CHAPTER

36

Pneumatic

CHAPTER 36
PNEUMATIC

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

CHAPTER 36
PNEUMATIC

Subject/Page	Date	COC	Subject/Page	Date	COC
36-11-00 (cont.)			36-11-00 (cont.)		
17	May 05/2015		39	May 05/2015	
18	May 05/2015		40	Sep 05/2016	
19	May 05/2015		41	May 05/2015	
20	May 05/2015		42	Sep 05/2016	
21	May 05/2015		43	May 05/2018	
22	May 05/2015		44	May 05/2018	
23	May 05/2015		45	May 05/2015	
24	May 05/2015		46	May 05/2015	
25	May 05/2015		47	May 05/2015	
26	May 05/2015		48	May 05/2015	
27	May 05/2015		49	May 05/2018	
28	May 05/2015		50	May 05/2018	
29	May 05/2015		51	May 05/2015	
30	May 05/2015		52	Sep 05/2016	
31	May 05/2015		53	Sep 05/2016	
32	May 05/2015		54	Sep 05/2016	
33	May 05/2015		55	Sep 05/2016	
34	May 05/2015		56	Sep 05/2016	
35	May 05/2015		57	Sep 05/2016	
36	May 05/2015		58	Sep 05/2016	
37	May 05/2015		59	Sep 05/2016	
38	May 05/2015		60	Sep 05/2016	

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

CHAPTER 36
PNEUMATIC

Subject/Page	Date	COC	Subject/Page	Date	COC
36-11-00 (cont.)			36-12-00 (cont.)		
61	Sep 05/2016		17	May 05/2015	
62	Sep 05/2016		18	May 05/2015	
63	Sep 05/2016		19	May 05/2015	
64	Sep 05/2016		20	Sep 05/2016	
65	Sep 05/2016		21	Sep 05/2016	
66	BLANK		22	Sep 05/2016	
36-12-00			23	May 05/2015	
1	May 05/2015		24	Sep 05/2016	
2	May 05/2015		25	Sep 05/2016	
3	May 05/2015		26	Sep 05/2016	
4	May 05/2015		27	May 05/2015	
5	May 05/2015		28	May 05/2018	
6	May 05/2015		29	May 05/2018	
7	May 05/2015		30	Sep 05/2016	
8	May 05/2015		31	Jul 25/2018	
9	May 05/2015		32	Sep 05/2016	
10	May 05/2015		33	May 05/2018	
11	May 05/2015		34	May 05/2018	
12	May 05/2015		35	Jul 25/2018	
13	May 05/2015		36	May 05/2015	
14	May 05/2015		37	May 05/2015	
15	May 05/2015		38	May 05/2015	
16	Sep 05/2017		39	May 05/2018	

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

CHAPTER 36
PNEUMATIC

Subject/Page	Date	COC	Subject/Page	Date	COC
36-12-00 (cont.)					
40	May 05/2018				
41	May 05/2015				
42	BLANK				
36-20-00					
1	May 05/2015				
2	May 05/2015				
3	May 05/2015				
4	May 05/2015				
5	May 05/2015				
6	May 05/2015				
7	May 05/2015				
8	May 05/2015				
9	May 05/2015				
10	May 05/2015				
11	May 05/2015				
12	May 05/2015				
13	May 05/2015				
14	May 05/2015				
15	May 05/2015				
16	May 05/2015				
17	Sep 05/2016				
18	Sep 05/2016				
19	May 05/2015				
20	BLANK				

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

CHAPTER 36
PNEUMATIC

CHAPTER 36
PNEUMATIC

CHAPTER 36
PNEUMATIC

CHAPTER 36
PNEUMATIC

PNEUMATIC - INTRODUCTION

Purpose

The pneumatic system supplies air from one of these sources to the user systems:

- Engines
- Auxiliary power unit (APU)
- Ground air.

The user systems use the air supply for these functions:

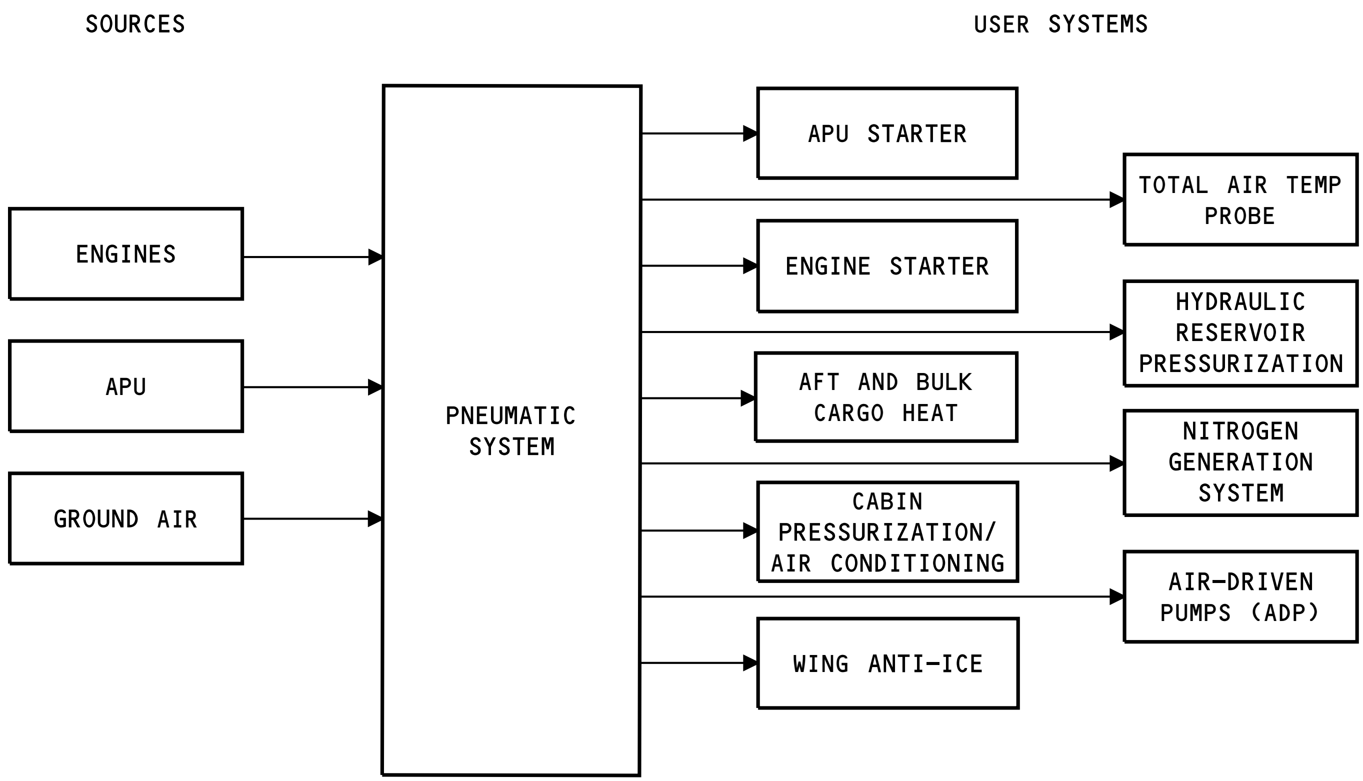
- Start the APU
- Start the engines
- Supply aft and bulk cargo heat
- Cabin pressurization and air conditioning
- Prevent ice from forming on the wing slats
- Supply air flow across the total air temperature probe
- Pressurize the hydraulic reservoirs
- Supply power to the air driven hydraulic pumps.
- Supply air to the Nitrogen Generation System (NGS).

Abbreviations and Acronyms

- ACIPS - airfoil and cowl ice protection system
- ACMS - airplane condition monitoring system
- ADIRU - air data inertial reference unit
- ADP - air driven pump
- AFDS - autopilot flight director system
- AGS - air ground system
- AIMS - airplane information management system
- APL - airplane
- APT - APU-to-Pack Takeoff
- APU - auxiliary power unit
- APUC - auxiliary power unit controller
- ARINC - aeronautical radio, inc.
- ASC - air supply control
- ASCS - air supply control system
- ASCPC - air supply cabin pressure controller
- ASG - arinc signal gateway
- bld - bleed
- CGO - cargo
- cl - closed
- CMCF - central maintenance computing function
- CMCS - central maintenance computing system
- COMPT - compartment
- CPC - cabin pressure control
- CPCS - cabin pressure control system
- CPRSR - compressor
- CTC - cabin temperature controller
- DDG - dispatch deviations guide
- DLODS - duct leak and overheat detection system
- EAI - engine anti-ice
- EAS - engine air supply
- ECS - environmental control system
- ECSMC - environmental control system miscellaneous card
- EEC - electronic engine control
- EFIS - electronic flight instrument system
- EICAS - engine indicating and crew alerting system
- ELMS - electrical load management system
- ENG - engine
- FAMV - fan air modulating valve
- FMCS - flight management computing system
- FS - manifold flow sensor
- FSEU - flap/slat electronics unit

PNEUMATIC - INTRODUCTION

- HP - high pressure
- HPC - high pressure compressor
- HPFAC - high pressure fan air controller
- HPSOV - high pressure shutoff valve
- HYD - hydraulic
- HYDIM - hydraulic interface module
- INST - instrument
- IP - intermediate pressure
- IPCV - intermediate pressure check valve
- ISLN - isolation
- isol - isolate
- lch - latch
- LW - left wing
- MANF - manifold
- NGS - nitrogen generation system
- OPAS - overhead panel ARINC 629 system
- OPN - operation
- OVHT - overheat
- POS - position
- PRESS - pressure
- PRESSN - pressurization
- PRI - primary
- PRSOV - pressure regulating and shutoff valve
- PRSOVC - pressure regulating and shutoff valve controller
- PSEU - proximity sensor electronic unit
- PWR - power
- RVDT - rotary variable differential transformer
- SEC - secondary
- SNSR - sensor
- STBY - standby
- STRTR - starter
- TAT - total air temperature
- TEMP - temperature
- TM - manifold dual temperature sensor
- TMCF - thrust management computing function
- VCU - valve control unit
- VLV - valve
- WAI - wing anti-ice
- WES - warning electronic system
- WOW - weight on wheels



1557325 S0000286879_V1

PNEUMATIC - INTRODUCTION

THIS PAGE IS INTENTIONALLY LEFT BLANK

PNEUMATIC - GENERAL DESCRIPTION

General

The pneumatic system has these three sections:

- Engine air supply
- Air supply distribution
- Indicating.

Two air supply cabin pressure controllers (ASCPC) give control, indication and BITE for all sections of the pneumatic system and for the pressurization system.

See the air pressurization section for more information on the pressurization system (SECTION 21-30)

The controllers also set the amount of air that the air conditioning packs use (flow schedules) and give backup control to the cabin temperature controllers for air conditioning pack flow control and trim air control.

See the air conditioning chapter for more information on air conditioning backup control (CHAPTER 21)

The left ASCPC controls the left engine air supply and the right ASCPC controls the right engine air supply. Both controllers control the isolation valves and APU shutoff valve.

Engine Air Supply

The engine air supply part of the pneumatic system can operate at any one of three levels (modes) of control:

- Digital (primary control)
- Analog (backup control)
- Pneumatic.

See the engine air supply section for more information about the engine air supply (SECTION 36-11).

The engine air supply system supplies the users with bleed air from two stages of the high pressure compressor (HPC). Low pressure bleed air comes from the 4th stage of the HPC. High pressure bleed air comes from the 9th stage of the HPC. These are the specified limits for pressure, temperature, and flow:

- Pressure - 0 through 75 psig (mode dependent)
- Temperature - 380F (193C) or 250F (121C) (mode dependent)
- Flow - 10 lbs/sec maximum (engine bleed airflow management).

The ASCPCs monitor the user systems to make decisions about how much air to supply. The ASCPCs manage engine bleed airflow three ways:

- Sheds user loads through an ARINC 629 signal (aft and bulk cargo heat, wing anti-ice)
- Sheds user loads by direct control (air conditioning packs, air conditioning trim air)
- Keeps engine bleed airflow to a limit.

The ASCPCs also monitor the user systems to make decisions about the temperature of air to supply. The ASCPCs manage engine bleed air temperature in two ways:

- Controls the flow of fan air though the precooler
- Keeps engine bleed air flow to a limit.

The ASCPCs use the pressure regulating and shutoff valve controller (PRSOVC) and the high pressure and fan air controller (HPFAC) to control the engine bleed air. The PRSOVC and HPFAC usually adjust the positions of the pressure regulating and shutoff valve (PRSOV) and the high pressure shutoff valve (HPSOV) as necessary to regulate pressure and flow. The HPFAC adjusts the position of the fan air modulating valve (FAMV) as necessary to regulate temperature. See the engine air supply section for more information about the engine air supply (SECTION 36-11).

Air Supply Distribution

The air supply distribution system supplies air from the sources to the user systems. The ASCPCs monitor the condition of the airplane, air sources and user systems to make decisions about which source to use and where the air is needed. The ASCPCs open and close the isolation valves and APUSOV as necessary to distribute the air to the user systems.

Indicating

Eight sensors monitor the air in the pneumatic system (right side sensors not shown):

- Manifold flow sensor (2)
- Manifold pressure sensor (2)
- Manifold dual temperature sensor (2)
- Intermediate pressure sensor (2).

RVDTs monitor valve position for these valves:

- Left, right, and center isolation valves
- APU shutoff valve
- Left and right fan air modulating valves.

The left and right ASCPCs monitor the sensors for flow, pressure, and temperature data. The ASCPCs monitor the RVDTs for valve position data. The ASCPCs use the data to control these components:

- Three isolation valves
- APU shutoff valve
- Two pressure regulating and shutoff valve controllers (PRSOVC)
- Two high pressure fan air controllers (HPFAC).

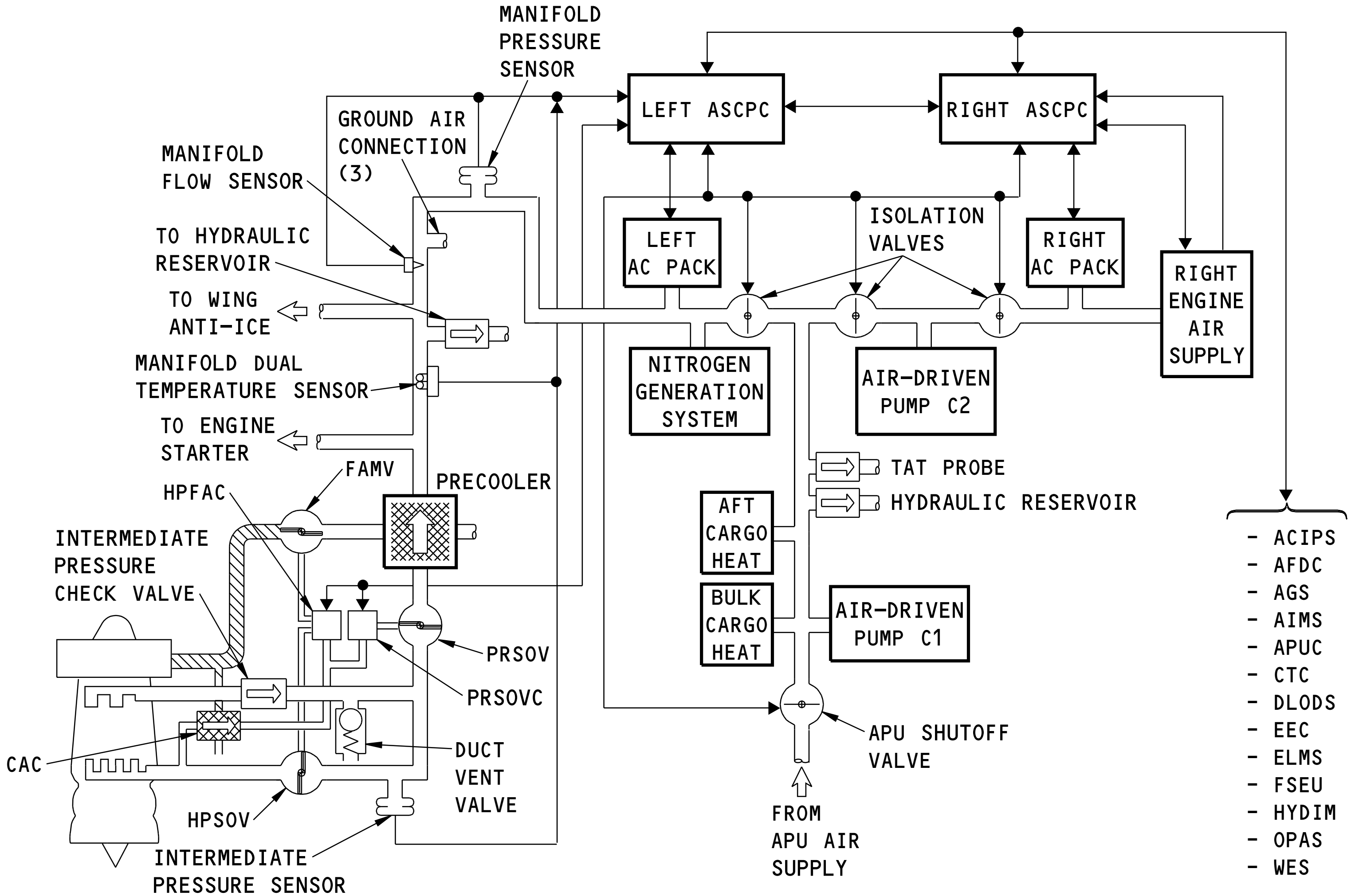
The ASCPCs send information to the airplane information management system (AIMS). The AIMS gives EICAS messages and synoptic and maintenance information.

Interfaces

The pneumatic system has interfaces with these systems and components:

- Left and right cabin temperature controllers (CTC)
- Overhead panel ARINC 629 system (OPAS)
- Electronic engine control (EEC)
- Airplane information management system (AIMS)
- Electrical load management system (ELMS)
- Warning electronic system (WES)
- Auxiliary power unit controller (APUC)
- Flap slat electronics unit (FSEU)
- ARINC signal gateway (ASG)

See the section on the ASCPC for more information on interfaces.



1557331 S0000286886_V1

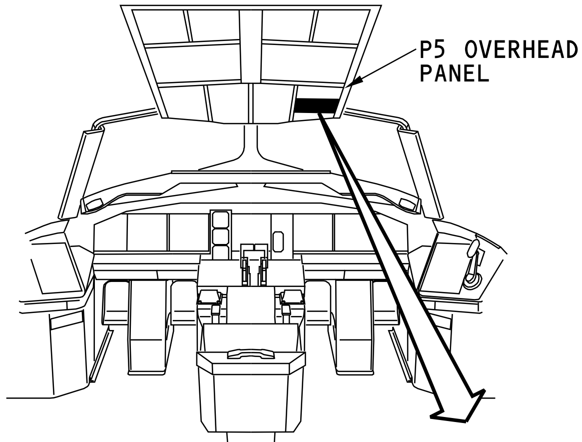
PNEUMATIC - GENERAL DESCRIPTION

PNEUMATIC - COMPONENT LOCATIONS

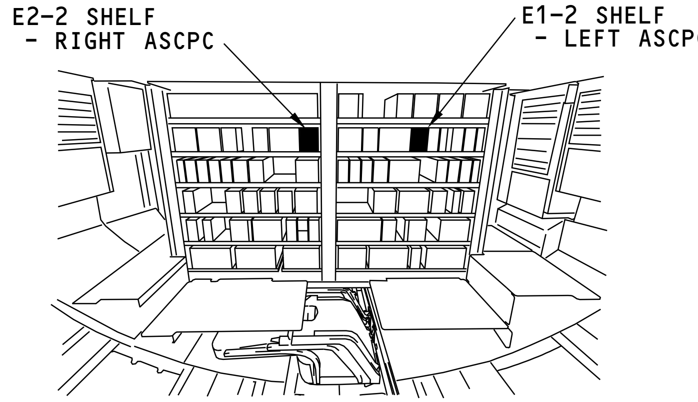
Component Locations

Two ASCPCs are in the main equipment center. The left ASCPC is on the E1-2 shelf. The right ASCPC is on the E2-2 shelf.

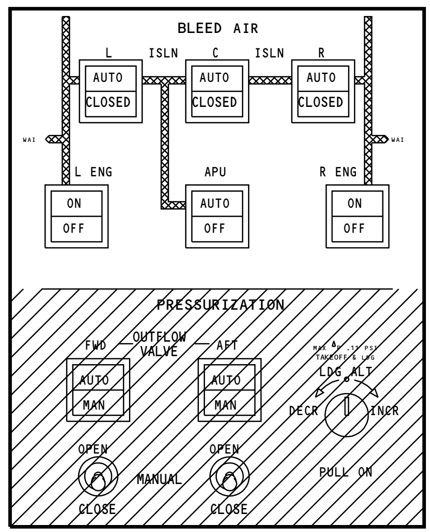
The bleed air/pressurization panel is on the P5 overhead panel. Switches on the bleed air part of the panel give control and indications for the pneumatic system.



FLIGHT DECK



MAIN EQUIPMENT CENTER
(LOOKING AFT)



BLEED AIR/PRESSURIZATION PANEL

M42887 S000620045_V1

PNEUMATIC - COMPONENT LOCATIONS

THIS PAGE IS INTENTIONALLY LEFT BLANK

Bleed Air/Pressurization Panel

Switches on the bleed air/pressurization panel (P5) have interfaces with the left and right ASCPCs to give control and supply indications for the pneumatic system. These switches control and give indications for the pneumatic sources:

- Left engine bleed switch (L ENG)
- APU bleed switch (APU)
- Right engine bleed switch (R ENG).

These switches control and give indications for the pneumatic distribution:

- Left isolation valve (L ISLN)
- Center isolation valve (C ISLN)
- Right isolation valve (R ISLN).

See the indicating section for more information about the indicating system (SECTION 36-20).

Engine Bleed Switches

The L ENG and the R ENG switches have an annunciator light that comes on when the pressure regulation and shutoff valve (PRSOV) is set to off by the related ASCPC. The switches have two positions:

- In (usual position)
- Out (non-normal).

The ON position (switch in) lets the related engine bleed air system supply air when the engine is running.

The switch out position sets the related engine bleed air system so it does not supply air and turns on the OFF light in the switch. The OFF light gives an indication that the PRSOV is set to OFF and does not relate to the actual position of the PRSOV.

When the switch is in, the OFF light comes on if the engine is off or if any of the these protective shutdown, non-normal conditions occurs:

- Wing or strut duct overheat (wing bleed loss)
- Bleed air overtemperature
- Bleed air overpressure
- Engine fire switch pulled.

When the OFF light is on, the BLEED OFF ENG L(R) advisory message usually shows. This message does not show if the engine is off or if the OFF light comes on because of wing or strut overheat. See the duct leak and overheat detection section for more information (SECTION 26-18).

See the engine air supply section for more information on engine bleed air control and operation (SECTION 36-12).

APU Bleed Switch

The APU switch has an annunciator light that comes on when the APUSOV is closed because of a non-normal condition. The APU switch has two positions:

- In (usual position)
- Out (non-normal).

The AUTO position (switch in) lets the APU shutoff valve (APUSOV) OPEN/CLOSE as necessary to supply air to the pneumatic distribution system.

See the air supply distribution section for more information about the APU shut off valve OPEN/CLOSE position control (SECTION 36-12).

The switch out position sets the APU shutoff valve to close. With the switch set to out, the OFF light in the switch comes on when the valve closes.

When the switch is in, the OFF light comes on when the valve is closed and any of the these non-normal conditions occurs:

- Wing or body duct overheat
- APUSOV failed closed

- APU fire switch pulled.

When the OFF light comes on, the BLEED OFF APU advisory message usually shows. This message does not show if the APU is off. See the duct leak and overheat detection system section for more information (SECTION 26-18).

Isolation Bleed Switches

The isolation bleed switches have an annunciator light that comes on when the related isolation valve is closed because of a non-normal condition. The switches have two positions:

- In (usual position)
- Out (non-normal position.)

The AUTO position (switch in) lets the related isolation valve, left, center, or right OPEN/CLOSE as necessary to control the direction of air flow in the pneumatic distribution system.

The switch out position sets the related isolation valve to close. The CLOSED annunciator light in the switch comes on when the valve is closed.

The AUTO position with CLOSED indication (switch in) can occur when the related valve is closed and any of the these non-normal conditions occurs:

- Wing or body duct overheat
- Related isolation valve failed closed
- Left (right) bleed source loss.

When the CLOSED light comes on because the related valve is failed closed or the related switch is set to out, the advisory message, BLEED ISLN CLOSED L (C, R) shows.

See the air supply distribution section for more information on the isolation valve OPEN/CLOSE position control (SECTION 36-12).

Training Information Point

Annunciator lights and EICAS messages on the bleed air/pressurization panel usually relate to valve positions that the left and right ASCPCs control and monitor.

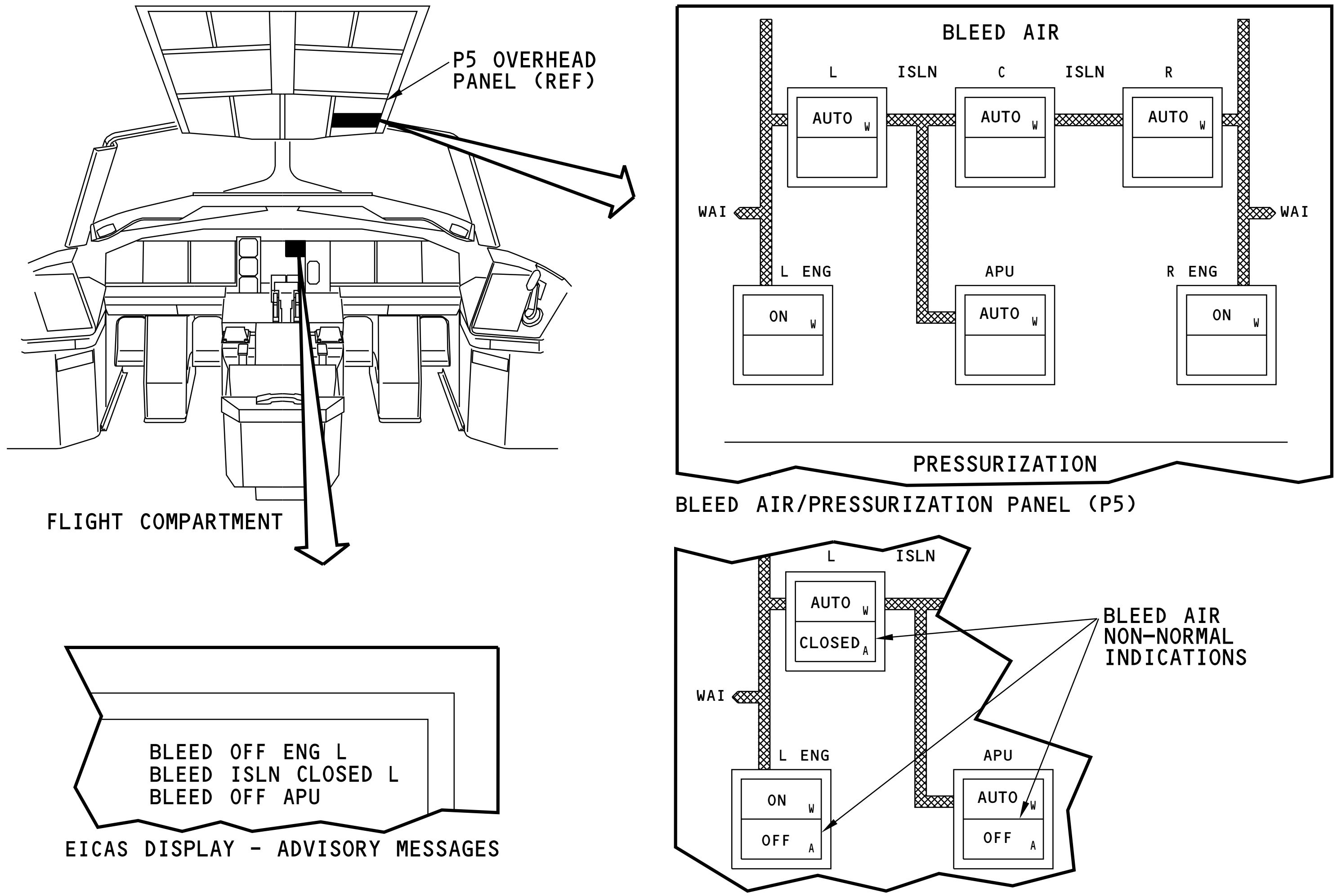
The isolation valves and APUSOV have RVDTs that the ASCPCs use to calculate when to turn on the related CLOSED or OFF lights. If a RVDT fails, the ASCPCs calculate when to turn on or show the related indications without the use of the failed RVDT. The calculation for the lights is based on the ASCPC set position for the related valve. The calculation for the message is based on switch position for the related valve.

The PRSOVs do not have any direct feedback to the ASCPC, no RVDTs, no limit switches and no proximity switches. The ASCPCs calculate the related valve position for all indications based on set position.

The primary control (digital) part of the ASCPCs usually gives control and indications for the related engine bleed air system, the isolation valves and APUSOV. If primary control fails in one controller, the other controller controls the isolation valves and APUSOV. All indications that are related to the ASCPC that has the failed primary control are lost. These are the indications lost related to the bleed air/pressurization panel:

BLEED AIR/PRESSURIZATION PANEL	
FAILED PRIMARY CONTROL	INDICATIONS LOST FOR THESE VALVES
LEFT ASCPC	L ISLN
	C ISLN
RIGHT ASCPC	R ISLN
	APUSOV

The backup control (analog) part of the ASCPCs that has a failed primary control gives limited engine bleed air control and engine OFF indications.



M42888 S000620046_V1

PNEUMATIC - OPERATION

PNEUMATIC - INDICATIONS - EICAS DISPLAY AND SECONDARY ENGINE DISPLAY

General

You can see duct pressure for the left and right parts of the pneumatic distribution system on these displays:

- EICAS display
- Secondary engine display
- Air synoptic display (not shown)
- Air supply maintenance page (not shown)
- Ice protection maintenance page (not shown)
- Performance maintenance page (not shown).

The synoptic display and the maintenance pages are described later in this section.

The units of duct pressure are psig. The color of the pressure readout changes from white to amber when pressure is less than 11 psig. No pressure will show if any of these conditions occurs:

- Related ASCPC primary (digital) control fails
- Fault in the indication circuit.

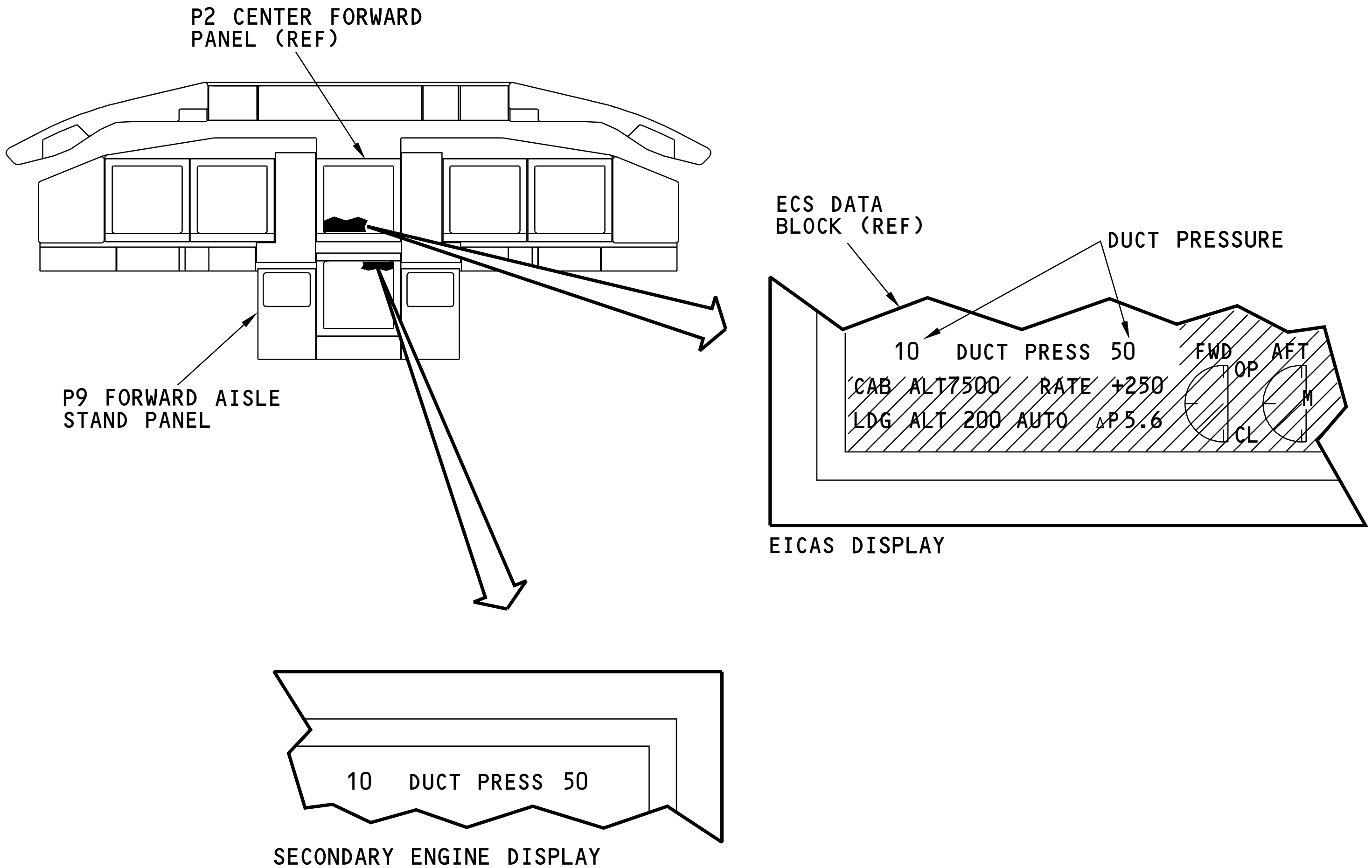
EICAS Display

Duct pressure shows in the ECS data block part of the EICAS display. This block shows if any of these conditions occur:

- Loss of landing altitude, FMC to ASCPCs
- Loss of automatic pressurization control
- Loss of automatic fwd or aft pressurization outflow valve control
- MAN selected for outflow valve control
- Exceedance for cabin altitude or cabin differential pressure
- Duct pressure less than 11 psig and the related engine is on
- Air synoptic display shows.

Secondary Engine Display

Duct pressure shows on the secondary engine display if one or both engines are off and the related engine fire switch is not pulled.



M42793 S000620047_V1

PNEUMATIC - INDICATIONS - EICAS DISPLAY AND SECONDARY ENGINE DISPLAY

PNEUMATIC - INDICATIONS - AIR SYNOPTIC DISPLAY

Air Synoptic Display

The lower part of the air synoptic display gives information about the pneumatic system, air conditioning zone temperature control system, cargo heat systems, and air user system.

See the air conditioning chapter for more information about the temperature control and cargo heat systems (CHAPTER 21).

For the pneumatic system the display shows:

- Air flow direction and user systems
- Isolation valve position
- Duct pressure (manifold duct pressure)
- Engine bleed valve (PRSOV) calculated position
- APU shutoff valve position
- Air source status (engine, APU and ground).

Green flow bars show air flow direction and identify which sources and users are on.

Valve positions show as one of the following symbols:

- Open (white circle with flow bar in-line with duct)
- Closed (white circle with flow bar 90 degrees to duct)
- Failed open (amber valve open symbol with amber X)
- Failed closed (amber valve closed symbol with amber X)
- Selected closed (amber valve closed symbol with amber X) for isolation and APU shutoff valves only
- Invalid (white circle with no flow bar).

The units of duct pressure are psig. The color of the pressure readout changes from white to amber when pressure is less than 11 psig. No pressure will show if any of these conditions occurs:

- Related ASCPC primary (digital) control fails
- Fault in the indication circuit.

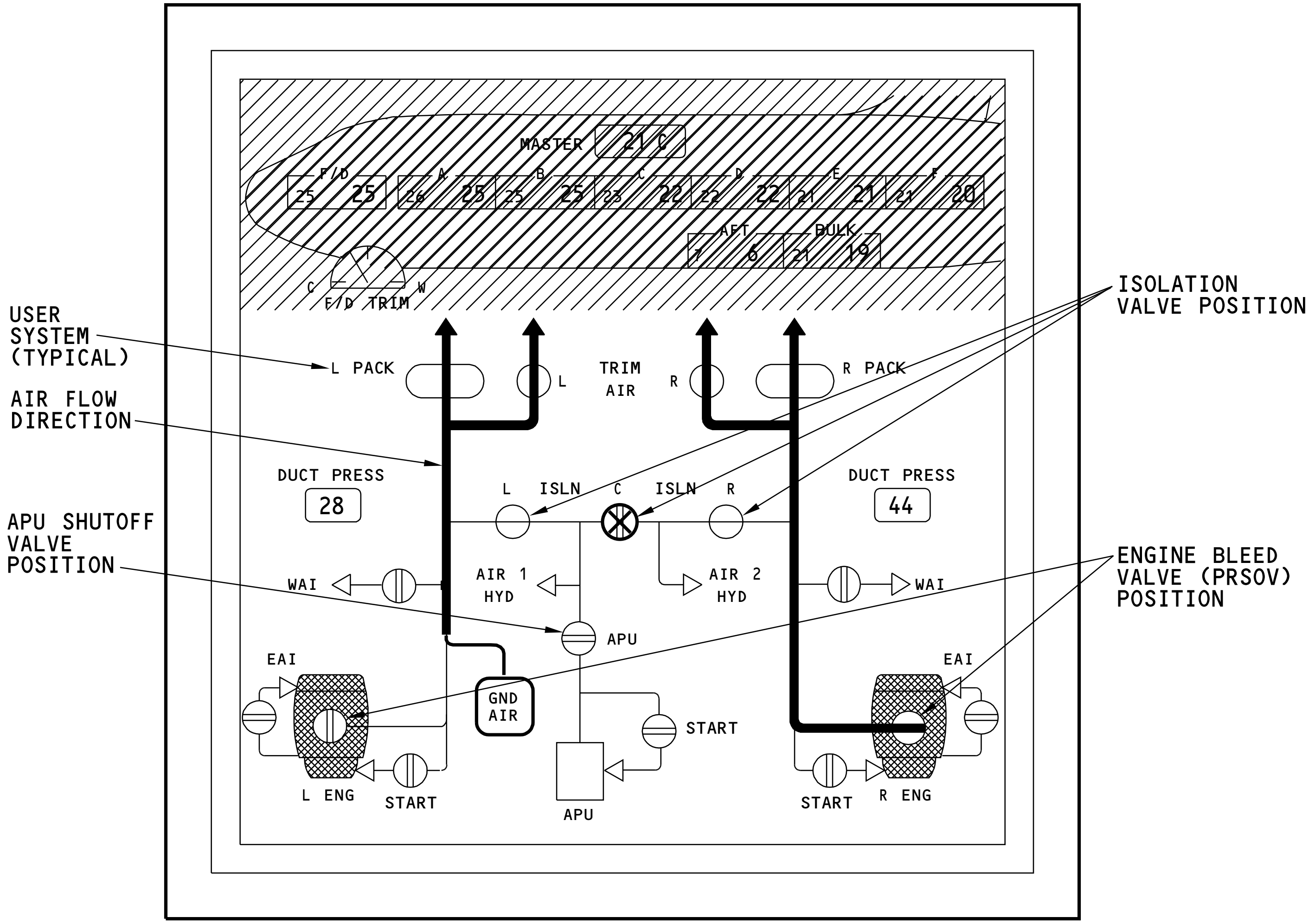
Air source status for the engines is not shown on the air synoptic display. Air source status for the APU shows by color change of the APU symbol. The APU symbol is white for APU off and green for APU on. The ground air symbol shows if manifold duct pressure is more than 11 psig and all of the following are true:

- Airplane on the ground
- No active engine or APU bleed air sources or any active bleed sources isolated from ground air source
- User system on (pack, trim air, WAI, starter, ADP).

Training Information Point

The related ASCPC calculates engine bleed valve (PRSOV) position. Actual valve position does not always agree with the position shown on the air synoptic display. If you must make sure that the PRSOV is open or closed, do a check the position indicator on the valve.

The positions of the isolation valves and the APUSOV, are usually based on actual valve position measured by RVDTs. If a RVDT fails, the related valve position is calculated by the related ASCPC. If the related ASCPC has a failed primary control, then valve position information will show as invalid.



M42889 S000620048_V1

PNEUMATIC - INDICATIONS - AIR SYNOPTIC DISPLAY

PNEUMATIC - INDICATIONS - AIR SUPPLY MAINTENANCE PAGE

Air Supply Maintenance Page

The upper part of the air supply maintenance page contains information about the pneumatic system. The primary control (digital) part of left and right ASCPCs and the EEC supply the information. The ASCPCs supply most of the information. This information comes from the EECs:

- STARTER VLV position
- ENG HIGH STAGE PRESS
- ENG N1 FAN SPEED.

