PNEUMATICS

SYSTEM OVERVIEW

The Pneumatic system is used to supply High Pressure (HP) air for air conditioning, pressurization, Fuel Tank Inerting System (FTIS), engine start and anti-icing.

HP air can be supplied from the two engines, the APU or an external ground source.

ENGINE BLEED

The engine bleed air is pressure regulated and temperature controlled before it supplies the aircraft pneumatic system.

Air is bled from the engine High Pressure Compressor (HPC) stages:

HP3 via an Intermediate Pressure Check Valve (IPCV)

HP8 via the HP Valve (HPV).

The High-Pressure Bleed Valve (HPV) supplies air to the system when the engine is at low power.

When the Intermediate Pressure (IP) bleed is sufficient (High Power), the HPV closes.

The bleed valves are electro-pneumatically controlled.

The Pressure Regulating Valve (PRV) installed downstream the IPCV and HPV regulates the bleed pressure.

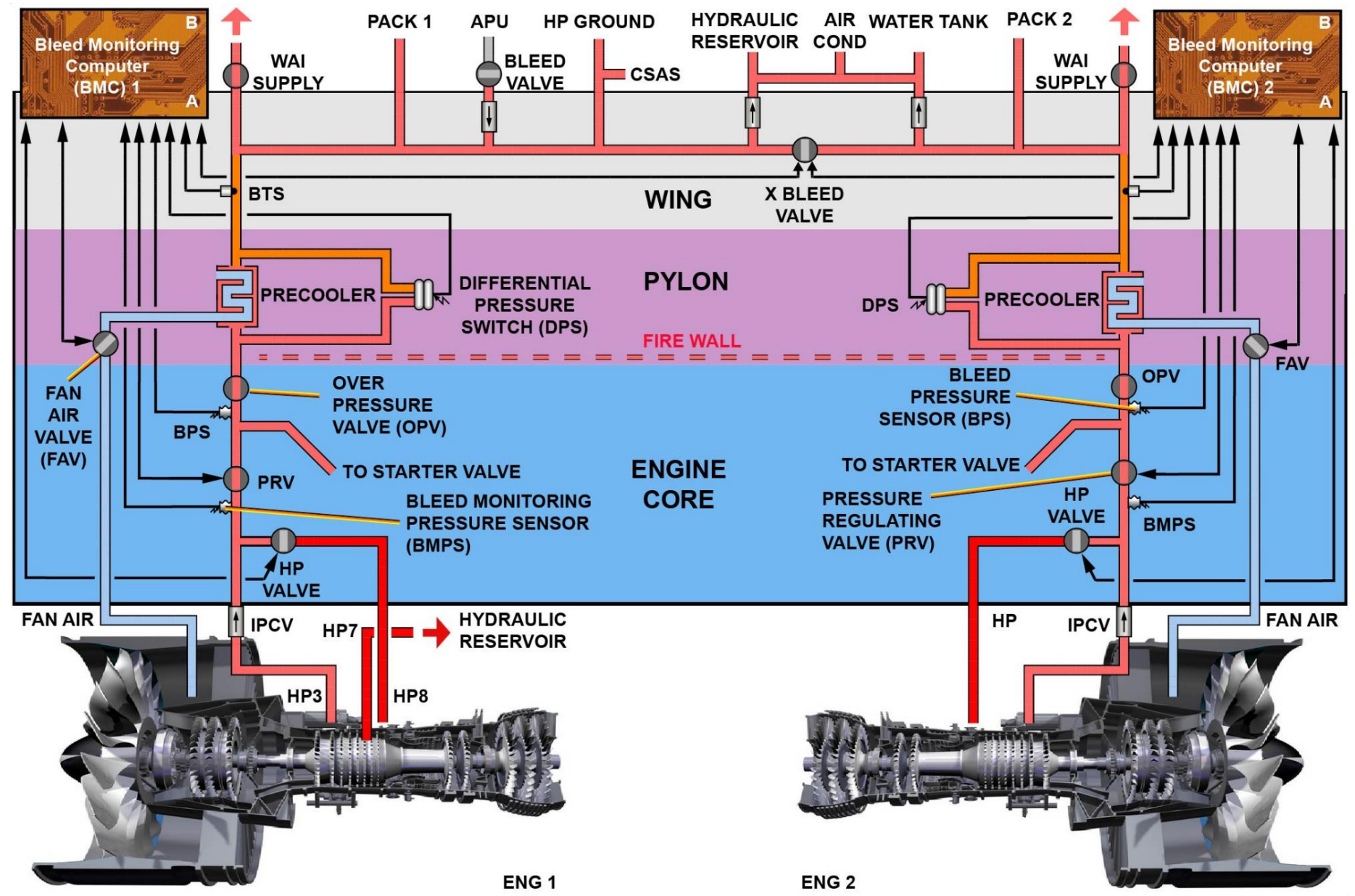
Each Bleed Monitoring Computer (BMC) controls and monitors its engine bleed system and the opposite.

An Overpressure Valve (OPV) is installed downstream from the bleed valve as a protection of the system if the pressure is too high.

The engine bleed air is temperature regulated.

The hot bleed air goes through an air-to-air heat exchanger called Precooler.

Fan discharge air, modulated by the Fan Air Valve (FAV), is blown across the precooler to keep the temperature within limits.


Bleed Monitoring Computer (BMC) 1
B
A
PACK 1
APU
HP GROUND
HYDRAULIC RESERVOIR
AIR COND
WATER TANK
PACK 2
Bleed Monitoring Computer (BMC) 2
WAI SUPPLY
BLEED VALVE
CSAS
WAI SUPPLY
BTS
WING
X BLEED VALVE
PRECOOLER
DIFFERENTIAL PRESSURE SWITCH (DPS)
PYLON
DPS
PRECOOLER
FIRE WALL
FAN AIR VALVE (FAV)
FAV
OVER PRESSURE VALVE (OPV)
BLEED PRESSURE SENSOR (BPS)
OPV
BPS
TO STARTER VALVE
ENGINE CORE
TO STARTER VALVE
PRV
BLEED MONITORING PRESSURE SENSOR (BMPS)
PRESSURE REGULATING VALVE (PRV)
HP VALVE
BMPS
HP VALVE
FAN AIR
IPCV
HP7
HYDRAULIC RESERVOIR
HP
IPCV
FAN AIR
HP3
HP8
ENG 1
ENG 2

APU BLEED/EXTERNAL AIR

The left and right bleed systems are connected by a crossbleed duct.

A Crossbleed valve is used for their interconnection or isolation.

The APU can also be used for bleed air supply.

This is usually done on the ground for air conditioning and for engine start.

But APU BLEED air can also be used in flight, in relation to the altitude.

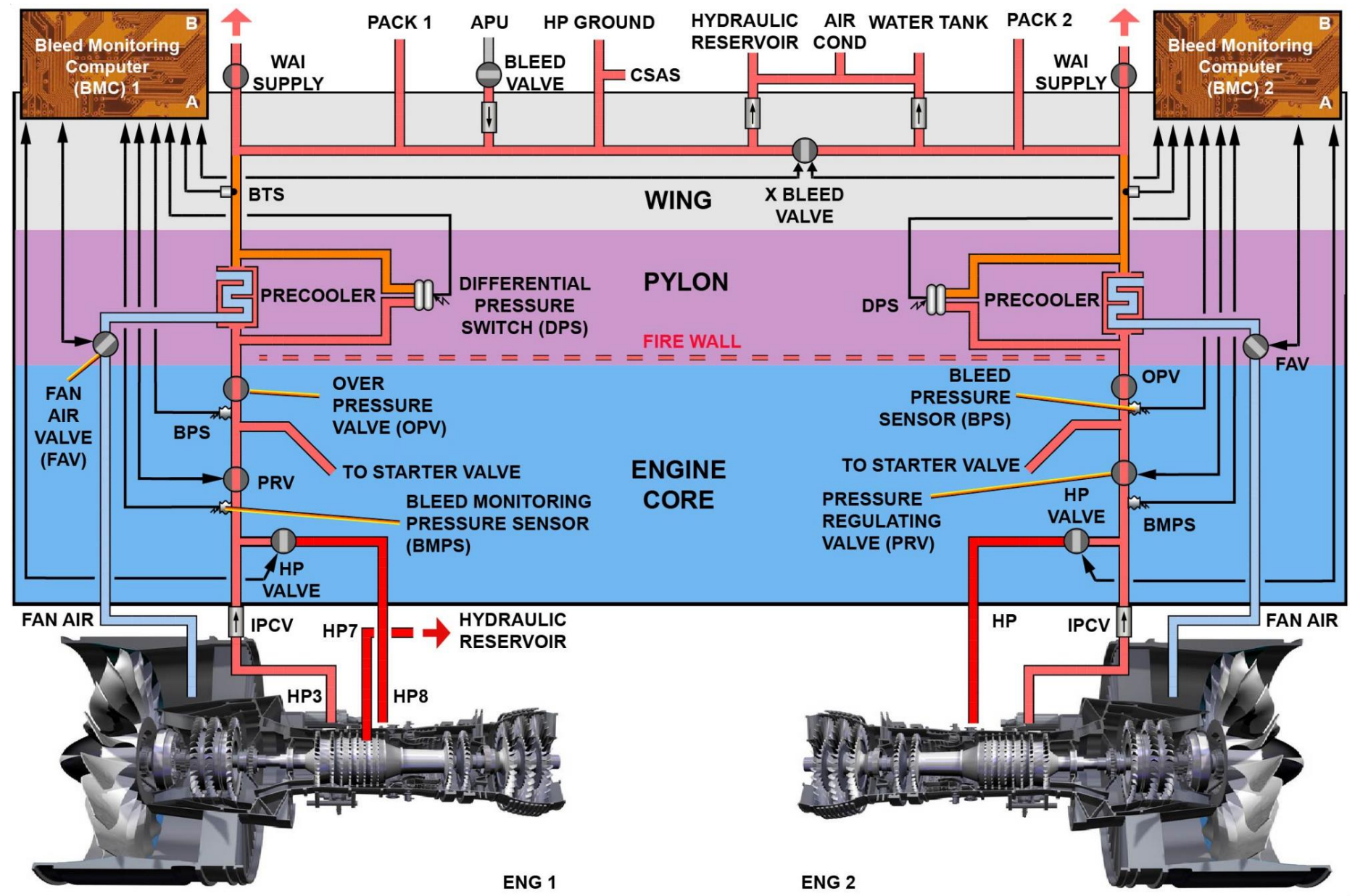
The altitude can be different for each aircraft.

These altitude limits are given by the manufacturer.

The APU bleed supply is connected to the left side of the crossbleed duct.

On the ground, a HP ground power unit can be connected to the left side pneumatic system.

The right side can be supplied by opening the crossbleed valve.


