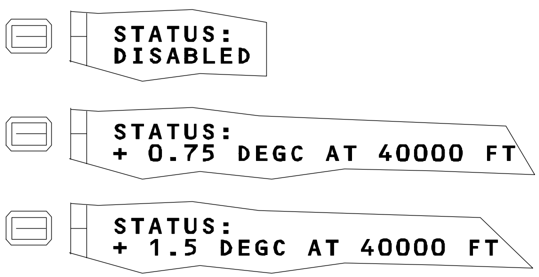
CAB TEMP

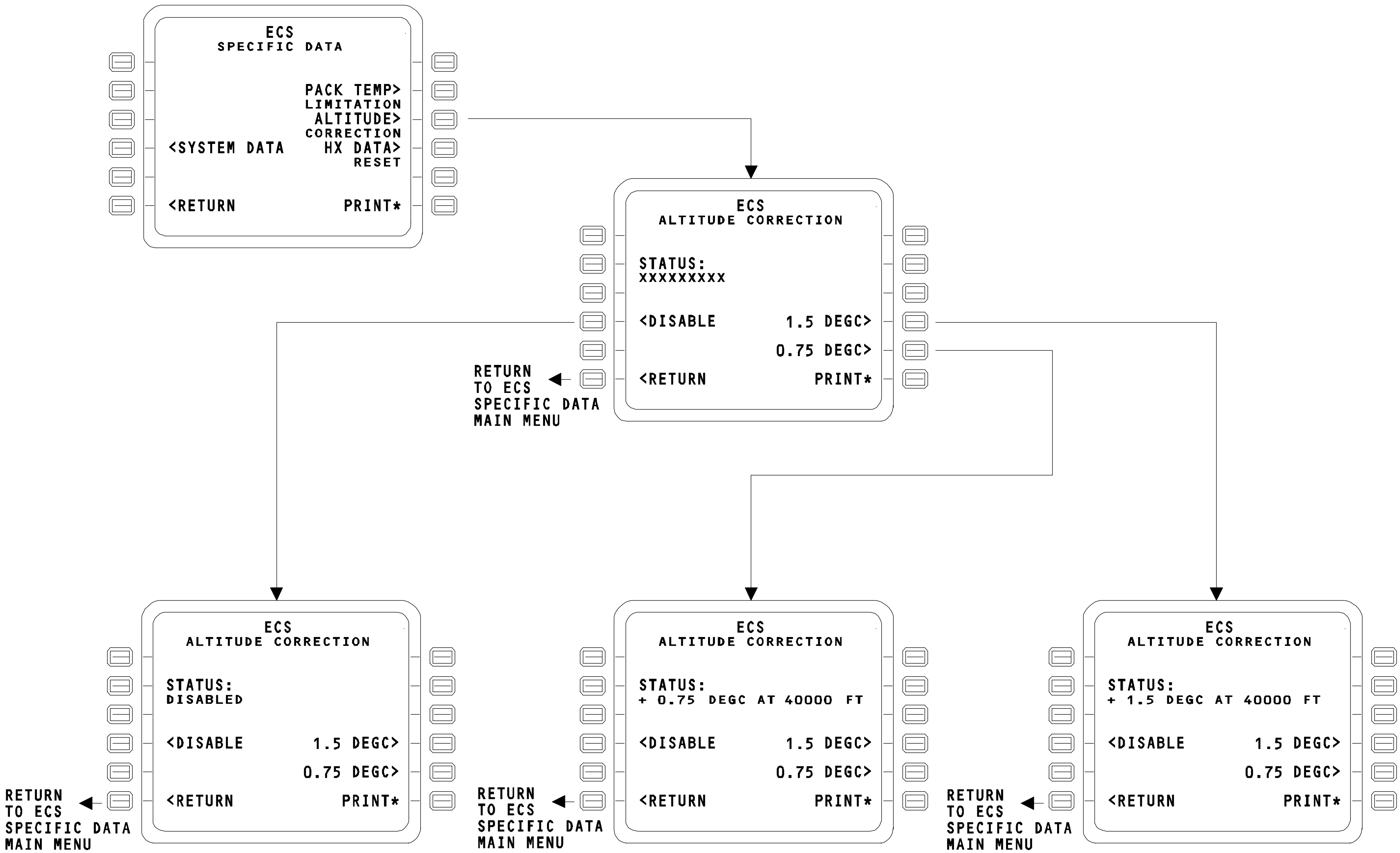
The selection of the ALTITUDE CORRECTION line key leads to the display of the ECS ALTITUDE CORRECTION submenu.
This page contains three items and displays the correction status. The status depends on which correction was previously selected.
The three possible statuses are :



The selection of the DISABLE line key disables the altitude correction for the temperature control.

The selection of the 0.75 DEG C line key sets an altitude correction value which will linearly vary from 0 DEG. C on ground to 0.75 DEG. C at an altitude of 40000 ft.

The selection of the 1.5 DEG C line key sets an altitude correction value which will linearly vary from O DEG. C on ground to 1.5 DEG. C at an altitude of 40000 ft.
This altitude correction is the default one.