Valve positions are shown as OPEN or CLOSED. Pressure values are shown in psig. Temperature values are shown in degrees C. Flow rate values are shown in kg/min.

Flight phase may be any one of these:

- Initialization (INIT)
- GND
- TAKEOFF
- CLIMB
- CRUISE
- DESCENT
- LANDING.

Either ASCPC can give the flight phase information; the left is the primary source.

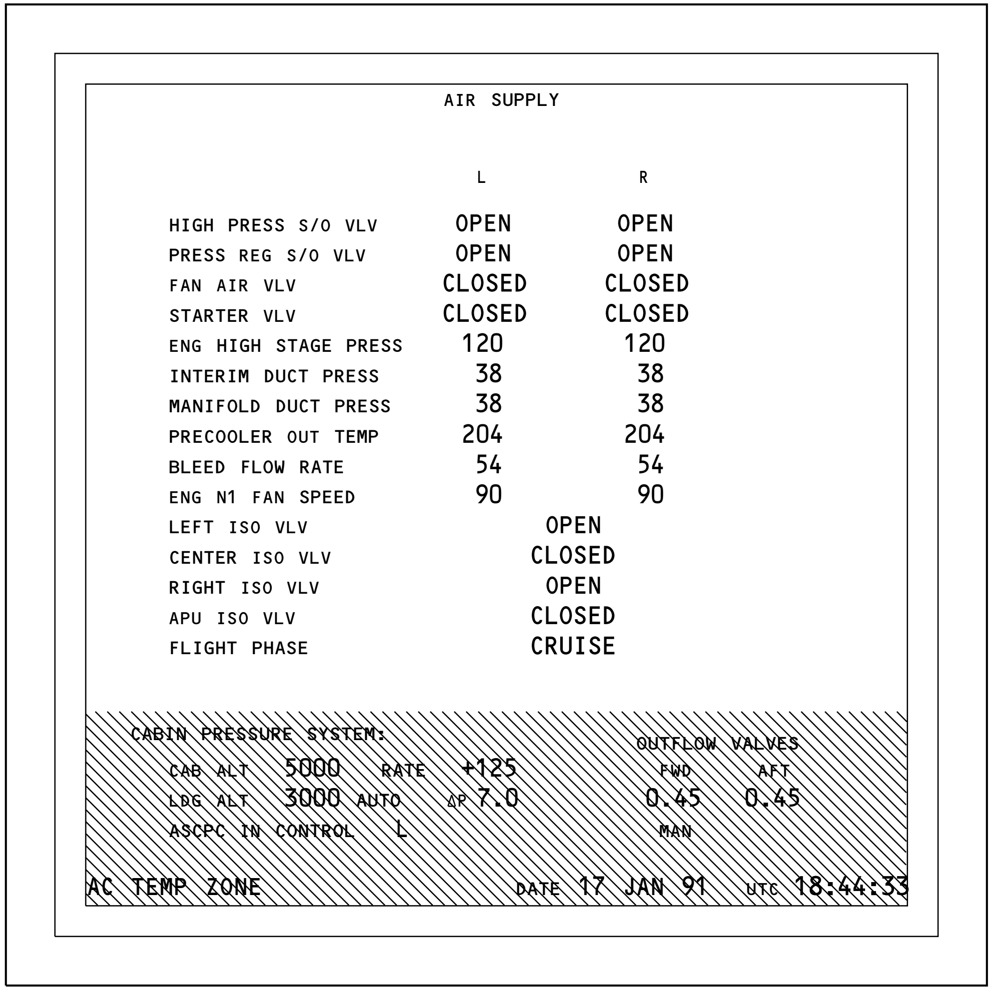
If any information is not available, the indication is blank.

Training Information Point

The related ASCPC calculates valve position information for the PRSOV and the HPSOV. Actual valve position does not always agree with the position shown. If you must make sure that the PRSOV or the HPSOV is open or closed, do a check of the position indicator on the valve.

The positions of the isolation valves and the APUSOV, are usually based on actual valve position measured by RVDTs. If a RVDT fails, the related valve position is calculated by the related ASCPC.

If an ASCPC has a failed primary control, then all information that normally comes from that controller will not show. The left ASCPC gives indications for the left part of the pneumatic system plus the center isolation valve. The right ASCPC gives indications for the right part of the pneumatic system plus the APU isolation valve (APUSOV).



M42797 S000620053_V2

PNEUMATIC - INDICATIONS - AIR SUPPLY MAINTENANCE PAGE

PNEUMATIC - SYSTEM TESTS

General

These are the pneumatic system tests that show when you select ATA 36 Air Supply System:

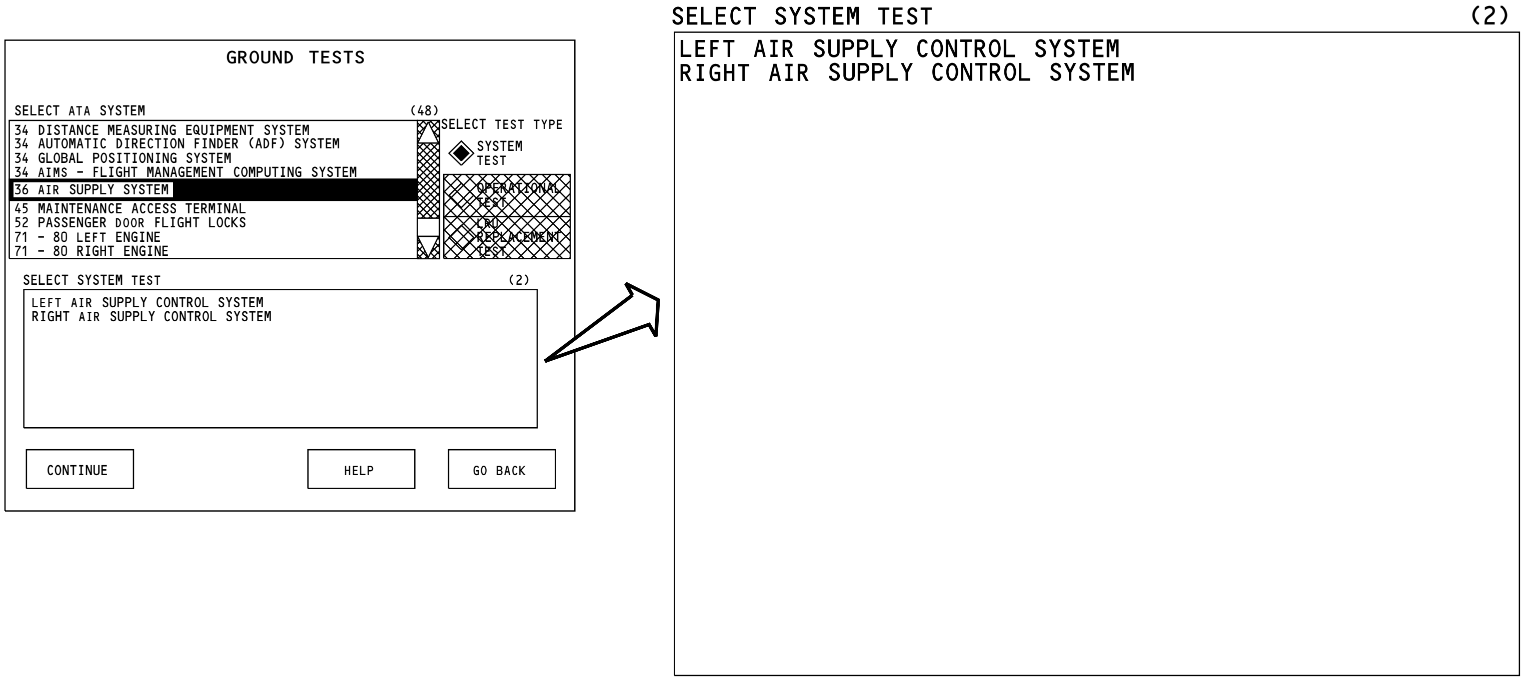
- Left air supply control system
- Right air supply control system.

Left and Right Air Supply Control System

These tests make sure that the electrical circuits for these air supply control system LRUs operate correctly:

- Valves
- Controllers
- Interfaces.

You must remove pressure in the pneumatic ducts for this test. During the test, the torque motors and solenoids move. The tests each take less than 1 minute.



M42891 S000620054_V1

PNEUMATIC - SYSTEM TESTS

THIS PAGE IS INTENTIONALLY LEFT BLANK

ENGINE AIR SUPPLY - INTRODUCTION

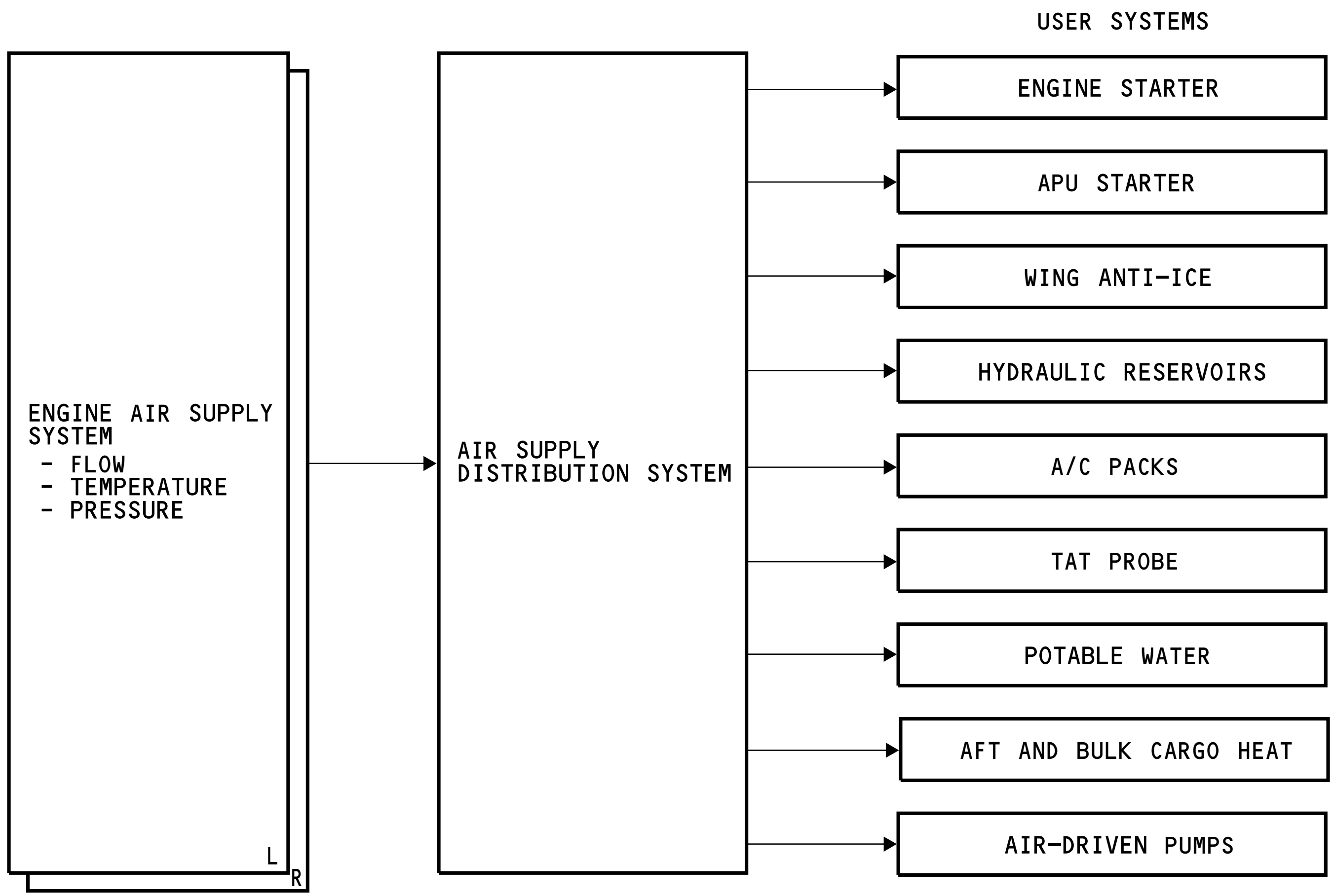
General

The engine air supply system supplies regulated bleed air to the air supply distribution system.

The engine air supply uses bleed air from an intermediate stage and a high stage of the high pressure compressor. The air supply cabin pressure controllers (ASCPC) control the bleed air to regulate flow, temperature, and pressure.

These are the air user systems:

- Engine starter
- APU starter
- Wing anti-ice
- Hydraulic reservoir
- Air conditioning pack
- Total air temperature (TAT) probe
- Potable water
- Aft and bulk cargo heat
- Air driven pump.



M42799 S000620056_V1

ENGINE AIR SUPPLY - INTRODUCTION

THIS PAGE IS INTENTIONALLY LEFT BLANK

ENGINE AIR SUPPLY - GENERAL DESCRIPTION

General Description

The engine air supply system has three levels of control:

- Digital (primary mode)
- Analog (backup mode)
- Pneumatic.

The ASCPC supplies the primary and backup modes. The high pressure fan air controller (HPFAC) and the pressure regulating and shutoff valve controller (PRSOVC) are set to let the engine air supply system operate without ASCPC control. This is the pneumatic mode.

For usual operation, all functions that have a relation to the primary mode and some functions for the backup mode operate at the same time. The primary mode and backup modes work together to supply the most efficient control for the engine air supply system.

If the primary mode fails, all functions for the backup and the pneumatic modes operate together. The backup and the pneumatic modes give a limited amount of control, protection, and indications for the engine air supply system.

If the primary and backup modes fail, the pneumatic mode sets the engine air supply system to the default condition. In the default condition, the engine air supply system supplies air in the pneumatic mode with no protection or indications.

The primary mode is described below. See engine air supply functional description section for more information.

Bleed Port Selection

The ASCPC selects the lowest possible bleed air source while still satisfying the needs of the users systems. Selection is based on pressure, flow, altitude, air conditioning pack operation, and engine starting. The manifold pressure sensor, the intermediate pressure sensor and the EEC monitor the pneumatic duct pressure. The pneumatic duct pressure data goes to the ASCPC. If pressure goes below specified values, the ASCPC sends a command to the HPFAC. The HPFAC adjusts the position of the high pressure shutoff valve (HPSOV) so that high pressure air adds to low pressure air.

Pressure Control

The ASCPC controls the engine air supply pressure. The manifold pressure sensor and the intermediate pressure sensor monitor the pneumatic duct pressure. The pneumatic duct pressure data goes to the ASCPC. The ASCPC then sends a command to the HPFAC and the PRSOVC. The HPFAC adjusts the HPSOV and the PRSOVC adjusts the pressure regulating shutoff valve (PRSOV). The valves open and close as necessary to control the pressure.

The duct vent valve (DVV) releases high pressure to prevent overpressure indication when the engine is on and the bleed system is set to off.

Temperature Control

The ASCPC controls the engine air supply temperature. The manifold dual temperature sensors monitor the pneumatic duct temperature. The pneumatic duct temperature data goes to the ASCPC. The ASCPC then sends a signal to the HPFAC. The HPFAC adjusts the fan air modulating valve (FAMV) to control the temperature.

If the temperature of the bleed air gets above the usual limits, a signal goes to the PRSOVC. The PRSOVC adjusts the PRSOV as necessary to decrease the amount of hot bleed air supplied.

ENGINE AIR SUPPLY - GENERAL DESCRIPTION

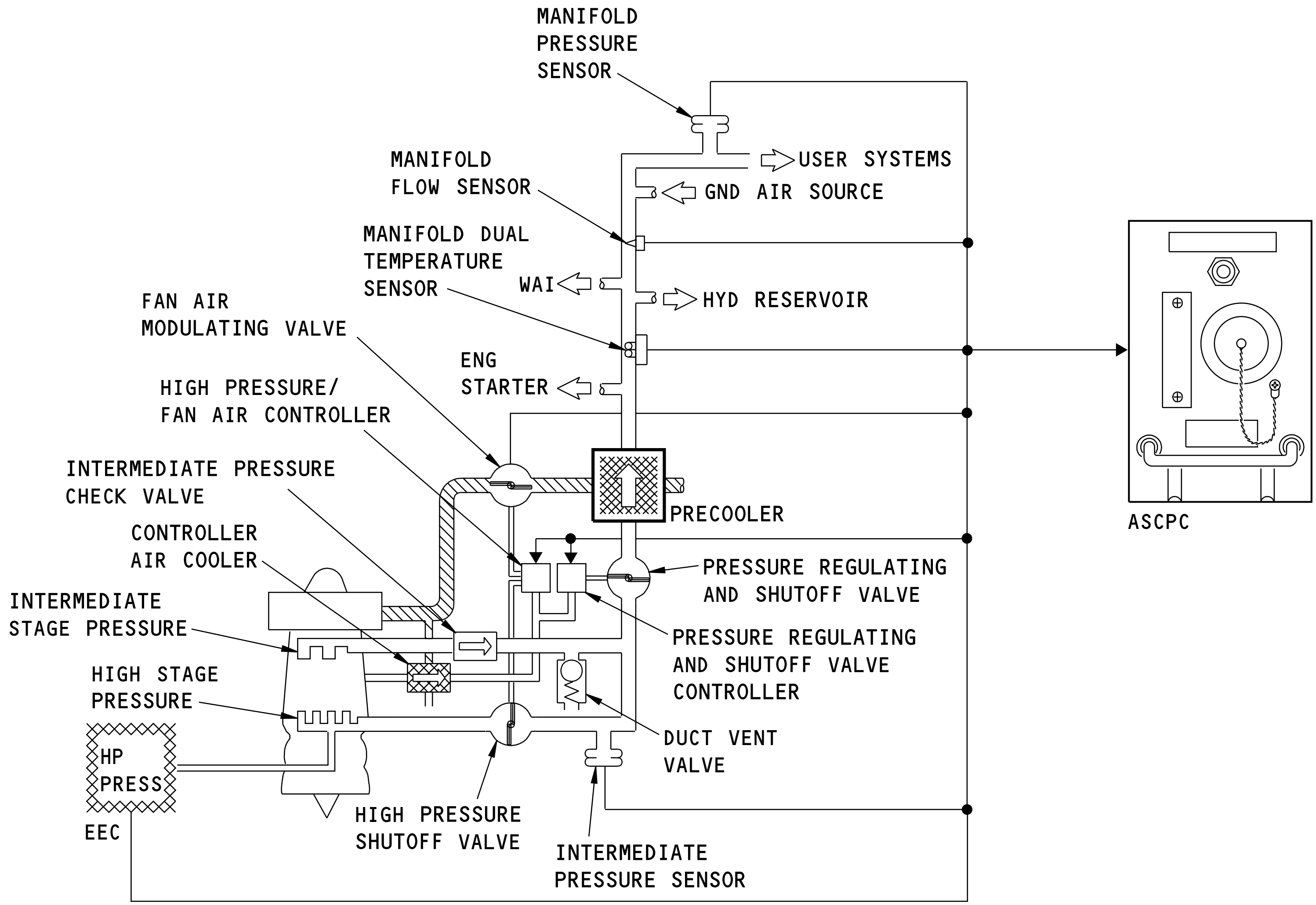
Flow Control

The ASCPC keeps the amount of bleed air that flows from the engine to a limit. The ASCPC uses inputs from these components or systems to monitor engine bleed airflow:

- Manifold flow sensor (FS)
- Engine anti-ice (EAI) system (not shown)
- Wing anti-ice (WAI) system (not shown).

The ASCPC uses the PRSOVC to control the flow. The PRSOVC adjusts the position of the PRSOV to regulate the bleed air flow into the air supply distribution system.

EAI and ECS controllers are sensitive to contamination. To remove contamination, a cyclonic collector assembly is installed upstream of the EAI controller and PRSOVC. The cyclonic collector spins the pneumatic air to remove contamination before it goes into the controllers.



W19019 S0000115239_V1

ENGINE AIR SUPPLY - GENERAL DESCRIPTION

ENGINE AIR SUPPLY SYSTEM - ENGINE LEFT SIDE COMPONENT LOCATIONS

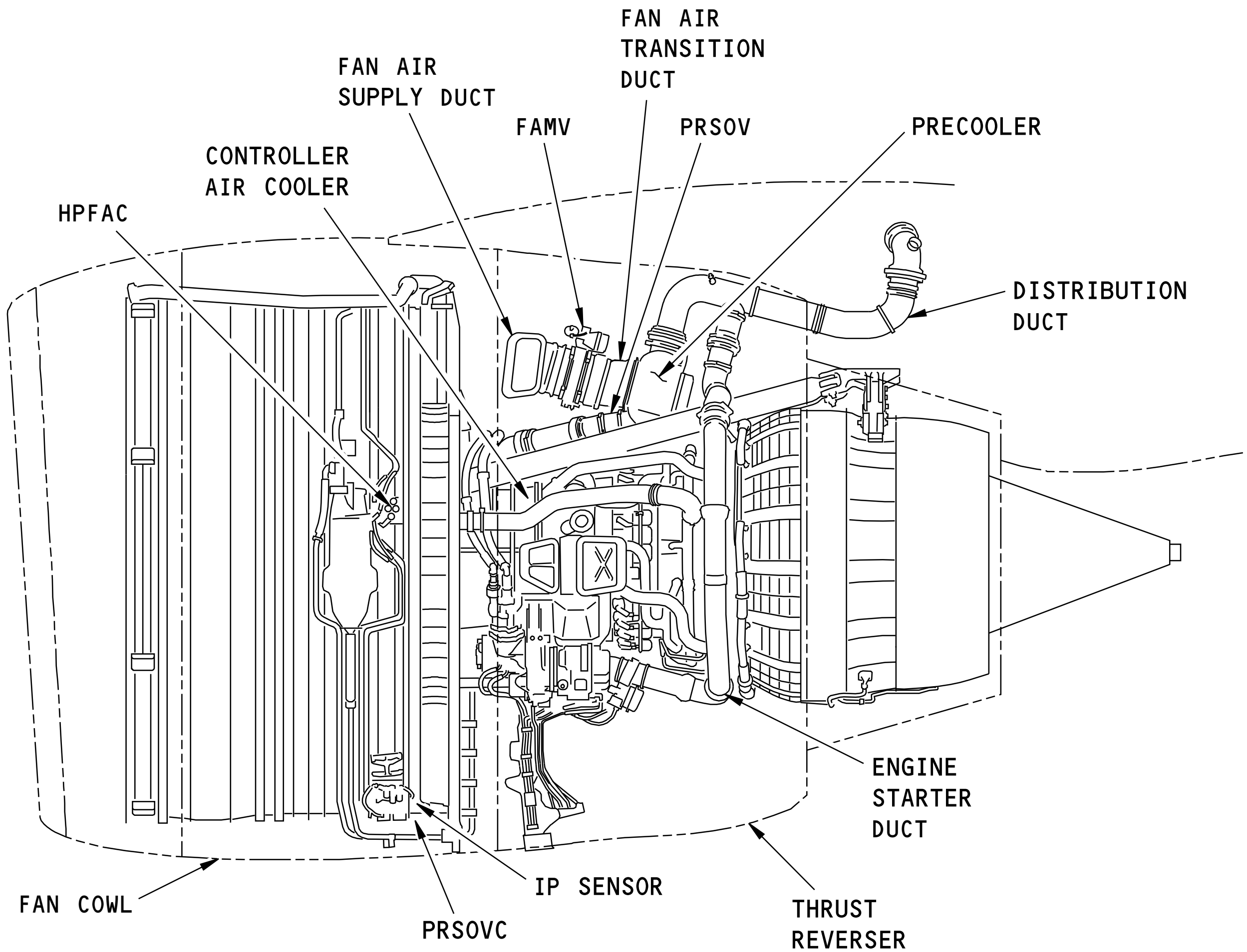
General

These are the engine left side components of the engine air supply system:

- Controller air cooler
- Fan air supply duct
- Fan air modulating valve (FAMV)
- Fan air transition duct
- High pressure fan air controller (HPFAC)
- Intermediate pressure sensor
- Pressure regulating and shutoff valve (PRSOV)
- Precooler
- Pressure regulating and shutoff valve controller (PRSOVC).

Training Information Point

Open the left fan cowl and thrust reverser to get access to the engine air supply components.



W18396 S0000115297_V2

ENGINE AIR SUPPLY SYSTEM - ENGINE LEFT SIDE COMPONENT LOCATIONS

ENGINE AIR SUPPLY SYSTEM - ENGINE RIGHT SIDE COMPONENT LOCATIONS

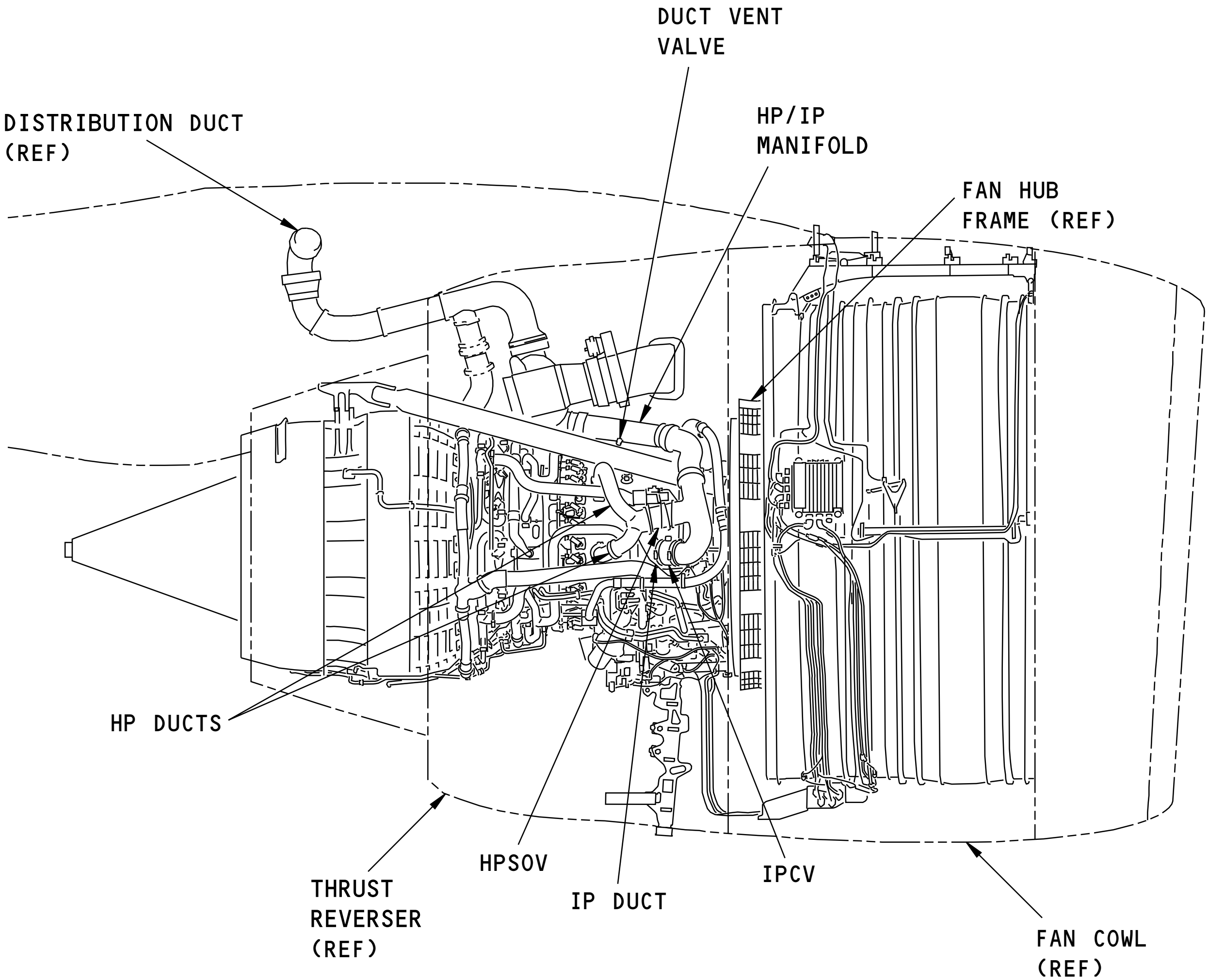
General

These are the engine right side components for the engine air supply system:

- Duct vent valve (DVV)
- HP/IP manifold
- Intermediate pressure check valve (IPCV)
- Intermediate pressure (IP) duct
- High pressure shutoff valve (HPSOV)
- High pressure (HP) duct (2).

Training Information Point

Open the right fan cowl and thrust reverser to get access to the engine air supply components.



W18513 S0000115299_V1

ENGINE AIR SUPPLY SYSTEM - ENGINE RIGHT SIDE COMPONENT LOCATIONS

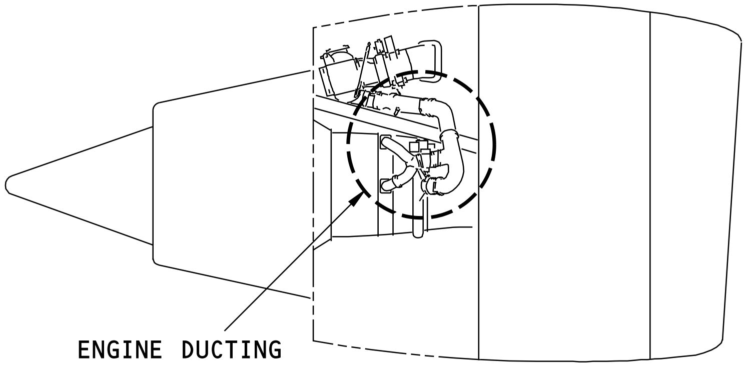
ENGINE AIR SUPPLY SYSTEM - ENGINE DUCT

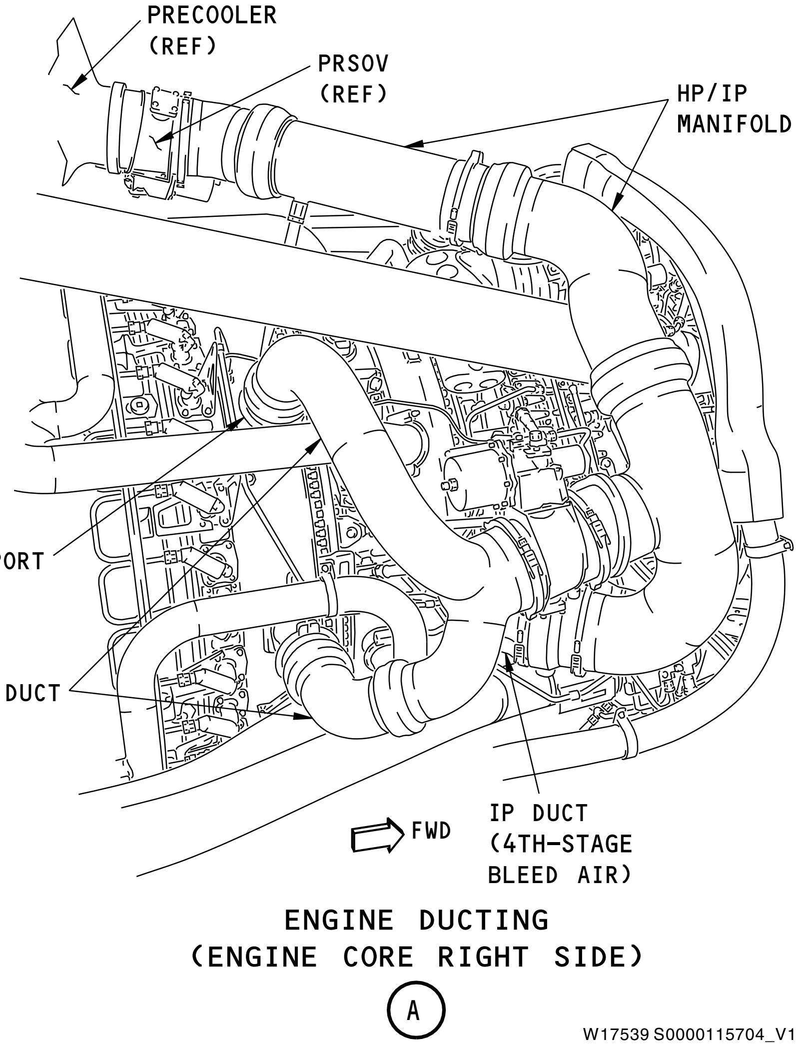
Purpose

The engine ducts move the engine bleed air flow from the engine compressor section to the pressure regulating valve (PRSOV).

Location

The engine ducts are on the right side of the engine core. The ducts are forward of the PRSOV.





W17539 S0000115704_V1

ENGINE AIR SUPPLY SYSTEM - ENGINE DUCT

ENGINE AIR SUPPLY SYSTEM - INTERMEDIATE PRESSURE CHECK VALVE

Purpose

The intermediate pressure check valve (IPCV) prevents air in the HP/IP manifold from going into the fourth stage bleed air source.

Physical Description

The IPCV is a pneumatically-operated check valve. The IPCV has these parts:

- Valve body
- Flapper
- Flapper stop
- Hinge pin.

The flow direction arrow is part of the valve body.

Location

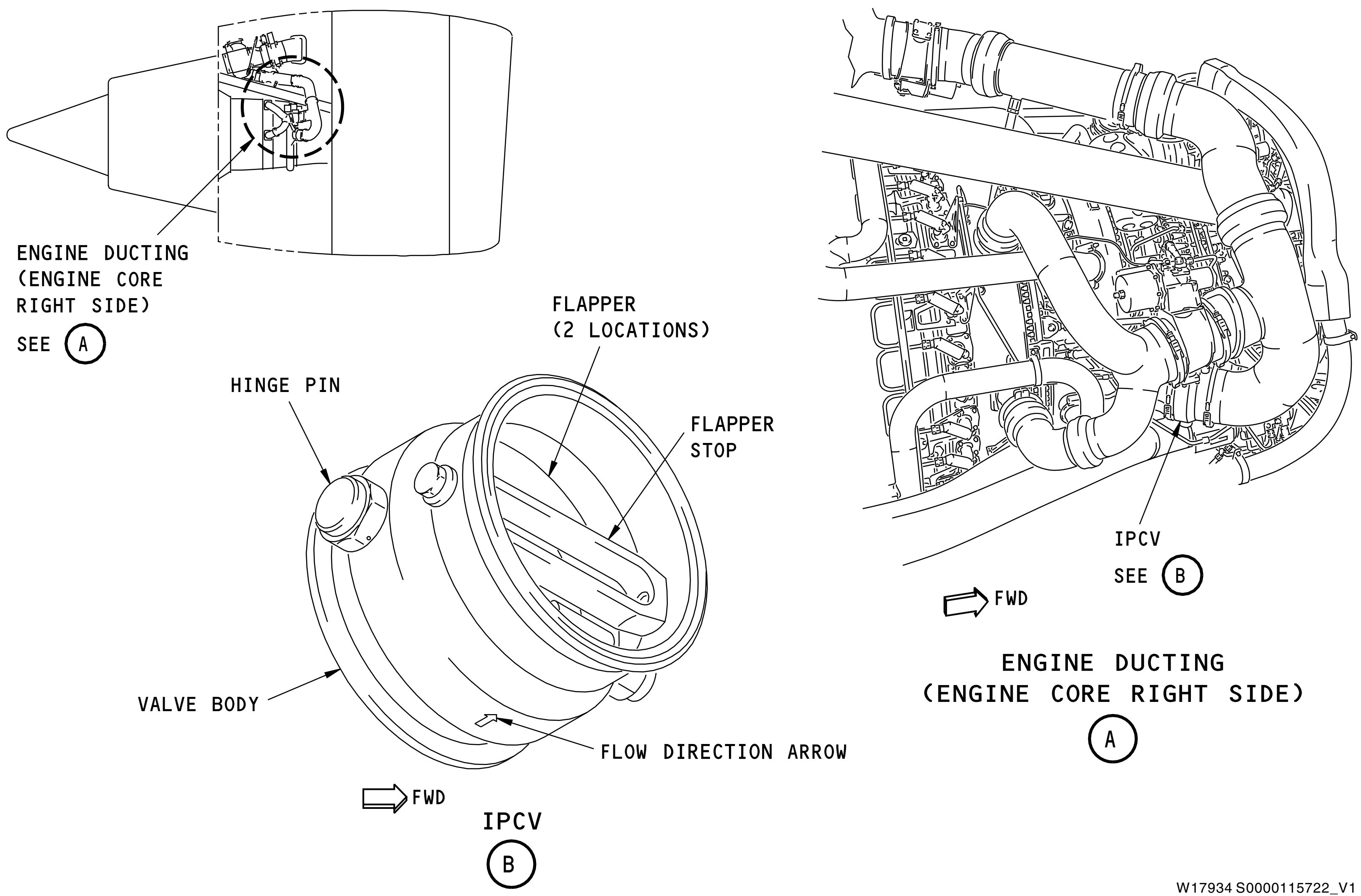
There is one IPCV on the right side of each engine. The valve is next to the fourth stage bleed air source at the 3:00 position in the engine ducting.

Functional Description

The flappers hinge around the hinge pin. The flapper stop keeps the flappers from opening too far. Fourth stage bleed air pressure and engine manifold pressure control the position of the flappers.

Training Information Point

A male and a female flange prevents the IPCV from incorrect installation. A flow direction arrow on the valve also helps prevent incorrect installation.



ENGINE AIR SUPPLY SYSTEM - INTERMEDIATE PRESSURE CHECK VALVE

ENGINE AIR SUPPLY SYSTEM - HIGH PRESSURE SHUTOFF VALVE / PRESSURE REGULATING & SHUTOFF VALVE

Purpose

The high pressure shutoff valve (HPSOV) controls the direction of flow and the pressure of the bleed air from the high stage of the high pressure compressor.

The pressure regulating and shutoff valves (PRSOV) control the direction of flow and the air pressure to the pneumatic distribution system.

The HPSOV/PRSOV (-5 assemblies) are equipped with a manual override plunger. A valve that has been manually locked closed will occasionally become stuck in place after it is unlocked. The manual override plunger will free a valve that is stuck in the closed position.

Physical Description

The HPSOV and PRSOV are the same. They are of the spring loaded closed, pneumatically-operated type of valve. The valves have these parts:

- Pneumatic connector
- Manual override and position indicator assembly
- Manual override plunger (-5 assemblies)
- Flow direction arrow
- Valve body
- Valve disc
- Actuator.
- Manual Override Plunger (only on valves with -5 part numbers)

The valves do not have any electrical parts.

Location

The HPSOV is on the right side of the engine core at the 2:30 position. The HPSOV is in the engine ducting between the HP duct and the HP/IP manifold downstream of the tenth stage bleed air ports.

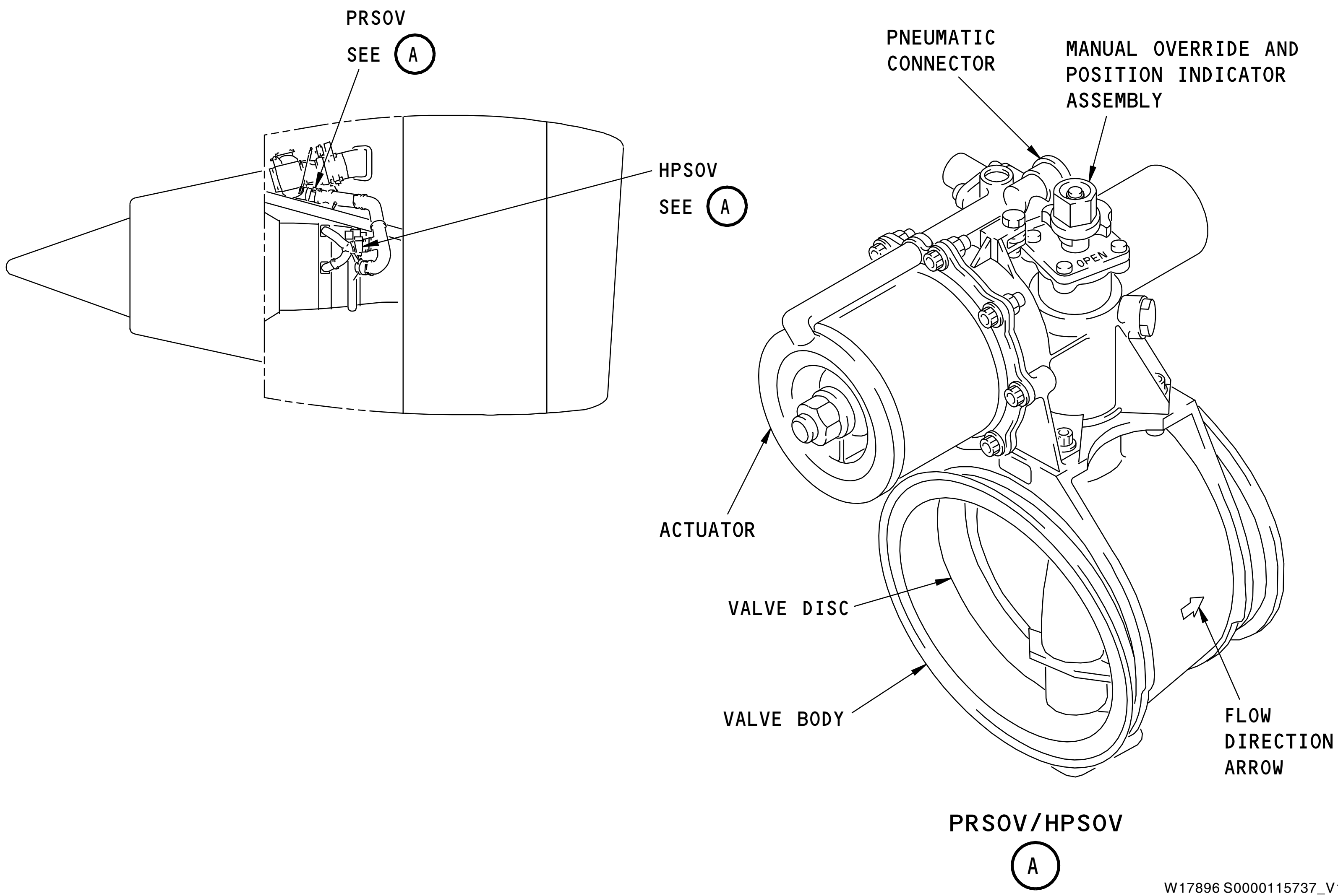
The PRSOV is above the engine core forward and below the precooler at the 12:00 position. It is between the HP/IP manifold and the precooler. The actuator side of the valve faces to the left. You can see the valve from either side of the engine. But you get access for removal/installation from the left side of the engine.