Bleed Monitoring Computer (BMC) 1
B
A
PACK 1
APU
HP GROUND
HYDRAULIC RESERVOIR
AIR COND
WATER TANK
PACK 2
Bleed Monitoring Computer (BMC) 2
WAI SUPPLY
BLEED VALVE
CSAS
WAI SUPPLY
BTS
WING
X BLEED VALVE
PRECOOLER
DIFFERENTIAL PRESSURE SWITCH (DPS)
PYLON
DPS
PRECOOLER
FIRE WALL
FAN AIR VALVE (FAV)
FAV
OVER PRESSURE VALVE (OPV)
BLEED PRESSURE SENSOR (BPS)
OPV
BPS
TO STARTER VALVE
ENGINE CORE
TO STARTER VALVE
PRV
BLEED MONITORING PRESSURE SENSOR (BMPS)
PRESSURE REGULATING VALVE (PRV)
HP VALVE
BMPS
HP VALVE
FAN AIR
IPCV
HP7
HYDRAULIC RESERVOIR
HP
IPCV
FAN AIR
HP3
HP8
ENG 1
ENG 2

LEAK DETECTION

Leak detection loops are installed along the hot air supply ducts of the pneumatic system and are connected to the BMCs.

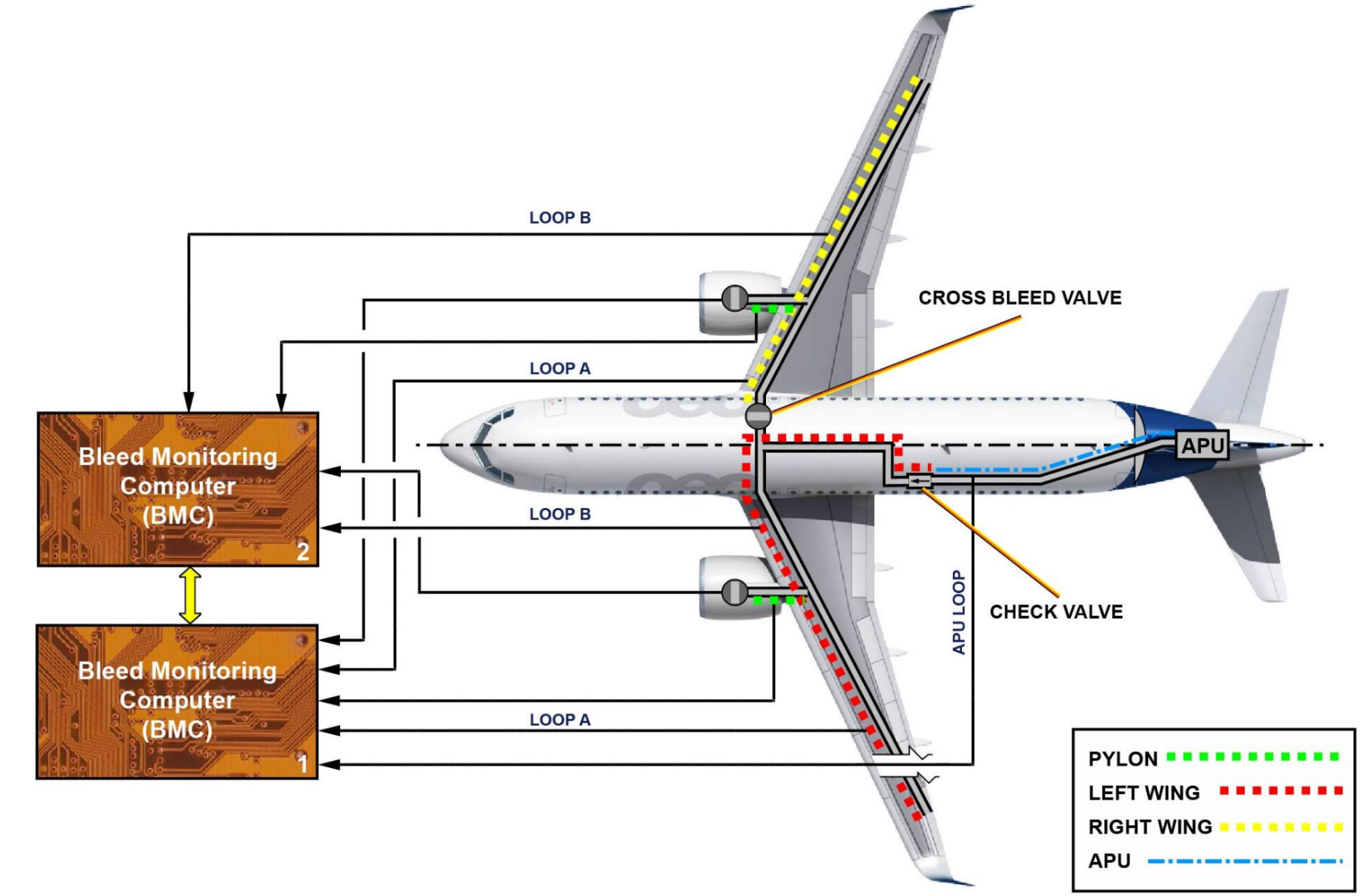
The leak detection system is organized into three loops.

Here are the loops and the protected areas:

PYLON: the precooler outlet area,

WING: wing leading edge and belly fairing,

APU: APU aft supply duct (left hand side of the fuselage) from APU firewall to wheel well area.


LOOP B
LOOP A
LOOP B
LOOP A
CROSS BLEED VALVE
APU
APU LOOP
CHECK VALVE
Bleed Monitoring Computer (BMC) 2
Bleed Monitoring Computer (BMC) 1
PYLON
LEFT WING
RIGHT WING
APU

COMPONENT LOCATION

The primary components of the pneumatic system are installed on the engines and in the pylons.

PRESSURE REGULATION COMPONENTS

The pressure regulation components on the engines are the:

Engine HPV,

Engine BLEED PRV,

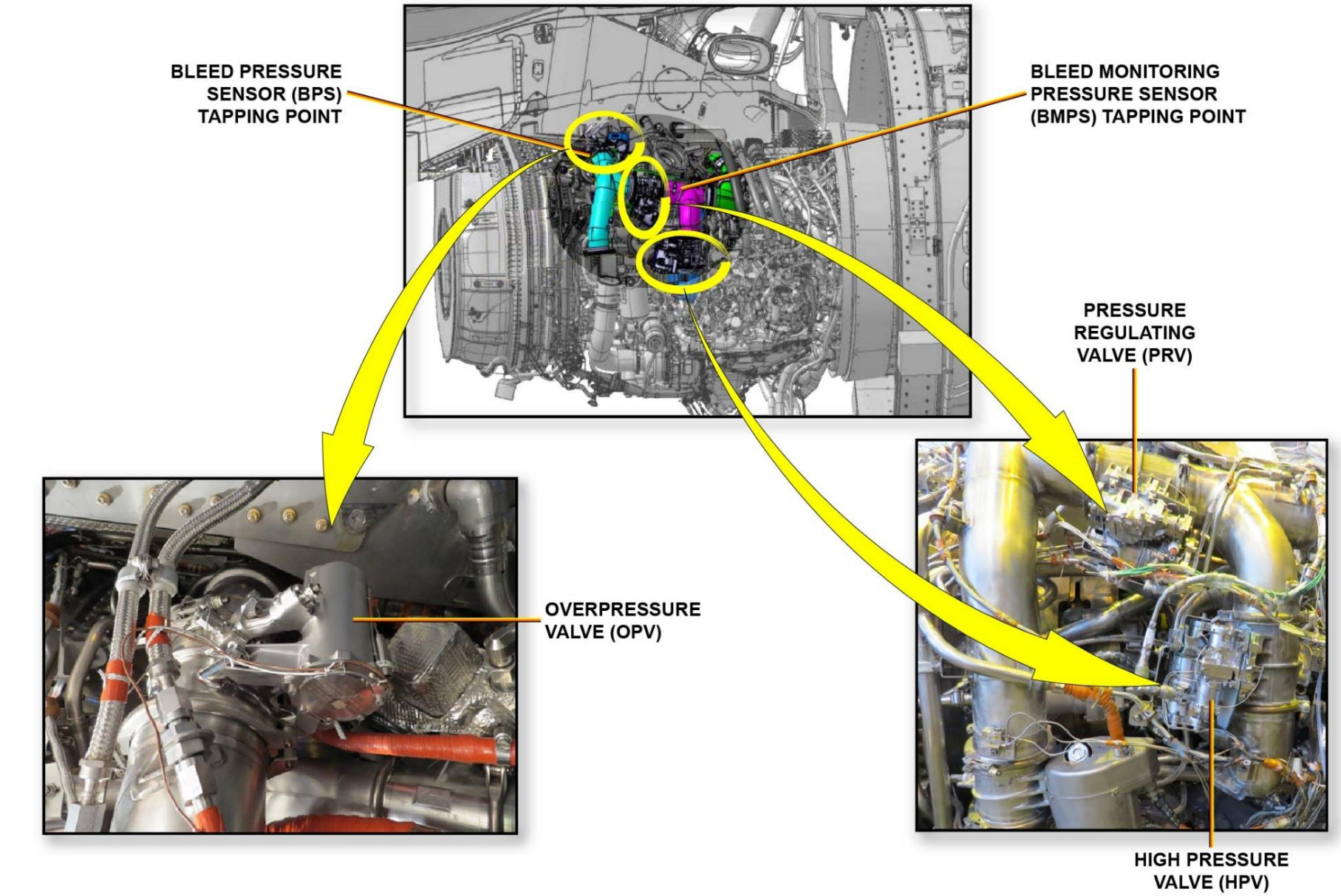
OPV,

Bleed Monitoring Pressure Sensor (BMPS),

Bleed Pressure Sensor (BPS),

Differential Pressure Sensor (DPS).

To get access, open the right fan cowl and thrust reverser cowl.


BLEED PRESSURE SENSOR (BPS) TAPPING POINT
BLEED MONITORING PRESSURE SENSOR (BMPS) TAPPING POINT
PRESSURE REGULATING VALVE (PRV)
OVERPRESSURE VALVE (OPV)
HIGH PRESSURE VALVE (HPV)

Engine Components

The system consists of the components below.