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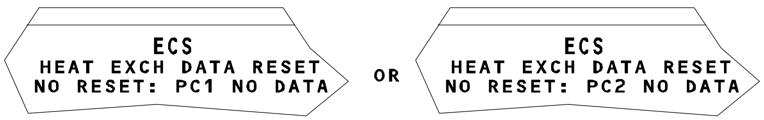
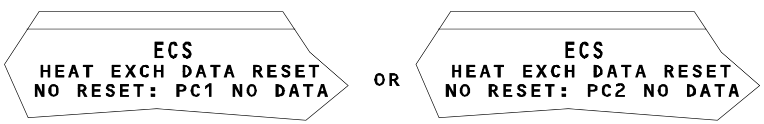
CAB TEMP

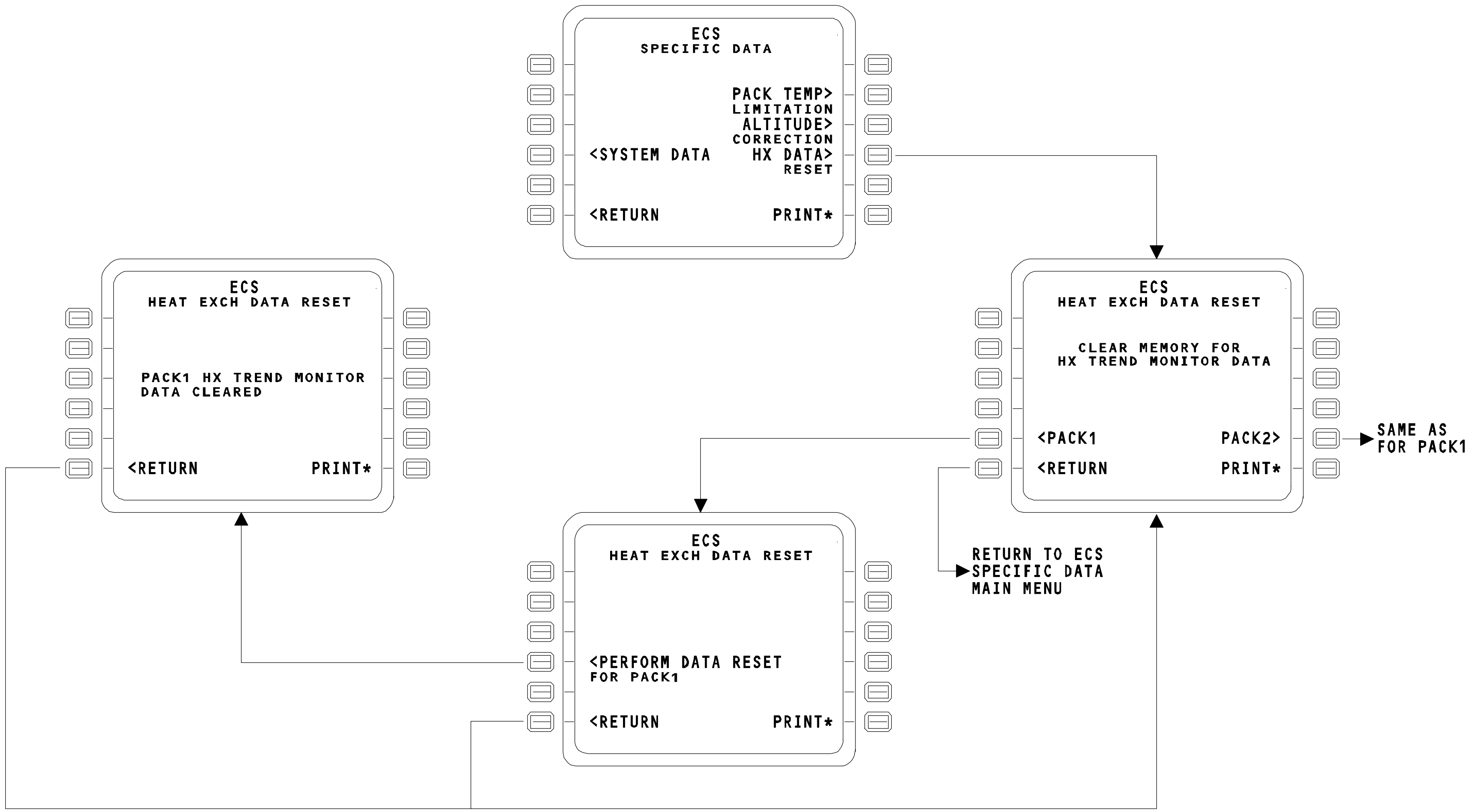
The selection of the HX DATA RESET line key leads to the display of the ECS HEAT EXCH DATA RESET main menu.
This indication is displayed only if there is no PCX (1 or 2) reset possible (no data from pack controller 1(2)).



The selection of the PACK 1 or PACK 2 line key leads to the display of the corresponding ECS HEAT EXCH DATA RESET submenu.
It enables a heat exchanger data reset of the corresponding pack to be performed.
This indication is displayed only if the reset of PCX (1 or 2) is performed but no possible (no data from pack controller 1(2)).