Training Information Point

Use the manual override and position indicator assembly to lock the valve in the closed position.

Each valve has a flow direction arrow and alignment marks (not shown). The arrow and alignment marks help install the valves correctly. A male flange and a female flange prevent incorrect installation.

HPSOV/PRSOVs that have a part number that ends with -5 have a manual override plunger. The manual override plunger is used to free a valve that has become stuck after it has been manually wrenched closed.



ENGINE AIR SUPPLY SYSTEM - HIGH PRESSURE SHUTOFF VALVE / PRESSURE REGULATING & SHUTOFF VALVE

ENGINE AIR SUPPLY SYSTEM - HPSOV/PRSOV - TRAINING INFORMATION POINTS

Purpose

The manual override and position indicator assembly lets you lock the valve closed and lets you see the position of the valve.

Location

The assembly is on the same side of the valve body as the actuator next to the pneumatic connector.

Physical Description

The manual override and position indicator assembly has these parts:

- Cam follower
- Vent valve pin
- Vent valve
- Position indicator
- Hex cam
- OPEN / CLOSED / LOCKED placards.

Functional Description

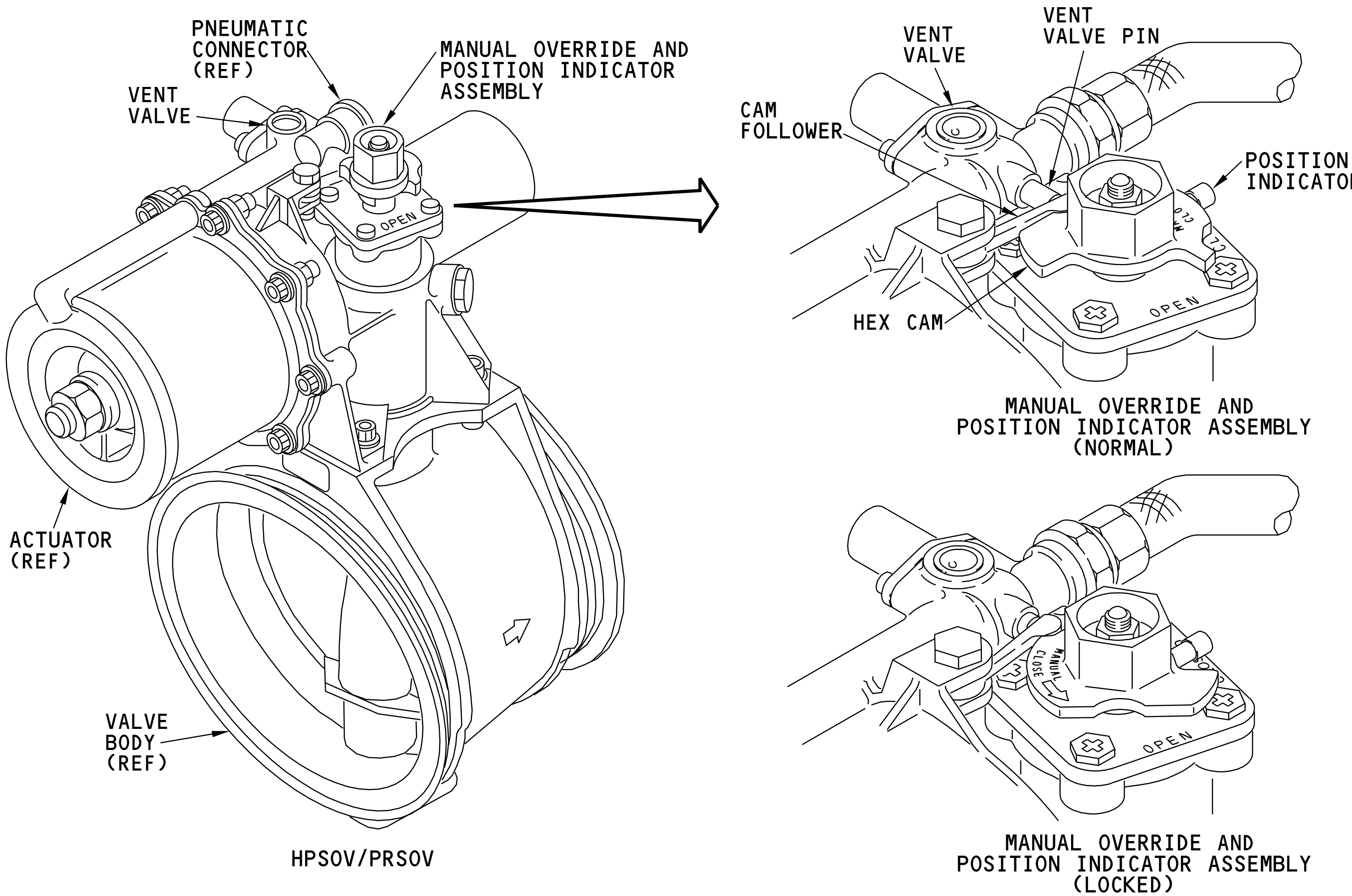
The position indicator connects through a spline to the same shaft (not shown) as the valve disc. This lets it show you actual valve disc position and is also used to lock the valve disc closed.

The hex cam connects without a spline to the valve disc shaft. This lets the valve move freely for normal operation.

When the hex cam turns in the direction indicated on the cam it causes these events to occur:

- Moves the hex cam so you can see the LOCKED placard
- Pushes and locks the position indicator to the valve closed position
- Moves the cam follower so that it pushes in on the vent valve pin and locks the hex cam in the valve closed position
- The vent valve pin sets the vent valve to vent
- The vent valve removes pressure from the actuator and blocks incoming control pressure.

When you turn the hex cam in the opposite direction as indicated on the cam it returns the valve to normal operation.



M42817 S000620076_V1

ENGINE AIR SUPPLY SYSTEM - HPSOV/PRSOV - TRAINING INFORMATION POINTS

ENGINE AIR SUPPLY SYSTEM - PRESSURE REGULATING AND SHUTOFF VALVE CONTROLLER

Purpose

The pressure regulating and shutoff valve controller (PRSOVC) supplies control pressure to the PRSOV.

Location

The PRSOVC is on the left side of the engine fan case at the 7:00 position.

Physical Description

The PRSOVC is an electropneumatic controller. The PRSOVC has these parts:

- Two reference pressure regulators
- Torque motor
- Electrical connector
- Two pneumatic line connectors
- Filter (internal)
- Heater.

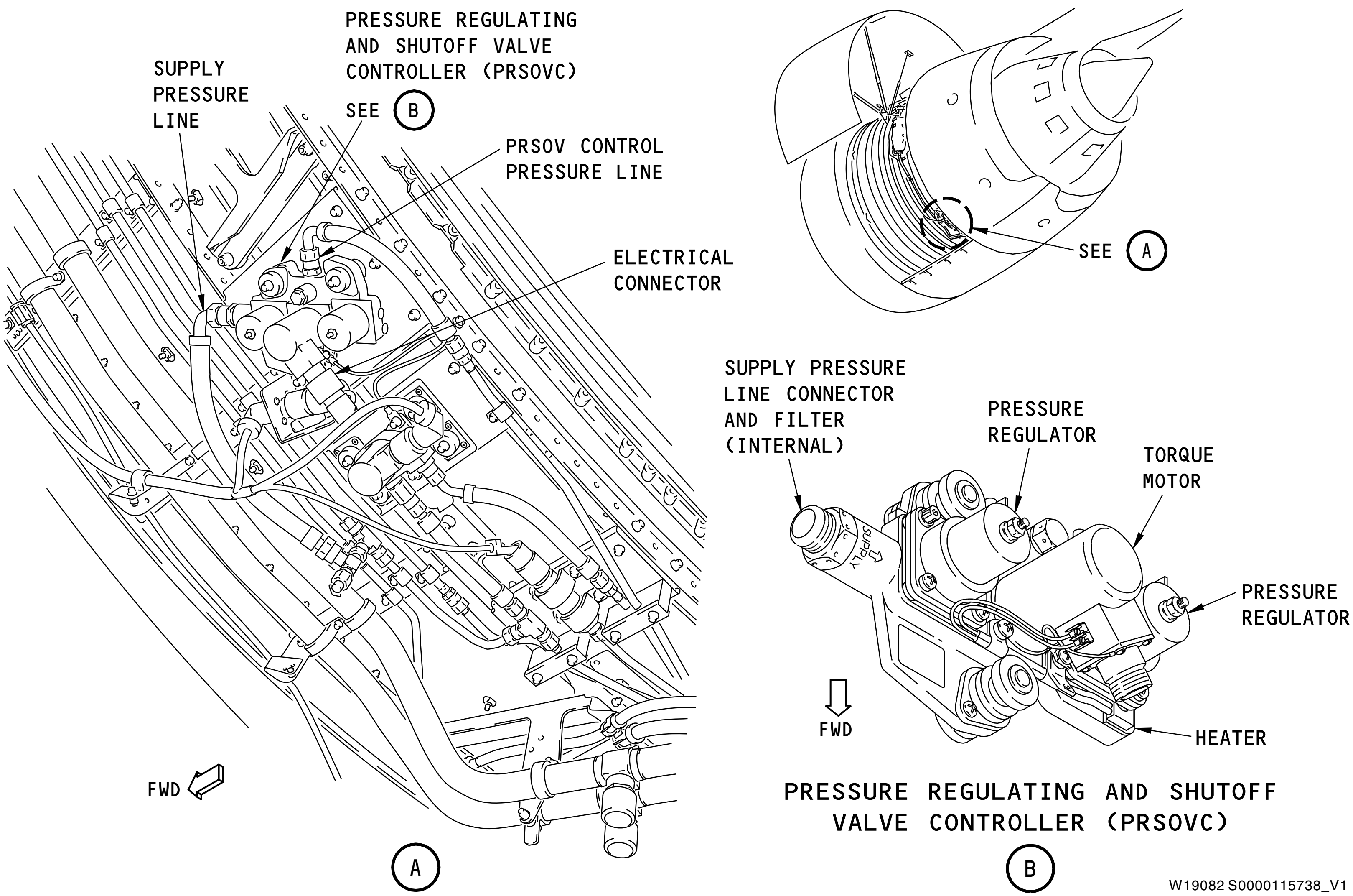
The reference pressure regulators set control pressure to a fixed value. The regulators are in series with each other. The torque motor adjusts the control pressure to values less than the reference pressure regulators. The torque motor always lets control pressure go to the PRSOV if it has no electrical power (fail safe on).

The heater prevents the controller from freezing.

Training Information Point

The mounting bolt hole pattern on the PRSOVC helps you install it correctly. The two pneumatic line connectors are of different sizes. This also helps you install the PRSOVC correctly.

The filter is line replaceable.



W19082 S0000115738_V1

ENGINE AIR SUPPLY SYSTEM - PRESSURE REGULATING AND SHUTOFF VALVE CONTROLLER

ENGINE AIR SUPPLY - PRESSURE REGULATING AND SHUTOFF VALVE CONTROLLER - FUNCTIONAL DESCRIPTION

Functional Description

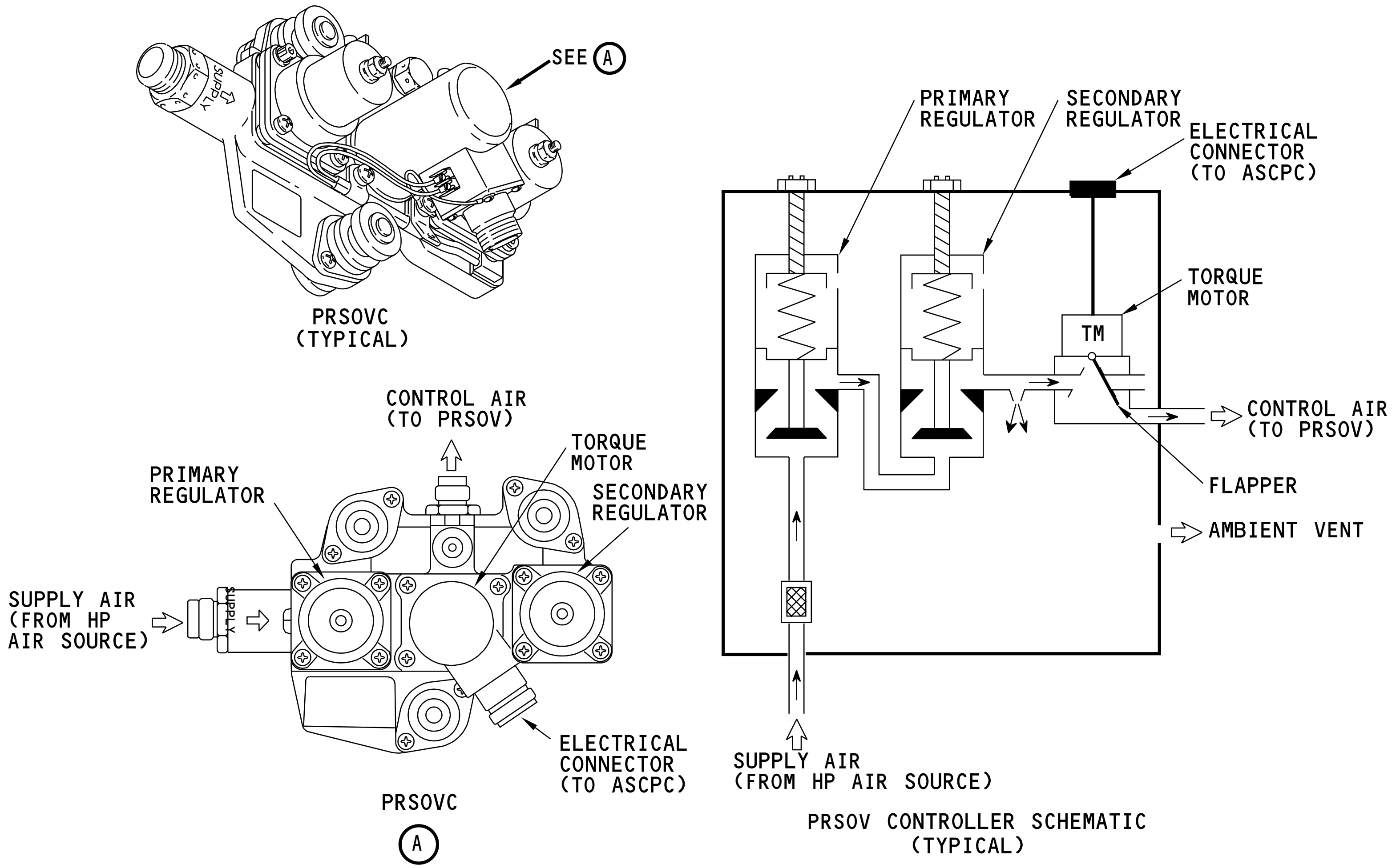
The pressure regulating and shutoff valve controller (PRSOVC) sets the pressure of the control air for the PRSOV. The PRSOVC uses two pressure regulators and a torque motor to set control air pressure. These devices are in series with each other.

Two regulators in series give an accurate control air pressure, at a fixed value. The fixed value gives these functions:

- Pneumatic and backup modes of operation for the PRSOV (PRSOV regulates to approximately 65 psig)
- Protection for the PRSOV actuator by setting the maximum pressure limit of the control air.

The primary and backup modes of the ASCPC use the torque motor to change the position of the PRSOV. The torque motor changes the amount of control air pressure to the valve.

The torque motor supplies maximum control air pressure to the PRSOV when it gets no current. When the ASCPC sends current to the torque motor, the flapper moves to let control air pressure vent to ambient. The amount of air that vents has a relation to the amount of current that goes to the torque motor. This is an example: if the ASCPC wants to close the PRSOV, it supplies full current to the torque motor. This sets the position of the flapper in the torque motor to stop supply air and vents control air pressure. A spring in the PRSOV (not shown) and duct pressure downstream of PRSOV moves the valve closed.



M42855 S000620112_V1

ENGINE AIR SUPPLY - PRESSURE REGULATING AND SHUTOFF VALVE CONTROLLER - FUNCTIONAL DESCRIPTION

ENGINE AIR SUPPLY SYSTEM - PRECOOLER

Purpose

The precooler decreases the engine bleed air temperature.

Location

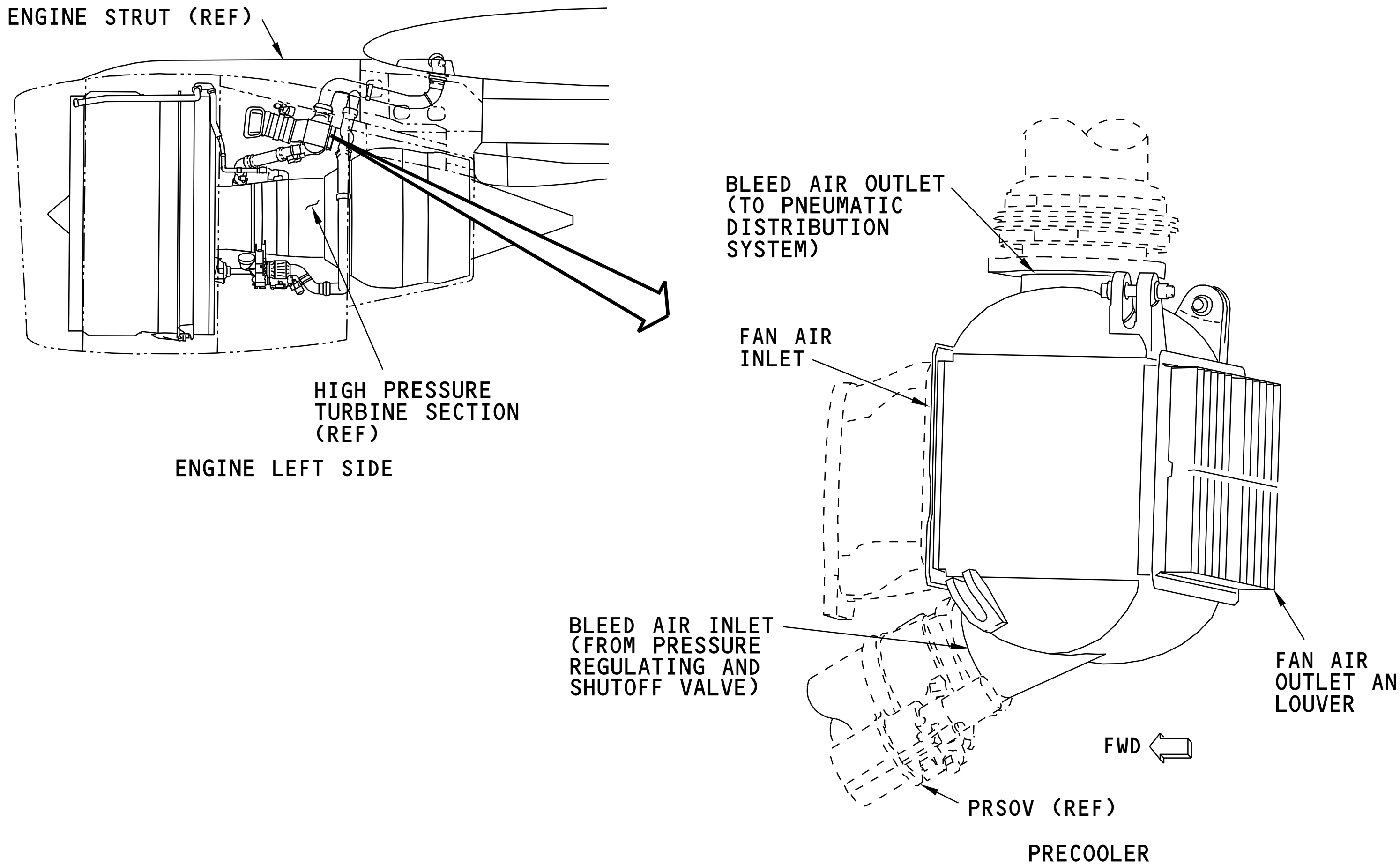
The precooler is on the bottom of the engine strut above the high pressure turbine section of the engine.

Physical Description

The precooler is a cross flow air-to-air heat exchanger. The precooler weighs 172 pounds (78 kg).

Functional Description

Engine bleed air flows through the precooler coils. Fan air flows over the precooler coils. This decreases the temperature of the engine bleed air.



M42821 S000620080_V1

ENGINE AIR SUPPLY SYSTEM - PRECOOLER

ENGINE AIR SUPPLY SYSTEM - FAN AIR MODULATING VALVE

Purpose

The fan air modulating valve (FAMV) controls the quantity of fan air that goes to the precooler.

Location

The FAMV is between the engine strut and the engine. The valve attaches to the FAMV inlet ducting forward of the precooler.

Physical Description

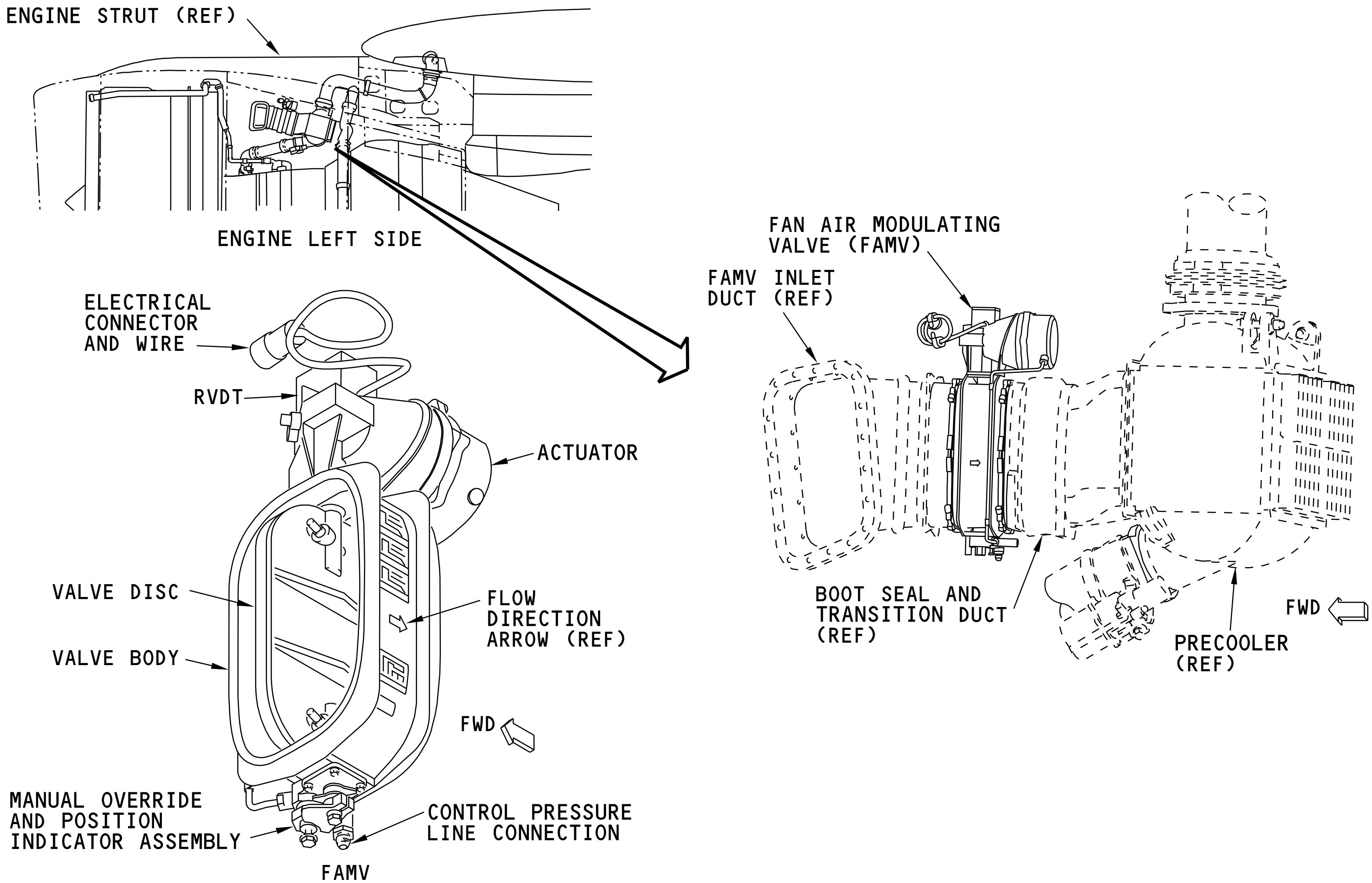
The FAMV is spring-loaded to the open position. It is pneumatically controlled and operated. The FAMV has these parts:

- Electrical lead and connector
- Actuator
- Control pressure line connection
- Manual override and position indicator assembly
- Valve body
- Valve disc
- RVDT.

Training Information Point

The FAMV has a flow direction arrow to help install it correctly.

The manual override and position indicator assembly locks the FAMV in the open or closed position. The valve must be locked in the closed position for removal or installation.



M42824 S000620083_V1

ENGINE AIR SUPPLY SYSTEM - FAN AIR MODULATING VALVE

ENGINE AIR SUPPLY SYSTEM - FAMV - TRAINING INFORMATION POINTS

General

The manual override and valve position indicator assembly lets you manually lock the valve closed or open and gives actual valve position.

Location

The assembly attaches to the valve body opposite from the actuator.

Physical Description

The assembly has these parts:

- Valve shaft
- Position indicator
- Lock plunger
- Locking cam.

Functional Description

The position indicator and locking cam attach to the valve shaft. As the valve shaft turns so does the indicator and locking cam.

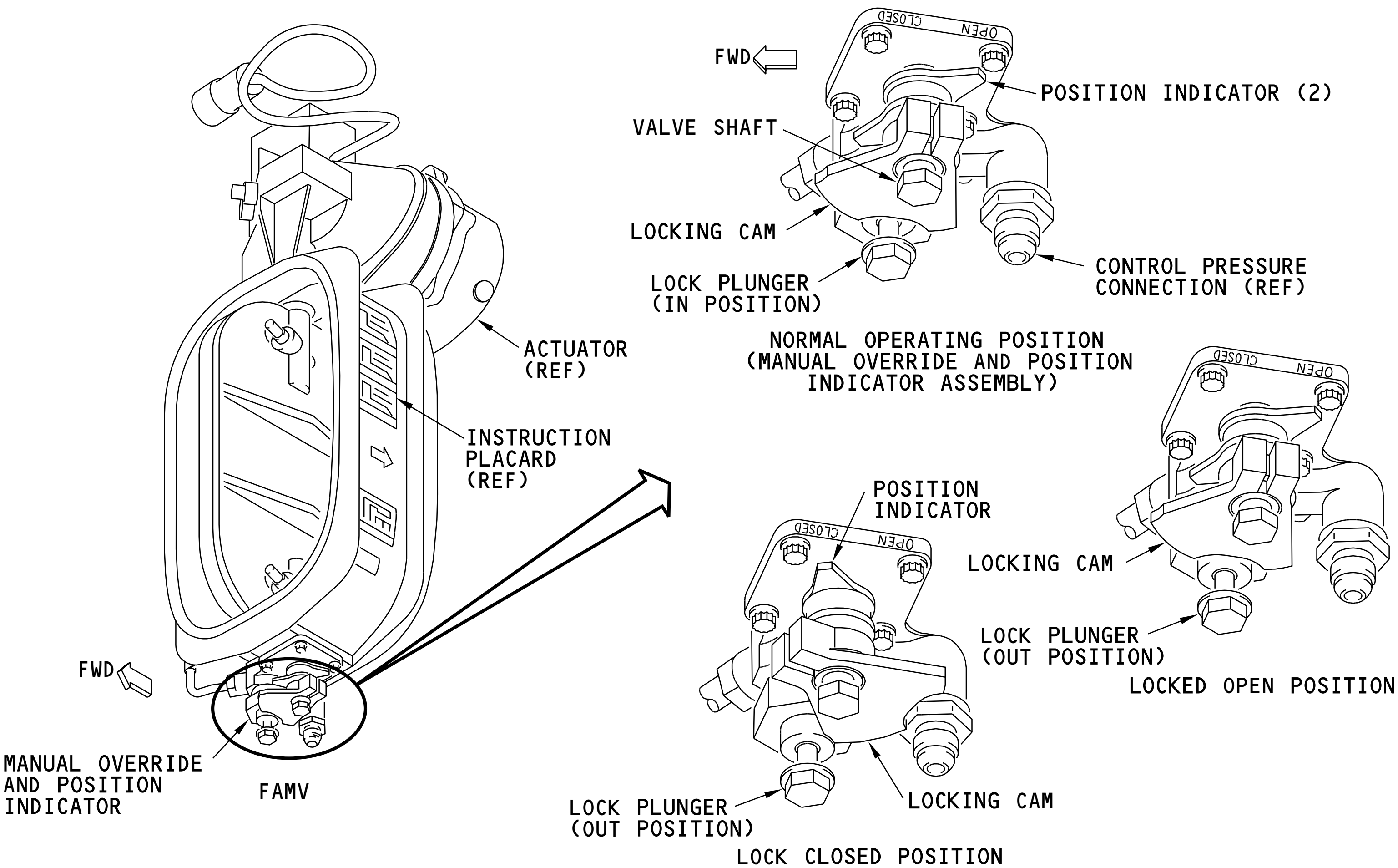
The locking cam has two slots. One is for the valve locked OPEN position and one is for the valve locked CLOSED position.

The lock plunger has two positions: in and out. The in position lets control pressure go to the valve actuator and permits free movement of the valve. The out position blocks control pressure, vents pressure from the valve actuator, and stops movement of the lock cam and valve. The plunger is spring-loaded out. The plunger is also threaded so you can push it in and turn it until it stays in (position for usual valve operation).

Operation

When the valve is in the open position, you turn the lock plunger counterclockwise (CCW) until it moves out to lock the valve open. To lock the valve closed, you first turn the lock plunger CCW until it moves out. Then push the plunger in and turn the valve shaft towards CLOSED position. The lock cam holds the plunger down as you turn the valve shaft to the closed position. The plunger moves out and stops movement of the cam and valve shaft when the valve is in the closed position.

You unlock the valve from the locked OPEN or CLOSED positions when you push the lock plunger in and turn it clockwise. The plunger must be torqued to make sure control pressure does not leak when you unlock the valve for usual operation.



M42827 S000620086_V1

ENGINE AIR SUPPLY SYSTEM - FAMV - TRAINING INFORMATION POINTS

ENGINE AIR SUPPLY SYSTEM - HIGH PRESSURE AND FAN AIR CONTROLLER

Purpose

The high pressure and fan air controller (HPFAC) regulates the control pressure that goes to the FAMV actuator and the HPSOV actuator.

Location

The HPFAC is outside the fan hub frame area of the engine at the 9:00 position.

Physical Description

The HPFAC is an electropneumatic controller. The controller has these parts:

- Two electrical connectors (FAMV and HPSOV)
- Two control pressure line connectors (FAMV and HPSOV)
- One supply pressure line connector and filter
- Two torque motors (TM) (FAMV & HPSOV)
- Two reference pressure regulators (FAMV and HPSOV).
- Electrical heater.

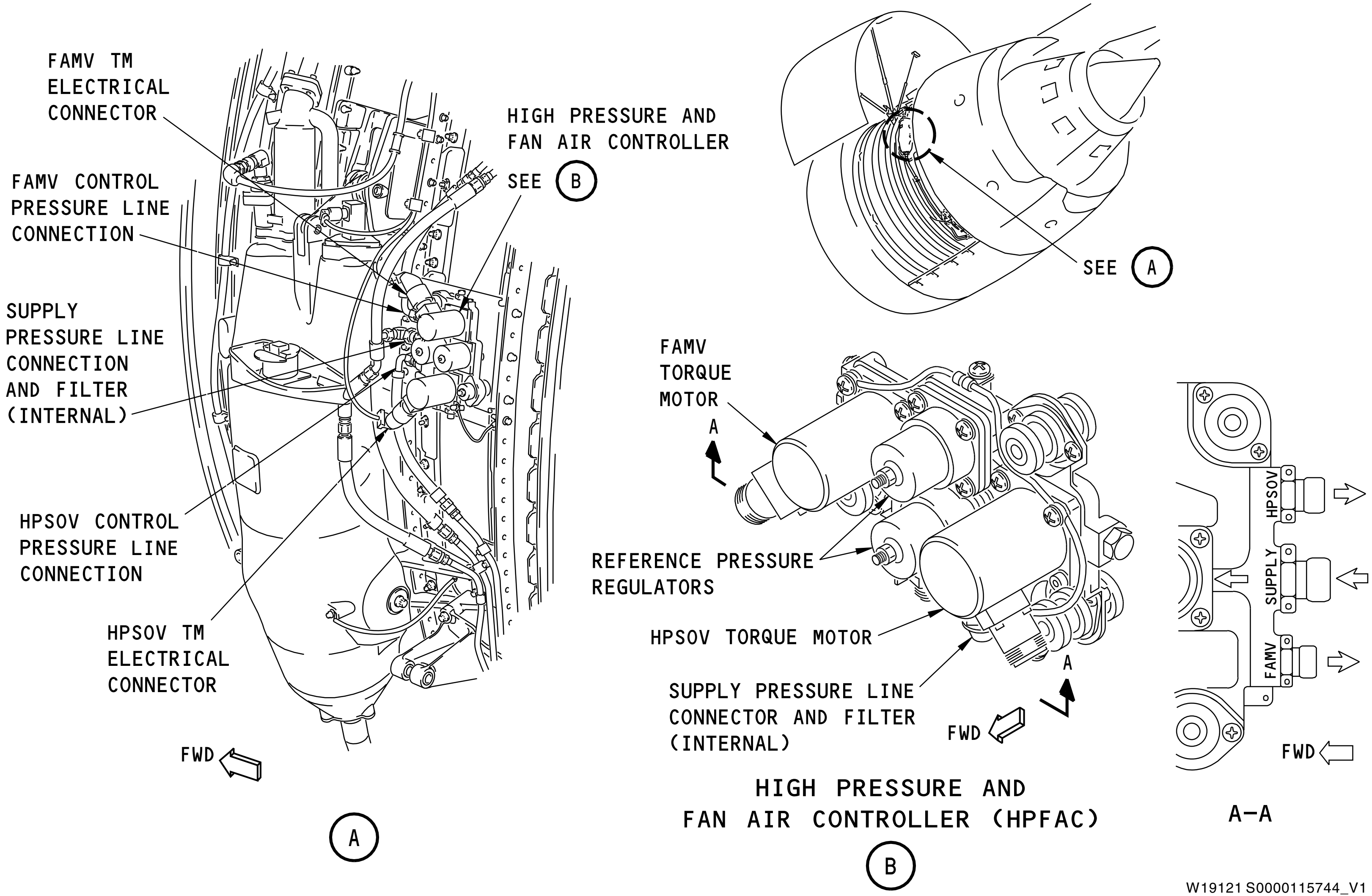
The reference pressure regulators set control pressure to a fixed value. The regulators are in series with each other. The torque motors regulate the control pressure to values less than the reference pressure regulators.

The heater makes sure the controller does not freeze.

Training Information Point

The mounting bolt hole pattern on the HPFAC helps install it correctly. Three pneumatic line connectors are of different sizes on the HPFAC. This makes sure you connect the lines correctly. Two electrical connectors are of different sizes to help install the HPFAC correctly.

The filter is line replaceable.



ENGINE AIR SUPPLY SYSTEM - HIGH PRESSURE AND FAN AIR CONTROLLER

Functional Description

The high pressure and fan air controller (HPFAC) sets the pressure of the control air for the HPSOV and the FAMV. The HPFAC uses two pressure regulators and two torque motors to set control air pressure. The torque motors are in parallel with each other and in series with the regulators.

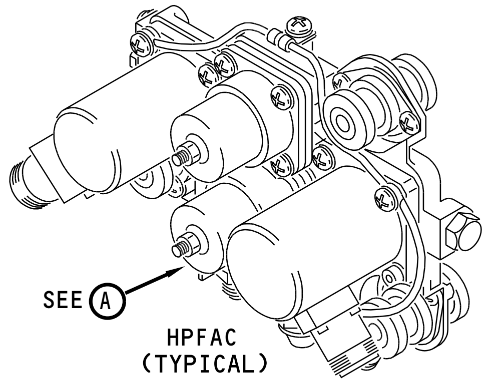
Two regulators in series give an accurate control air pressure, at a fixed value. The fixed value gives these functions:

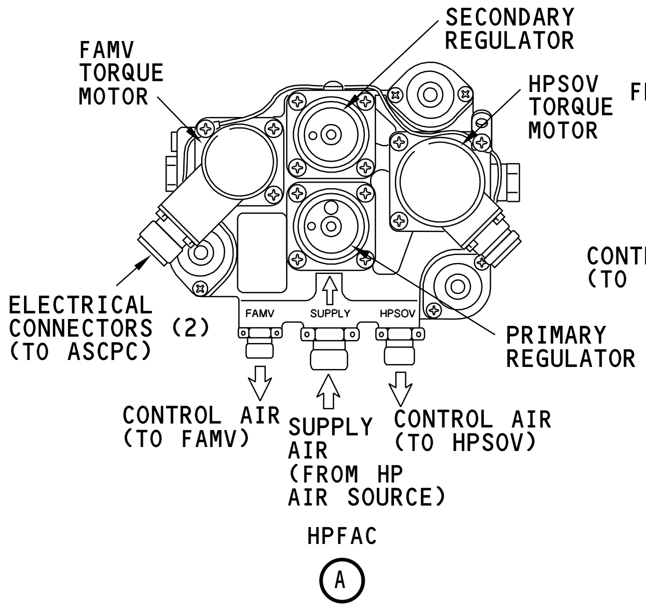
- Pneumatic and backup modes of operation for the HPSOV (HPSOV regulates to approximately 55 psig)
- Pneumatic and backup modes of operation for the FAMV (FAMV goes fully open)
- Protection for the HPSOV and FAMV actuators by setting the maximum pressure limit of the control air.