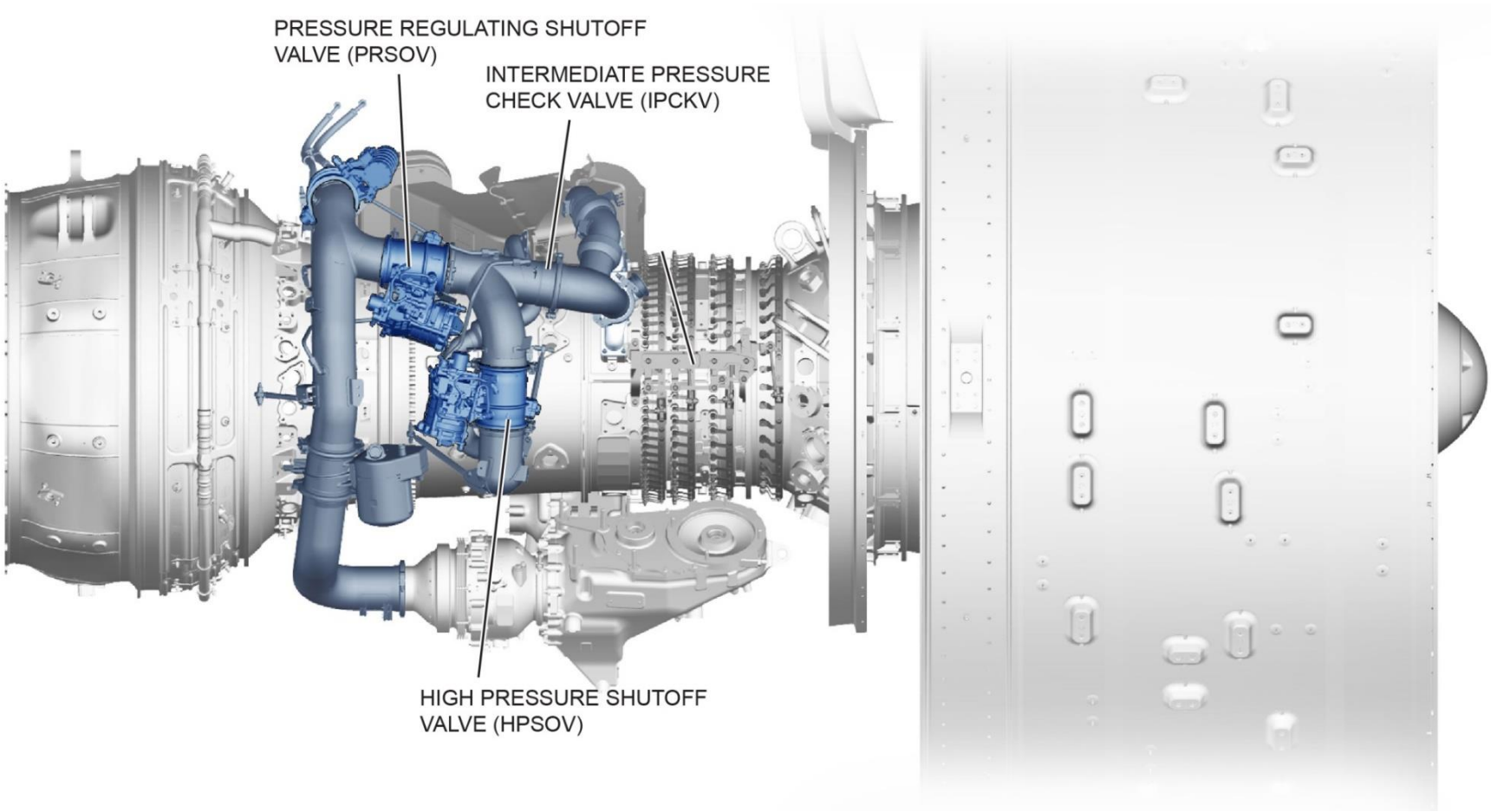
Ducting

High Pressure Shutoff Valve HPSOV

Pressure Regulating and Shutoff Valve PRSOV

Intermediate Pressure Check Valve IPCKV

Bleed air coming from the HPSOV or IPCKV is cooled via the precooler, prior to being sent into the aircraft Environmental Control System.


PRESSURE REGULATING SHUTOFF VALVE (PRSOV)
INTERMEDIATE PRESSURE CHECK VALVE (IPCKV)
HIGH PRESSURE SHUTOFF VALVE (HPSOV)

High Pressure Shutoff Valve (HPSOV)

Purpose:

The HPSOV controls the flow of Stage 8 HPC air to the Environmental Control System.

Location:

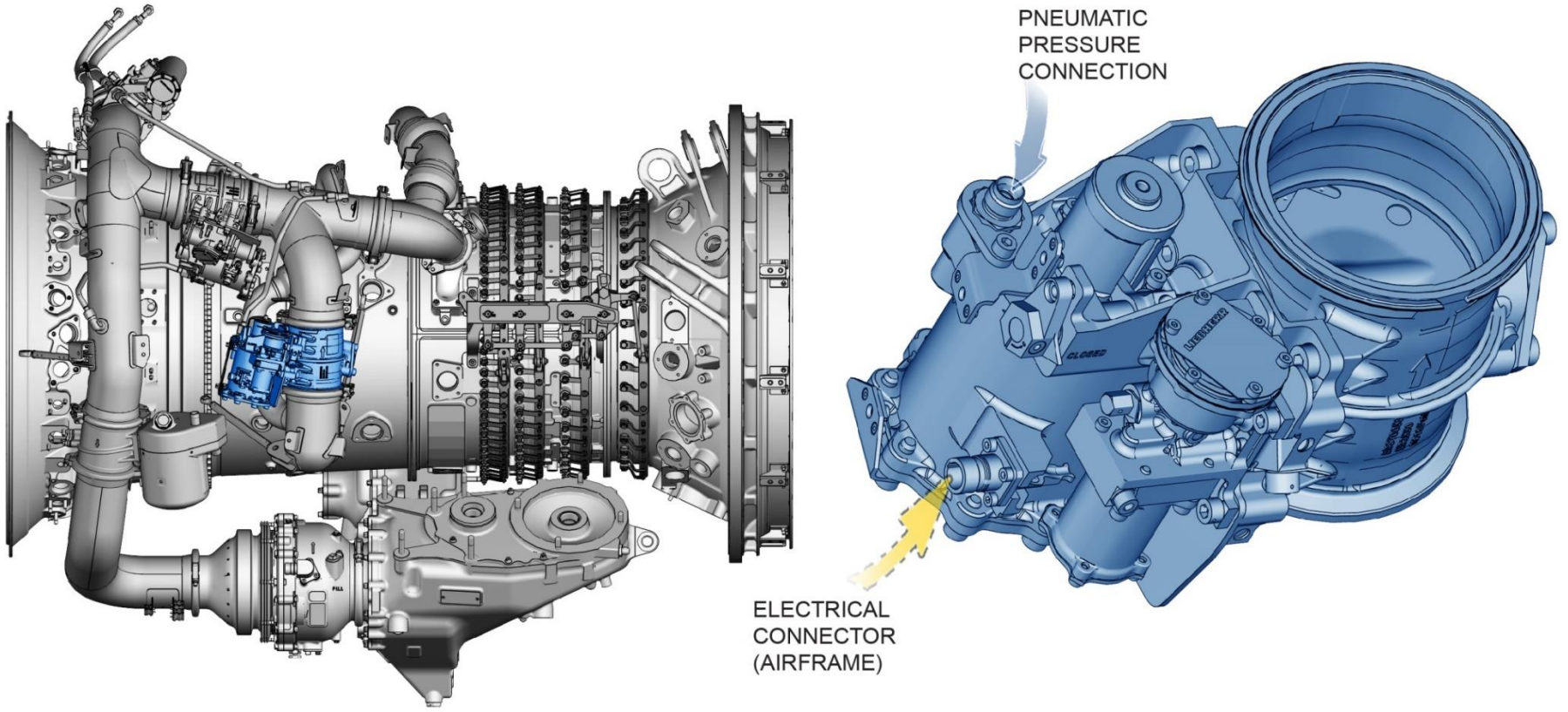
The HPSOV is located on the right side of the engine at 3:00, just aft of the IFPC.

Description:

The HPSOV is pneumatically operated by a solenoid which is controlled by the aircraft computers.

Operation:

At low N2 speeds, the HPSOV is open to provide adequate air pressure to the PRSOV for aircraft use.


PNEUMATIC
PRESSURE
CONNECTION
ELECTRICAL
CONNECTOR
(AIRFRAME)

Pressure Regulating and Shutoff Valve (PRSOV)

Purpose:

The Pressure Regulating and Shutoff Valve (PRSOV) regulates air pressure from the HPC.

Location:

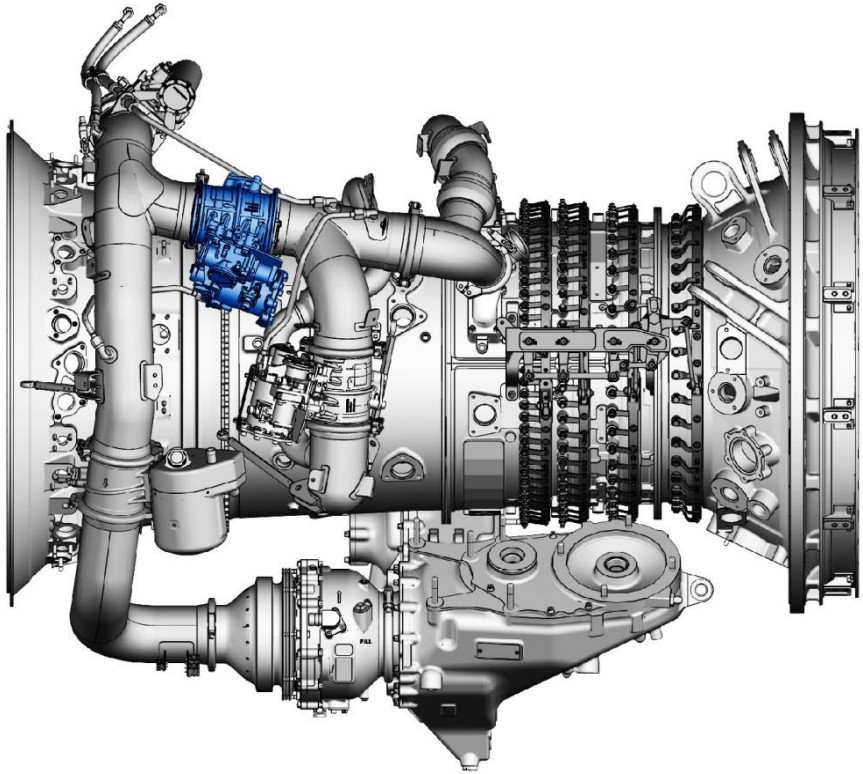
The PRSOV is located on the right side of the engine just below the ACC inlet duct at 2:00.

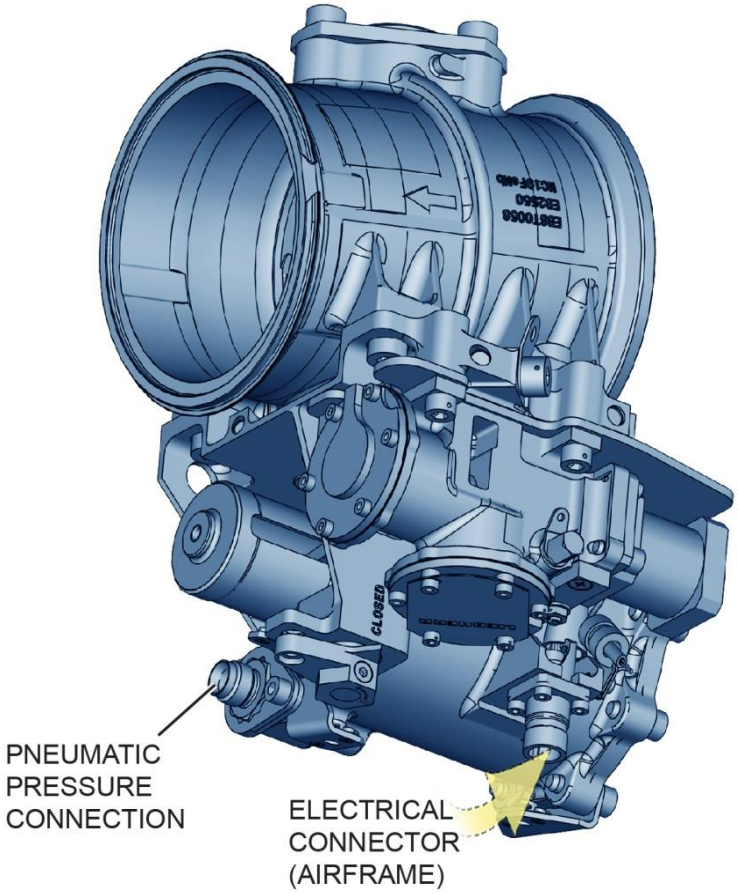
Description:

The PRSOV is pneumatically operated by a solenoid which is controlled by the aircraft computers.