PACK 1(2) HX TREND MONITOR DATA CLEARED indication appears if the reset is possible.



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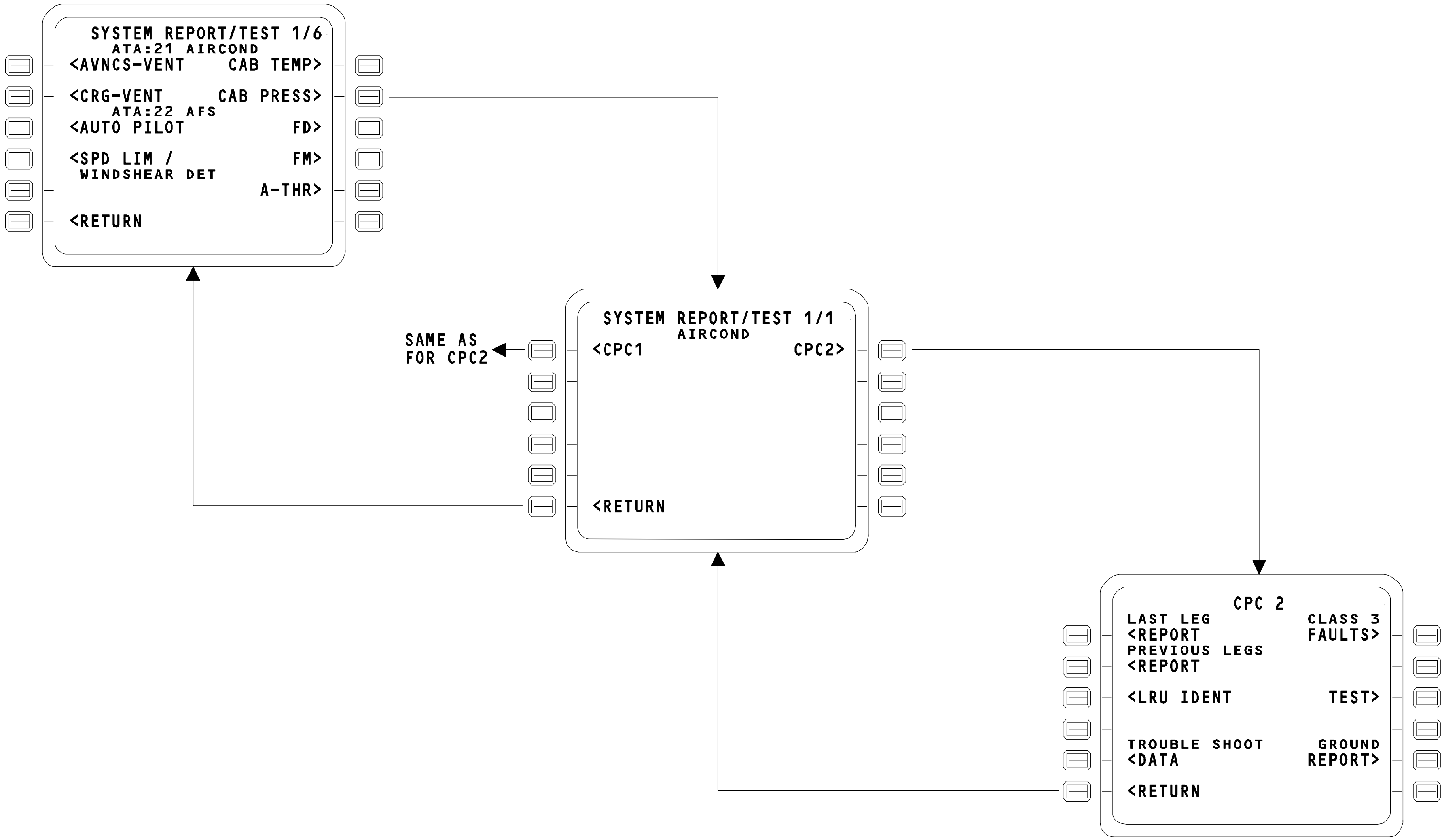
CAB PRESS

The selection of the CAB PRESS line key leads to the display of the CPC main menu with two items.

CPC 1 and CPC 2 submenus are identical and standard.


SYSTEM REPORT/TEST 1/6
ATA:21 AIRCOND
<AVNCS-VENT
CAB TEMP>
<CRG-VENT
CAB PRESS>
ATA:22 AFS
<AUTO PILOT
FD>
<SPD LIM /
WINDSHEAR DET
FM>
A-THR>
<RETURN
SYSTEM REPORT/TEST 1/1
AIRCOND
SAME AS
FOR CPC2
<CPC1
CPC2>
<RETURN
CPC 2
LAST LEG
<REPORT
CLASS 3
FAULTS>
PREVIOUS LEGS
<REPORT
<LRU IDENT
TEST>
TROUBLE SHOOT
<DATA
GROUND
REPORT>
<RETURN

STUDENT NOTES