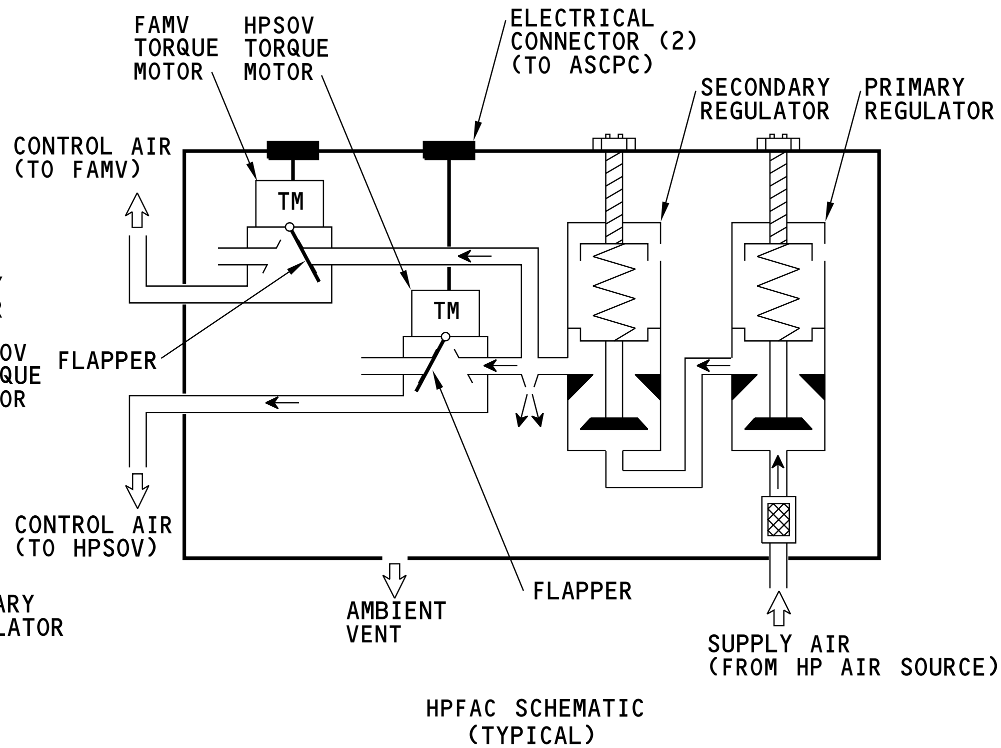
The primary mode of the ASCPC uses the torque motors to change the position of the HPSOV and FAMV. The torque motors change the amount of control air to the valves.

The torque motor for the HPSOV is set to supply maximum control air pressure to the HPSOV when it gets no current. When the ASCPC sends current to the torque motor, the flapper moves to let control air pressure vent to ambient. The amount of air that vents has a relation to the amount of current that goes to the torque motor. This is an example: If the ASCPC wants to close the HPSOV, it supplies full current to the torque motor. This sets the position of the flapper in the torque motor to stop supply air and vent control air pressure. A spring in the HPSOV (not shown) and duct pressure downstream of HPSOV move the valve closed.

The torque motor for the FAMV is set to stop control air pressure to the FAMV when it gets no current. When the ASCPC sends current to the torque motor, the flapper moves to let control air pressure go to the actuator of the FAMV. The amount of control air pressure given to the actuator has a relation to the amount of current that goes to the torque motor. This is an example: if the ASCPC wants to close the FAMV, it supplies full current to the torque motor. This sets the position of the flapper in the torque motor to let supply air flow through the regulators and to the actuator for the FAMV.







M42857 S000620114_V1

ENGINE AIR SUPPLY - HIGH PRESSURE AND FAN AIR CONTROLLER - FUNCTIONAL DESCRIPTION

ENGINE AIR SUPPLY SYSTEM - CONTROLLER AIR COOLER

General

The engine air supply controller air cooler decreases the temperature of the engine 9th stage bleed air that goes to these controllers:

- Pressure regulating and shutoff valve controller (PRSOVC)
- High pressure and fan air controller (HPFAC).

Physical Description

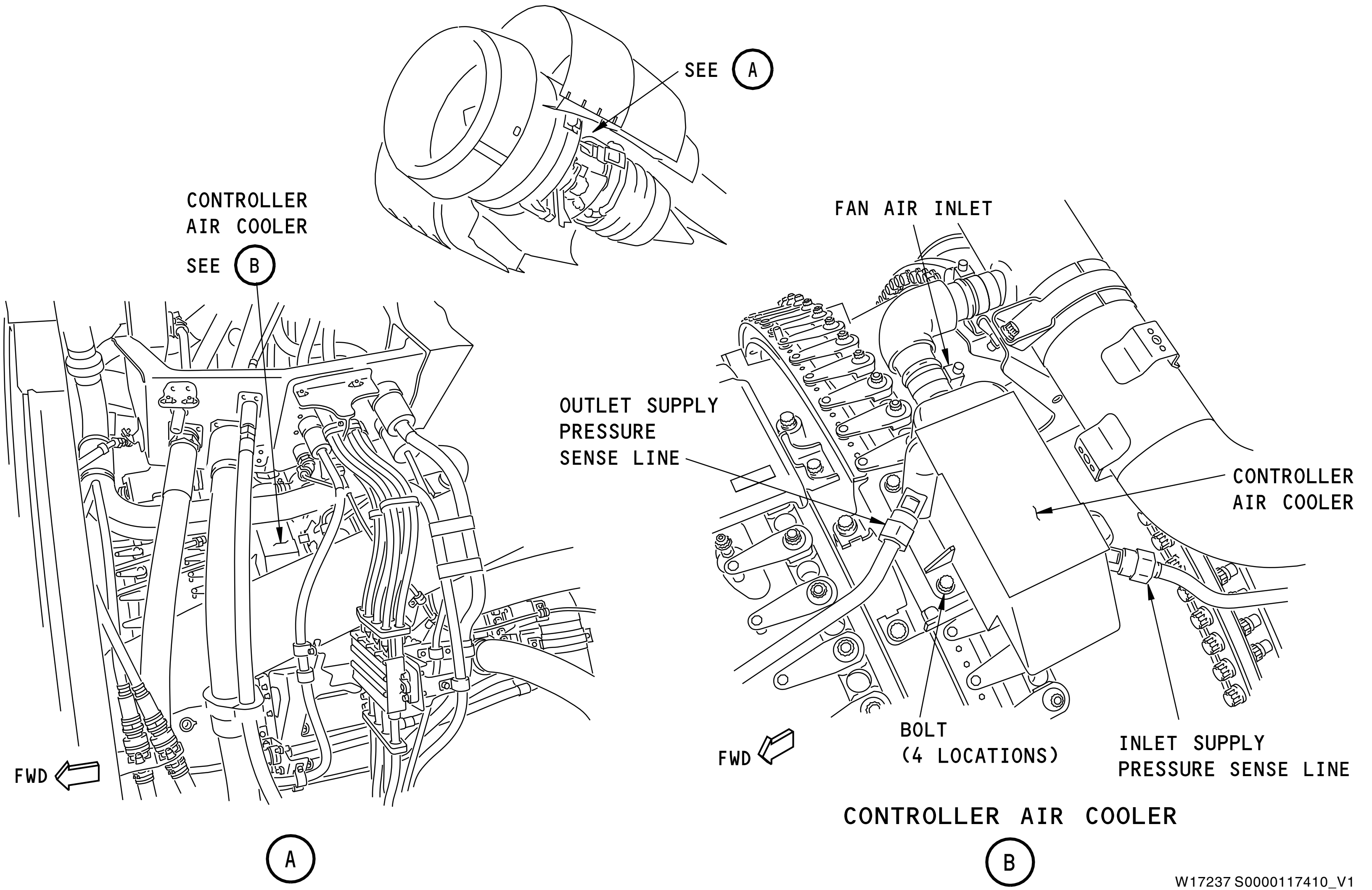
The controller air cooler is an air-to-air heat exchanger. It has three pneumatic line connectors, two high pressure and one low pressure (fan air).

Location

The controller air cooler is on the left side of the engine core at the 11:00 position. The cooler is under the system disconnect panel.

Functional Description

Hot air from the high stage compressor section and cool fan air flows through the controller air cooler. The cool air carries heat away from the hot air. This decreases the temperature of the hot air.



ENGINE AIR SUPPLY SYSTEM - CONTROLLER AIR COOLER

ENGINE AIR SUPPLY SYSTEM - DUCT VENT VALVE

Purpose

The duct vent valve (DVV) releases air pressure from the engine duct when there is too much pressure in the duct. It prevents an overpressure condition if there is leakage through the HPSOV when the both HPSOV and PRSOV are closed. If the HPSOV is not fully closed, the flow out of the DVV is not sufficient to prevent an overpressure condition.

Location

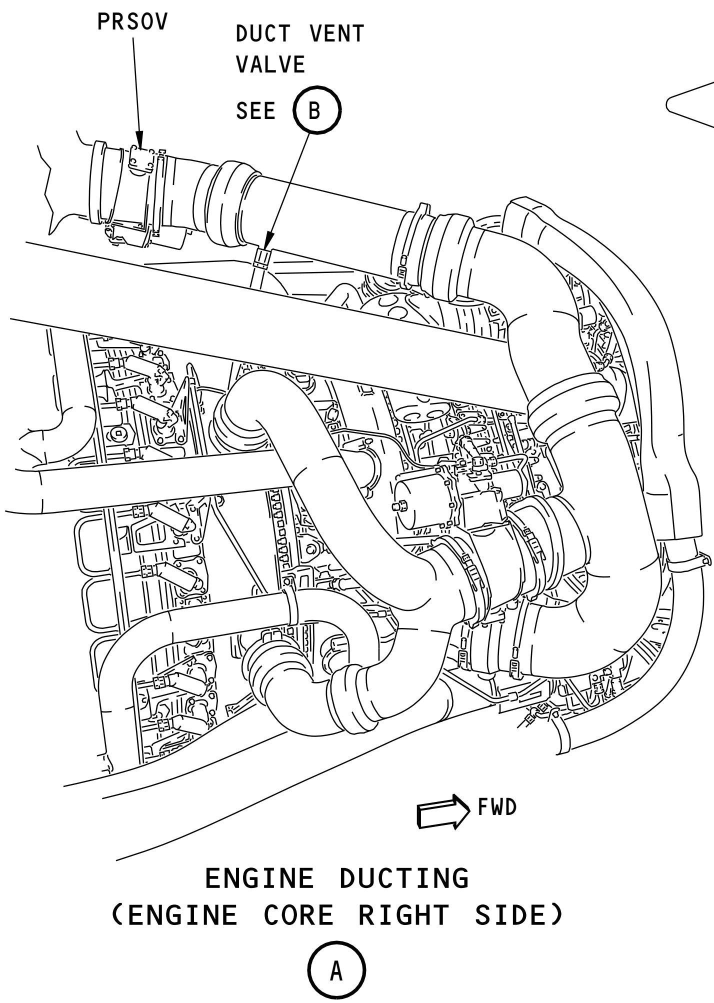
The DVV attaches to the engine HP/IP manifold on the right side of the engine core near the 12:30 position. The valve is forward of the PRSOV and below the FAMV adjacent to one of the tenth stage bleed air ports.

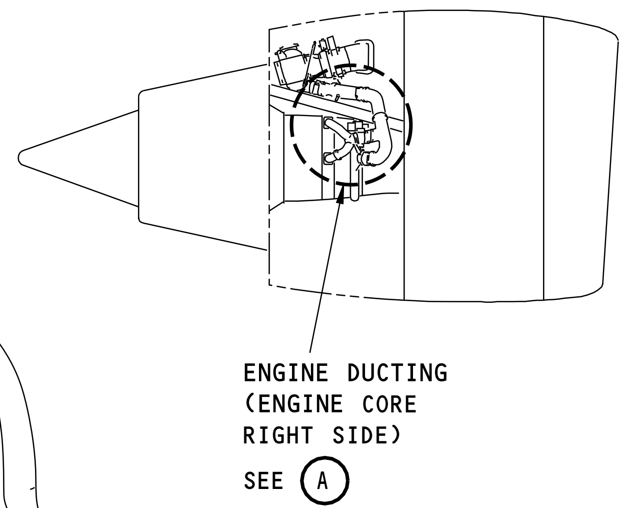
Physical Description

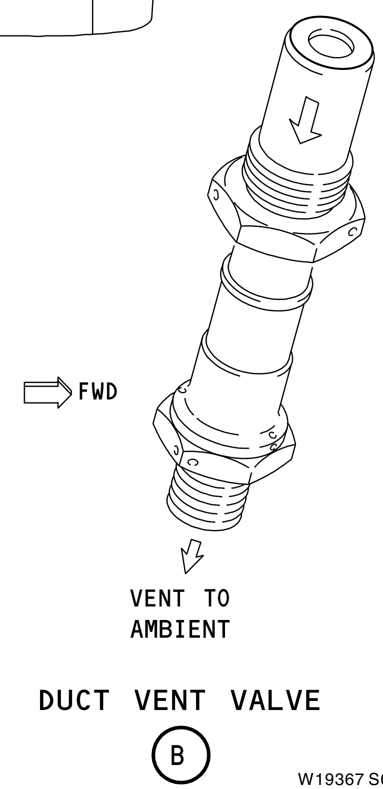
The DVV is a spring-loaded closed pressure relief valve. The valve is pneumatically actuated. The valve has a flow direction arrow on it.

Functional Description

The DVV opens when the pressure in the HP/IP manifold is more than 185 psig. The valve releases the air into the engine compartment at a flow of 6 to 8 lbs/min (2.72 to 3.63 kg/min). The valve resets at 145 psig.







W19367 S0000117412_V1

ENGINE AIR SUPPLY SYSTEM - DUCT VENT VALVE

ENGINE AIR SUPPLY SYSTEM - AIR SUPPLY CABIN PRESSURE CONTROLLER - PHYSICAL DESCRIPTION

Location

The left and right air supply cabin pressure controllers (ASCPC) are in the MEC on the E1 and E2 racks.

Physical Description

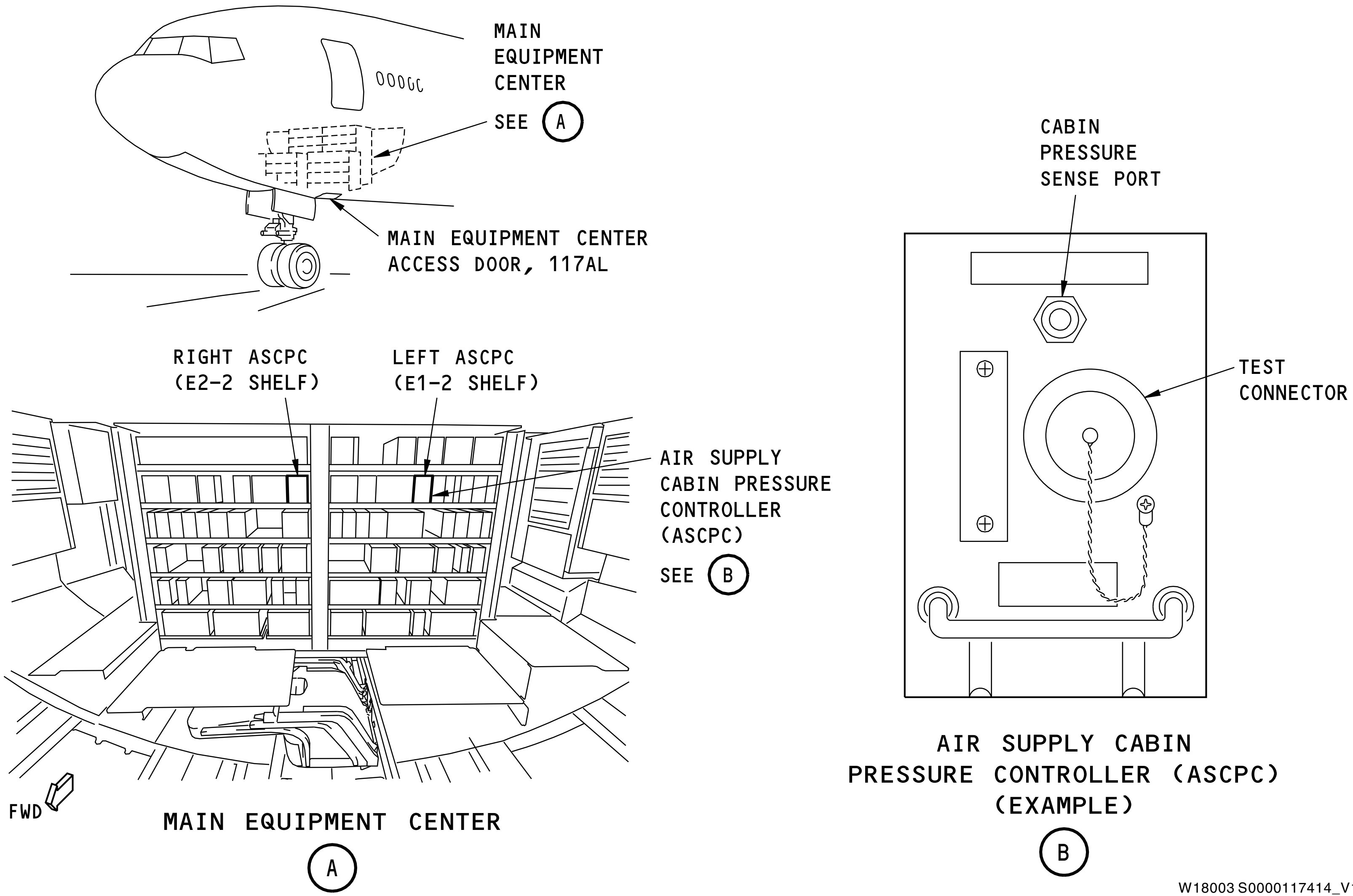
The ASCPCs have test and cabin pressure sense ports on the front. The test port is for in-shop service. The cabin pressure sense port lets the controllers monitor cabin pressure.

The ASCPCs use operational program software (OPS) that you can load.

Training Information Point

The ASCPCs are LRUs. The circuit cards inside the ASCPC are not LRUs.

The left and right ASCPCs are interchangeable.



W18003 S0000117414_V1

ENGINE AIR SUPPLY SYSTEM - AIR SUPPLY CABIN PRESSURE CONTROLLER - PHYS

ENGINE AIR SUPPLY SYSTEM - AIR SUPPLY CABIN PRESSURE CONTROLLER - PURPOSE

Purpose

The left and right air supply cabin pressure controllers (ASCPC) give control for these systems:

- Pneumatic (engine air supply and air supply distribution)
- Pressurization
- Air conditioning (pack flow schedule and backup pack control).

The controllers also give indications, have BITE, and have interfaces with other airplane systems to give engine bleed air flow management. See the engine bleed air flow management page in this section for more information about flow management.

Control Modes

The ASCPCs have two modes: digital and analog. The ASCPCs use the digital control mode for these systems:

- Engine air supply
- Air supply distribution
- Pressurization
- Pack flow schedule
- Backup pack flow control.

The ASCPCs use analog control mode as a backup to digital mode for the engine air supply system.

The digital mode of the ASCPCs controls in any one of three ways:

- At the same time
- Primary
- Backup control.

These are the systems controlled by the ASCPCs:

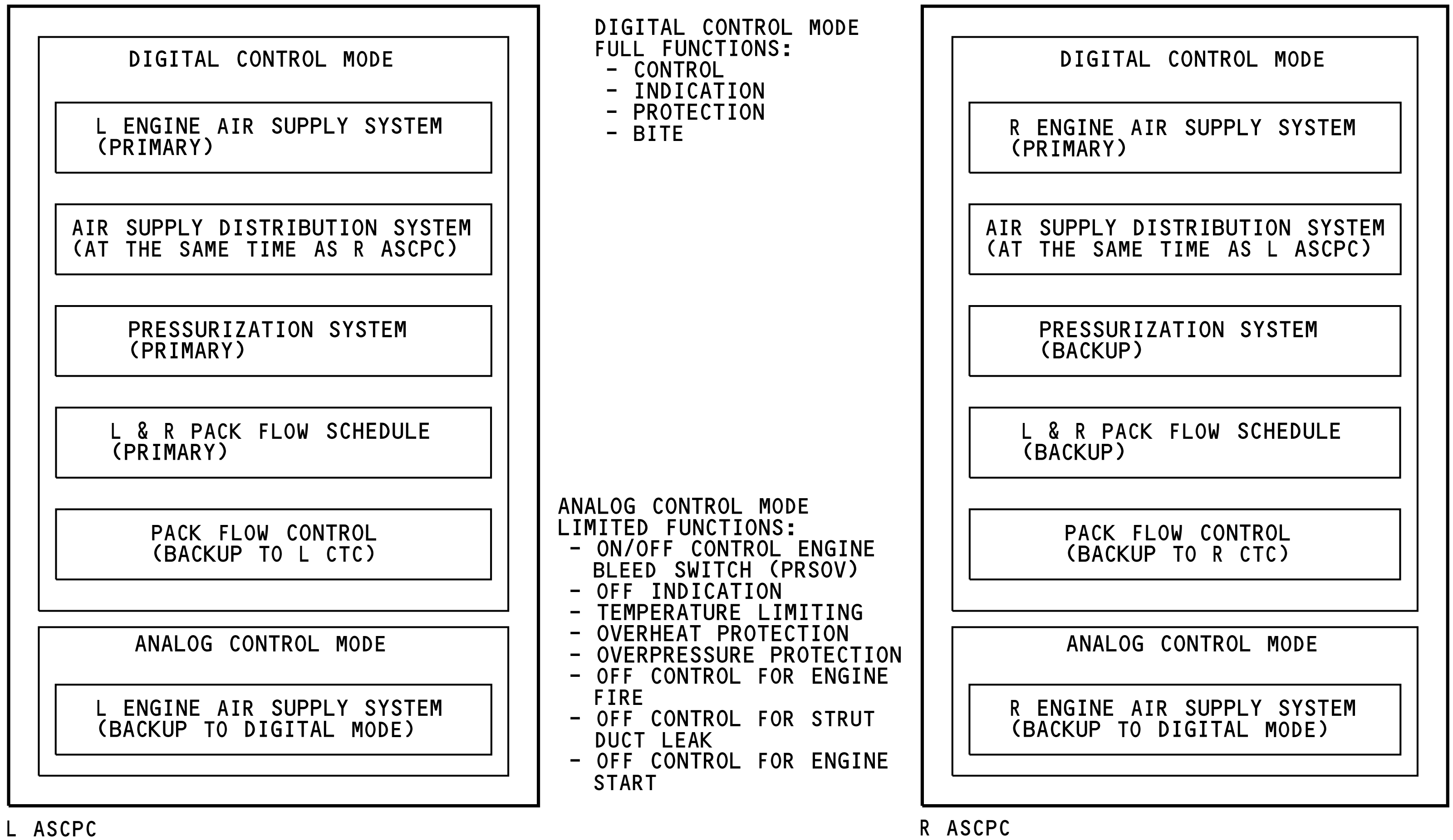
SYSTEM	ASCPC	CONTROL
L ENGINE AIR SUPPLY	L	PRIMARY
R ENGINE AIR SUPPLY	R	PRIMARY
AIR SUPPLY DISTRIBUTION	L & R	SAME TIME
PRESSURIZATION & PACK FLOW SCHEDULE	L	PRIMARY
PRESSURIZATION & PACK FLOW SCHEDULE	R	BACKUP
L PACK FLOW CONTROL	L	BACKUP TO L CTC
R PACK FLOW CONTROL	R	BACKUP TO R CTC

For the systems listed in the above table, the digital control mode supplies these functions:

- Control
- Indication
- Protection
- BITE.

For the engine air supply system, the analog control mode gives these functions:

- ON/OFF control through the engine bleed air switch (PRSOV only)
- OFF indications
- Temperature limiting through the PRSOV
- Overheat protection
- Overpressure protection
- OFF control through the engine fire switch
- OFF control through the duct leak detection system
- OFF control for the engine start condition.



M42838 S000620097_V1

ENGINE AIR SUPPLY SYSTEM - AIR SUPPLY CABIN PRESSURE CONTROLLER - PURPOSE

ENGINE AIR SUPPLY SYSTEM - ASCPC - POWER AND ARINC 629 INPUTS

Power Inputs

The left ASCPC gets 28v dc power from section two of the battery bus. The right ASCPC gets 28v dc power from the captain's flight instrument bus and the first officer's flight instrument bus.

The digital (primary) mode circuits get power through the AIR SPLY L(R) PRI and SEC circuit breakers.

The digital mode gets power through the AIR SPLY L(R) SOL circuit breakers to operate solenoids such as the solenoids in the isolation valves and the APU shutoff valve (not shown).

The analog (backup) mode circuits get power through the AIR SPLY L(R) BACKUP circuit breaker.

Airplane Systems ARINC 629 Inputs

The ASCPCs receives inputs through the left and right ARINC 629 system buses.

Anti-ice air flow rates for the wings and engines are from the airfoil and cowl ice protection system (ACIPS).

Vertical navigation active yes/no information is from the autopilot flight director computer (AFDC).

These inputs are from the air data inertial reference unit (ADIRU):

- Total air temperature
- Airplane pressure altitude
- Airplane static pressure
- Ground speed.

Inputs from the ADIRU come through the AIMS from the flight control buses.

The airplane information management system (AIMS) gives inputs from the central maintenance computing system (CMCS), the primary display system (PDS), and the flight management computing system (FMCS).

CMCS gives these inputs:

- Flight phase
- Flight leg
- Date/Time
- Airplane registration number
- CMCS master for the source of CMCF data YES/NO
- Data load
- Equipment ID number
- Start built in test
- Stop built in test
- Show fault history.

PDS gives these inputs:

- Pressure altitude of the selected landing field
- Pressure altitude of the actual landing field
- Left/right engine on status
- Barometric correction
- Left/right engine simulated on status.

FMCS gives these inputs:

- Engine manufacture
- Planned cruise altitude
- Time remaining for climb
- Time remaining for descent
- ETA for start top of descent
- FMC master for the source of CMCF data YES/NO.

TMCF gives these inputs:

- APT has been commanded.

These inputs are between the left and right ASCPCs:

- Cabin Pressure Control (CPC) mode status, active/standby/fail
- Current operational CPC flight mode

ENGINE AIR SUPPLY SYSTEM - ASCPC - POWER AND ARINC 629 INPUTS

- CPC data to flight compartment
- CPC channel configuration for the number of outflow valves that can be controlled
- Left and right ARINC 629 bus activity check
- CPC doing an initiated BIT
- Fwd/aft outflow valve (OFV) set to auto/manual
- Sensed cabin pressure
- Manifold duct pressure
- Manifold flow rate
- Engine bleed air control (digital) failed
- PRSOV position
- APUSOV, left/center/right isolation valve solenoid current
- APUSOV, Left/center/right isolation valve RVDT voltage
- APUSOV, left/center/right isolation valve control failed to off or to on
- ASCPC software version number.

APU on/off, APU bleed air start and APU mode of operation (cool down, pneumatic) information is from the auxiliary power unit controller (APUC).

These inputs are from the cabin temperature controllers (CTC):

- Left and right pack inlet pressure
- Left and right pack set air flow rates
- Left and right pack mass air flow rates
- Request for an increase in engine manifold air pressure (6 psig)
- Request for a decrease in precooler out temperature (250F, 121C)
- Left and right CTC status, active or off
- Left or right upper flow control valves set to close
- Left or right lower flow control valves set to close.
- CTC is APT capable.

These are the inputs from the duct leak and overheat detection system (DLODS):

- left and right strut overheat
- Left and right wing overheat
- Body overheat.

Position of the cargo heat shutoff and temperature control valves is from the left and right environmental control system miscellaneous card (ECSMC).

The engine electronic control (EEC) gives high pressure 9th stage (PS 3) bleed air source pressure, N1 speed, and ambient pressure (P 0).

The engine electronic control (EEC) gives high pressure 9th stage (PS 3) bleed air source pressure, N1 speed, ambient pressure (P 0), and engine configuration code.

These inputs are from the electrical load management system (ELMS):

- Sensed cabin pressure from remote sensor
- Airplane on standby power only
- Battery bus section 2 status, on/off.
- HPFAC heater fault
- PRSOVC heater fault.

These inputs are from the flap/slat electronics unit (FSEU):

- ADP(s) necessary for flap/slat movement
- Slat position.

The hydraulic interface module (HYDIM) gives air driven pump (ADP) status for ON/OFF intermittent operation or on for landing gear retraction.

The overhead panel ARINC 629 system (OPAS) gives inputs for the positions of these switches:

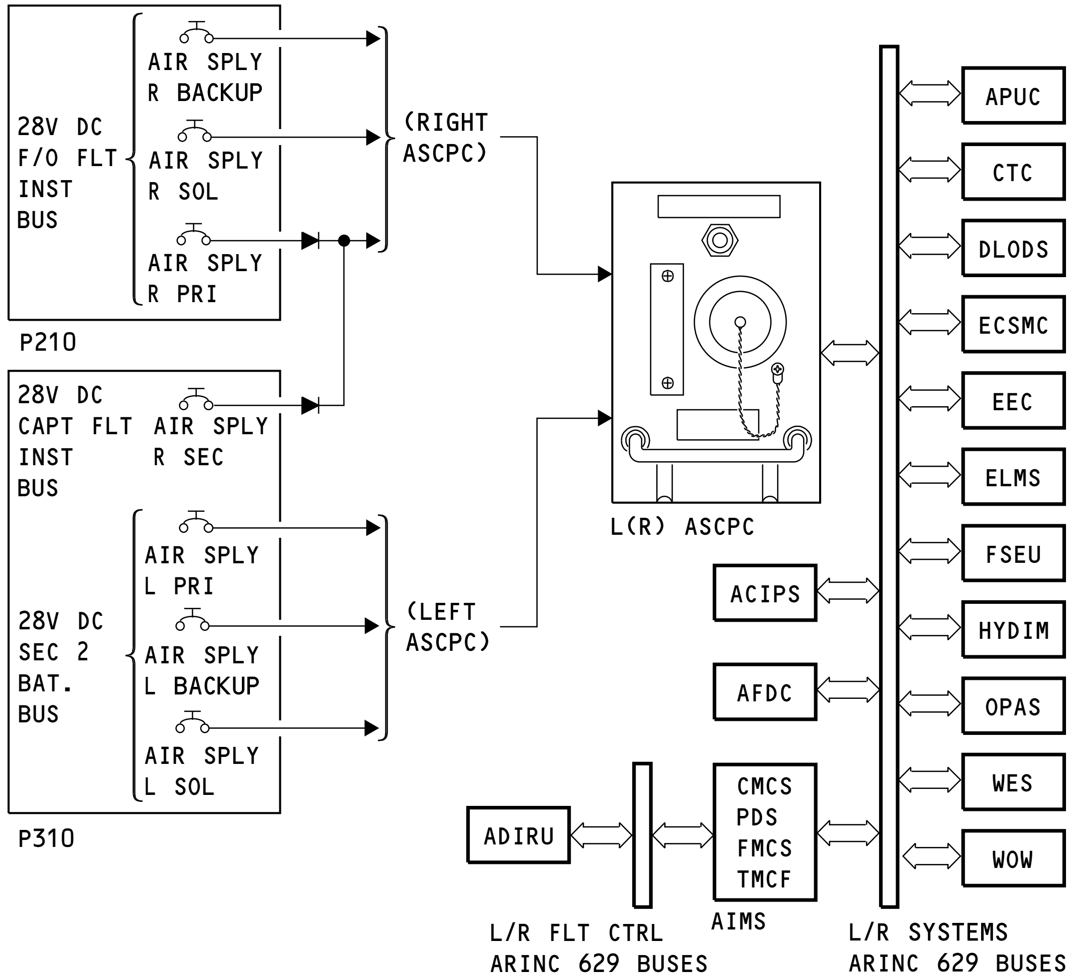
- APU bleed air switch
- Left and right engine bleed air switches
- Left, center, and right isolation switches

ENGINE AIR SUPPLY SYSTEM - ASCPC - POWER AND ARINC 629 INPUTS

- Left and right trim air switches
- Left and right engine start/ignition switches
- Left and right pack switches
- Forward and aft outflow valve switches
- Landing altitude selector
- Forward and aft cargo fire arm switches.

The warning electronic system (WES) gives input for a stall condition.

Weight-on-wheels (WOW) cards give air/ground inputs.

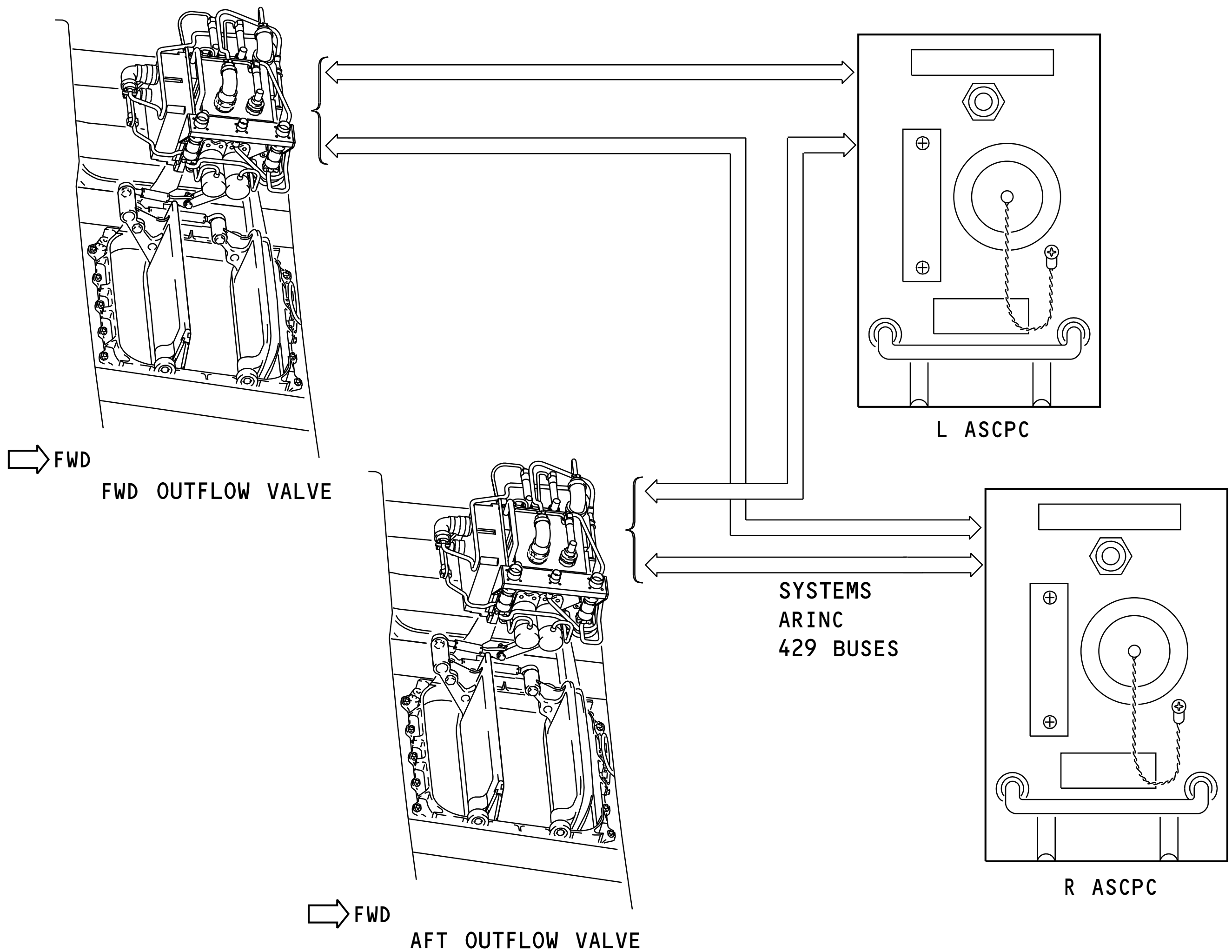


W17770 S0000117416_V1

ENGINE AIR SUPPLY SYSTEM - ASCPC - POWER AND ARINC 629 INPUTS

ARINC 429 Inputs/Outputs

The cabin pressurization control part of the left and right ASCPCs interface with the control units of the forward and aft pressurization outflow valves through ARINC 429 buses. The left ASCPC has interfaces with the left control channels of the forward and aft control units. The right ASCPC has interfaces with the right control channels of the forward and aft control units.



ENGINE AIR SUPPLY SYSTEM - ASCPC - ARINC 429 INPUTS/OUTPUTS

THIS PAGE IS INTENTIONALLY LEFT BLANK

ENGINE AIR SUPPLY SYSTEM - ASCPC - DISCRETE AND ANALOG INPUTS/OUTPUTS

Discrete Inputs

Discrete inputs to the digital and analog parts of the ASCPC are hardwired.

These are the discrete inputs to the digital part of the left ASCPC:

- L engine running, AIMS
- Other engine running, AIMS
- L engine bleed air switch position, ON/OFF
- START position of the L engine start switches
- APU fire switch position, NORM/FIRE
- L engine fire switch position, NORM/FIRE
- L strut/wing overheat is from the duct leak and overheat detection system (DLODS).

The discrete inputs to the digital part of the right ASCPC are the same type as the left ASCPC except they are from right system components. The APU fire switch also inputs to the right ASCPC.

These are the discrete inputs to the analog part of the left ASCPC:

- L engine running, AIMS
- L engine bleed air switch position, ON/OFF
- START position of the L engine start switches
- L engine fire switch position, NORM/FIRE
- L strut/wing overheat is from the duct leak and overheat detection system (DLODS).

The discrete inputs to the analog part of the right ASCPC are the same type as the left ASCPC except they are from right system components.

Discrete Outputs

Discrete outputs are hardwired from the digital and analog parts of the ASCPCs to solenoids, torque motors, indicator lights, and AIMS for EICAS advisory messages.

These are the devices that get discrete outputs from the digital part of the left ASCPC:

- APUSOV solenoid
- Left isolation valve solenoid
- Center isolation valve solenoid
- Right isolation valve solenoid
- Left air conditioning upper flow control valves torque motor
- Left trim air pressure regulating and shutoff control valve shutoff solenoid.

These are the devices that get discrete outputs from the digital part of the right ASCPC:

- APUSOV solenoid
- Left isolation valve solenoid
- Center isolation valve solenoid
- Right isolation valve solenoid
- Right air conditioning upper flow control valves torque motor
- Right trim air pressure regulating and shutoff control valve shutoff solenoid.

The discrete outputs from the analog part of the left and right ASCPCs are for the OFF light in the engine bleed air switches and the advisory EICAS message that agrees with the OFF light.

Analog Inputs

The left and right ASCPC receives inputs from system sensors and RVDTs. The digital and analog parts of each controller get inputs from different sensors.

These are the analog inputs to the digital part of the left ASCPC:

- Temperature of the left pneumatic distribution duct air is from element number two of the left manifold dual temperature sensor

- Temperature of the compressor discharge air in the left air conditioning pack is from the left pack ASCPC compressor discharge temperature sensor
- Temperature of the left pack discharge air is from the left pack ASCPC discharge temperature sensor
- Differential pressure data at the left air conditioning pack inlet is from the ASCPC differential pressure sensor that is part of the left flow sensor
- Pressure of the left pneumatic distribution duct air is from the left manifold pressure sensor
- Air flow of the left pneumatic distribution duct air is from the left manifold flow sensor
- Valve position of the left and center isolation valves and the left fan air modulating valve. Position data is from RVDTs in each valve.

The digital part of the right ASCPC has the same analog inputs as the left ASCPC except the inputs are from right system sensors and valve position are from these valves:

- Right isolation valve
- APUSOV
- Right fan air modulating valve.

These are the analog inputs to the analog part of the left ASCPC:

- Temperature of the left pneumatic distribution duct air is from element number one of the left manifold dual temperature sensor
- Pressure of the left engine HP/IP manifold air is from the left intermediate pressure sensor.

The analog part of the right ASCPC has the same analog inputs as the left ASCPC except the inputs are from the right system sensors.