Operation:

The PRSOV regulates air pressure coming from the HPC to provide adequate air pressure for aircraft use.




CLOSED
PNEUMATIC
PRESSURE
CONNECTION
ELECTRICAL
CONNECTOR
(AIRFRAME)

Intermediate Pressure Check Valve (IPCKV)

Purpose:

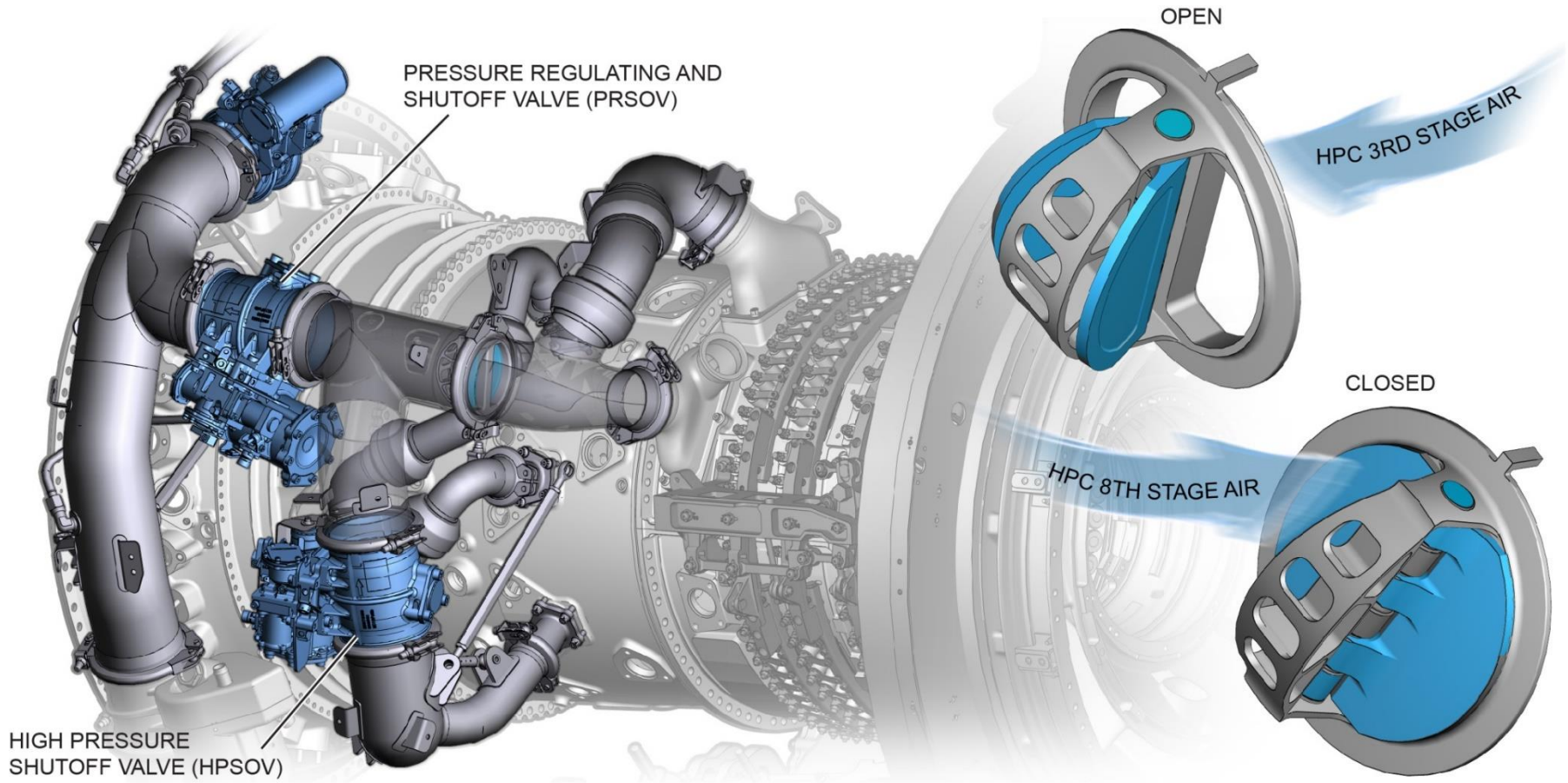
The Intermediate Pressure Check Valve allows the flow of HPC 3rd Stage air to the ECS duct when the High-Pressure Shutoff Valve is closed.

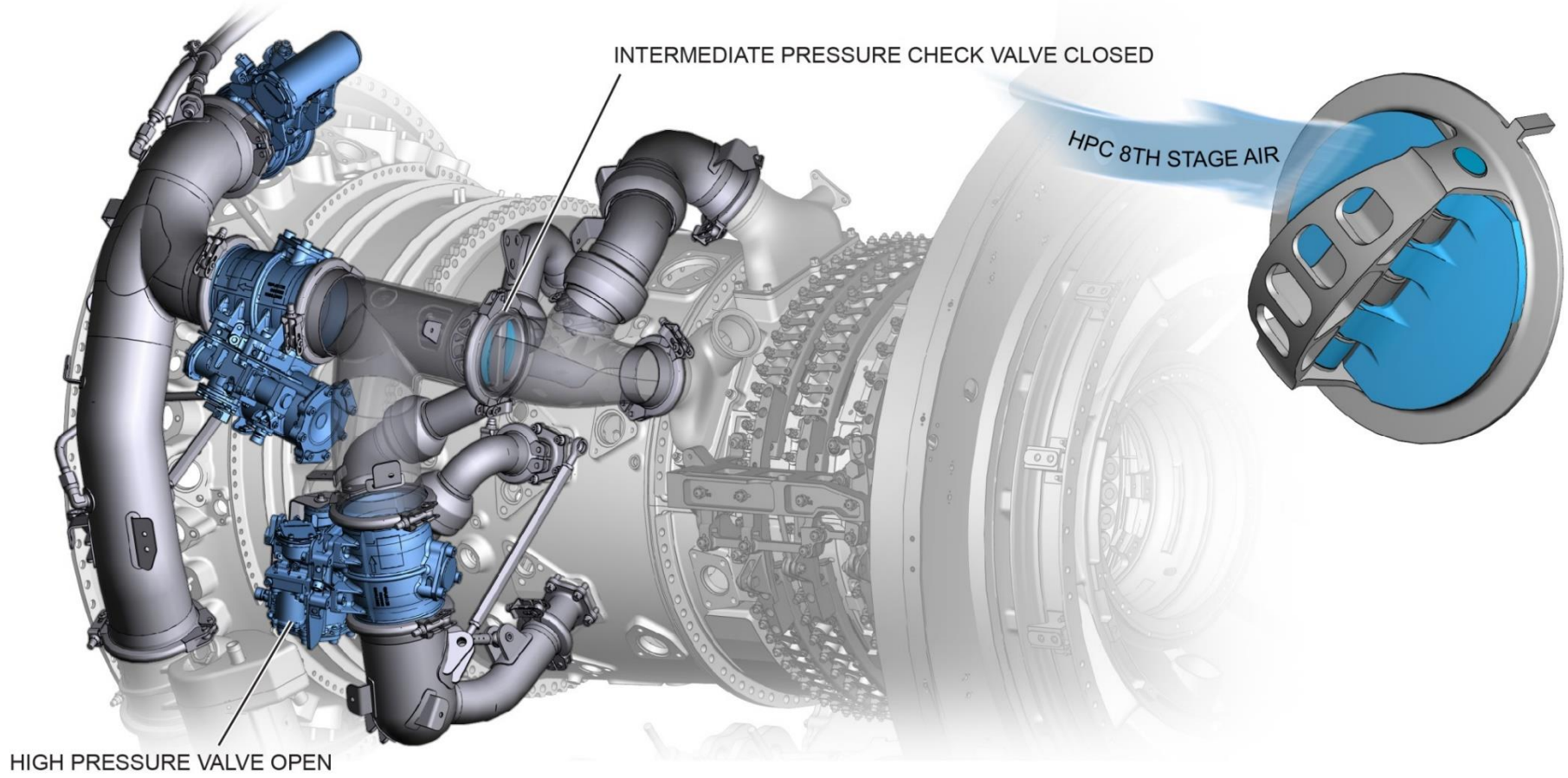
Location:

The IPCKV is located inside the mid-stage ECS duct at 2:00.

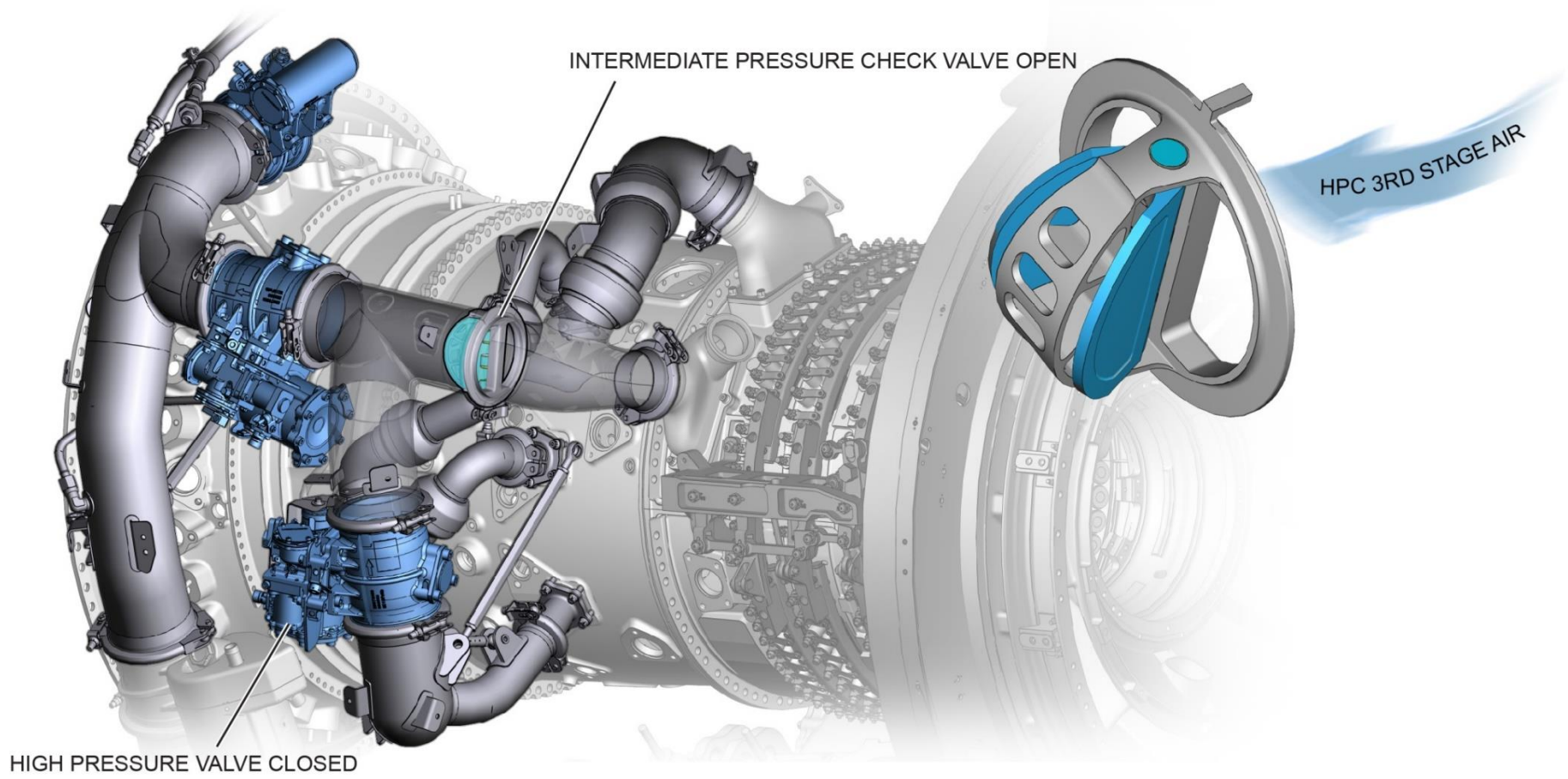
Description:

The IPCKV is a split flapper valve.


PRESSURE REGULATING AND
SHUTOFF VALVE (PRSOV)
HIGH PRESSURE
SHUTOFF VALVE (HPSOV)
OPEN
HPC 3RD STAGE AIR
CLOSED
HPC 8TH STAGE AIR



AIRFLOW AT LOW POWER



AIRFLOW AT HIGH POWER AND CRUISE

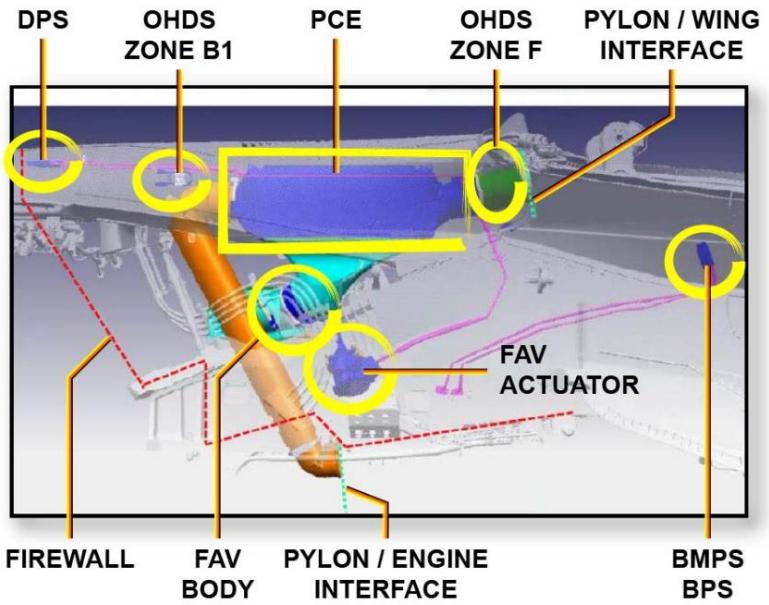
TEMPERATURE REGULATION COMPONENTS

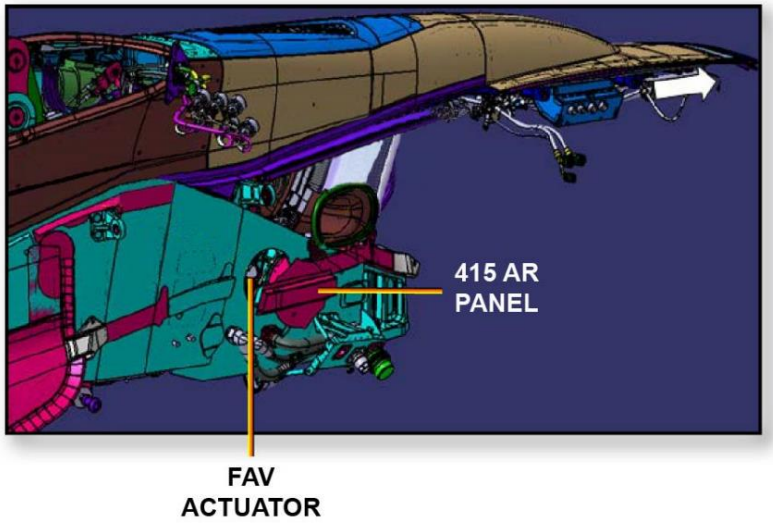
The temperature regulation components are in the pylons:

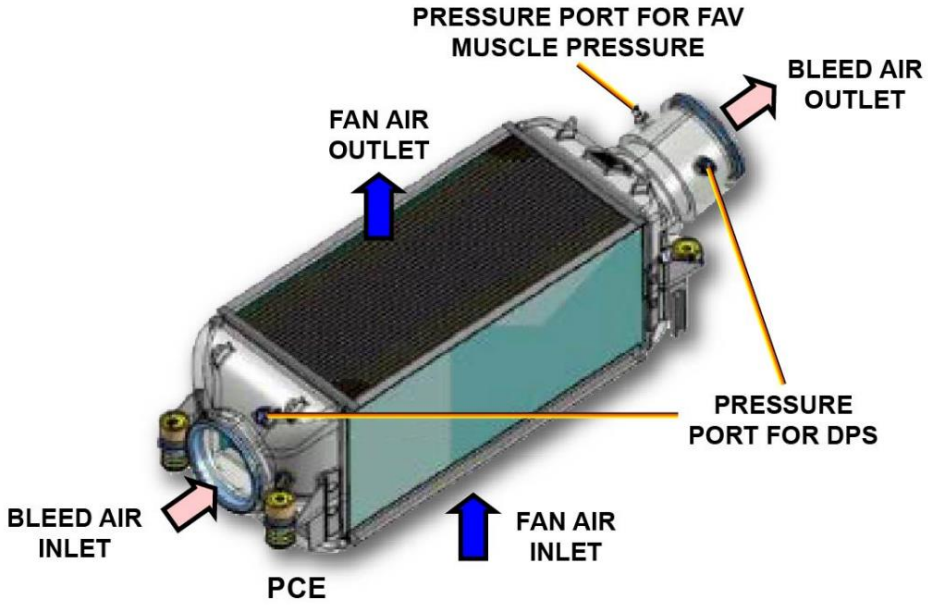
the FAV,

the Precooler,

the Bleed Temperature Sensor (BTS).







BMPS: Bleed Monitoring Pressure Sensor
BPS: Bleed Pressure Sensor
DPS: Differential Pressure Sensor
FAV: Fan Air Valve
OHDS: OverHeat Detection System
PCE: Precooler Exchanger

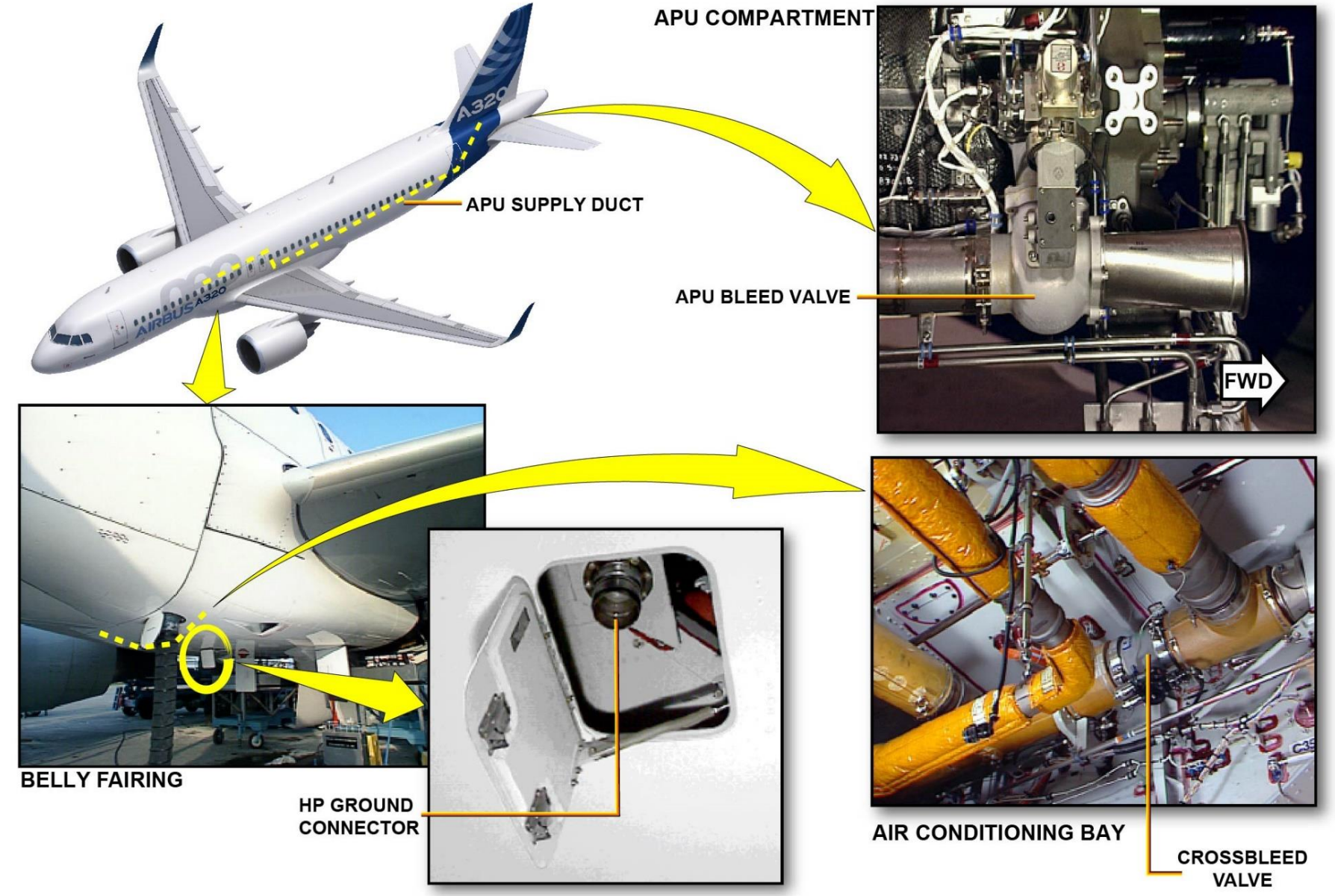
OTHER COMPONENTS

The Crossbleed valve is in the forward section of the lower fuselage belly fairing area.

The access to the HP ground connector is through a small access door on the lower fuselage belly fairing.

The APU bleed valve is on the APU.

The APU supply duct is installed along the left-hand side of the fuselage to the wheel well area and is connected to the crossbleed duct in the forward belly fairing area.


APU COMPARTMENT
APU SUPPLY DUCT
APU BLEED VALVE
FWD
BELLY FAIRING
HP GROUND
CONNECTOR
AIR CONDITIONING BAY
CROSSBLEED
VALVE

SYSTEM CONTROLS AND INDICATING

ENGINE BLEED VALVE PUSHBUTTON

When pressed in, the related engine Pressure Regulating Valve (PRV) opens, provided the engine is running, the APU bleed not ON and no fault is detected (by its Bleed Monitoring Computer).