Analog outputs

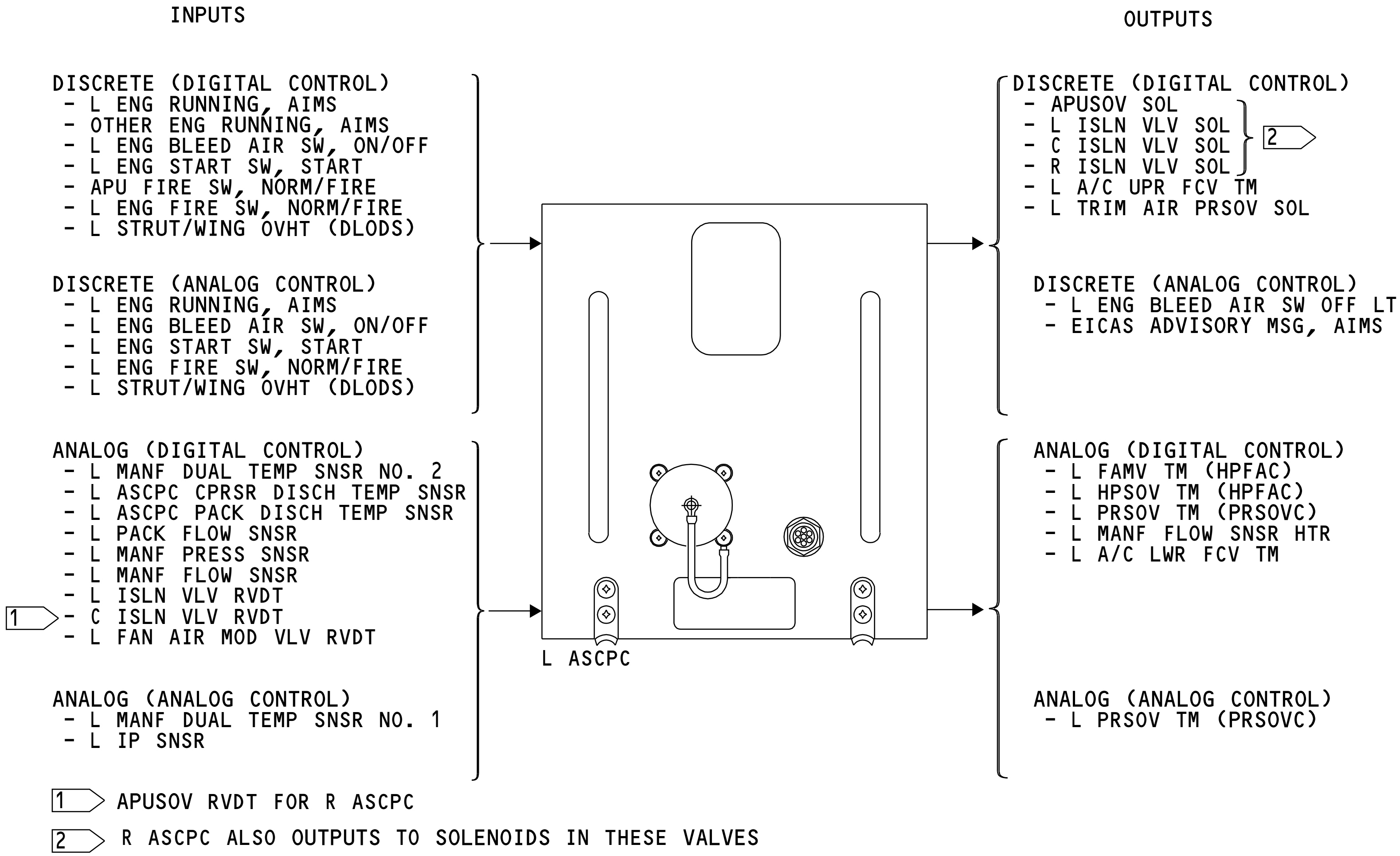
The left and right ASCPCs control current to torque motors in different valve controllers and to heater elements in different flow sensors.

These are the analog outputs from the digital part of the left ASCPC:

- Left fan air modulating valve torque motor in the HPFAC
- Left high pressure shutoff valve torque motor in the HPFAC
- Left pressure regulating and shutoff valve torque motor in the PRSOVC
- Left manifold flow sensor heater element
- Left air conditioning pack lower flow control valve torque motor.

The analog part of the left ASCPC outputs to the torque motor of the left pressure regulating and shutoff valve.

The right ASCPC has the same analog outputs as the left ASCPC except the outputs are to right system components.



M42844 S000620101_V1

ENGINE AIR SUPPLY SYSTEM - ASCPC - DISCRETE AND ANALOG INPUTS/OUTPUTS

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 1

General

The left air supply cabin pressure controller (ASCPC) controls the left engine air supply system. The right ASCPC controls the right engine air supply system.

The engine air supply system has three modes:

- Primary (Digital)
- Backup (Analog)
- Pneumatic.

The ASCPC gives the primary and the backup modes of operation. The pneumatic mode is controlled by the reference pressure regulators in the HPFAC and the PRSOVC.

For usual operation, all of the functions of the primary mode operate and some of the functions of the backup mode operate at the same time.

If the primary mode does not operate, all of the functions for the backup and pneumatic modes operate at the same time.

If the primary and backup modes do not operate, the pneumatic mode controls the engine air supply without input from the flight deck or the ASCPC.

Primary Mode

The primary mode gives complete control and indications for the engine air supply system.

The operation monitor function in the ASCPC enables the primary mode if it finds no software or power supply faults related to the primary mode.

The primary mode uses the HPFAC and the PRSOVC to do these functions:

- On/off control
- Bleed source selection
- Pressure regulation
- Overpressure protection
- Temperature regulation
- Temperature limiting
- Overtemperature protection
- Flow limiting.

The primary mode gives power to these items:

- HPFAC
- FAMV RVDT
- PRSOVC
- Manifold flow sensor
- Manifold pressure sensor
- Manifold dual temperature sensor (TM 2)

The primary mode gets information directly from these sources:

- FAMV RVDT
- Manifold flow sensor
- Manifold pressure sensor
- Manifold dual temperature sensor (TM 2)
- Backup mode (IP data)
- AIMS
- DLODS
- Engine bleed air switch
- Engine fire switch
- Backup mode.

Information comes to the primary mode on the left and right ARINC 629 systems buses. These are the data sources and uses of this information in the primary mode:

- ACIPS - engine and wing anti-ice air flow rates for flow limiting
- ADIRU - primary source of altitude for bleed source selection
- AGS - airplane air/ground information for on/off control, temperature regulation and BITE
- AIMS - engine on/off information for engine air supply on/off

- CTC - request for lower precooler out temperature for temperature control
- CTC - request for high stage pressure increase for bleed air source selection
- CTC - pack inlet pressure for pressure regulation and overpressure functions
- CTC - pack flow information for flow limiting
- DLODS - strut/wing duct leak information for on/off
- EEC - high stage pressure for overpressure protection
- EEC - alternate ambient pressure source for bleed source selection
- FSEU - slat position for flow limiting
- HYDIM - ADP C1 and C2 on/off for flow limiting
- OPAS - position of the engine bleed air switches and the engine start selectors for on/off control
- WES - airplane stall for flow limiting.

These are some of the data sources and uses for information given directly to the primary mode:

- Engine bleed air switch - in/out position for on/off control function
- Engine start selector - START position information for on/off control function
- Engine fire switch - in/out position for on/off control function.

The backup mode gives information about its inputs to the primary mode.

The primary mode also has a BITE function.

Backup Mode

The backup mode monitors the primary mode for its on/off status and controls the engine air supply system when the primary mode is off.

The backup mode has functions that operate when the primary or backup modes are in control. Other backup mode functions only operate when the primary mode is off.

These backup functions operate when the primary or the backup mode is in control:

- On/off control - engine bleed air switch, engine fire switch, engine start selector
- Overtemperature protection.

These backup functions operate only when the primary mode is off:

- On/off control - strut/wing duct leak
- Overpressure protection
- Temperature limiting.

The backup mode controls the position of the PRSOV for these functions:

- On/off control
- Overpressure protection
- Temperature limiting.

With the engine air supply in backup control, the PRSOV and the HPSOV operate in the pneumatic mode to do pressure regulation and bleed source selection. The FAMV goes to the full open position.

The backup mode gives power to these items:

- PRSOVC
- Manifold dual temperature sensor (TM 1)
- Intermediate pressure sensor.

The backup mode gets information directly from these sources:

- Manifold dual temperature sensor (TM 1)
- Intermediate pressure sensor
- AIMS
- DLODS
- Engine bleed air switch
- Engine start selector
- Engine fire switch.

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 1

These are some of the data sources and uses in the backup mode:

- AIMS - engine on/off information for engine air supply on/off
- DLODS - strut/wing duct leak information for on/off.

Pneumatic Mode

The pneumatic mode does not use the ASCPC for control. It does not use electric power.

The pneumatic mode gives these functions for the engine bleed air supply system:

- Bleed source selection
- Pressure regulation.

The HPFAC is mechanically set to cause the FAMV to go full open. The HPFAC also causes the HPSOV to give bleed source selection and pressure regulation at a fixed value.

The PRSOVC is mechanically set to cause the PRSOV to give pressure regulation at a fixed value.

The engine bleed air system cannot be shut off unless the engine is stopped.

BITE

BITE for the ASCPC has:

- Continuous BIT
- Ground test.

Continuous BIT has these functions:

- Operates when the ASCPC has power and the ground test is not on
- Uses the HPFAC and PRSOVC to do a preflight test of the FAMV, PRSOV, and HPSOV and the related circuits.

Continuous BIT and ground tests do a check of the pneumatic system LRUs for correct operation. The preflight test and the ground test take approximately 20 seconds.

The preflight test operates when the related engine completes its start. To operate the ground test, select the appropriate test from the MAT.

Indications

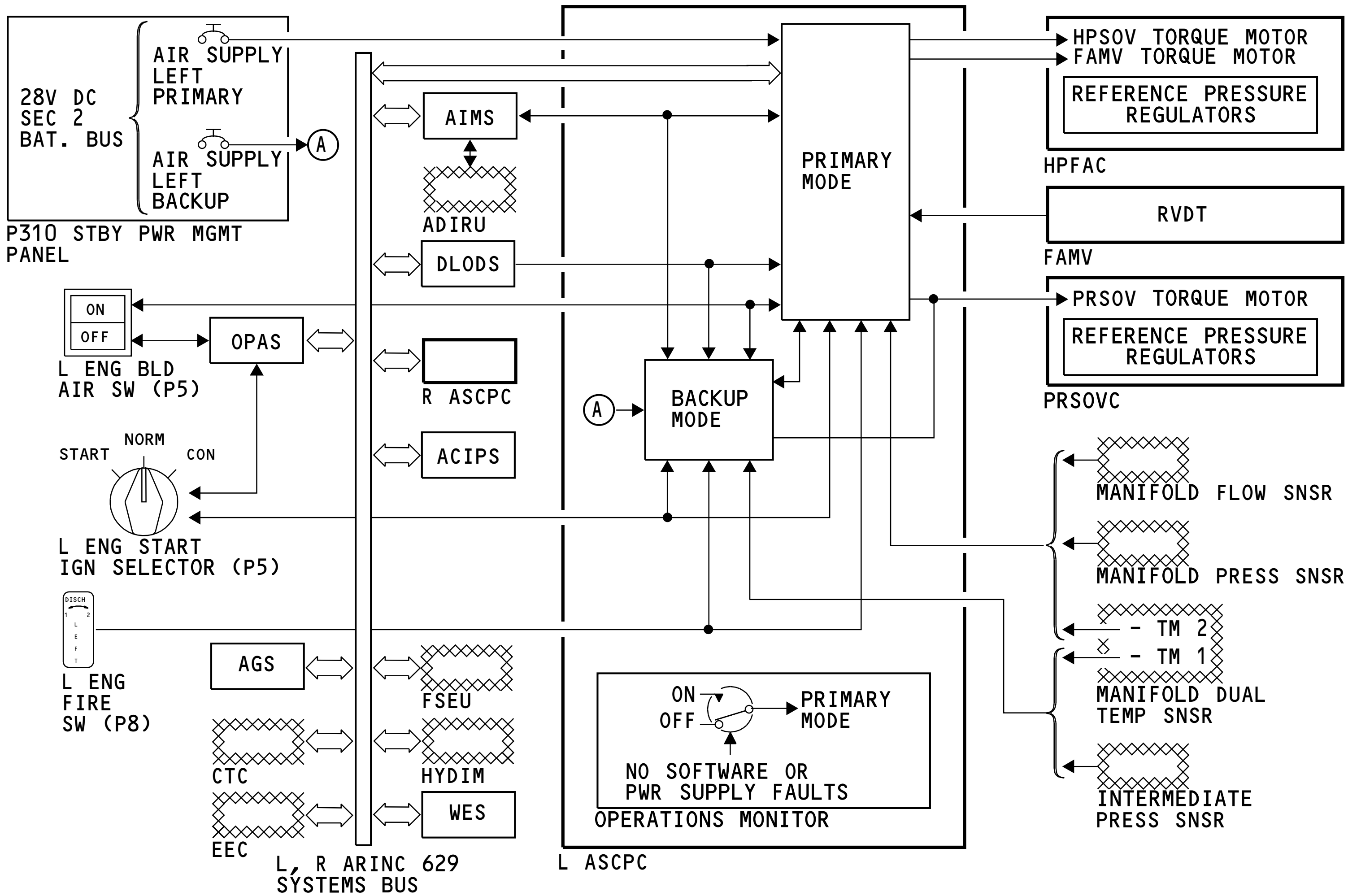
A status message (not shown) shows if the primary mode fails. No flight deck effects show if the backup or pneumatic mode fails.

See the indicating system section for more information about indications (SECTION 36-20).

Training Information Point

If the primary mode is off for the left or right ASCPC, it can affect the dispatch of the airplane. If a primary mode is off in one ASCPC, you must make sure the primary mode operates in the other ASCPC and that the backup mode operates in both ASCPCs.

See part II of the airplane maintenance manual for the dispatch deviations guide (DDG) maintenance procedure you use to check the condition of the backup mode.



M42845 S000620102_V1

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 1

THIS PAGE IS INTENTIONALLY LEFT BLANK

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 2

General

The primary and backup modes of the ASCPC and the pneumatic mode supply control for the engine air supply system differently. The modes set the position of the HPSOV and PRSOV for these functions:

- On/off and reverse flow control - primary and backup modes
- Bleed source selection - primary and pneumatic modes
- Pressure regulation - primary and pneumatic modes
- Overpressure protection - primary and backup modes.

On/Off Control - Primary Mode

The following description is based on these conditions: the engine is on and set to idle.

When the engine bleed switch is set to the out (OFF) position, the primary mode commands the HPSOV and the PRSOV to close and the FAMV to open.

The primary mode also closes one or both of the valves, PRSOV and HPSOV if any of these conditions occur:

- Engine fire switch set to out (PRSOV, HPSOV)
- ASCPC looking for location of the duct leak (PRSOV)
- Source loss (PRSOV)
- This engine start on ground (PRSOV)
- Ground air source supplies air (PRSOV)
- Engine off (HPSOV)
- TM sensor failed (HPSOV)
- HPSOV clamp logic (HPSOV).

The primary mode latches the PRSOV and the HPSOV close if any of these conditions occur:

- Engine strut duct leak
- Wing duct leak
- Engine bleed overtemperature, 490F (254C)
- Engine bleed overpressure, 242.5 psig
- PRSOV failed closed
- Bleed pressure loss.

When the PRSOV is set to close or latched close, these indications show in the flight deck:

- OFF light (not shown) in the related engine bleed switch
- ENG BLEED OFF L (R) advisory message (not shown).

When the engine bleed switch is set to the in (ON) position, the primary mode commands the HPSOV and the PRSOV to regulate to a setpoint. The FAMV is usually set towards closed.

Source Loss Condition Logic

The source loss condition logic lets the ASCPCs sense when there is not sufficient air pressure to the ADPs for landing gear retraction immediately after takeoff. Source loss can occur in the left or right parts of the pneumatic distribution system.

There are two sets of conditions that cause the ASCPCs to set the left source loss condition to true. The first set is true if all of these conditions occur:

- Landing gear is down
- Less than 180 seconds since takeoff
- Left engine is off.

The second set is true if all of these conditions occur:

- Landing gear is down
- Less than 180 seconds since takeoff
- Left duct pressure is less than 20 psig and right duct pressure is more than 20 psig.

The conditions that cause a right source loss are equivalent.

See the distribution section for more information about the configuration of the pneumatic distribution system during source loss (SECTION 36-20).

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 2

Bleed Pressure Loss Condition Logic

The bleed pressure loss condition logic lets the ASCPCs sense when a pneumatic duct breaks. Engine starter duct failure is the primary reason for this logic.

There are two sets of conditions that cause the ASCPCs to set the left bleed pressure loss condition to true. The first set is true if all of these conditions occur for more than 10 seconds:

- Left duct pressure is less than 13 psig
- Left pack inlet pressure is less than 13 psig
- Right duct pressure is more than 13 psig
- Left PRSOV is open
- Right PRSOV is open
- No duct leak signal from the duct leak and overheat detection system (DLODS)
- Landing gear is up
- Less than 180 seconds after takeoff.

The second set is true if all of these conditions occur for more than 10 seconds:

- Left duct pressure is less than 13 psig
- Left pack inlet pressure is less than 13 psig
- Right PRSOV is open
- Left PRSOV is closed
- Landing gear is up or more than 180 seconds after takeoff
- Left engine bleed air flow is more than 2.0 lbs/sec
- No left engine start.

The conditions that cause a right bleed pressure loss are equivalent.

See the distribution section for more information about the configuration of the pneumatic distribution system during bleed pressure loss (SECTION 36-20).

On/Off Control - Backup Mode

The backup mode provides on/off control differently from the primary mode. The backup mode only sets the PRSOV to open or close. It does not control the position of the HPSOV or the FAMV.

The backup mode sets the PRSOV to closed for the applicable engine if any of these conditions occur:

- Engine bleed air switch set to out
- Engine fire switch set to out (pulled)
- Engine start selected
- Engine is off.

The backup mode latches the PRSOV closed if any of these conditions occur:

- Engine strut duct leak
- Engine bleed overtemperature, 490F (254C)
- Engine bleed overpressure, 242.5 psig.

The backup mode gives the same flight deck indications as the primary mode when the PRSOV is set to close or latched closed.

Bleed Source Selection - Primary Mode

The bleed source selection function makes sure there is sufficient pressure downstream of the HPSOV for the systems that use engine bleed air. This is the same as the logic for the pressure regulation function.

The primary mode sets the position of the HPSOV to provide control of the bleed air source. When the intermediate pressure air source is not sufficient for the downstream systems, the air supply system uses HP air.

These are three possible combinations for the engine bleed air source:

- HP air is the only source
- IP air is the primary source. HP air adds air as necessary
- IP air is the only source.

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 2

The primary mode uses the IP sensor to get data about the pressure downstream of the HPSOV. The IP data is used to calculate the position of the HPSOV necessary to keep the setpoint pressure. These are the duct pressure setpoints:

- 40 psig when the altitude is less than or equal to 27,000 feet (8230m)
- Decreasing value, 40 through 32.5 pisg when the altitude is more than 27,000 feet (8230m) and is less than or equal to 43,000 feet (13,106m)
- 32.5 psig when the altitude is more than 43,000 feet (13,103m).

The value of the setpoint pressure is biased by any of these conditions:

- CTC request for more pressure - 6 psig bias
- Engine cross bleed start - 9 psig bias.

The setpoint pressure increases by the amount of the highest request.

If the quantity of the intermediate pressure air is enough to supply the user systems, the HPSOV closes.

See the functional description part of the air conditioning - pack cooling and mix manifold temperature control section for the conditions that cause the CTC to request more pressure (SECTION 21-52).

Bleed Source Selection - Backup and Pneumatic Modes

The pneumatic mode automatically gives bleed source selection when the backup mode or the pneumatic mode controls the engine air supply.

Similar to the primary mode, the pneumatic mode provides three combinations for the source of engine bleed air:

- HP air alone
- IP air with HP air added as necessary
- IP air alone.

The pneumatic mode uses the HPFAC internal reference pressure regulators (not shown) to control HPSOV position. The regulators are set to provide the HPSOV with the necessary control pressure so that the valve regulates to a setpoint of 55 +/- 15 psig. This setpoint is designed to make sure pressure downstream of the HPSOV is more than sufficient for the systems that use engine bleed air.

If IP air pressure is less than the setpoint, then HP is the only source for engine bleed air.

If IP air pressure is more than the setpoint but can not provide the necessary air flow to keep pressure downstream of the HPSOV above the setpoint, the HPSOV adds HP air as necessary.

If IP air provides the necessary air flow and keeps pressure downstream of the HPSOV to a value more than the setpoint, the HPSOV closes.

HPSOV Clamp Logic

Primary mode provides HPSOV clamp logic. HPSOV clamp logic closes the HPSOV when the HP air source pressure is high. The primary reason for the HPSOV clamp logic is to prevent too much engine bleed if a pneumatic distribution duct fails. The logic gets pressure information about the HP air source from the EEC. The set pressure changes with airplane altitude.

This is an example of the airplane altitudes and the HP air pressure values that cause the HPSOV to close:

- -2,000 feet (-610m) through 20,000 feet (6,100m) the set pressure is 270 psia
- > 20,000 feet (6,100m) through 43,000 feet (13,115m) the value decreases with altitude
- > 43,000 feet (13,115m) the value is 120 psia.

Pressure Regulation - Primary Mode

The pressure regulation function uses the HPSOV and PRSOV to control duct pressure. The HPSOV gives pressure regulation when the HP source gives air. The PRSOV gives pressure regulation when the HPSOV is closed. The HPSOV and the PRSOV regulate to different values.

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 2

Primary mode control of the HPSOV is the same as for the bleed source selection function.

The position of the PRSOV controls duct pressure to the usual setpoint value of 50 +/- 5 psig.

Pressure Regulation - Backup and Pneumatic Modes

The pneumatic mode automatically gives pressure regulation when the backup mode or the pneumatic mode controls the engine air supply.

The pneumatic mode uses the reference pressure regulators (not shown) in the PRSOVC to give pressure regulation. The regulators are set to give the PRSOV the necessary control pressure so that the valve regulates to a usual setpoint of 60 +/- 15 psig. This setpoint is designed to make sure pressure downstream of the PRSOV is more than sufficient for the systems that use engine bleed air.

Overpressure Protection - Primary and Backup Modes

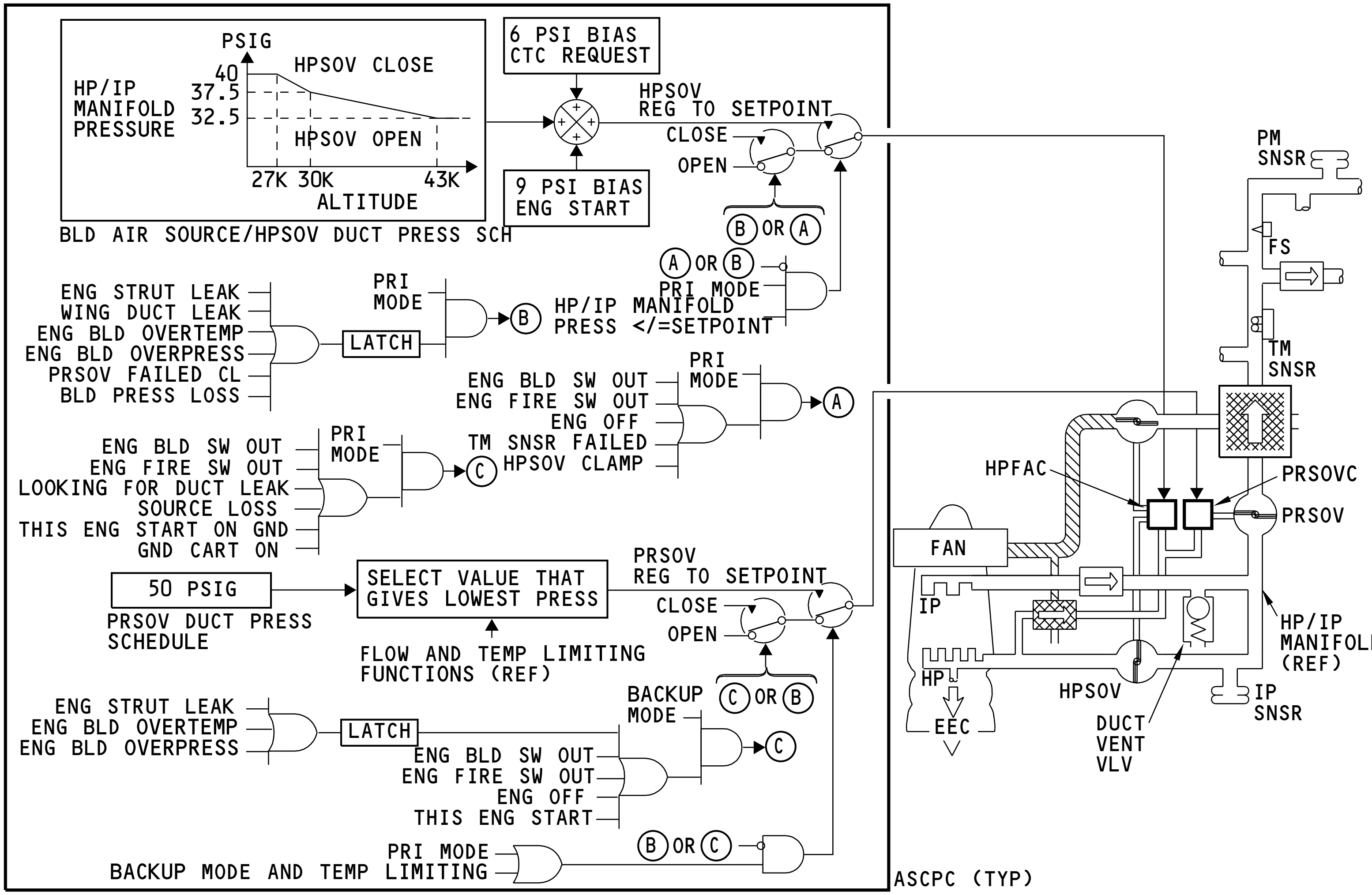
The logic used by the primary and backup modes for overpressure protection is similar. Both modes monitor the pressure in the HP/IP manifold. If the pressure is 242.5 psig or more for 5 seconds, the engine air supply latches off. The primary mode inhibits the latch during landing gear retraction.

These components give pressure information used by the overpressure protection function:

- Intermediate pressure (IP) sensor - HP/IP manifold pressure to the primary and backup modes
- EEC - gives pressure information about the HP source to the primary mode only.

Training Information Point

When a latched condition occurs, do not put the applicable engine bleed switch to out and then back to in. This will reset the latched condition and any active fault will disappear. Use the Fault Isolation Manual to troubleshoot a latched condition.



M42848 S000620105_V1

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 2

THIS PAGE IS INTENTIONALLY LEFT BLANK

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 3

General

The ASCPC changes the position of the FAMV and the PRSOV for temperature control. The primary and backup modes use torque motors in the HPFAC and the PRSOVC to change the amount of control air to the valves.

The primary mode can change the position of the fan air modulating valve (FAMV) to give the usual temperature regulation function. The primary and backup modes can change the position of the pressure regulating and shutoff valve (PRSOV) to give these functions:

- Temperature limiting - primary and backup modes
- Overtemperature protection - primary and backup modes
- Flow limiting - primary mode.

The pneumatic mode gives no temperature control of any type and does not give flow limiting. When the backup mode or the pneumatic mode gives control, the FAMV goes to the default position of fully open.

Temperature Regulation

The primary mode usually controls the precooler outlet temperature to one of these fixed values:

- 250F (121C): if the CTC requests lower temperature and wing anti-ice off
- 320F (160C): during cruise when both engines are operating and 250F (121C) is not being commanded
- 380F (193C): usual value.

Element 2 in the manifold temperature sensor (TM2) gives the temperature information to the primary mode. If element 2 fails, the primary mode gets temperature information from element 1 (TM1) through the backup mode.

The primary mode usually uses the FAMV to control the precooler out temperature. The position of the FAMV is set to control the amount of fan air allowed through the precooler. The fan air cools the engine bleed air as it goes through the precooler.

The primary mode sets the usual temperature of 380F (193C) to make sure sufficient heat is in the air for the wing anti-ice system.

If the wing anti-ice system is off, the primary mode can set the temperature to 250F (121C) if the related cabin temperature controller (CTC) tells the ASCPC that a lower temperature is necessary.

Primary mode of the ASCPC sets the precooler out temperature to 320F (160C) if all of the following are true:

- 250F (121C) precooler out temperature is not set
- The FMC is in cruise phase of flight
- Both engines are operating.

See the functional description part of the air conditioning pack cooling and mix manifold temperature control section for more information about CTC request for lower precooler out temperature (SECTION 21-52).

Temperature Limiting

The primary and backup modes give the same temperature limiting function. When the precooler out temperature is 450F (232C) or more, the applicable mode sets the position of the PRSOV to limit the amount of bleed air allowed through the precooler.

Temperature information comes from TM2 for the primary mode or TM1 for the backup mode.

When the precooler out temperature is equal to or more than 450F (232C), the primary and backup modes command the PRSOV towards closed to limit bleed air flow. When bleed air flow is limited, the bleed air temperature usually goes down.

Overtemperature Protection

The engine bleed air overtemperature protection function is enabled at the same time by the primary and backup modes. Temperature information comes from TM2 for the primary mode or TM1 for the backup mode.

If the precooler out temperature is more than 490F (254C), the primary and backup modes command the PRSOV to the fully closed position.

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 3

Flow Limiting

The primary mode limits the flow of engine bleed air to 10 lbs/sec (4.5 kg/sec). The limit includes the amount of air used or measured by these systems or components:

- Wing anti-ice (WAI)
- Engine anti-ice (EAI)
- Air supply distribution, flow sensor (FS).

The primary mode calculates the total amount of engine bleed air used based on the inputs. If the flow is more than 10 lbs/sec (4.5 kg/sec), the primary mode commands the PRSOV towards closed to limit bleed air flow.

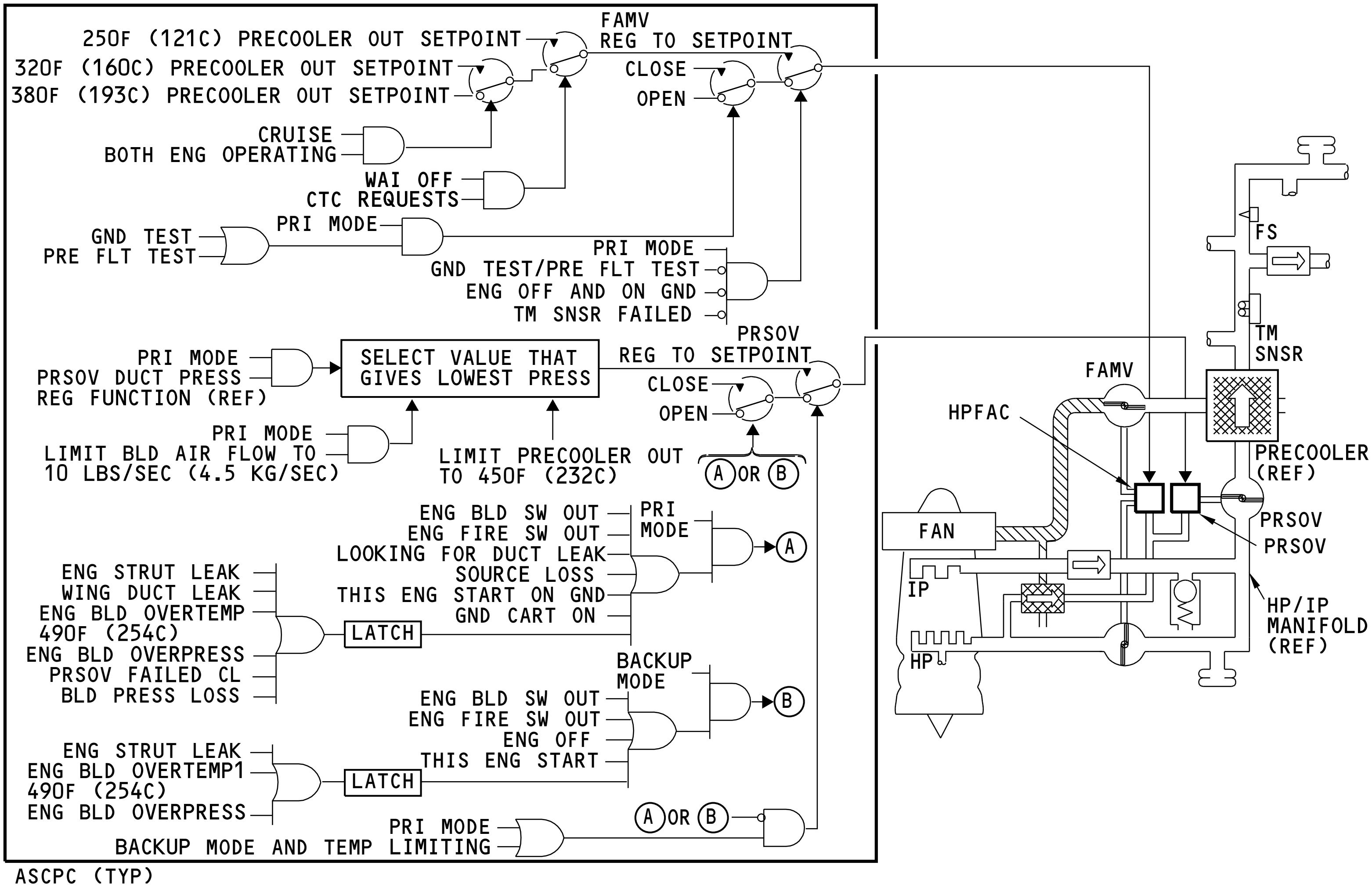
See the wing anti-ice section for more information about WAI (SECTION 30-11).

See the engine anti-ice section for more information about EAI (SECTION 30-21).

See the indicating system section for more information about the flow sensor (FS) (SECTION 36-20).

BITE

During the ground test or the preflight test, the FAMV will be closed and open to do a test of the valve and its related circuit.



M42854 S000620111_V1

ENGINE AIR SUPPLY SYSTEM - FUNCTIONAL DESCRIPTION - 3

THIS PAGE IS INTENTIONALLY LEFT BLANK

AIR SUPPLY DISTRIBUTION - INTRODUCTION

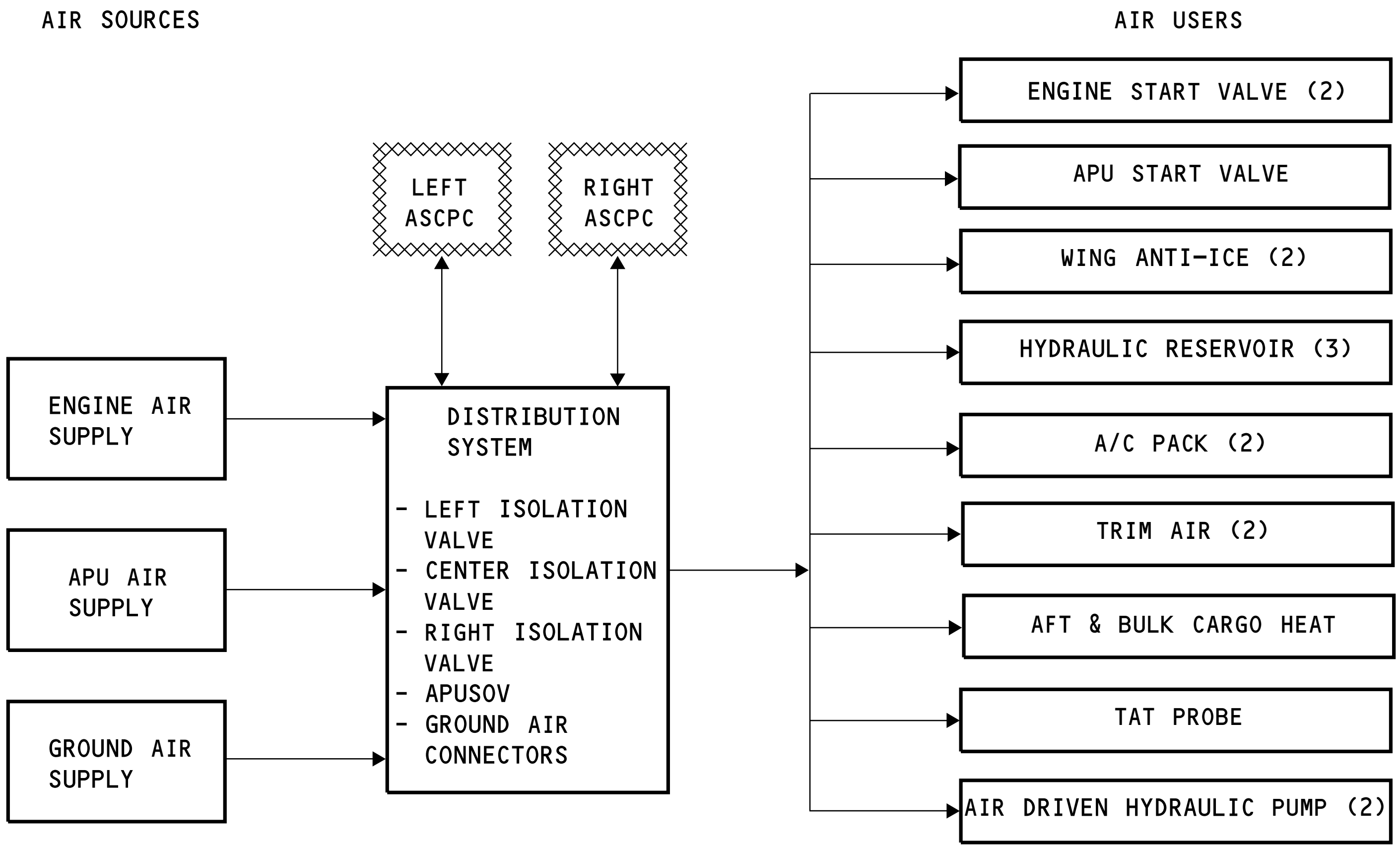
Purpose

The air supply distribution system supplies air from the air sources to users. The system also isolates the air sources from each other.

General

The air supply distribution system supplies compressed air from the engines, APU, and ground carts to user systems. The left and right air supply cabin pressure controllers (ASCPCs) control three isolation valves and the APUSOV in the distribution system. Both controllers control the valves at the same time. The valves then supply air to these components and systems:

- Engine start valve
- APU start valve
- Wing anti-ice
- Hydraulic reservoirs
- Air conditioning packs
- Aft and bulk cargo heat
- Trim air
- Total air temperature probe
- Air driven hydraulic pumps



1399269 S0000250911_V1

AIR SUPPLY DISTRIBUTION - INTRODUCTION

AIR SUPPLY DISTRIBUTION - GENERAL DESCRIPTION

General

The air supply distribution system has these parts:

- Large main distribution ducts (wing, body)
- Small ducts
- Left isolation valve
- Center isolation valve
- Right isolation valve
- APU shutoff valve (APUSOV)
- Three high pressure ground connectors.

The large main distribution ducts connect to the engines and the APU. The smaller ducts connect the user systems to the main distribution ducts.

You use switches on the bleed air/pressurization panel to set the mode of control for the isolation valves and APUSOV. AUTO and CLOSED are the positions for the isolation valve switches. AUTO and OFF are the positions for the APUSOV switch. The switches also have annunicator lights that give you information about the system.

The left and right ASCPCs control the isolation valves and the APUSOV. The controllers use inputs from these systems/components to calculate when a valve should be open or closed:

- ELMS
- OPAS
- AIMS
- APU fire switch
- DLODS
- APUC
- ADIRU.

The ELMS tells the ASCPCs when the airplane is on standby power. The ASCPCs use this when calculating APUSOV position.

The OPAS is the interface between the ARINC 629 buses and the bleed air/pressurization panel. The ASCPCs get information about switch position and control the annunicator lights through the OPAS and the ARINC 629 buses. The ASCPCs use switch position when calculating valve positions.

The AIMS gives information about the system through the primary display system.

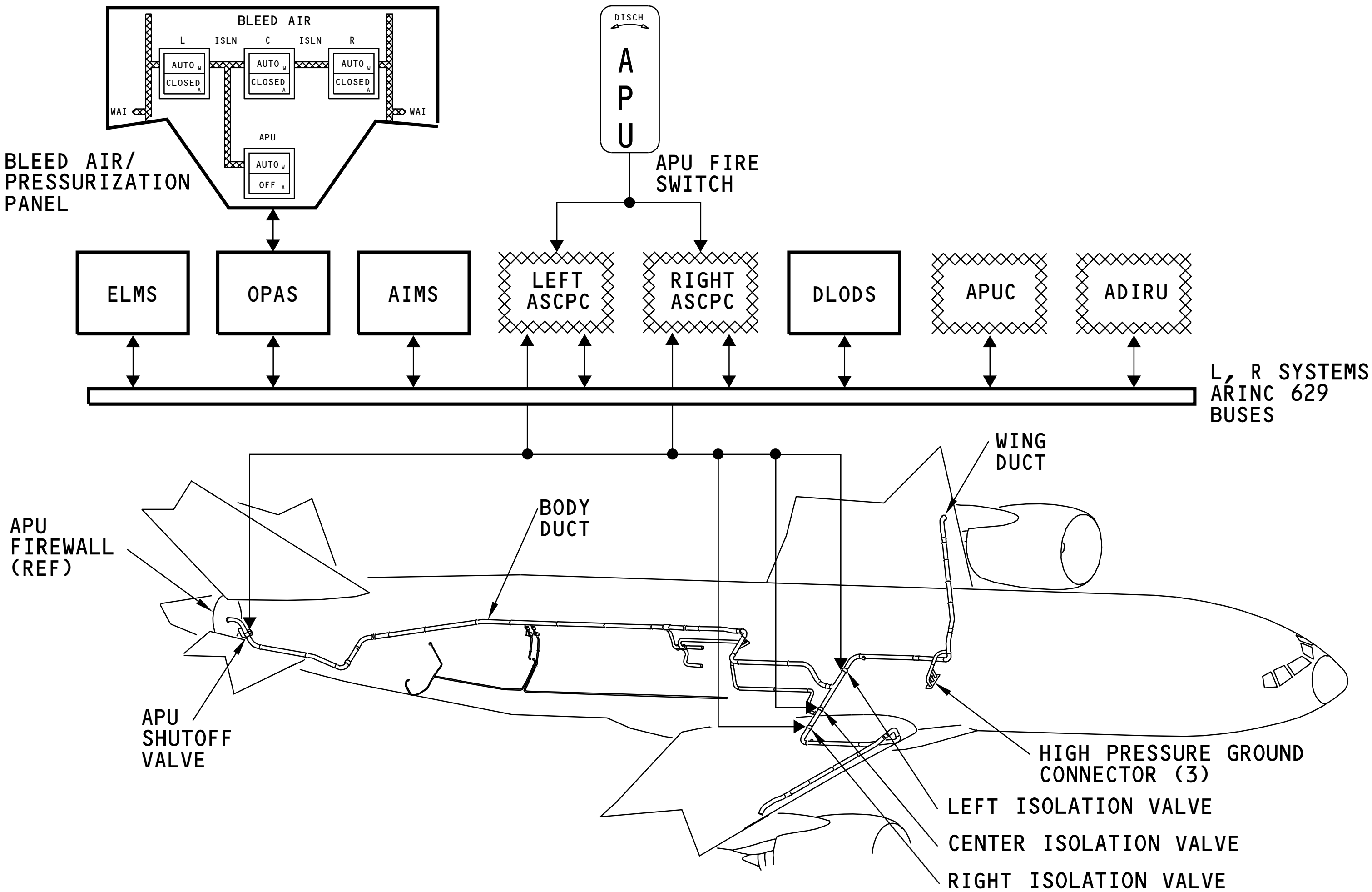
The APU fire switch gives switch position information directly to the ASCPCs. The ASCPCs use this when calculating valve positions.