When released out, the related PRV and HP valve are closed.

APU BLEED VALVE PUSHBUTTON

When pressed in, the APU bleed valve opens provided the APU is running and no leak is detected by BMC1.

When released out, the APU bleed valve is closed.

NOTE: When the APU bleed valve is open, the X bleed valve is open and both engine bleed valves are closed, provided X bleed valve selector at AUTO.

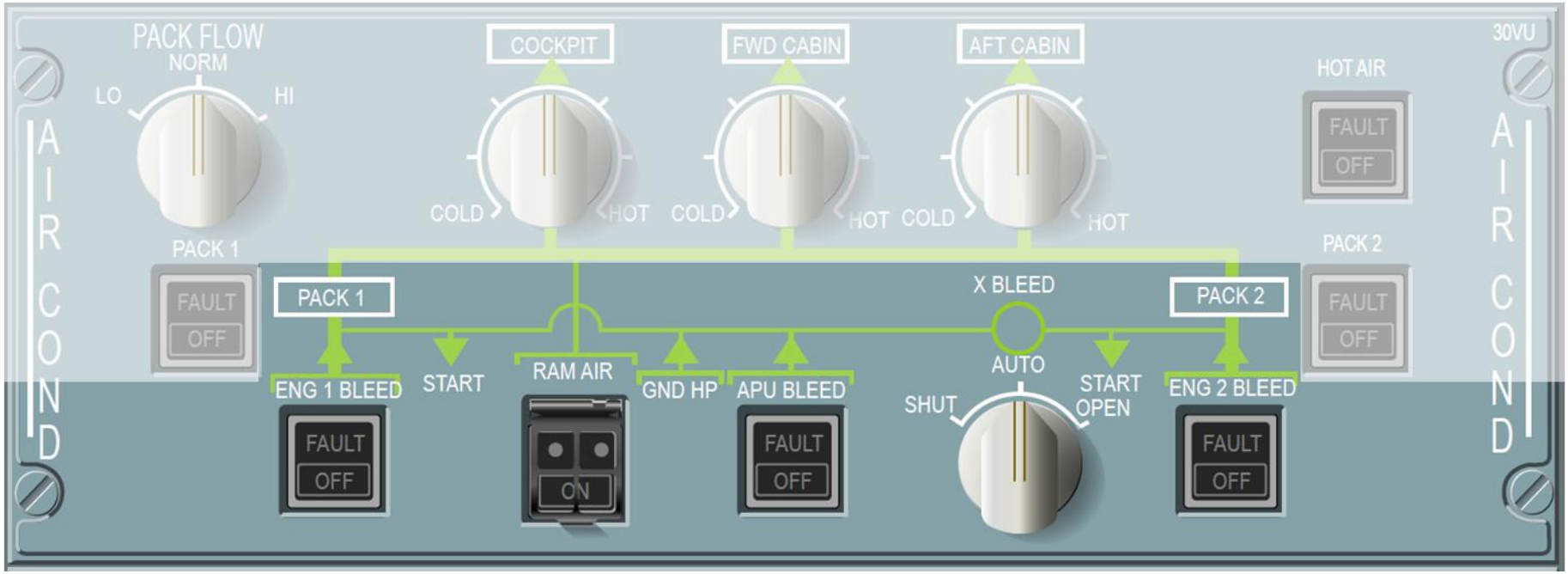
CROSS BLEED VALVE SELECTOR

In AUTO, the cross-bleed valve takes the same configuration as the APU bleed valve (closed or open).

When OPEN is selected, the cross-bleed valve is controlled to open.

When SHUT is selected, the cross-bleed valve is controlled to close.

NOTE: If SHUT is selected and the APU bleed valve is open, only engine 2 bleed valve is open.


AIR COND
PACK FLOW
NORM
LO
HI
COCKPIT
COLD
HOT
FWD CABIN
COLD
HOT
AFT CABIN
COLD
HOT
HOT AIR
FAULT
OFF
30VU
AIR COND
PACK 1
FAULT
OFF
PACK 1
X BLEED
PACK 2
PACK 2
FAULT
OFF
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
START
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
OFF
FAULT
OFF
FAULT
OFF

ECAM PAGE PRESENTATION

SOURCES

Engine symbol 1 or 2 is amber when the corresponding engine is stopped. It becomes white when engine is running.

The green ground symbol and the white GND indication are displayed when the aircraft is on ground, independently of ground cart connection.

The white HP, IP and APU indications are always displayed.

ENGINE AND APU BLEED VALVES

Green is used when the engine bleed valve position corresponds to the required position, and amber in case of disagreement.

The APU bleed valve is green in line when open, and green cross line when closed.

The engine bleed valve symbol is replaced by XX when information is not valid.

The APU bleed valve is displayed when APU is running; it is not displayed when APU MASTER SW is set to OFF.

DUCTS

The ducts are represented by green lines when corresponding valves are open, and become amber or are not displayed when the valves are closed.

ENGINE HP VALVE

The engine HP VALVE is displayed cross line when closed, and in line when open.

Green is used when HP valve position corresponds to the required position, and amber in case of disagreement.

The engine HP valve symbol is replaced by XX when HP valve information is not valid

CROSS BLEED VALVE

The cross-bleed valve is displayed in line when open, and cross line when closed.

BLEED AIR PARAMETERS

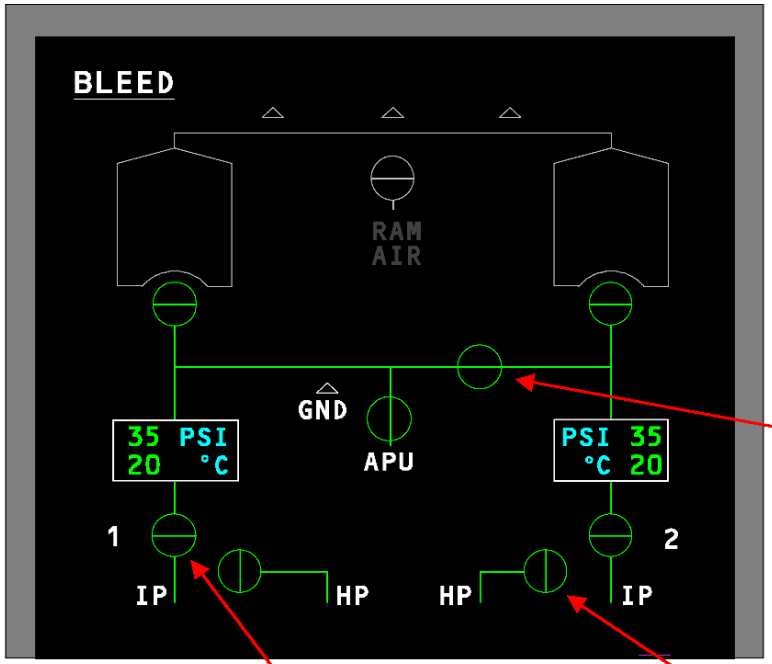
Bleed temperature and pressure are shown in the shaded boxes; they are green when normal, amber when out of limits.

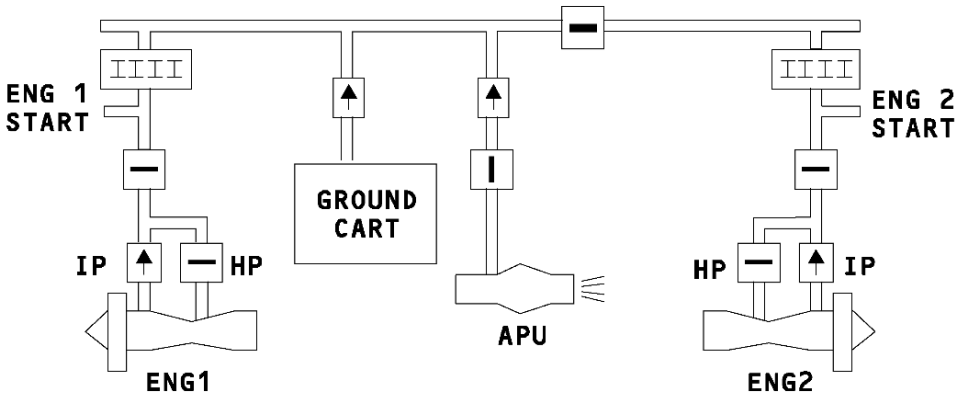
Bleed pressure parameter becomes amber if lower than 4 psi or in case of overpressure detected by BMC (above 57 psi).

Temperature parameter becomes amber in case of overheat detection by BMC.

Overheat is detected if temperature exceeds:

290°C for more than 5 seconds or,
270°C for more than 15 seconds or,
257°C for more than 55 seconds.





CROSS BLEED VALVE	
NORMAL (GREEN)	ABNORMAL (AMBER)
FULLY OPEN FULLY CLOSED TRANSIT (GREEN LINE AND AMBER VALVE)	DISAGREEMENT WITH THE REQUIRED POSITION

ENGINE BLEED VALVE:	
NORMAL (GREEN)	ABNORMAL (AMBER)
FULLY CLOSED OPEN	FULLY CLOSED AND LOW REGULATION OPEN AND DISAGREE

ENGINE HP VALVE:	
NORMAL (GREEN)	ABNORMAL (AMBER)
FULLY CLOSED OPEN	FULLY CLOSED AND DISAGREEMENT WITH THE REQUIRED POSITION

ENGINE BLEED SYSTEM DESCRIPTION (PW1100G)