The DLODS monitors the pneumatic distribution ducts for leaks and sends a signal if there is a leak. The ASCPCs calculate valve positions to isolate the leak based on the duct leak signal from DLODS.

The APUC gives APU on or off information to the ASCPCs. It also sends a signal to open the APUSOV for an air start of the APU. The ASCPCs use APUC information when calculating valve positions.

The ADIRU gives airplane altitude information to the ASCPCs. The ASCPCs use altitude information when they do a test of the system.

BITE circuits in the ASCPCs monitor the condition of the system. You use the MAT to do ground tests of the system.



M42894 S000620117_V1

AIR SUPPLY DISTRIBUTION - GENERAL DESCRIPTION

AIR SUPPLY DISTRIBUTION - ISOLATION VALVE AND GROUND CONNECTOR - COMPONENT LOCATIONS

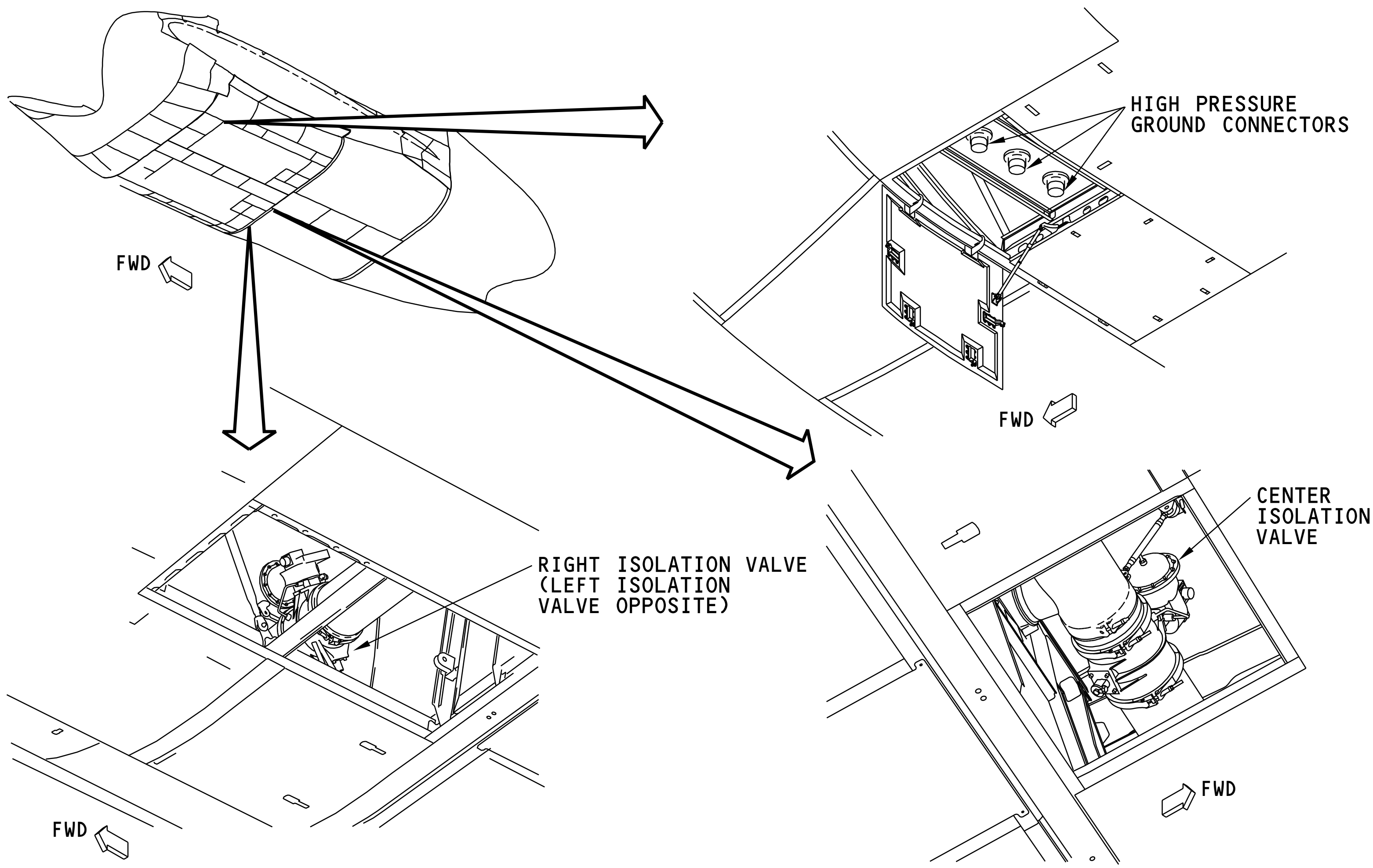
General

There are three isolation valves and three high pressure ground connectors.

Location

The isolation valves are installed in the pneumatic manifold just aft of the ECS bay door.

The connectors are forward of the environmental control system bay door to the left of the keel beam.



M42860 S000620118_V1

AIR SUPPLY DISTRIBUTION - ISOLATION VALVE AND GROUND CONNECTOR - COMPONENT LOCATIONS

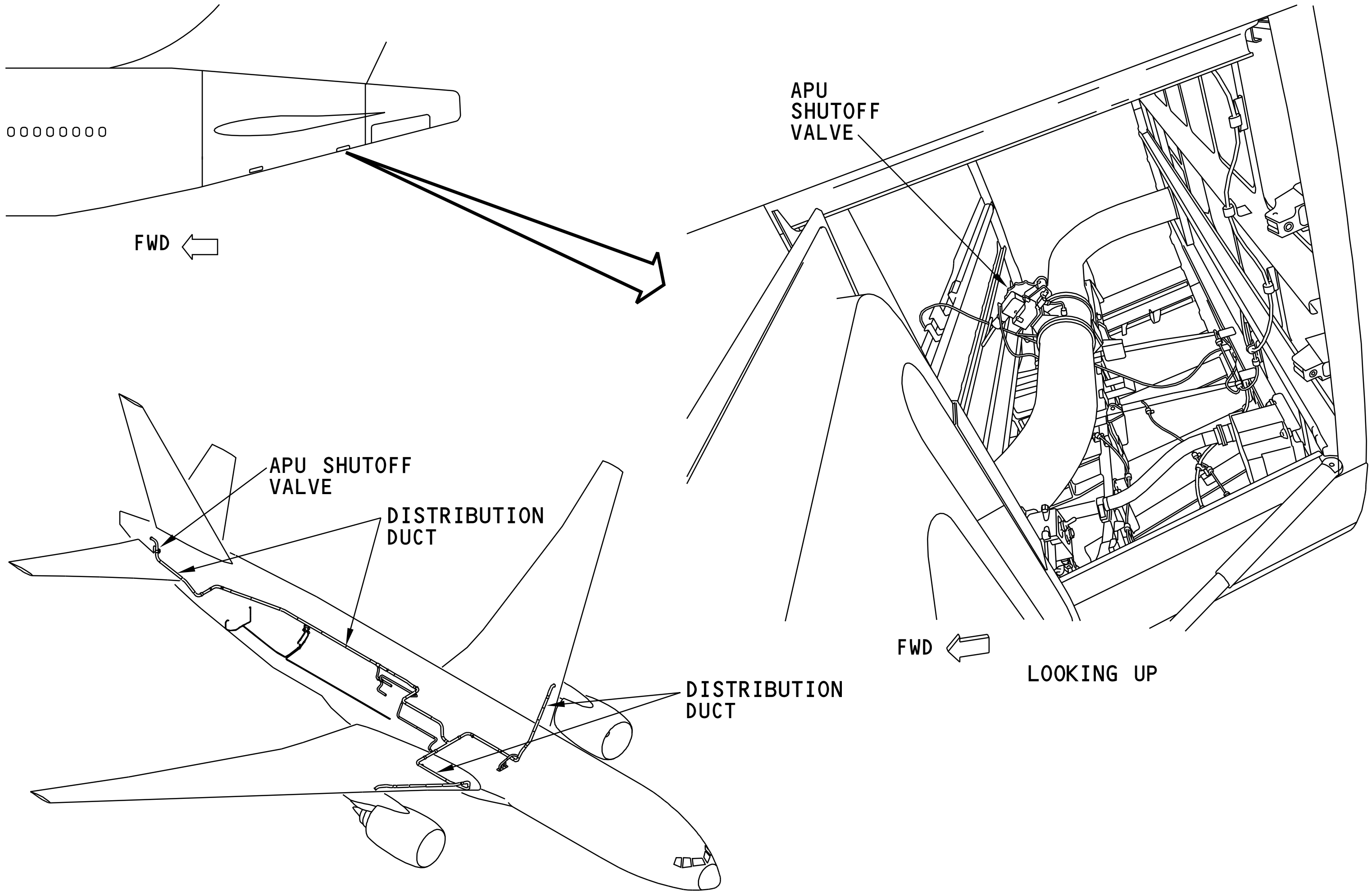
AIR SUPPLY DISTRIBUTION - APU SHUTOFF VALVE AND DUCT - COMPONENT LOCATIONS

Auxiliary Power Unit Shutoff Valve

The auxiliary power unit shut off valve (APUSOV) is forward of the APU access door. You open the access the door forward of the APU access door to get access to the APUSOV.

Distribution Duct

The main distribution duct is along the front wing spar and in the fuselage from the ECS bays to the APU firewall.



M42861 S000620119_V1

AIR SUPPLY DISTRIBUTION - APU SHUTOFF VALVE AND DUCT - COMPONENT LOCATIONS

AIR SUPPLY DISTRIBUTION - ISOLATION VALVES

Purpose

The isolation valves control the air flow direction in the pneumatic manifold from both engines, the APU, and the ground air supply.

Physical Description

Each isolation valve has these parts:

- Actuator
- Solenoid
- Valve body
- Electrical connector
- Manual override and position indicator assembly
- Rotary variable differential transformer (RVDT).

Location

The left isolation valve is aft of the left environmental control system (ECS) access door. You open the access panel 195QL to get access to the left isolation valve.

The center isolation valve is aft of the right ECS access door. You open the access panel 196NR to get access to the center isolation valve.

The right isolation valve is aft of the right ECS door. You open the access panel 196QR to get access to the right isolation valve.

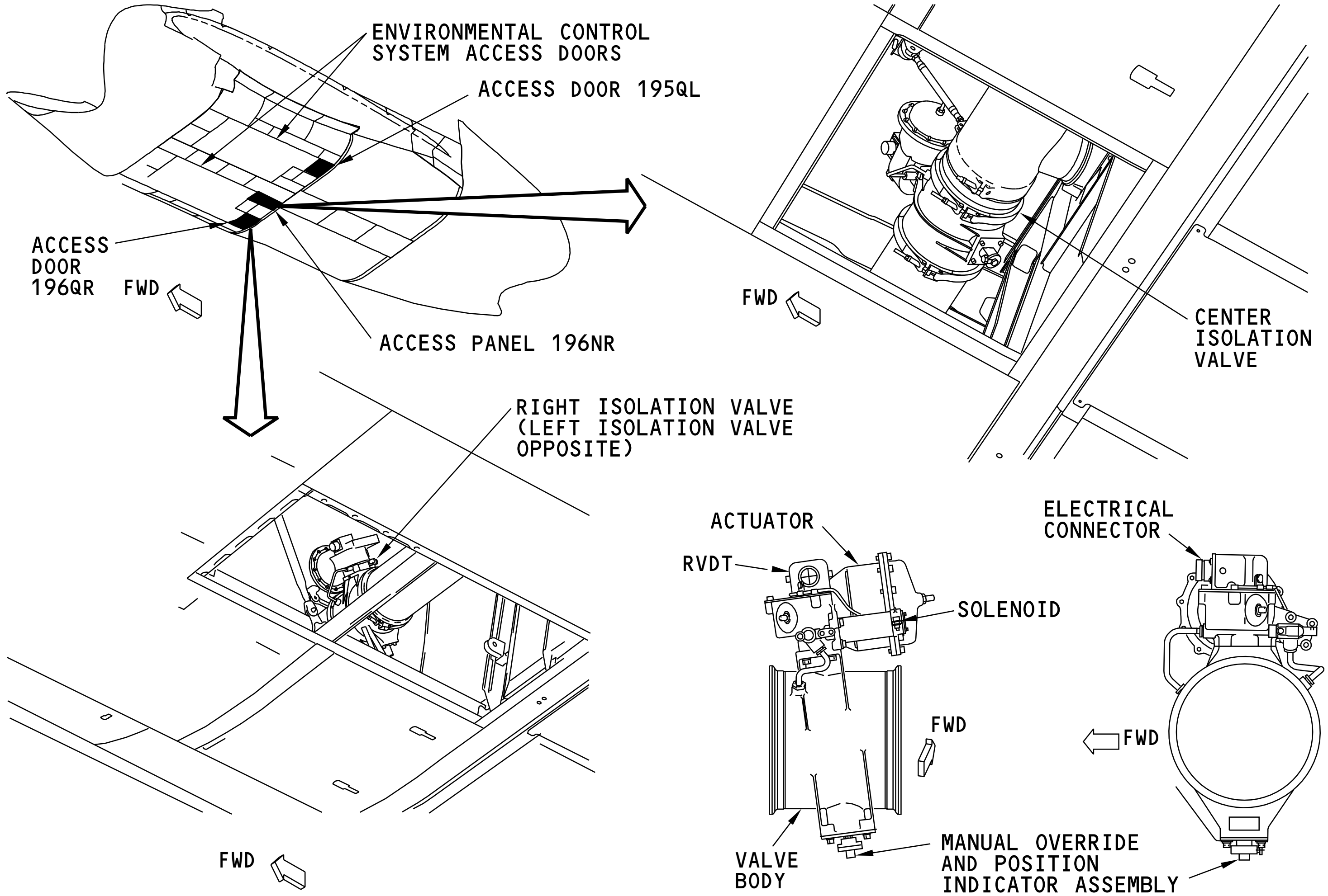
Functional Description

The isolation valves are two-position valves that are spring-loaded closed. The valves are electrically controlled and pneumatically actuated.

Training Information Point

Install the isolation valves with the placard in view and the electrical connection accessible.

The isolation valves are identical and interchangeable with each other and with the APU shutoff valve.



M42862 S000620120_V1

AIR SUPPLY DISTRIBUTION - ISOLATION VALVES

AIR SUPPLY DISTRIBUTION - APU SHUTOFF VALVE

Purpose

The APU shutoff valve (APUSOV) controls the flow of bleed air from the APU into the pneumatic manifold.

Location

The APUSOV is in the lower aft section of the airplane just forward of the APU firewall.

Physical Description

The APUSOV has these parts:

- Actuator
- Manual override and position indicator assembly
- Valve body
- Electrical connector
- Rotary variable differential transformer (RVDT)
- Solenoid.

Functional Description

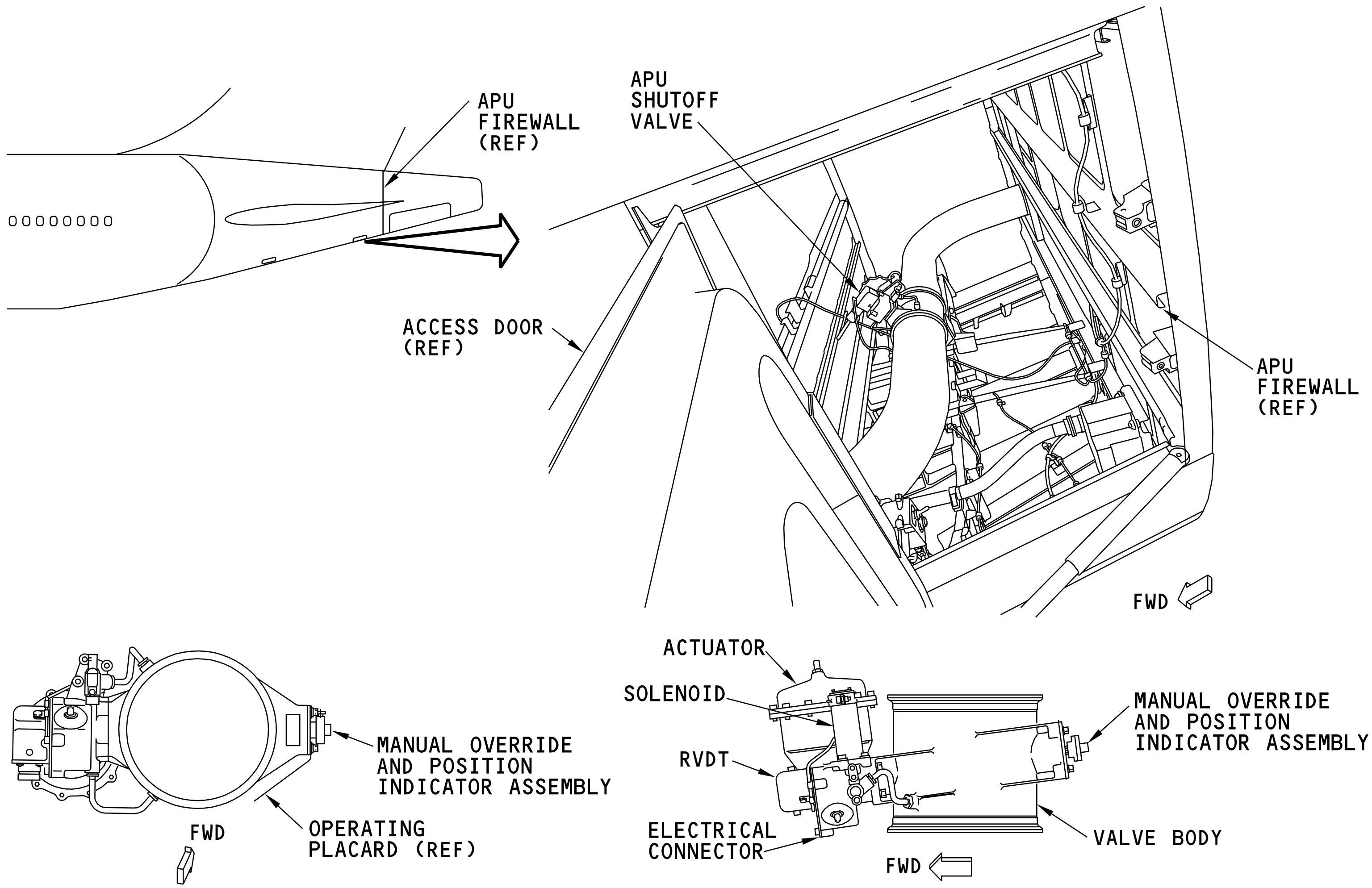
The APUSOV is a two position valve that is spring loaded closed. The valve is electrically controlled and pneumatically actuated.

Training Information Point

The APU shutoff valve should have the operating placard in view and the electrical connection accessible.

The APU shutoff valve is identical and interchangeable with the isolation valves.

When the APU is running with the APU shutoff valve open and with no downstream bleed air demand selected, the trapped APU bleed air can cause a rumbling noise to be heard near Door 3. This condition is common when no downstream bleed air is selected. The rumbing noise will go away when a downstream bleed air demand is selected.



M42863 S000620121_V1

AIR SUPPLY DISTRIBUTION - APU SHUTOFF VALVE

AIR SUPPLY DISTRIBUTION - ISOLATION/APU SHUTOFF VALVES - TRAINING INFORMATION POINTS

Purpose

The manual override and position indicator assembly lets you lock the valve closed or open and lets you see the position of the valve.

Location

The assembly is on the opposite side of the valve body as the actuator.

Physical Description

The manual override and position indicator assembly has these parts:

- Retainer plate
- Knob bolt
- Valve shaft hex
- Lock knob/position indicator
- OPEN / CLOSED placards.

Functional Description

The knob bolt lets you unlock or lock the lock knob/position indicator to the valve shaft.

The lock knob/position indicator shows you the actual valve disc position. You also use the indicator to lock the valve disc closed or open. The lock knob/position indicator has two positions: LATCH (in) and UNLATCH (out).

The retainer plate holds the lock knob/position indicator and valve shaft so they can not move when the lock knob/position indicator is in the LATCH position (pushed in position).

The hex part of the valve shaft lets you move the valve to OPEN or CLOSED.

Operation

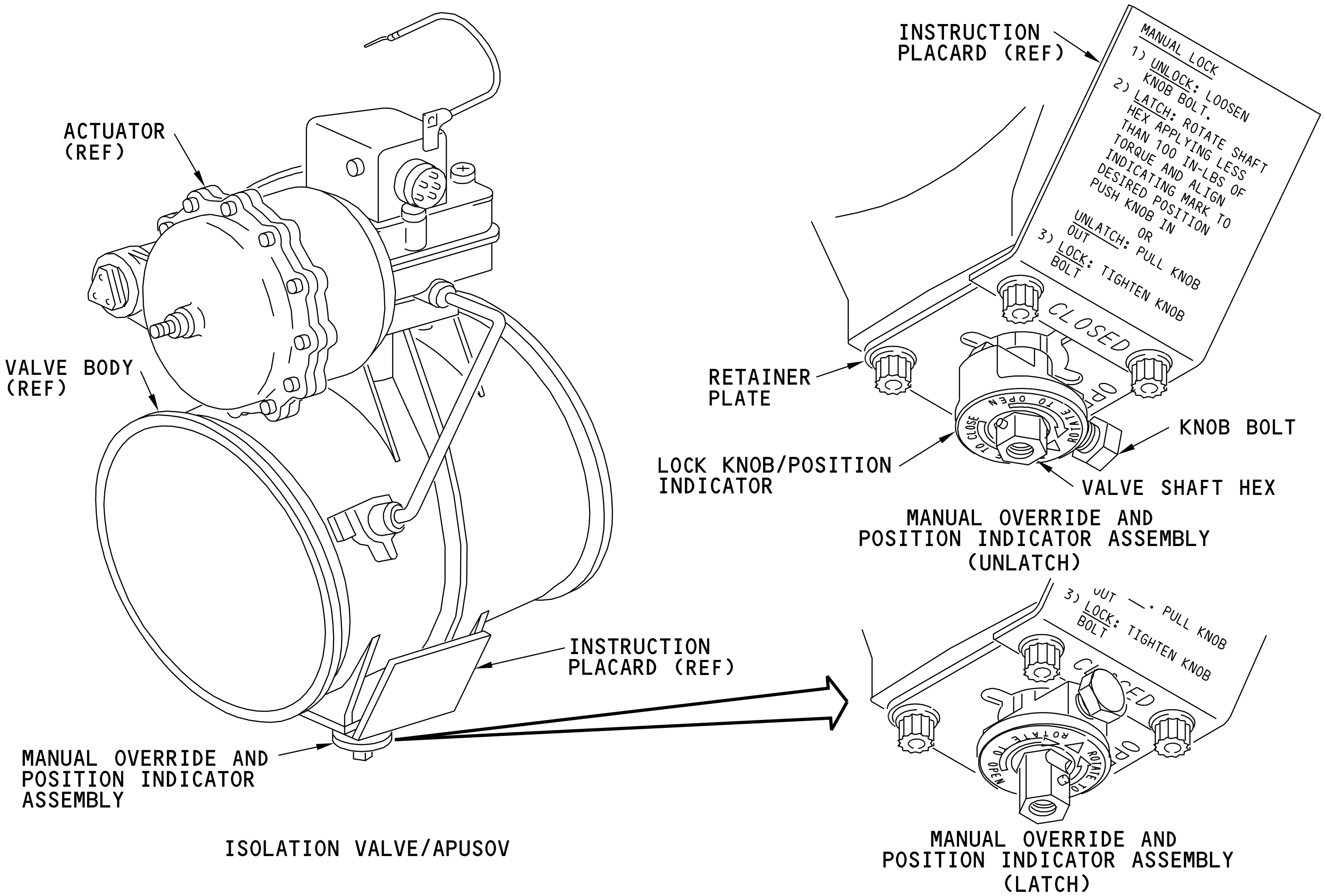
Usually the lock knob/position indicator is locked by the knob bolt to the UNLATCH position. This lets the valve open and close freely.

When you loosen the knob bolt (UNLOCK), the lock knob/position indicator freely moves in or out along the valve shaft. This lets you set the lock knob/position indicator to any one these positions:

- LATCH: valve open
- LATCH: valve closed
- UNLATCH: valve free movement.

To keep the lock knob/position indicator in one of the above positions you tighten the knob bolt (LOCK).

You use standard hand tools to manually lock or unlock the isolation and APU shutoff valves. The valve shaft and knob bolt are sized for a 7/16 inch wrench.



M42864 S000620122_V1

AIR SUPPLY DISTRIBUTION - ISOLATION/APU SHUTOFF VALVES - TRAINING INFORMATION POINTS

AIR SUPPLY DISTRIBUTION - HIGH PRESSURE GROUND CONNECTOR

Purpose

The high pressure ground connectors let an external air source connect to the main pneumatic distribution system. Check valves in the connectors prevent loss of pressurized air.

Location

The high pressure ground connectors are in the under wing fuselage area, forward of the ECS access door, 195EL. You open the access door 195BL to get access to the high pressure ground connectors.

Physical Description

The high pressure ground connector has these parts:

- Check valve
- Connector
- Flange.

Training Information Point

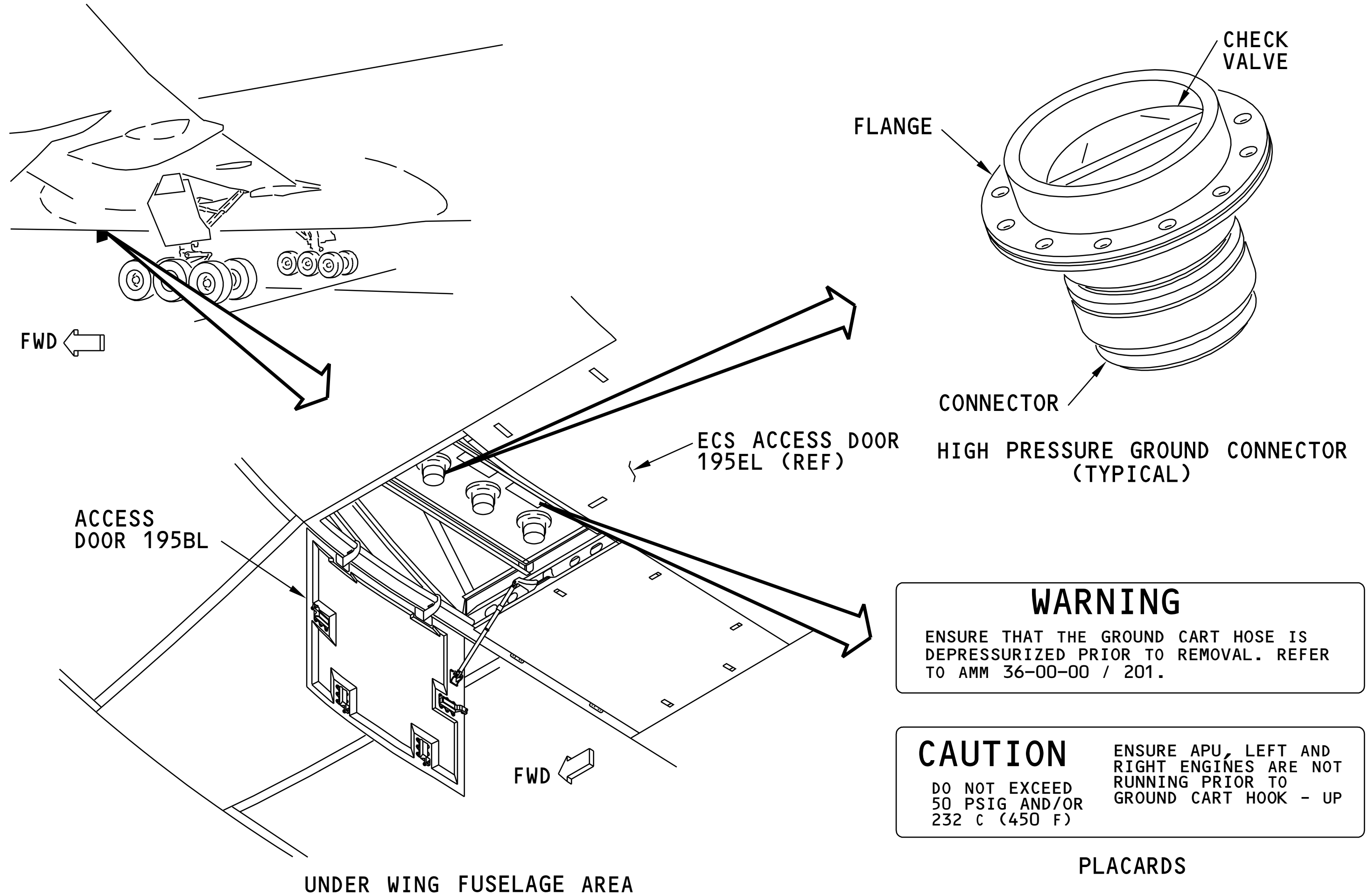
WARNING DO NOT SUPPLY GREATER THAN 50 PSIG AND/OR 232C (450F) TO THE PNEUMATIC SYSTEM. IF YOU SUPPLY TO MUCH PRESSURE AND/OR TEMPERATURE DAMAGE TO EQUIPMENT AND INJURY TO PERSONAL CAN OCCUR.

CAUTION TO PREVENT DAMAGE TO AIR CONDITIONING SYSTEM COMPONENTS, APPLY ELECTRICAL POWER BEFORE YOU APPLY PNEUMATIC POWER AND REMOVE PNEUMATIC POWER BEFORE YOU REMOVE ELECTRICAL POWER.

The air conditioning packs will operate without any protective functions if you pressurize the pneumatic system before you apply electrical power.

Before you depressurize the pneumatic system, make sure the air conditioning packs are off. If you depressurize the pneumatic system with the packs on, the packs will not do the normal pack shutdown on the ground sequence.

See the pack flow control section for more information on air conditioning pack start and shutdown sequences (SECTION 21-51).



M42865 S000620123_V1

AIR SUPPLY DISTRIBUTION - HIGH PRESSURE GROUND CONNECTOR

AIR SUPPLY DISTRIBUTION - DUCT

Purpose

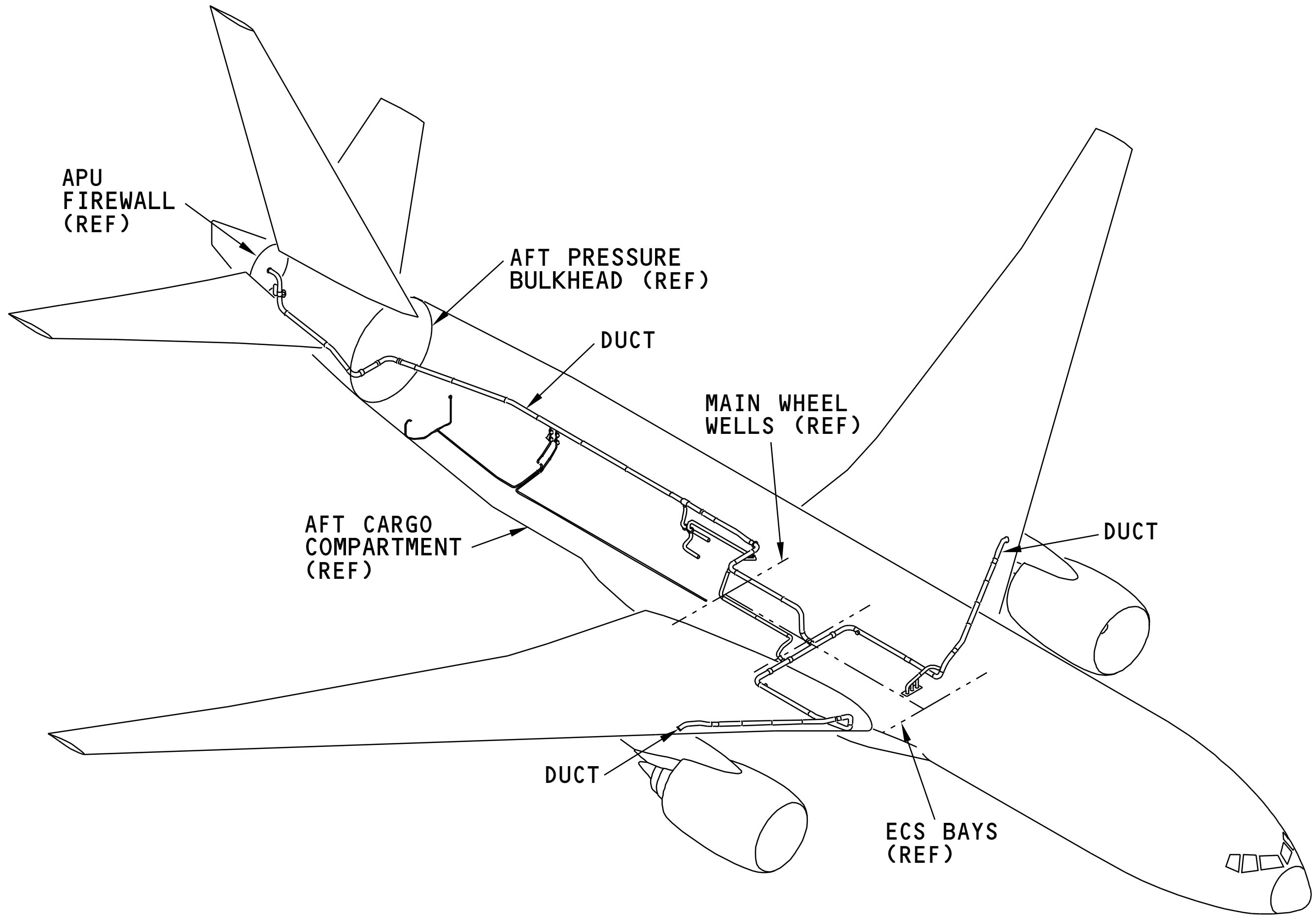
The air supply distribution duct connects the pneumatic sources to the users.

Location

The ducts are along the wing front spar. In the fuselage, the ducts go from the ECS bays in the wing-to-body area to APU firewall.

Physical Description

The large main distribution ducts are seven inches (18cm) in diameter. The smaller ducts are of different sizes from four inches (10cm) to three eights of an inch (1cm).



M42866 S000620124_V1

AIR SUPPLY DISTRIBUTION - DUCT

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - ISOLATION VALVES AND APUSOV

General

The left, center and right bleed isolation (L,C,R ISLN) switches and the APU bleed switch have two positions: in (AUTO) and out. The isolation switches have a CLOSED light. The APU bleed switch has an OFF light.

The AUTO position lets the ASCPCs set the position of the valves. The out position commands the ASCPCs to close the related valve. The CLOSED and OFF lights give indication for non-normal conditions.

These are the usual positions of the valves when the switches are set to AUTO and both engine air supply systems are on:

- Left isolation valve - open
- Center isolation valve - closed
- Right isolation valve - open
- APUSOV - closed.

The digital (primary) mode of both ASCPCs control the valves at the same time. The valves have a solenoid with two coils, one for each controller. A RVDT gives valve position information directly to one of the two ASCPCs. The other ASCPC monitors valve position through the ARINC 629 buses.

If the digital mode for both ASCPCs fail, the valves go to a default position. With duct pressure available, the valves open. With no duct pressure, a spring in the actuator closes the valves.

The left controller supplies BITE for the solenoid coils and RVDTs that connects to it. The right controller supplies BITE for the solenoid coils and RVDTs that connects to it.

The left ASCPC gets 28v dc for control and operation of the valves from the section 2 battery bus (not shown). The right ASCPC gets 28v dc for control and operation of the valves from the first officer's flight instrument bus (not shown).

See the engine air supply section for more information on ASCPC power (SECTION 36-11).

See the DC generation section for more information about DC power (SECTION 24-30).

Valve Functional Description

The internal parts for the left isolation valve is shown, the other isolation valves and the APUSOV have the same parts.

Air pressure to operate the valve comes from one of the two sides of the valve. The side of the valve that has the higher pressure supplies the air that goes through the shuttle valve to the switcher valve. The ASCPCs use the coils in the solenoid to control switcher valve position.

To open the valve, the ASCPCs remove power from the solenoid coils. The switcher valve spring moves to the position that lets air pressure go to the actuator. Pressure more than 10 psi opens the valve.

The RVDT sends a valve position signal to the ASCPC.

To close the valve, the ASCPCs energize the solenoid coils. The switcher valve moves to block pressure from the shuttle valve and releases pressure from the actuator. The spring in the actuator closes the valve.

The ASCPCs have control logic that sets the valves to one of these configurations:

- Open
- Closed
- Latched closed.

See the pages in this section about isolation valve and APUSOV control logic for more information on valve configurations.

Indications

These are the flight deck effects that have a relation to the position of the isolation valves and the APUSOV:

- Left, center, right bleed isolation CLOSED lights
- APU bleed OFF light
- Advisory message, BLEED ISLN CLOSED L,C,R
- Advisory message, BLEED ISLN OPEN L,C,R (not shown)
- Advisory message, BLEED OFF APU.

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - ISOLATION VALVES AND APUSOV

A status message, (not shown) also shows if a valve is not in its set position.

The CLOSED light lets the flight crew know that the valve is closed due to a non-normal condition of the valve or the pneumatic system. The OFF light lets the flight crew know that APU bleed air is not available due to a non-normal condition of the valve or the pneumatic system.

The advisory messages let the flight crew know that the related valve is:

- Not in the position set by the ASCPCs or
- Selected to a non-normal mode of control (related switch set to out).

The ASCPC logic that causes the CLOSED or OFF light, is different from that used to cause the related closed or off message. This means that the light and the related message do not always show at the same time.

The primary mode of the left ASCPC has the logic that calculates when to supply the indications related to the left and center isolation valves. The primary mode of the right ASCPC supplies the indications related to the right isolation valve and the APUSOV.

Valve Closed/Off Indications

The ASCPCs usually use RVDT valve position information and non-normal condition information to calculate when to show the valve closed/off indications. If the RVDT circuit fails, the ASCPCs use non-normal condition information to calculate when to show the valve closed/off indications.

The applicable bleed isolation CLOSED light comes on if any of these non-normal conditions occur:

- A bleed isolation switch is set to out
- An isolation valve is latched closed
- A valve is set to close as the ASCPCs try to find the location of a duct leak (wing, body)
- An isolation valve fails closed and the RVDT circuit functions correctly
- Source loss condition (L for L ISLN val, R for R ISLN val, L or R for C ISLN val).

The source loss condition logic lets the ASCPCs sense when there is not sufficient air pressure to the ADPs for landing gear retraction, immediately after takeoff.

There are two sets of conditions that cause the ASCPCs to set the left source loss condition to true. The first set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left engine off.

The second set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left duct pressure less than 20 psig and right duct pressure more than 20 psig.

The conditions that cause the right source loss condition to be true are equivalent to the conditions that cause the left source loss.

The APU bleed OFF light turns on if any of these non-normal conditions occur:

- APU bleed switch set to out
- APU shutoff valve latched closed
- Left wing or body duct leak
- APU shutoff valve failed close and the RVDT circuit functions correctly
- APU fire switch pulled.