GENERAL

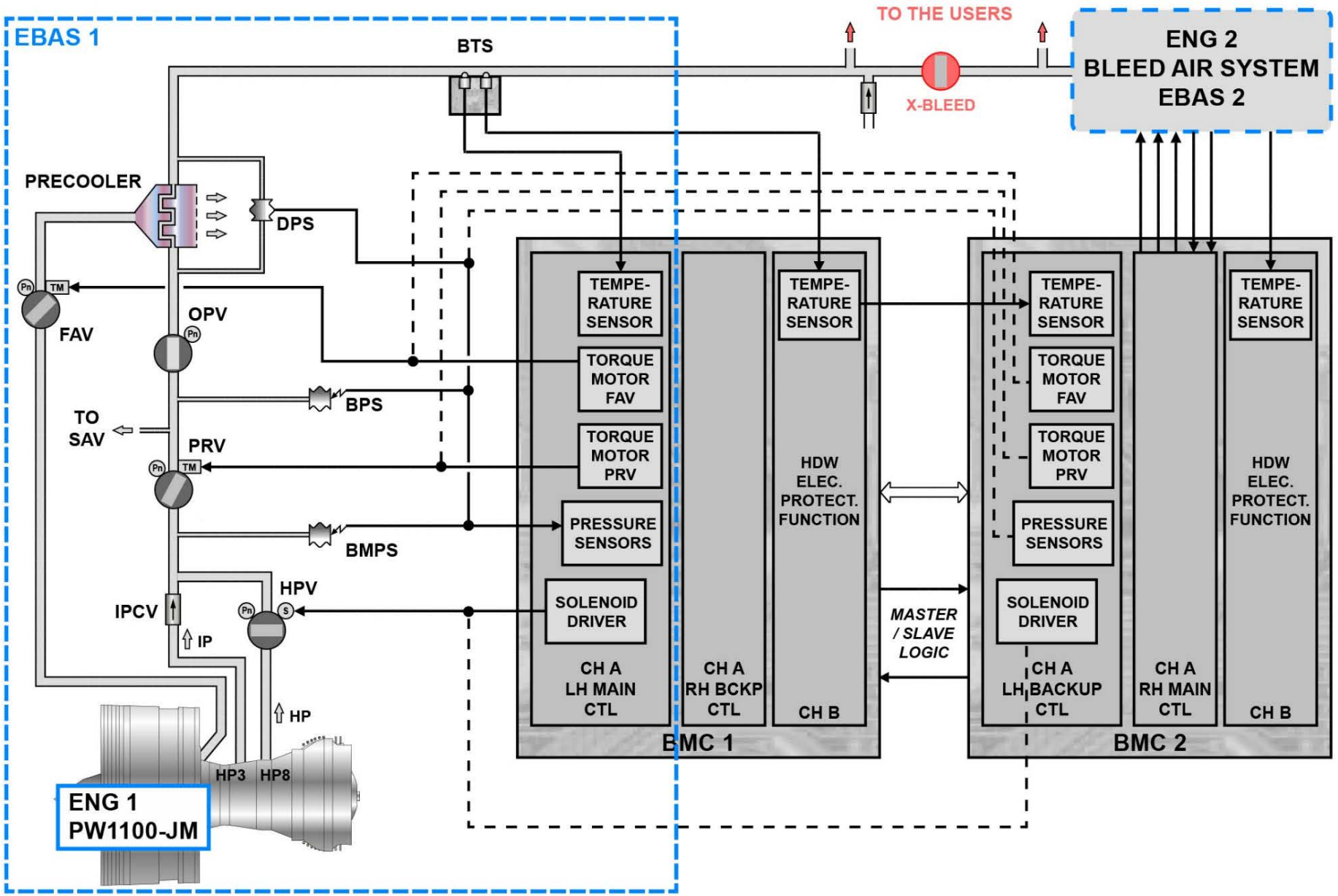
The Engine Bleed Air System (EBAS) supplies pressure and temperature regulated airflow from each engine to the air system users.

During normal operation, each engine bleed system is isolated from adjacent system by the Crossbleed valve; except during 2nd engine starting using air bled from 1st started engine, Crossbleed valve opened or under APU Bleed.

The pressure regulation system is controlled and monitored by two Bleed Monitoring Computers (BMCs).

As compared to A320 CEO, the NEO engine has higher bleed air temperatures during High Pressure (HP) operation, lower air pressure during Intermediate Pressure (IP) operation, lower fan pressures for cooling air flow supply and limited space for installation due to new pylon configuration.

To achieve better performance requirements a new electro-pneumatic bleed air system is designed for A320 NEO.


EBAS 1
BTS
TO THE USERS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
FAV
OPV
BPS
TO
SAV
PRV
BMPS
HPV
IPCV
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
BMC 2

BMC

Normally BMC 1 Channel A does all the control and monitoring of the LH EBAS and BMC 2 Channel A the RH EBAS.

Each BMC channel A controls torque-motor and solenoid for the electro-pneumatic valves, monitors sensors.

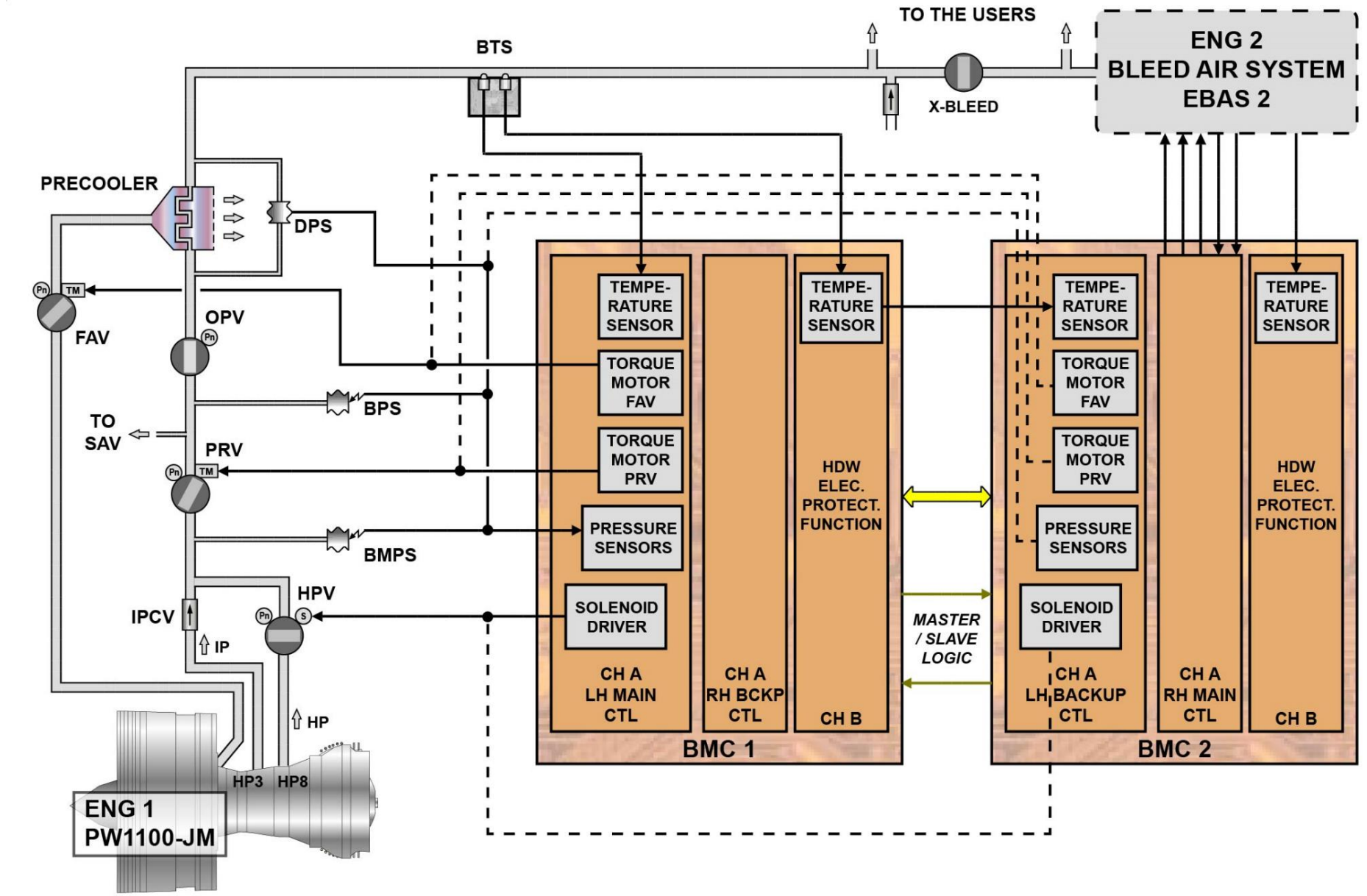
As both BMC interface, each one is capable to control both sides.

The channel B is a fully hardware part able to detect the system overtemperature.

The Electrical Protection Function (EPS).

This detection is fully independent from software part.

Each BMC reports the failures independently of each other.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
Pn
TM
FAV
OPV
Pn
BPS
TO
SAV
PRV
Pn
TM
BMPS
HPV
IPCV
Pn
S
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
TEMPE-
RATURE
SENSOR
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
TEMPE-
RATURE
SENSOR
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 2

HPC

HP VALVE (HPV)

The engine air bleed pressure is pneumatically regulated by the HP Valve (HPV) when air is supplied by the High-Pressure Compressor (HPC) stage or directly by the Pressure Regulating Valve (PRV) when the air is supplied by the Intermediate Pressure (IP) HPC stage.

Intermediate-pressure service port: IP is defined by HP3.

High-pressure service port: HP is defined by HP8.

The HPV lets air to be bled from the engine HP stage at lower power settings.

It is a pressure regulating and shut-off valve with a butterfly closure element.

It regulates the pressure of the bleed air between 15 and 65 psig.

With the Solenoid energized, the minimum upstream muscle pressure needed to operate the valve is 15 psig.

When the solenoid is not energized, the HPV is commanded to the full closed position.

When the solenoid is energized but without pressure in the valve body, the HPV stays closed.

The HPV is forced to close when the PRV is closed.

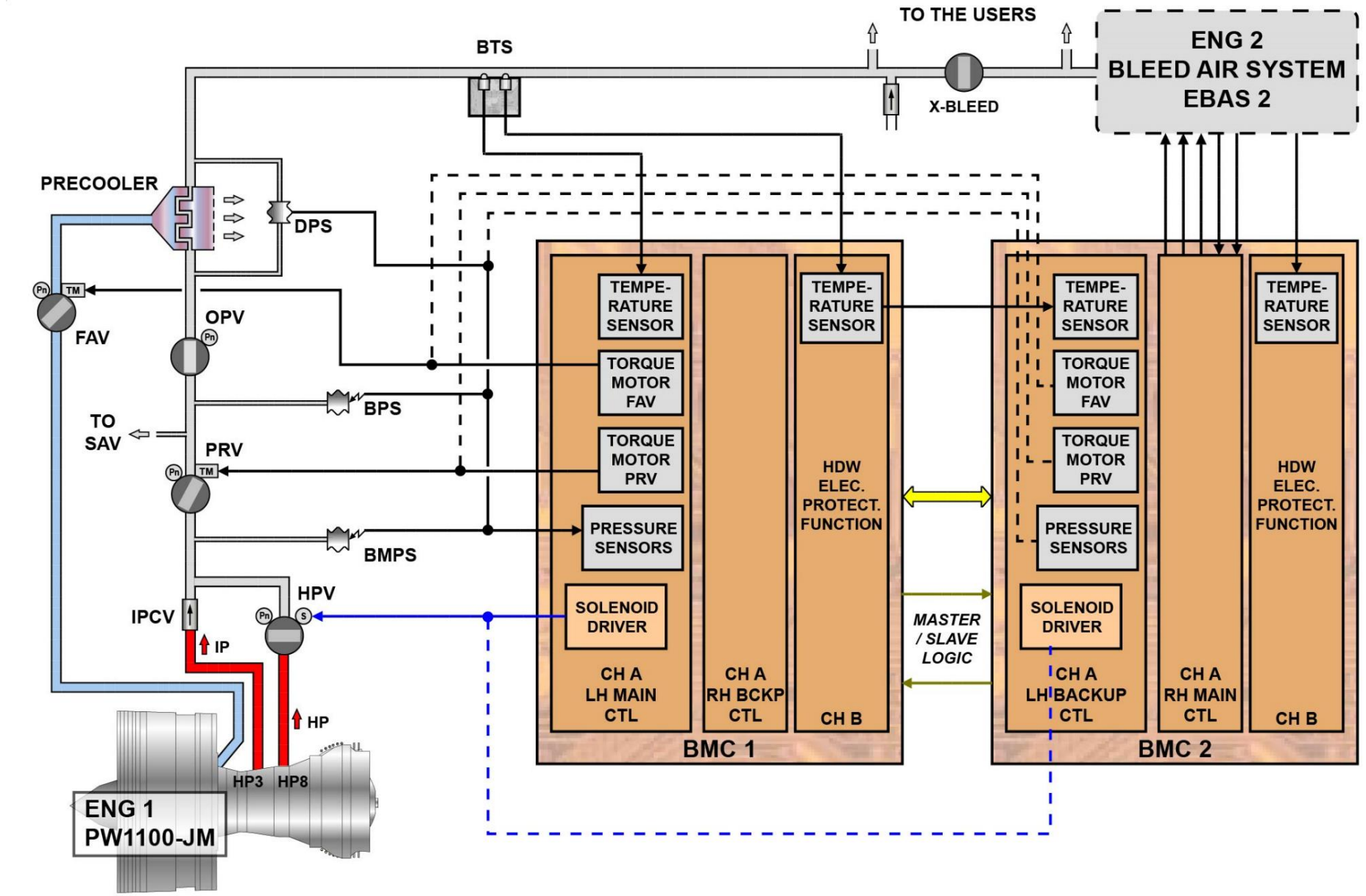
The valve has a manual override and test port for pneumatic test in-situ.