For each valve there are two sets of conditions that cause the related closed or off advisory message, BLEED ISLN CLOSED L, C, R or BLEED OFF APU. The first set causes the applicable message if all of these conditions occur:

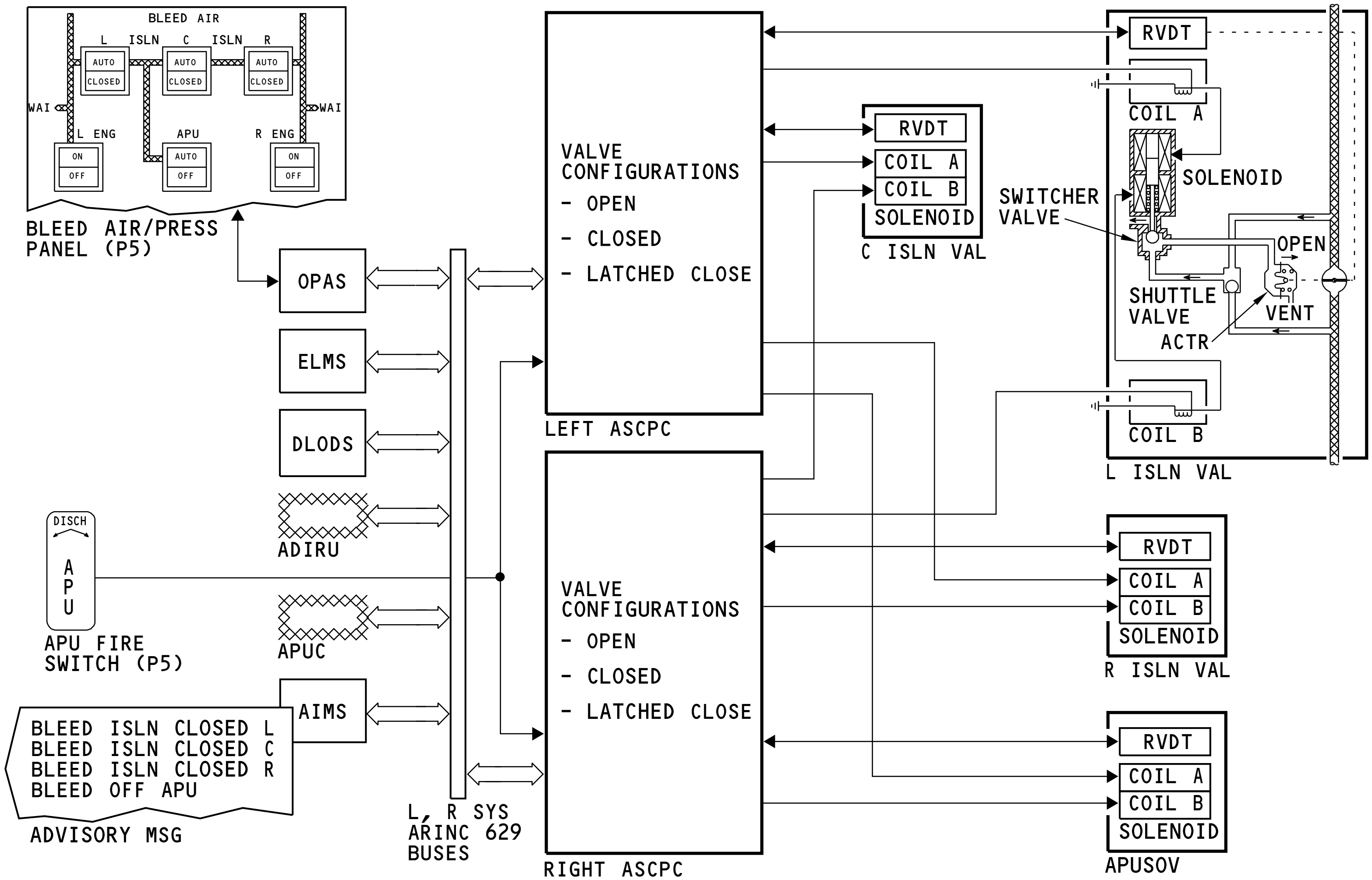
- Bleed isolation switch (L, R, C, APU) set to out
- Related valve is in the closed position or has a failed RVDT circuit.

The second set causes the applicable message if all of these conditions occur:

- Related valve fails in the closed position
- The RVDT circuit functions correctly.

Isolation Valve Open Indication Logic

The applicable advisory message, BLEED ISLN OPEN L,C,R shows if the RVDT circuit for the related valve operates correctly and the related valve fails in an open position.



M42896 S000620125_V1

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - ISOLATION VALVES AND APUSOV

THIS PAGE IS INTENTIONALLY LEFT BLANK

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - LEFT AND RIGHT ISOLATION VALVE CONTROL LOGIC

Control Logic

The ASCPCs have control logic that sets the left and right isolation valves to one of these configurations:

- Open
- Closed
- Latched closed.

The following information tells about the control logic for the left isolation valve. The control logic used to set the right isolation valve is equivalent to the left isolation valve except where specified.

Valve Open Control Logic

There are three sets of conditions that cause the ASCPCs to open the left isolation valve. The first set of conditions is true if all of these conditions occur:

- Valve closed logic is not true
- Valve latched closed logic is not true.

The second set is true if all of these conditions occur:

- Valve latched closed logic is not true
- L ISLN switch is set to AUTO
- No duct leak signal for Left (strut, wing, or body)
- No left source loss
- Center isolation valve operates correctly (right isolation valve logic only)
- Left engine start.

The third set is true if all of these conditions occur:

- Valve latched closed logic is not true
- L ISLN switch is set to AUTO
- Cross bleed engine start.

See the duct leak and overheat detection system section for more information about strut, wing, and body leaks (SECTION 26-18).

Source Loss Condition Logic

The source loss condition logic lets the ASCPCs sense when there is not sufficient air pressure to the ADPs for landing gear retraction, immediately after takeoff.

Source loss can occur in the left or right parts of the pneumatic distribution system. There are two sets of conditions that cause the ASCPCs to set the left source loss condition to true. The conditions that cause the right source loss condition are equivalent to left. The first set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left engine off.

The second set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left duct pressure less than 20 psig and right duct pressure more than 20 psig.

Center Isolation Valve Operates Correctly Logic

Control logic for the right isolation valve monitors the center isolation valve. If the center valve fails open, the right isolation valve closes as necessary to isolate the left the right engine bleed air supply systems.

Valve Closed Control Logic

The ASCPCs set the valve to close if the valve latched close logic is not true and any of these conditions occur:

- Left bleed isolation switch set to out
- Right engine start and not left engine start
- Left source loss
- Center isolation valve open when it should be closed (right isolation valve logic only).

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - LEFT AND RIGHT ISOLATION VALVE CONTROL LOGIC

If an engine cross bleed start condition is not true, the ASCPCs also close the valve when they use the valve to find the location of a duct leak. If the ASCPCs find that the valve has no effect on the leak, the valve is set to open. If the ASCPCs find that the valve does effect the leak, the valve is latched close.

Valve Latched Close Control Logic

The left isolation valve latches closed to isolate a section of duct that has a leak or pressure less than it should be for the airplane conditions. The valve is latched closed if any of these conditions occur:

- The ASCPCs identify the location of a Left strut, left wing or left body duct leak
- The ASCPCs fail to identify the location of a duct leak after a specified quantity of time
- Left bleed pressure loss.

When a duct leak condition occurs, the ASCPCs latch the valve closed only after the location of the leak is known or after a specified quantity of time. These are examples of the quantity of time permitted to find the location of a leak:

- Strut leak - 5 seconds
- Wing leak - 185 seconds
- Body leak - 95 seconds.

Bleed Pressure Loss Condition Logic

The bleed pressure loss condition logic lets the ASCPCs sense when a pneumatic duct breaks. Possible engine starter duct failure is the primary reason for this logic.

There are two sets of conditions that cause the ASCPCs to set the left bleed pressure loss condition to true. The conditions for a right bleed pressure loss condition are equivalent to the left. The first set is true if all of these conditions occur for more than 10 seconds:

- Left duct pressure is less than 13 psig
- Left pack inlet pressure is less than 13 psig
- Right duct pressure is more than 13 psig
- Left PRSOV is open
- Right PRSOV is open
- No duct leak signal from the duct leak and overheat detection system (DLODS)
- Landing gear is up
- Less than 180 seconds after takeoff.

The second set is true if all of these conditions occur for more than 10 seconds:

- Left duct pressure is less than 13 psig
- Left pack inlet pressure is less than 13 psig
- Right PRSOV is open
- Left PRSOV is closed
- Landing gear is up or 180 seconds after takeoff
- Left engine bleed air flow is more than 2.0 lbs/sec
- No left engine start.

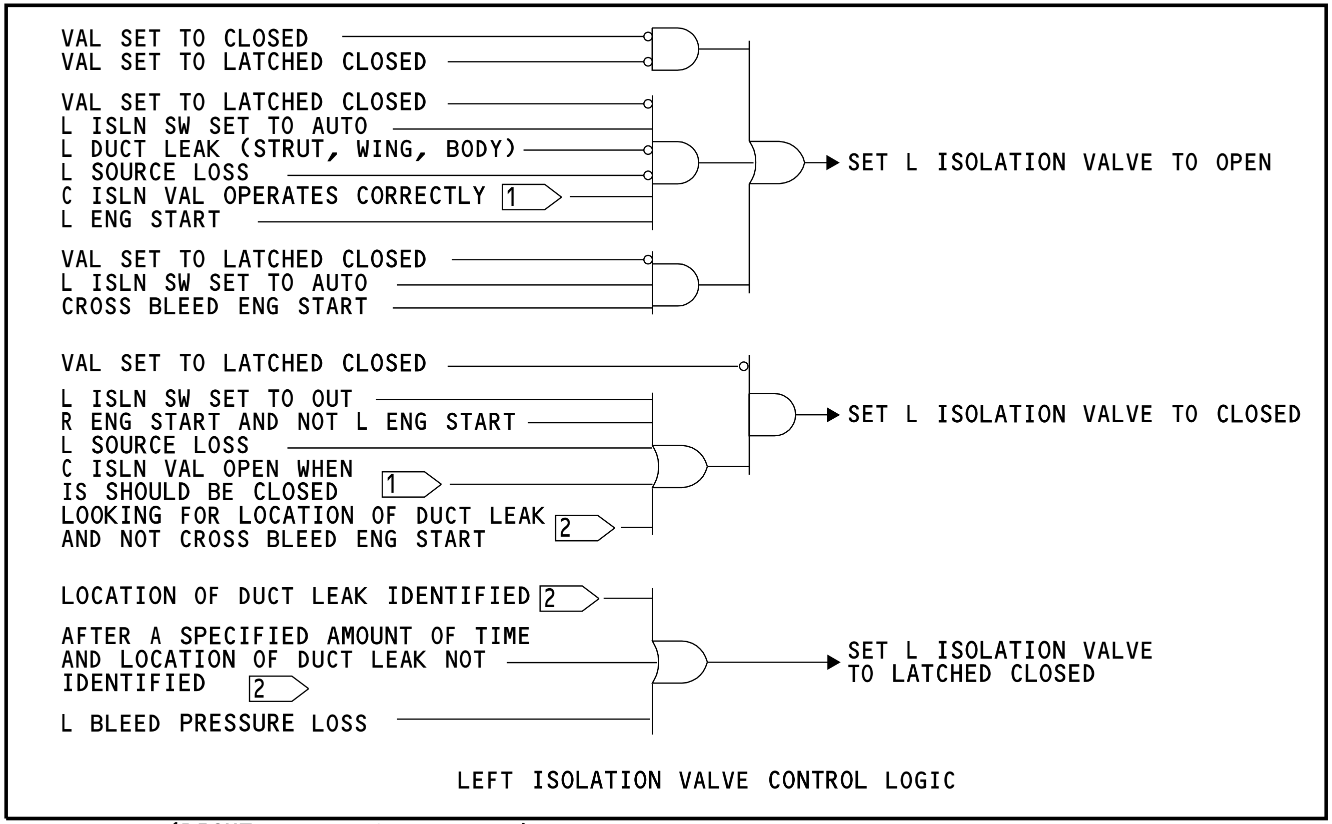
Training Information Point

The ASCPC has logic that lets the left or right isolation valves stay open if the airplane has a wing or body duct leak and any of these conditions occur:

- An engine start is in progress
- An ADP is on and it is less than 3 minutes since the airplane has taken off.

This logic lets the engine start complete or makes sure air is available for ADP operate immediately after takeoff. If a wing or body duct leak occurs after a valve is latched close, the valve will not open for engine start or for ADP operation.

You must set the applicable bleed isolation switch to out and then AUTO to reset the related isolation valve after it latches closed. The latch will not reset if the condition that caused it is still true.



LEFT ASCPC (RIGHT ASCPC IS THE SAME)

1 RIGHT ISOLATION VALVE ONLY 2 INHIBIT IF ENG START IN PROGRESS OR IF AN ADP IS ON AND TAKEOFF < 3 MIN.

NOTE: CONTROL LOGIC FOR THE LEFT ISOLATION VALVE SHOWN, LOGIC FOR THE RIGHT VALVE IS EQUIVALENT

M42867 S000620126_V2

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - LEFT AND RIGHT ISOLATION VALVE CONTROL LOGIC

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - CENTER ISOLATION VALVE CONTROL LOGIC

Control Logic

The ASCPCs have control logic that sets the center isolation valve to one of these configurations:

- Open
- Closed
- Latched closed.

Valve Open Control Logic

There are four sets of conditions that cause the ASCPCs to open the center isolation valve. The first set is true if all of these conditions occur:

- C ISLN switch is set to AUTO
- Valve latched closed logic is not true
- Section two operation logic is not true
- Cross bleed engine start.

The second set is true if all of these conditions occur:

- C ISLN switch is set to AUTO
- Valve latched closed logic is not true
- Section two operation logic is not true
- No duct leak signal for wing or body
- left or right engine bleed air supply systems are off.

The third set is true if all of these conditions occur:

- C ISLN switch is set to AUTO
- Valve latched closed logic is not true
- Section two operation logic is not true
- No duct leak signal for wing or body
- Left or right ISLN switch is set to out.

The fourth set is true if all of these conditions occur:

- C ISLN switch is set to AUTO
- Valve latched closed logic is not true
- Section two operation logic is not true
- No duct leak signal for wing or body
- Left or right source loss.

See the duct leak and overheat detection section for more information about wing and body duct leaks (SECTION 26-18).

Section Two Operation Logic

Section two operation logic makes sure that air is not given to an air conditioning pack that is without control. Possible engine battery start condition is the primary reason for this logic. This logic is true if all of these conditions occur:

- Both cabin temperature controllers (CTC) are off
- One ASCPC operates in digital (primary) mode and the other ASCPC primary mode is off
- Airplane on the ground.

Source Loss Condition Logic

The left and right source loss condition logic lets the ASCPCs sense when there is not sufficient air pressure to the ADPs for landing gear retraction, immediately after takeoff.

There are two sets of conditions that cause the ASCPCs to set the left source loss condition to true. The first set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left engine off.

The second set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left duct pressure less than 20 psig and right duct pressure more than 20 psig.

There are two sets of conditions that cause the ASCPCs to set the right source loss condition to true. The first set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Right engine off.

The second set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Right duct pressure less than 20 psig and left duct pressure more than 20 psig.

Valve Closed Control Logic

There are four sets of conditions that cause the ASCPCs to set the center isolation valve to close. The first set is true if all of these conditions occur:

- Valve latched closed logic is not true
- C ISLN switch is set to out.

The second set is true if all of these conditions occur:

- Valve latched closed logic is not true
- Section two operation logic is true.

The third set is true if all of these conditions occur:

- Valve latched closed logic is not true
- L or R source loss logic is not true
- Cross bleed engine start logic is not true
- L and R PRSOVs open
- L and R engine bleed switch set to ON
- L and R engines are on
- L and R ISLN switches set to AUTO.

The fourth set is true if all of these conditions occur:

- Valve latched closed logic is not true
- ASCPC looking for the location of wing or body duct leak but not during a cross bleed engine start.

If the engine cross bleed start condition is not true, the ASCPCs close the valve when they use it to find the location of a duct leak. If the ASCPCs find that the valve has no effect on the leak, the valve is set to its usual position. If the ASCPCs find that the valve does effect the leak, the valve is latched close.

Valve Latched Closed Control Logic

The center isolation valve is latched closed to isolate a section of duct that has a leak. The valve is latched closed if there is a body or inboard (L or R) wing duct leak.

When a duct leak condition occurs, the ASCPCs latch the valve close after the location of the leak is known or after a specified quantity of time. These are examples of the time permitted to find the location of a leak:

- Wing leak, 185 seconds
- Body leak, 95 seconds.

Training Information Point

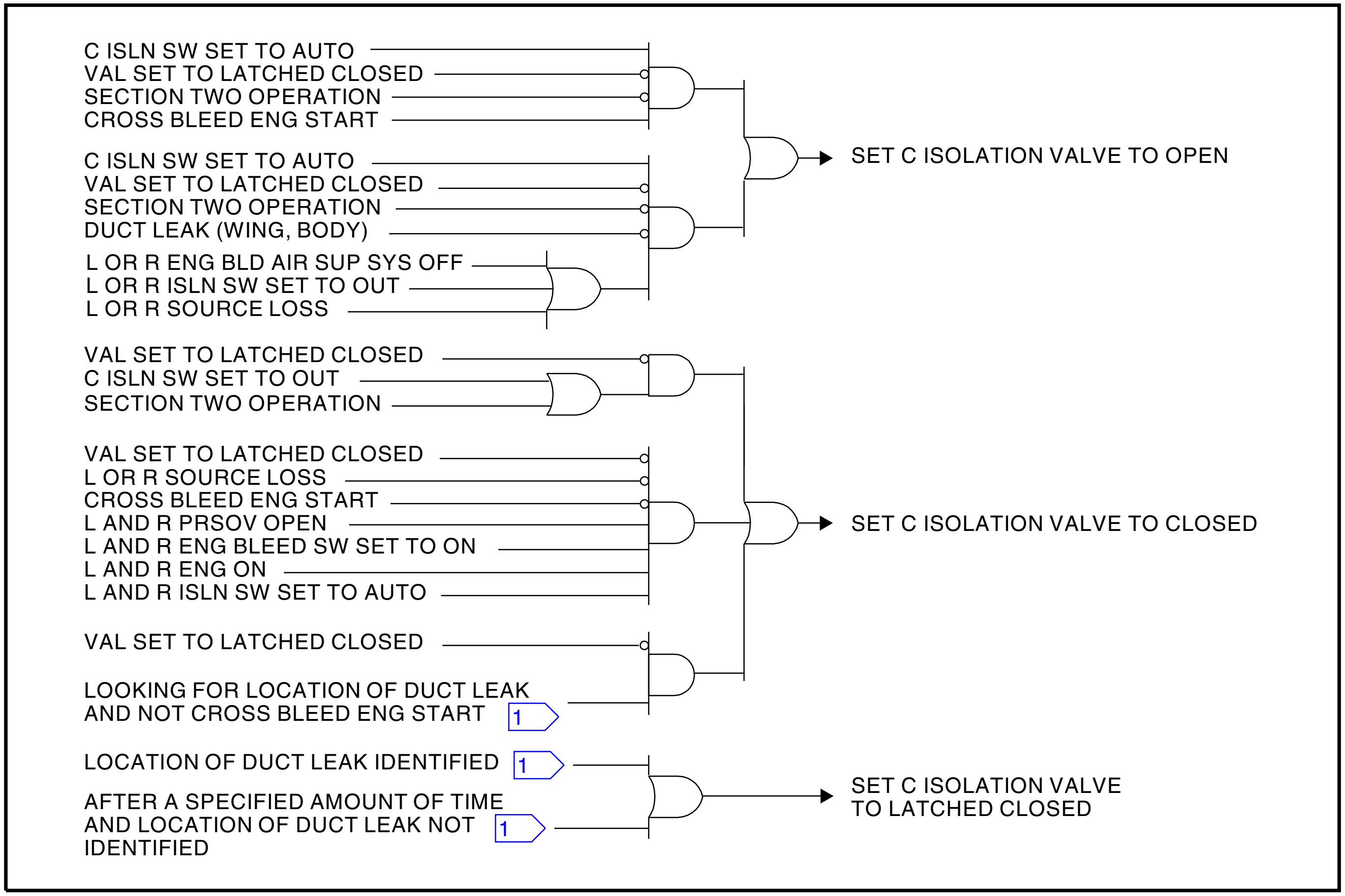
The ASCPC has logic that lets the center isolation valve stay open if the airplane has a wing or body duct leak and any of these conditions occur:

- An engine start is in progress
- An ADP is on and it is less than three minutes since the airplane has taken off.

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - CENTER ISOLATION VALVE CONTROL LOGIC

This logic lets the engine start complete or makes sure air is available for ADP operate immediately after takeoff. If a wing or body duct leak occurs after the valve is latched close, the valve will not open for engine start or for ADP operation.

You must set the center bleed isolation switch to OUT and then AUTO to reset the center isolation valve after it latches closed. The latch will not reset if the condition that caused it is still true.



LEFT ASCPC (RIGHT ASCPC IS THE SAME)

1 INHIBIT IF ENG START IN PROGRESS OR IF AN ADP IS ON AND TAKEOFF IS LESS THAN THREE MINUTES.

M42868 S000620127_V3

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - CENTER ISOLATION VALVE CONTROL LOGIC

THIS PAGE IS INTENTIONALLY LEFT BLANK

Control Logic

The ASCPCs have control logic that sets the APU shutoff valve (APUSOV) to one of these configurations:

- Open
- Closed
- Latched closed.

Valve Open Control Logic

There are five sets of conditions that cause the ASCPCs to open the APUSOV. The first set relates to APU autostart logic for when the airplane operates on standby power. This set is true if all of these conditions occur:

- APU fire switch is set to in
- APU bleed switch is set to AUTO
- Power is off the left and right transfer buses
- Airplane is in the air
- APU is off.

See the ignition/starting section for more information on APU autostart (SECTION 49-40).

The second set relates to cooldown for the solenoid on the APUSOV. Hot solenoid cooldown logic removes power when it is not necessary to set the valve to close. This second set is true if all of these conditions occur:

- APU fire switch is set to in
- APU bleed switch is set to AUTO
- Engine bleed air is isolated or off
- Ground air source is off
- APU is off.

The third set relates to a pneumatic start for the APU. This set is true if all of these conditions occur:

- APU fire switch is set to in
- APU bleed switch is set to AUTO
- No left wing inboard duct leak
- No left body duct leak
- APUC wants to do a pneumatic start of the APU.

The fourth set relates to when the APU is the only air source for the pneumatic system. This set is true if all of these conditions occur:

- APU fire switch is set to in
- APU bleed switch is set to AUTO
- No left wing duct inboard leak
- No left body duct leak
- Engine bleed air is isolated or off
- Ground air is off
- APU is on.

The fifth set relates to when the APU is used to start the left or right engines. This set is true if all of these conditions occur:

- APU fire switch is set to in
- APU bleed switch is set to AUTO
- No left wing inboard duct leak
- No left body duct leak
- Airplane on the ground
- Left or right engine start
- Ground air is off
- APU is on.

See the duct leak and overheat detection section for more information on wing and body duct leaks (SECTION 26-18).

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - APU SHUTOFF VALVE CONTROL LOGIC

Valve Closed Control Logic

There are six sets of conditions that cause the ASCPCs to set the APUSOV to close. The valve is set to close if any of these conditions occur:

- APU bleed switch selected to out (first set)
- APU fire switch pulled (second set).

The third set relates to when the ASCPCs close the valve to find the location of a duct leak. When the ASCPCs find the location of the leak, the ASCPCs open the valve if it has no effect on the leak or latch the valve close if it does effect the leak. This third set is true if all of these conditions occur:

- APU is on
- Valve latched closed logic is not true
- Hot solenoid cooldown logic is not true
- ASCPCs want to find the location of a wing inboard or body duct leak.

The fourth set is true if all of these conditions occur:

- APU is on or transfer buses have power
- Valve latched closed logic is not true
- Hot solenoid cooldown logic is not true
- No pneumatic start for APU
- Ground air is on.

The fifth set is true if all of these conditions occur:

- APU is on or transfer buses have power
- Valve latched closed logic is not true
- Hot solenoid cooldown logic is not true
- No pneumatic start for APU
- No engine start with APU air
- Engine 1 or 2 bleed air supply systems are on.

The sixth set is true if all of these conditions occur:

- Transfer busses have power
- Valve latched closed logic is not true
- Hot solenoid cooldown logic is not true
- No pneumatic start for APU
- APU is off.

Valve Latched Closed Control Logic

The APU shutoff valve is latched closed to isolate a section of duct that has a leak. The valve is latched closed if the APU is on and a duct leak is found in the left wing inboard area or in the left body area.

When a duct leak condition occurs, the ASCPCs latch the valve closed only after the location of the leak is known or after a specified quantity of time. These are examples of the time permitted to find the location of a leak:

- Wing leak, 185 seconds
- Body leak, 95 seconds.

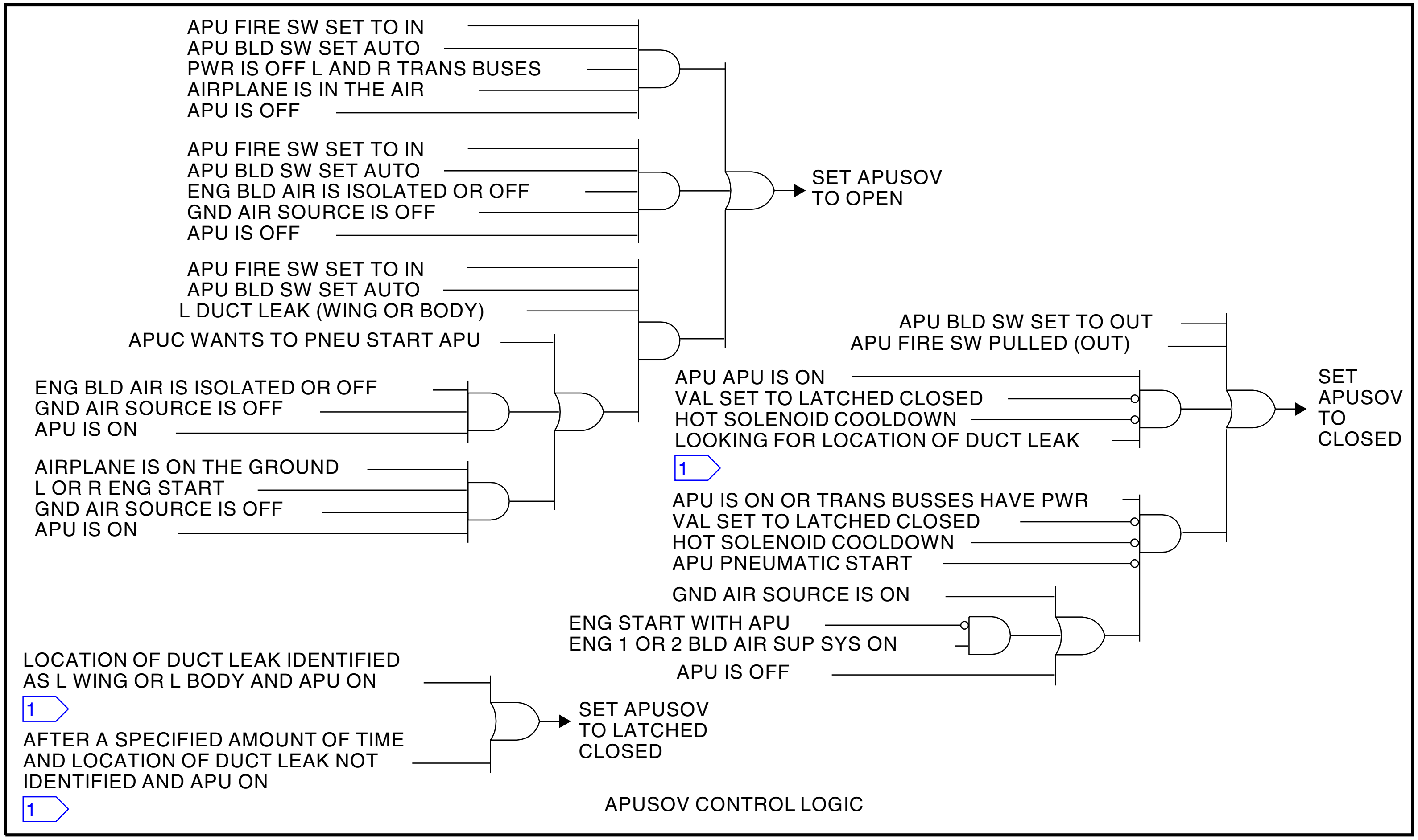
Training Information Point

The ASCPC has logic that lets the APU isolation valve stay open if the airplane has a wing or body duct leak and any of these conditions occur:

- Engine start is in progress
- ADP is on and it is less than three minutes since the airplane has taken off.

This logic lets the engine start complete or makes sure air is available for ADP operate immediately after takeoff. If a wing or body duct leak occurs after the valve is latched close, the valve will not open for engine start or for ADP operation.

You can reset the valve after a wing or body duct leak. Wait until the duct leak indication goes away then put the APU bleed switch out then back to AUTO.



LEFT ASCPC (RIGHT ASCPC IS THE SAME)

1 INHIBIT IF ENG START IN PROGRESS OR IF AN ADP IS ON AND TAKEOFF IS LESS THAN THREE MINUTES.

M42869 S000620128_V3

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - APU SHUTOFF VALVE CONTROL LOGIC

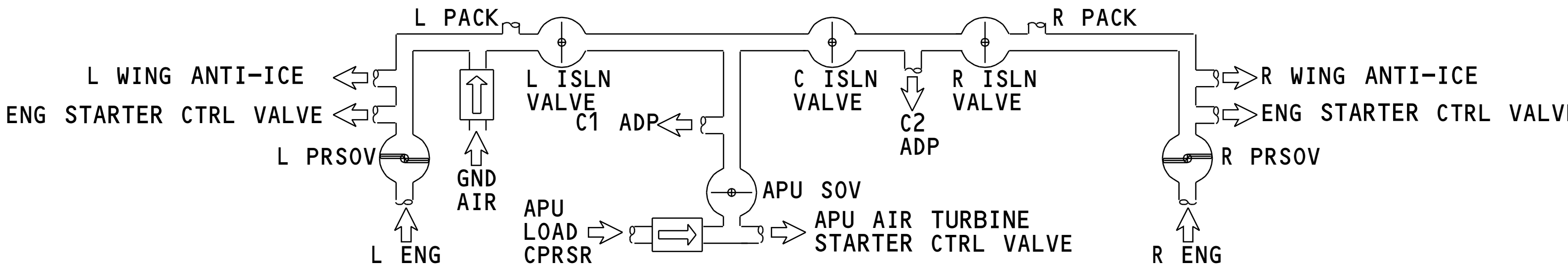
AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - SUMMARY - NORMAL CONDITIONS

Functional Description

The ASCPC controls the air supply distribution system. It controls the position of these valves:

- Left isolation valve
- Center isolation valve
- Right isolation valve
- APU shutoff valve
- Left PRSOV
- Right PRSOV.

The table shows different configurations of the valves for normal conditions.



NORMAL CONDITIONS (ALL BLEED AIR SWS SET TO AUTO/ON POSITION)	ASCPC SET POSITIONS					
	L PRSOV	L ISLN VALVE	APU SOV	C ISLN VALVE	R ISLN VALVE	R PRSOV
BOTH ENG ON & (APU ON OR OFF) & GND AIR OFF	OPEN	OPEN	CLOSED	CLOSED	OPEN	OPEN
BOTH ENG ON & (APU ON OR OFF) & GND AIR ON	CLOSED	OPEN	CLOSED	OPEN	OPEN	CLOSED
BOTH ENG OFF & APU ON & GND AIR OFF	CLOSED	OPEN	OPEN	OPEN	OPEN	CLOSED
L ENG ON & (APU ON OR OFF) & GND AIR OFF	OPEN	OPEN	CLOSED	OPEN	OPEN	CLOSED
R ENG ON & (APU ON OR OFF) & GND AIR OFF	CLOSED	OPEN	CLOSED	OPEN	OPEN	OPEN
L ENG START - (R ENG ON) (APL ON GND & APU ON & GND AIR OFF)	CLOSED	OPEN	OPEN	OPEN	CLOSED	OPEN
R ENG START - (L ENG ON) (APL ON GND & APU ON & GND AIR OFF)	OPEN	CLOSED	OPEN	OPEN	OPEN	CLOSED
APU PNEU START (BOTH ENG ON & GND AIR OFF)	OPEN	OPEN	OPEN	CLOSED	OPEN	OPEN
APU PNEU START (L ENG ON & GND AIR OFF)	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED
APU PNEU START (R ENG ON & GND AIR OFF)	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN
APU PNEU START (GND AIR ON)	CLOSED	OPEN	OPEN	OPEN	OPEN	CLOSED
L ENG START, CROSS BLD R ENG TO L ENG [APL IN AIR OR (APL ON GND & APU OFF & GND AIR OFF)]	CLOSED	OPEN	CLOSED	OPEN	OPEN	OPEN
R ENG START, CROSS BLD L ENG TO R ENG [APL IN AIR OR (APL ON GND & APU OFF & GND AIR OFF)]	OPEN	OPEN	CLOSED	OPEN	OPEN	CLOSED

M42870 S000620129_V1

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - SUMMARY - NORMAL CONDITIONS

THIS PAGE IS INTENTIONALLY LEFT BLANK

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - SUMMARY - NON-NORMAL CONDITIONS

General

The ASCPCs monitor for non-normal conditions that effect the distribution of the air to the ADPs and other air user systems. The ADPs are most important. If a non-normal condition occurs, the ASCPCs limit the effect, by isolating parts of the pneumatic distribution system.

The table shows the different configurations of the isolation, APU shutoff, and the pressure regulating and shutoff valves for non-normal conditions.

Source Loss Condition

The source loss condition logic lets the ASCPCs sense when there is not sufficient air pressure to the ADPs for landing gear retraction immediately after takeoff.

There are two sets of conditions that cause the source loss condition. One set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- Left engine off.

The second set is true if all of these conditions occur:

- Landing gear down
- Less than 180 seconds since takeoff
- left duct pressure less than 20 psig and right duct pressure more than 20 psig.

Bleed Pressure Loss Condition

The bleed pressure loss condition logic lets the ASCPCs sense when a pneumatic duct comes apart. Possible engine starter duct failure is the primary reason for this logic.

There are two sets of conditions that cause the ASCPCs to set the left bleed pressure loss condition to true. One set is true if all of these conditions occur for more than 10 seconds:

- Left duct pressure is less than 13 psig
- Left pack inlet pressure is less than 13 psig
- Right duct pressure is more that 13 psig
- Left PRSOV is open
- Right PRSOV is open
- No duct leak signal from the duct leak and overheat detection system (DLODS)
- Landing gear is up
- Takeoff less than 180 seconds.

The second set is true if all of these conditions occur for more than 10 seconds:

- Left duct pressure is less than 13 psig
- Left pack inlet pressure is less than 13 psig
- Right PRSOV is open
- Left PRSOV is closed
- Landing gear is up or (takeoff more than 180 seconds)
- Left engine bleed air flow is more than 2.0 lbs/sec
- No left engine start.

Bleed Leak Conditions

Ducts in the pneumatic distribution system are monitored by the duct leak and overheat detection system (DLODS) for air leaks that cause an overheat condition. The DLODS provides the ASCPCs this general location information:

- Bleed leak in the strut area L (R)
- Bleed leak in the wing area L (R)
- Bleed leak in the body area.

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - SUMMARY - NON-NORMAL CONDITIONS

The DLODS can not tell the ASCPCs the duct that caused the overheat. One overheat condition can be caused by different ducts. This is an example. An overheat in the left pack area can be caused by a duct that connects any of these components:

- L PRSOV to L Pack and L ISLN valve
- L ISLN valve to C ISLN valve and APUSOV
- C ISLN valve to R ISLN valve and C2 ADP
- R ISLN valve to R Pack and R PRSOV.

If there are no inhibits, the ASCPC closes a valve or valves to isolate a leak then waits to see if the leak conditions goes away.

Any one of these conditions can inhibit the logic the ASCPC uses to find a wing or boby duct leak.

- Left engine start
- Right engine start
- ADP operation within 3 minites after takeoff.

There are no inhibits that relate to a strut leak.

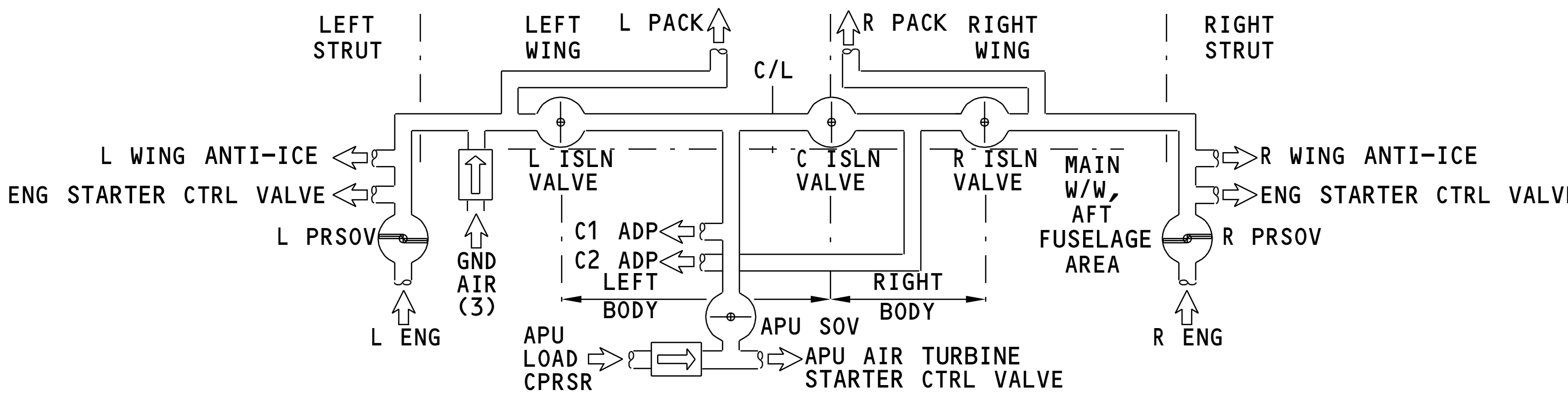
A strut leak is a leak in the duct at any of these areas:

- Engine strut
- Wing, between the engine strut and the inboard slat.

A wing duct leak is a leak in the duct adjacent to the inboard slat or in the under fuselage area forward of the main wheel wells.

A body duct leak is a leak in the duct in the main wheel wells or aft fuselage area, aft of the ECS bays. There is a left and right body duct. The left body duct connects to the left wing duct between the left and center isolation valves and connects to the C1 ADP and the APU. The right body duct connects to the right wing duct between the right and center isolation valve and connects to the C2 ADP.

See the duct leak and overheat detection section for more information (SECTION 26-18).



NON-NORMAL CONDITIONS (ALL BLEED AIR SWS SET TO AUTO/ON POSITION, BOTH ENG ON, APU ON, GND AIR OFF)	ASCPC SET POSITIONS					
	L PRSOV	L ISLN VALVE	APU SOV	C ISLN VALVE	R ISLN VALVE	R PRSOV
L SOURCE LOSS	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN
L BLEED PRESSURE LOSS	CLOSED 1	CLOSED 1	CLOSED	OPEN	OPEN	OPEN
BLEED LEAK STRUT L > 5 SEC	CLOSED 1	CLOSED 1	CLOSED	OPEN	OPEN	OPEN
BLEED LEAK L > 5 SEC AND <= 50 SEC	OPEN	CLOSED 2	CLOSED 2	CLOSED 2	OPEN	OPEN
BLEED LEAK L > 50 SEC AND <= 95 SEC	CLOSED 2	CLOSED 2	CLOSED	CLOSED 3	OPEN	OPEN
BLEED LEAK L > 95 SEC <= 140 SEC	CLOSED 3	CLOSED 3	CLOSED	CLOSED 2	CLOSED 2	OPEN
BLEED LEAK L > 140 SEC AND <= 185 SEC	CLOSED 3	CLOSED 3	CLOSED	CLOSED 3	CLOSED 2	CLOSED 2
BLEED LEAK L > 185 SEC	CLOSED 1	CLOSED 1	CLOSED 1	CLOSED 1	CLOSED 1	OPEN
BLEED LEAK BODY > 5 SEC AND <= 50 SEC	OPEN	CLOSED 2	CLOSED 2	CLOSED 2	OPEN	OPEN
BLEED LEAK BODY > 50 SEC AND <= 95 SEC	OPEN	OPEN	CLOSED	CLOSED 2	CLOSED 2	OPEN
BLEED LEAK BODY > 95 SEC	OPEN	CLOSED 1	CLOSED 1	CLOSED 1	CLOSED 1	OPEN

1 = LATCHED WHEN CONDITION BECOMES TRUE
2 = LATCHED IF BLEED LEAK STOPS FOR THIS CONDITION
3 = OPENS IF BLEED LEAK STOPS FOR THIS CONDITION
NOTE: CONDITIONS FOR L SYS SHOWN, R SYS SIMILAR

M42871 S000620130_V2

AIR SUPPLY DISTRIBUTION - FUNCTIONAL DESCRIPTION - SUMMARY - NON-NORMAL CONDITIONS

THIS PAGE IS INTENTIONALLY LEFT BLANK

INDICATING SYSTEM - INTRODUCTION

General

The indicating system supplies the left and right air supply cabin pressure controllers (ASCPC) with air flow, pressure, and temperature data. The ASCPCs use the data for control of the pneumatic system and flight deck indications.

The pneumatic indicating system has these components:

- Manifold pressure sensor (PM)
- Manifold flow sensor (FS)
- Manifold dual temperature sensor (TM)
- Intermediate pressure sensor (PI).

The indicating system uses information from these components in the air conditioning system:

- Pack flow sensor (ASCPC pack inlet differential pressure sensor)
- ASCPC compressor discharge temperature sensor
- ASCPC pack discharge temperature sensor.

The ASCPCs also get pressure, temperature and air flow rate information from the cabin temperature controllers.

The RVDTs are not part of the indication system but they do give valve position data to the ASCPCs. These valves in the pneumatic system use RVDTs:

- Isolation valves (left, center, right)
- APU shutoff valve (APUSOV)
- Fan air modulating valve (FAMV).

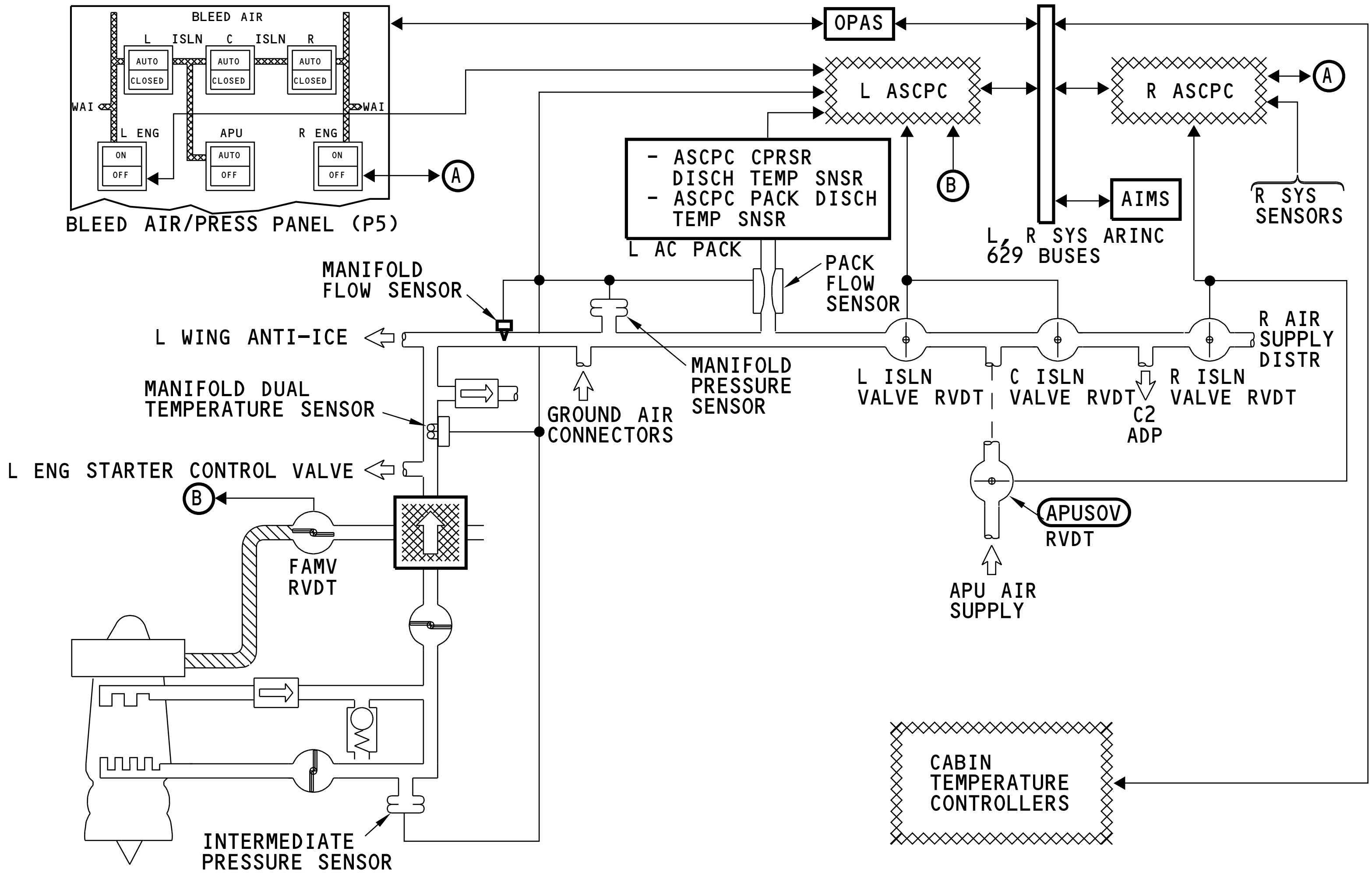
The ASCPC uses the data from the sensors and RVDTs to control the air supply flow, pressure, and temperature. The ASCPCs also use sensors to calculate open/close position data for valves that do not have RVDTs. The ASCPCs send the data to the AIMS and OPAS for flight deck indications. The ASCPCs also send the data to the cabin temperature controllers (CTC). The CTCs use the data for control and flight deck indications.

See the pack flow control section for more information on pack flow control and indication (SECTION 21-51).

See the pack flow cooling and mix manifold temperature control section for more information (SECTION 21-52).

See the engine air supply section for more information on the FAMV (SECTION 36-11).

See the air supply distribution section for more information on the isolation valves and the APUSOV (SECTION 36-12).



M42898 S000620131_V1

INDICATING SYSTEM - INTRODUCTION

INDICATING SYSTEM - ENGINE COMPONENT LOCATIONS

Engine Component Locations

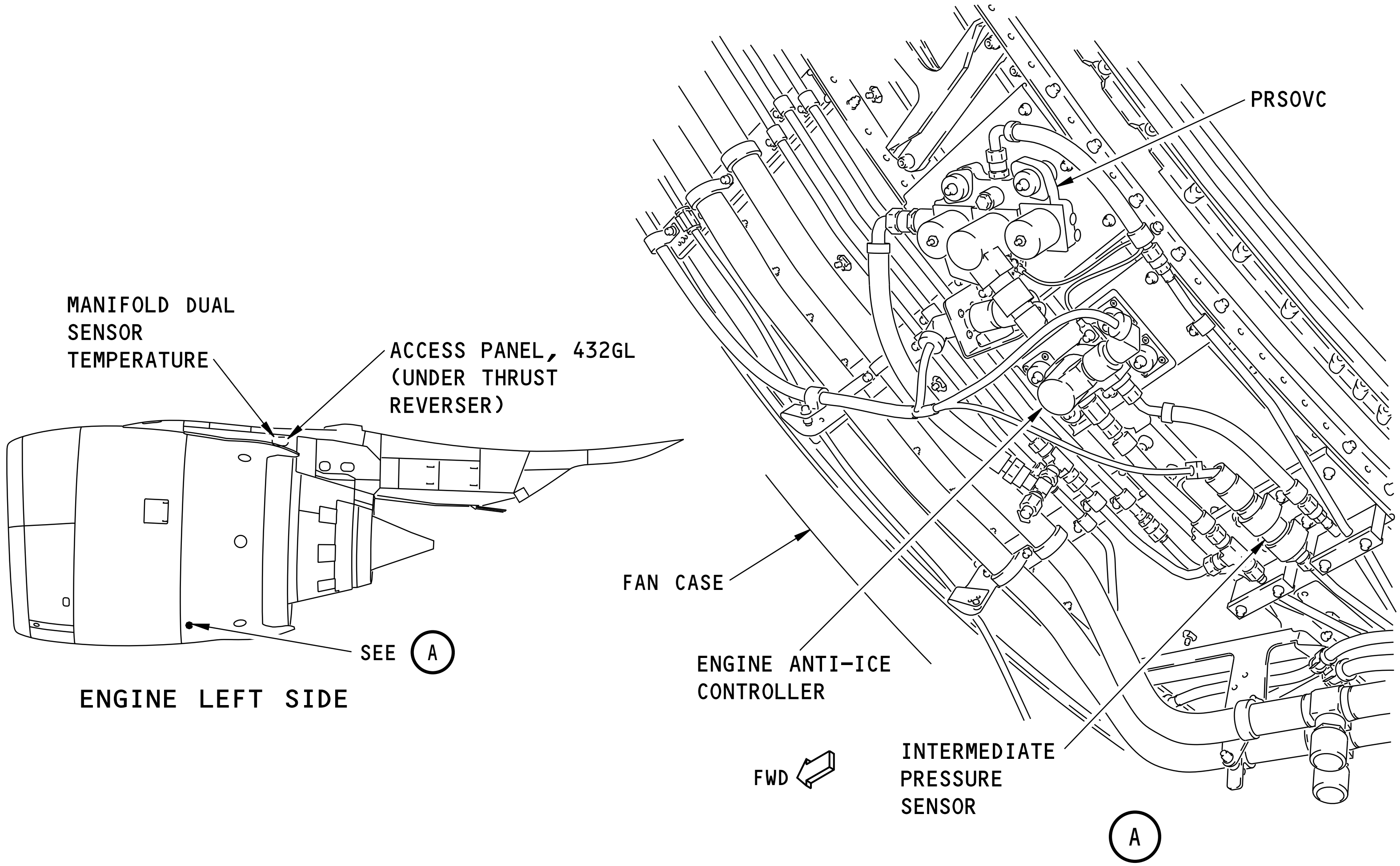
There is one intermediate pressure sensor (IP) on each engine fan hub at the 6:45 position.

The manifold dual temperature sensor is in the distribution duct downstream of the precooler that is in the engine strut.

Training Information Point

You open the left fan cowl of each engine to get access to the IP sensor.

For the left temperature sensor, you open the left fan cowl and thrust reverser on the left engine. Then you remove access panel 432GL on the engine strut to gain access. For the right temperature sensor, you open the left fan cowl and thrust reverser on the right engine. Then you remove access panel 442GL on the engine strut to gain access.



NOTE: LEFT ENGINE COMPONENTS ARE SHOWN,
RIGHT ENGINE COMPONENTS ARE EQUIVALENT.

W46269 S0000124209_V2

INDICATING SYSTEM - ENGINE COMPONENT LOCATIONS

INDICATING SYSTEM - WING UNDERBODY COMPONENT LOCATIONS

Wing Underbody Locations

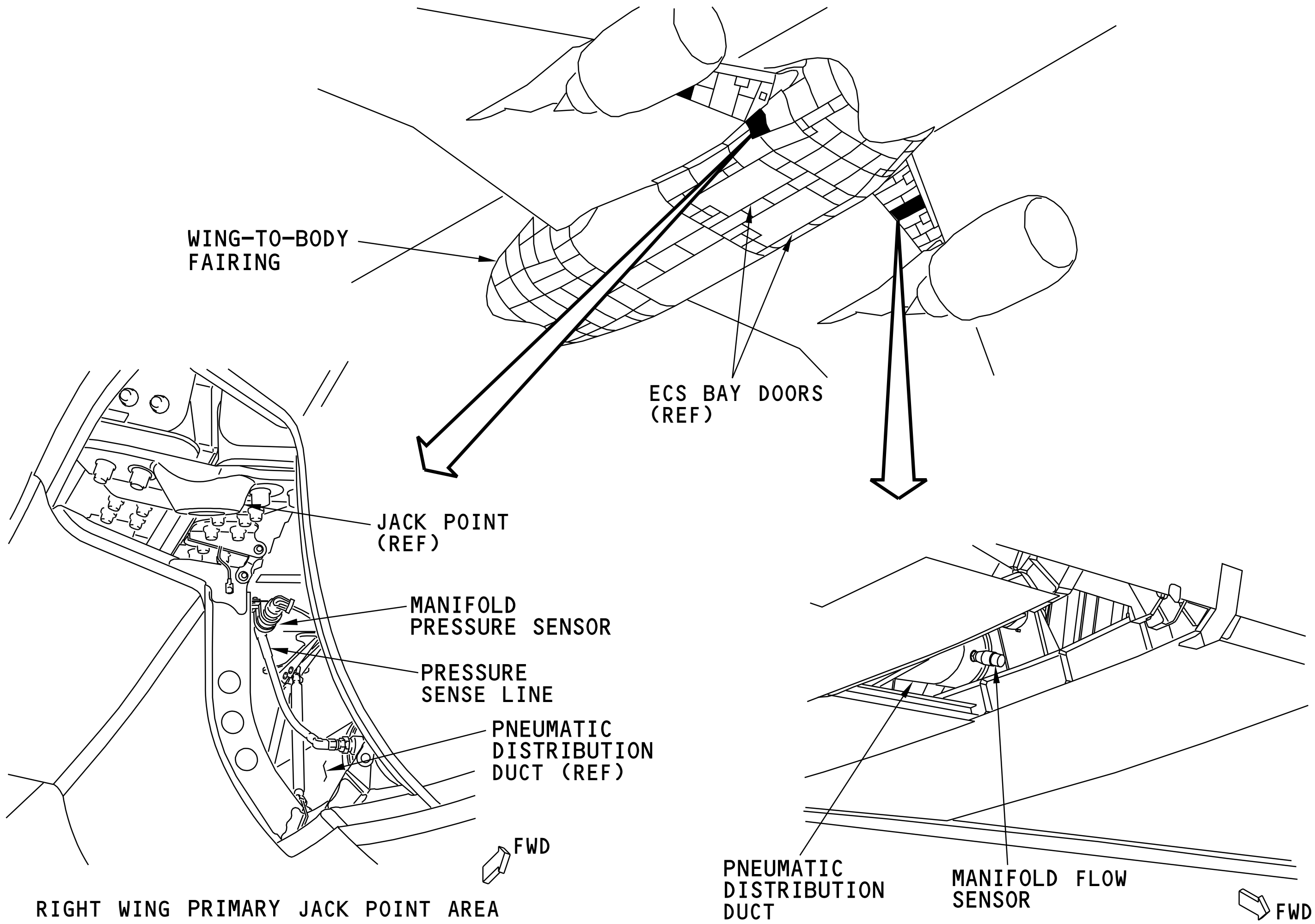
There are two manifold pressure sensors on the airplane. One attaches to airplane structure forward and outboard of the right ECS bay near the primary jack point for the wing. The other one is opposite, on the left side of the airplane.

There are two manifold flow sensors in the distribution system ducts. One is in the left wing under the fixed leading edge. The other one is in the right wing under the fixed leading edge.

Training Information Point

You remove the access panel 191SL (left jack point access panel) to get access to the left manifold pressure sensor. You remove access panel 192SR (right jack point access panel) to gain access to the right manifold pressure sensor.

You open access panel 511JB on the left wing to get access to the left manifold flow sensor. You open access panel 611JB on the right wing to get access to right manifold flow sensor.



M42875 S000620135_V1

INDICATING SYSTEM - WING UNDERBODY COMPONENT LOCATIONS

INDICATING SYSTEM - MANIFOLD PRESSURE SENSOR

Purpose

The manifold pressure sensors monitor the pressure in the air supply distribution system.

Location

There are two manifold pressure sensors. One attaches to airplane structure forward and outboard of the left ECS bay near the distribution duct. The other one is opposite, on the right side of the airplane.

Physical Description

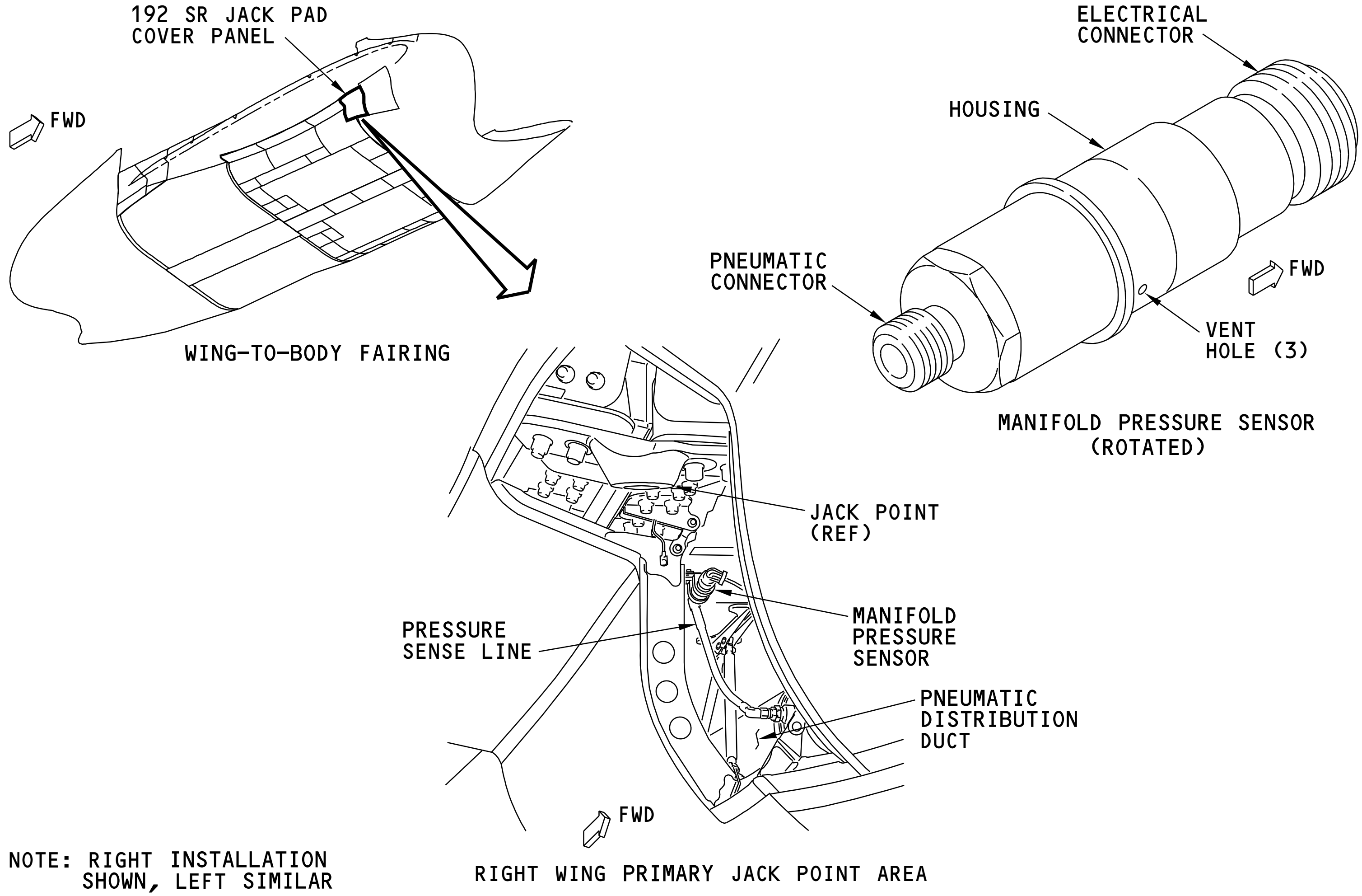
The pressure sensor is an electronic strain gage type. The sensor has these parts:

- Housing
- Electrical connector
- Vent hole (3)
- Pneumatic connector.

Training Information Point

You attach the sensor with band clamps around the housing. Do not attach the sensor so that the clamps cover the vents.

You remove the access panel 191SL (left wing primary jack point access panel) to get access to the left manifold pressure sensor. You remove access panel 192SR (right wing primary jack point access panel) to get access to the right manifold pressure sensor.



M42876 S000620136_V1

INDICATING SYSTEM - MANIFOLD PRESSURE SENSOR

INDICATING SYSTEM - INTERMEDIATE PRESSURE SENSOR

Purpose

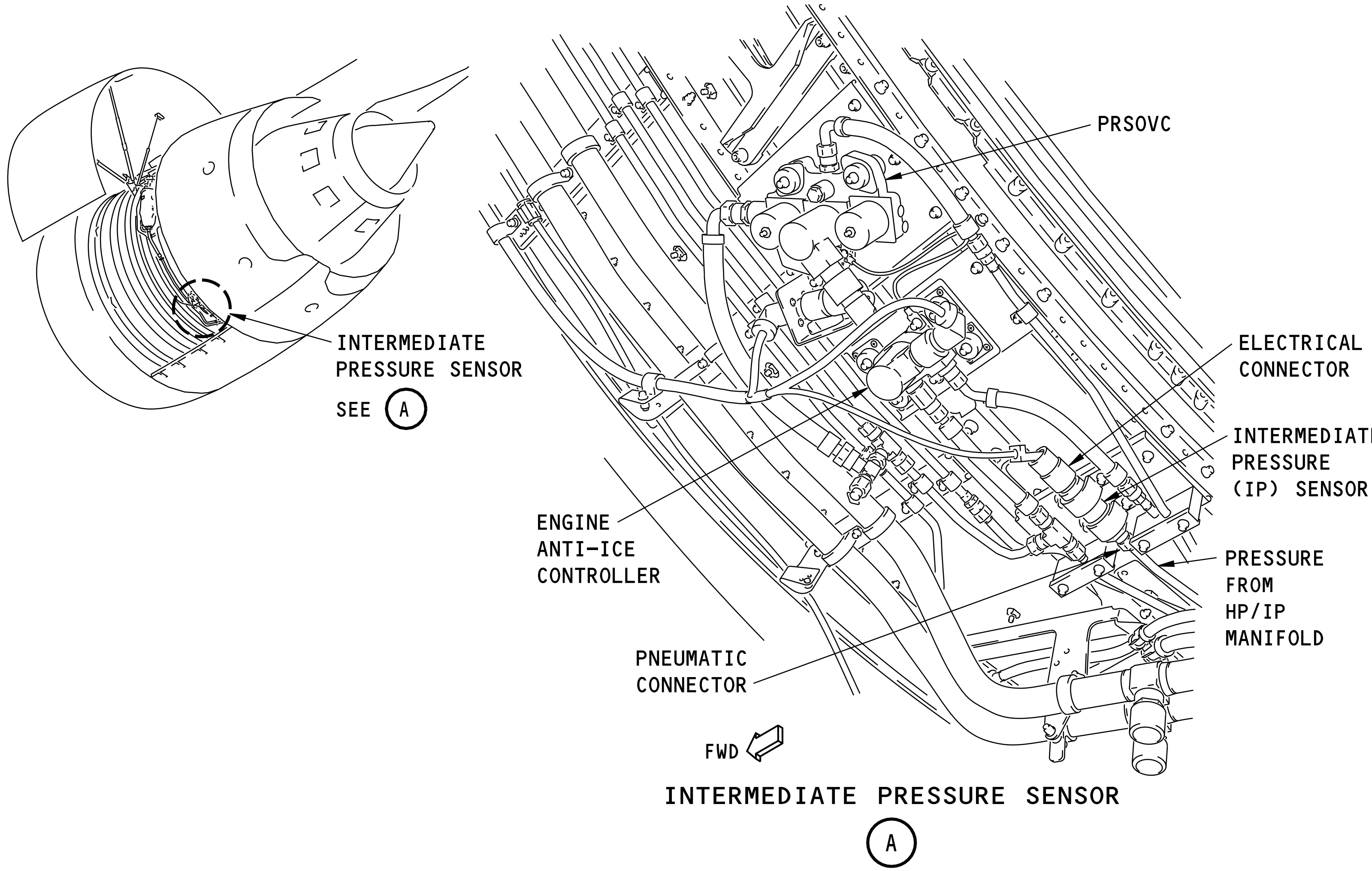
The intermediate pressure sensor (IP) monitors the pressure in the HP/IP manifold.

Location

There is one IP sensor on each engine fan hub at the 6:45 position.

Training Information Point

You open the left fan cowl to get access to the IP sensor.



W46276 S0000124210_V1

INDICATING SYSTEM - INTERMEDIATE PRESSURE SENSOR

INDICATING SYSTEM - MANIFOLD FLOW SENSOR

Purpose

The manifold flow sensor monitors the flow rate of the air in the air supply distribution system.

Location

There are two manifold flow sensors in the distribution system ducts. One is in the left wing under the fixed leading edge. The other one is in the right wing under the fixed leading edge.

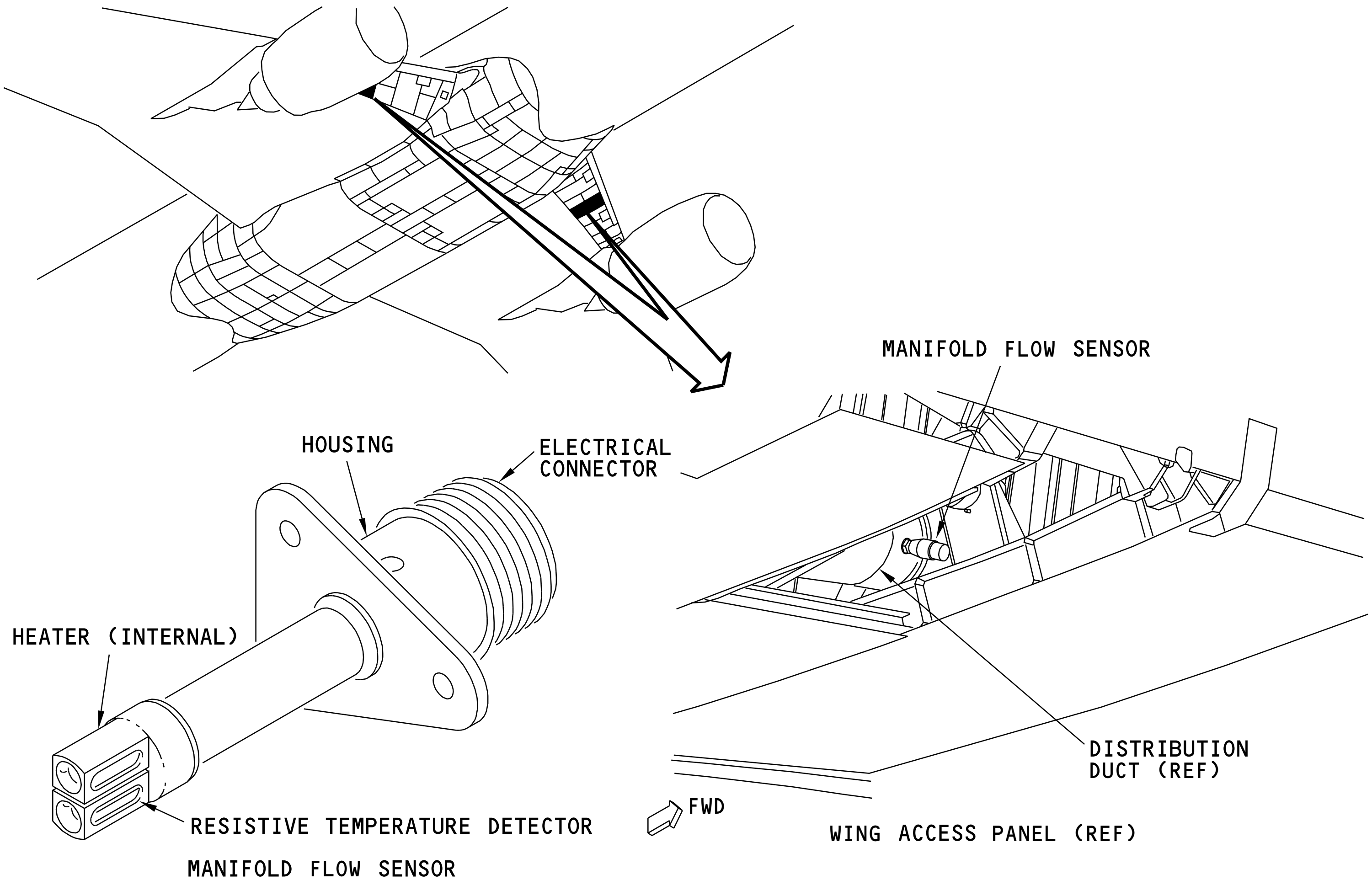
Physical Description

The sensor is an electrically heated unit. The sensor has these parts:

- Housing
- Electrical connector
- Resistive temperature detector
- Internal heater (not shown).

Training Information Point

You open access panel 511JB on the left wing to get access to the left manifold flow sensor. You open access panel 611JB on the right wing to gain access to right manifold flow sensor.



M42880 S000620140_V1

INDICATING SYSTEM - MANIFOLD FLOW SENSOR

INDICATING SYSTEM - MANIFOLD DUAL TEMPERATURE SENSOR

Purpose

The manifold dual temperature sensor monitors the air temperature downstream of the precooler.

Location

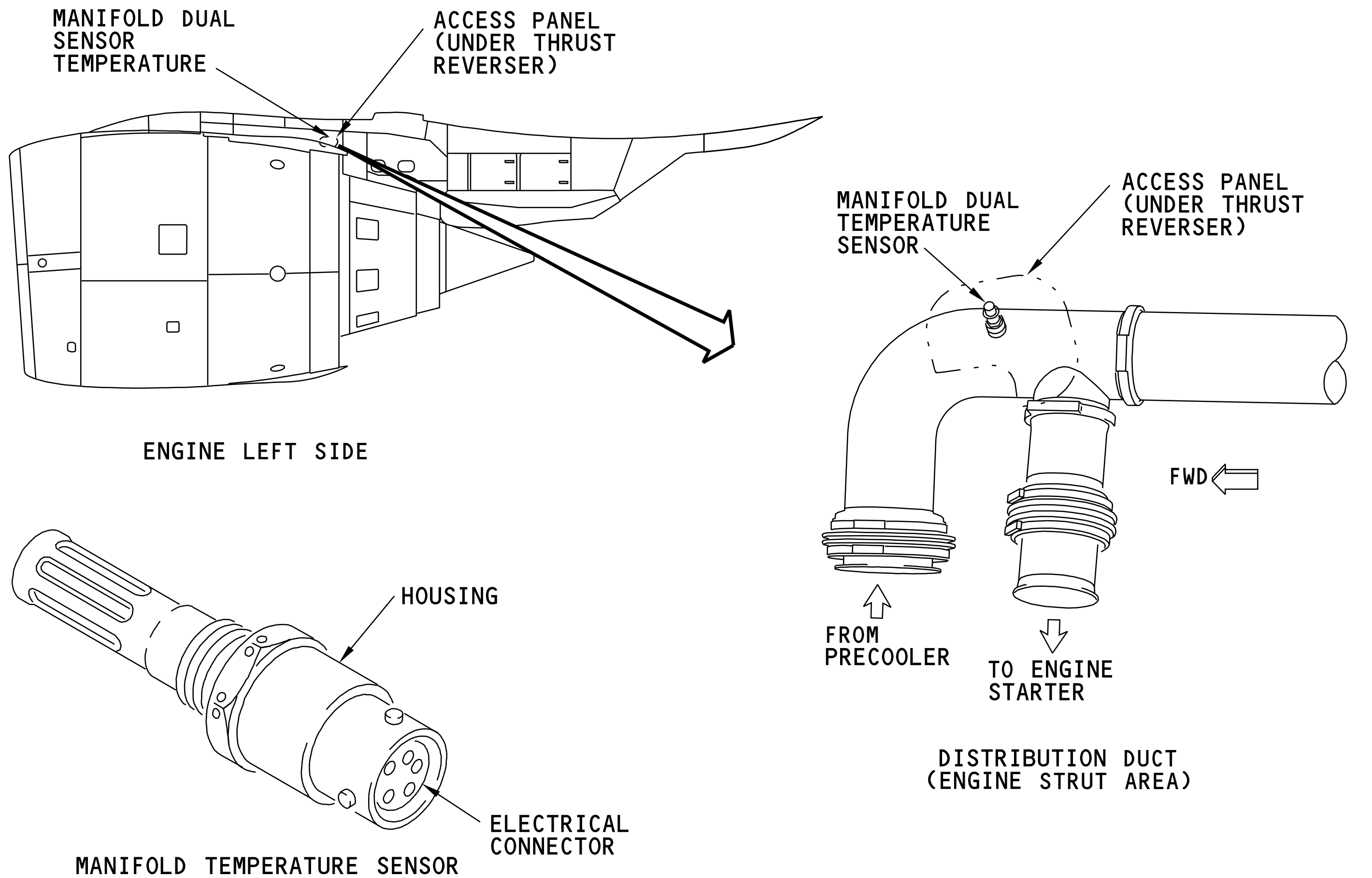
The temperature sensor is in the distribution duct downstream of the precooler in the engine strut.

Physical Description

The temperature sensor is a dual sensor. Internally it has two separate sensing elements (not shown). The sensor has a housing and an electrical connector.

Training Information Point

For the left temperature sensor, you open the left fan cowl and thrust reverser on the left engine. Then you remove access panel 432GL on the engine strut to gain access. For the right temperature sensor, you open the left fan cowl and thrust reverser on the right engine. Then you remove access panel 442GL on the engine strut to gain access.



M42885 S000620145_V1

INDICATING SYSTEM - MANIFOLD DUAL TEMPERATURE SENSOR

THIS PAGE IS INTENTIONALLY LEFT BLANK

INDICATING SYSTEM - FUNCTIONAL DESCRIPTION

General

The ASCPC gives indications about the pneumatic system and its components. The ASCPC also give indications about the air conditioning packs to the cabin temperature controllers (CTC).

The digital (primary) mode of the ASCPC uses these sensors to monitor the system for control and indication purposes:

- Manifold pressure sensor (PM)
- Manifold flow sensor (FS)
- Manifold dual temperature sensor (sensor element TM2)
- Pack flow sensor (ASCPC pack inlet differential pressure sensor)
- ASCPC compressor discharge temperature sensor
- ASCPC pack discharge temperature sensor.

See the pack flow control section for more information on pack flow indication and control (SECTION 21-51).

See the pack cooling and mix manifold temperature control section for more information on pack cooling and mix manifold temperature indication and control (SECTION 21-52).

The analog (backup) mode of the ASCPC uses these sensors to monitor the system for control and indication purposes:

- Manifold dual temperature sensor (sensor element TM1)
- Intermediate pressure (IP) sensor.

Information monitored by the backup mode goes to the primary mode through an internal ASCPC interface.

The primary mode of the ASCPCs monitor valve positions through RVDTs in these valves:

- Left isolation valve
- Center isolation valve
- Right isolation valve
- APU shutoff valve (APU SOV)
- Left fan air modulating valve (FAMV)
- Right fan air modulating valve (FAMV).

Indications

The primary mode of the ASCPCs send signals to the AIMS two ways, directly and through the ARINC 629 buses. The AIMS shows information in these places:

- Air synoptic display - valve position and duct pressure
- Air supply maintenance page - valve position, pressure, temperature and air flow rates
- Ice protection maintenance page - duct pressure
- EICAS display - messages and duct pressure
- Secondary engine display - duct pressure
- Status display - messages
- Performance maintenance page - duct pressure.

The backup mode of the ASCPCs send signals to the AIMS directly. The AIMS shows a message on EICAS for an engine bleed air off condition.

EICAS advisory messages show when any of these conditions occur:

- An isolation valve not in the commanded position or a bleed isolation switch is set to out
- APU SOV not in the commanded position or APU bleed switch is set to out
- Left PRSOV is close for non-normal condition(s)
- Right PRSOV is close for non-normal condition(s).

Status messages show when any of these conditions occur:

- ASCPC incompatible software
- ASCPC primary mode failure
- Isolation valve failure
- APU SOV failure
- HPSOV failure

- PRSOV failure
- FAMV failure
- Manifold dual temperature sensor failure
- Manifold pressure sensor failure
- Manifold flow sensor failure
- Intermediate pressure sensor failure
- ASCPC pack inlet differential pressure sensor failure
- ASCPC compressor discharge temperature sensor failure
- ASCPC pack discharge temperature sensor failure.

See the pneumatic section for more information on conditions that cause messages related to the pneumatic system operation (SECTION 36-00).

The primary and backup modes of the left ASCPC directly control the left engine bleed OFF light. The primary and backup modes of the right ASCPC directly controls the right engine bleed OFF light. The applicable ASCPC sends a signal directly to the AIMS to cause the related BLEED OFF ENG L (R) advisory message (not shown).

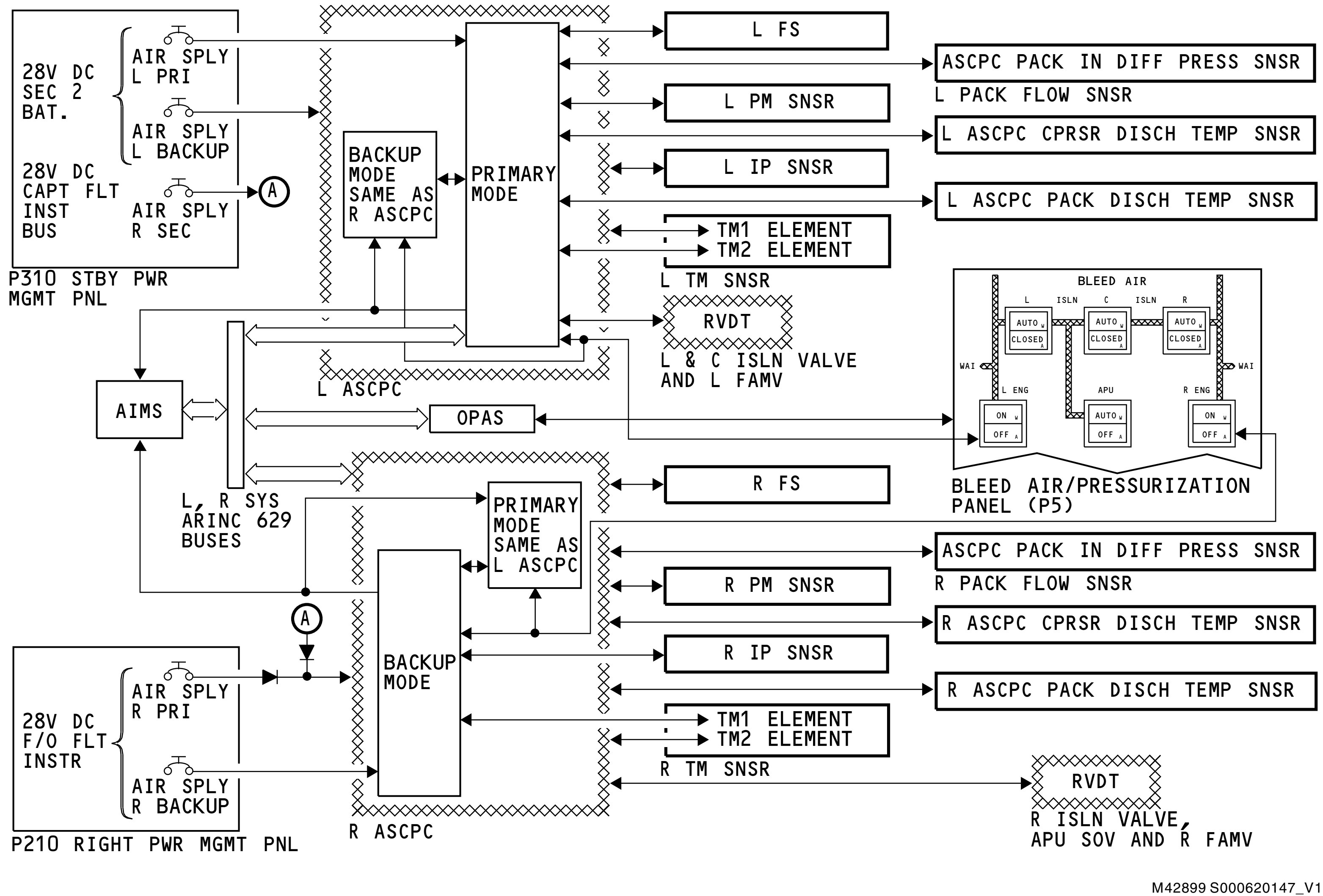
The primary mode of the left ASCPC controls the CLOSED lights for the left and center isolation valves through the ARINC buses and OPAS. The primary mode of the right ACSPC controls the APU OFF light and the CLOSED lights for the right isolation valve through the ARINC buses and OPAS. The applicable ASCPC sends signals through the ARINC buses to the AIMS to cause the related advisory messages (not shown) and for status messages (not shown).

See the engine air supply section for more information about conditions that cause indications to the engine air supply system (SECTION 36-11).

See the air supply distribution section for more information about conditions that cause indications to the isolation valves and the APUSOV systems (SECTION 36-12).

Training Information Point

If the primary mode of an ASCPC fails, then all indications controlled by that mode for the related ASCPC do not show.



INDICATING SYSTEM - FUNCTIONAL DESCRIPTION