IP CHECK VALVE (IPCV)

An Intermediate Pressure Check Valve (IPCV) lets air to be bled from the engine IP stage.

It is closed when air is bled from HP stage.

The purpose of this IPCV is to allow the flow from IP stage and avoid the reverse flow from either the HP port or the pneumatic manifold.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
FAV
OPV
BPS
TO
SAV
PRV
BMPS
IPCV
HPV
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
HDW
ELEC.
PROTECT.
FUNCTION
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
CH B
BMC 2

PRESSURE REGULATING VALVE (PRV)

The Pressure Regulating Valve (PRV) is a 4-inch diameter butterfly valve, installed downstream of the IPCV and HPV.

It regulates the pressure of the bleed air at 42 ± 2 psig in normal dual bleed operation (50 ± 2 psig in single bleed operation).

Its setting is modulated by the electric command on the torque-motor.

When the torque-motor is de-energized, the PRV is commanded to the full closed position.

When the torque-motor is energized but without pressure, the PRV stays closed.

With the torque-motor energized, the minimum upstream muscle pressure needed to operate the valve is 15 psig.

The PRV operates as a shut off valve when abnormal conditions occur.

In case of BPS measurement failure (Invalid Signal or Out of Range), the BMC will fully supply the PRV TM to engage the Pneumatic Back Up Mode. In this case the PRV will self-regulate the downstream pressure.

With no electrical power to the TM, the PRV will be fully closed (Fail safe position

The valve has a manual override and test port for pneumatic test in-situ.

OVERPRESSURE VALVE (OPV)

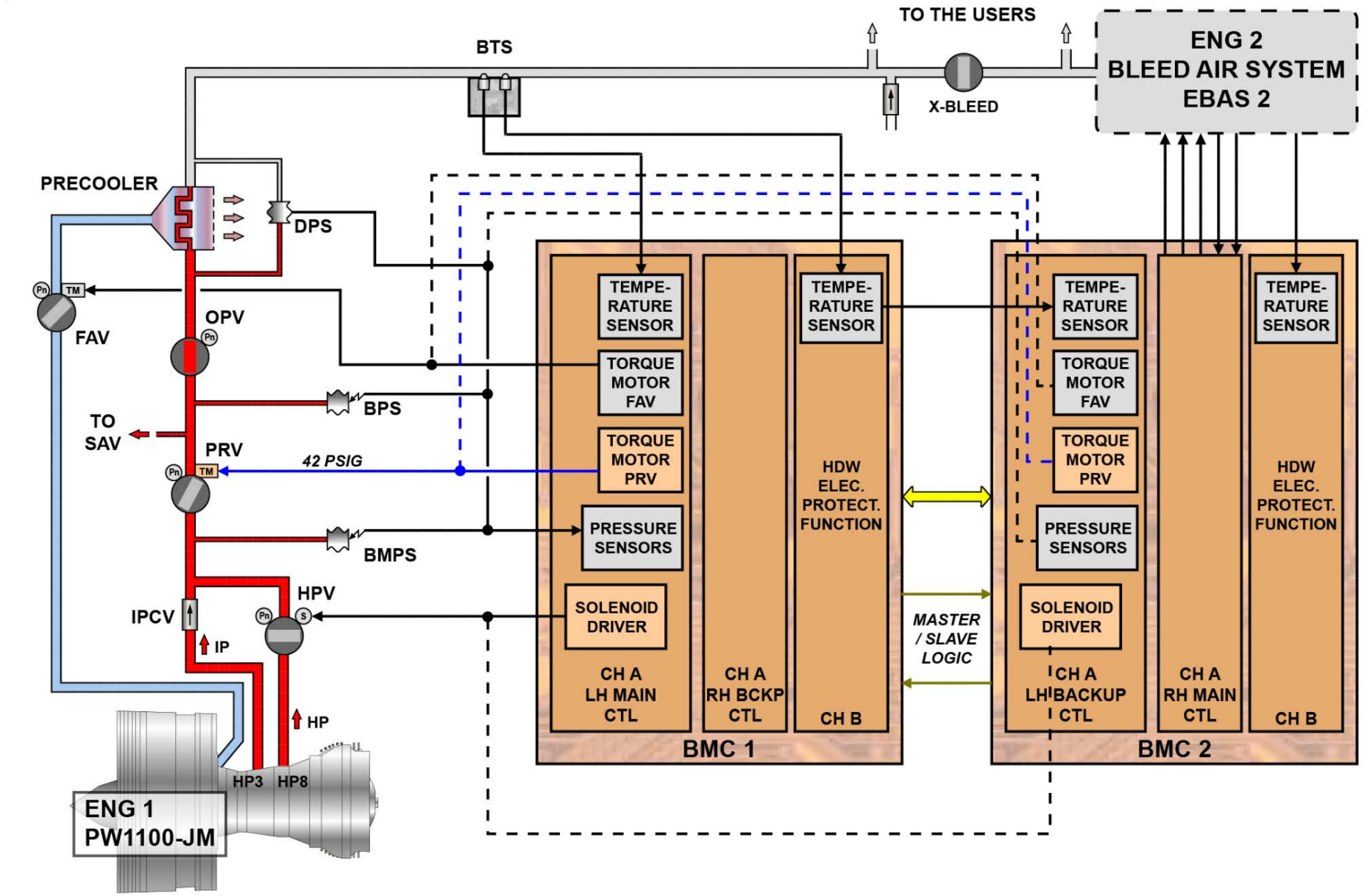
The Overpressure Valve (OPV) downstream of the PRV in the engine core, protects the system against damage if overpressure occurs.

It operates pneumatically.

The OPV, normally in spring-loaded open position and will start to close if the bleed pressure reached 75 Psi.

It will be fully closed if bleed pressure reaches 90 psig.

The valve has a manual override and test port for pneumatic test in-situ.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
FAV
OPV
BPS
TO
SAV
PRV
42 PSIG
BMPS
HPV
IPCV
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
BMC 2

PRESSURE SENSORS

BLEED MONITORING PRESSURE SENSOR (BMPS)

The Bleed Monitoring Pressure Sensor (BMPS) is used to perform bleed port switching function.

It is also used to estimate the position of the HPV butterfly and to monitor the HPV and the PRV.

BLEED PRESSURE SENSOR (BPS)

The Bleed Pressure Sensor (BPS) is installed downstream the PRV.

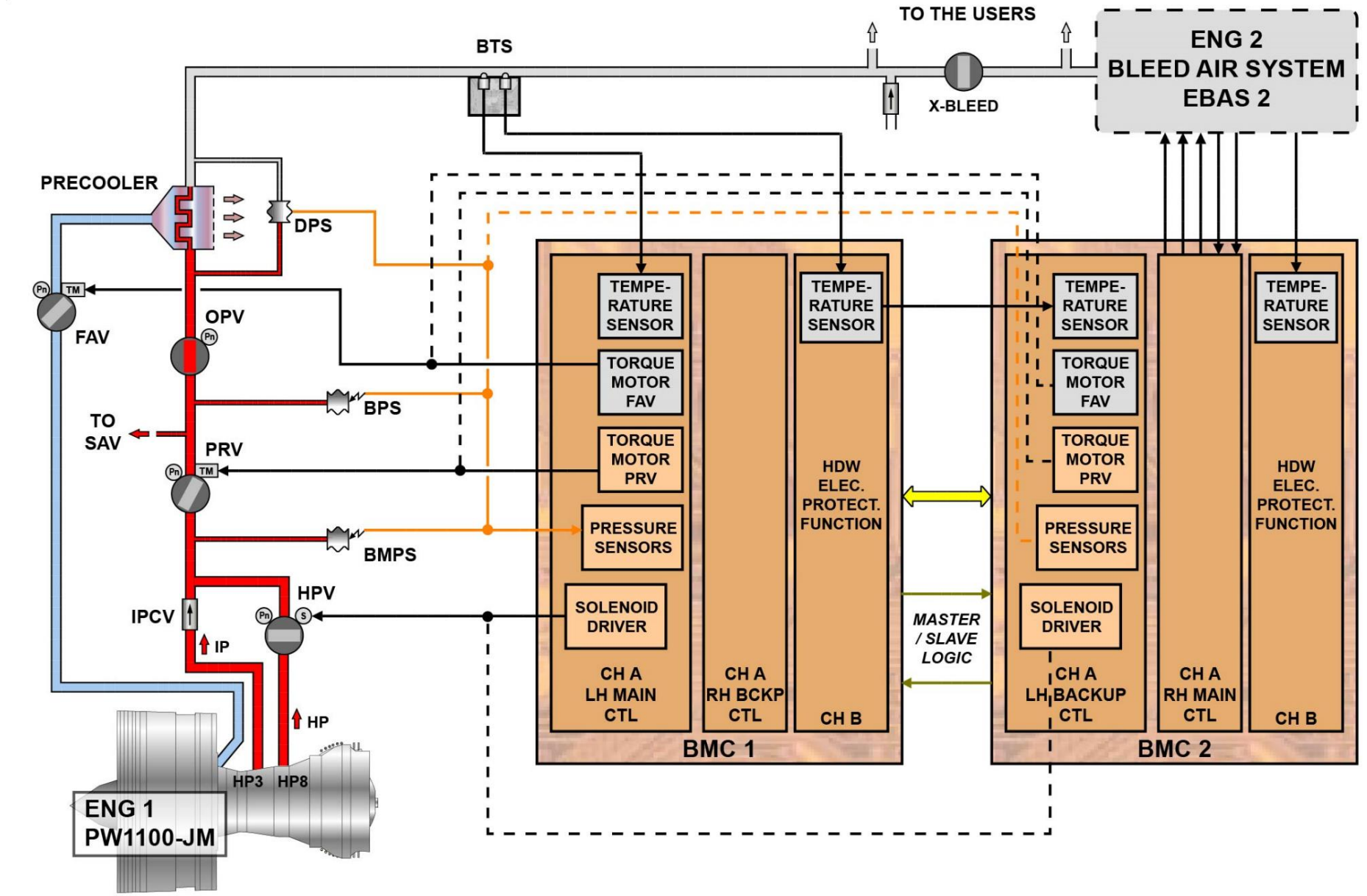
It provides to BMC the actual bleed air pressure delivered through the PRV.

This sensor is also used by the BMC for system monitoring (overpressure and low-pressure alarms) and to monitor the position of the OPV butterfly.

DIFFERENTIAL PRESSURE SENSOR (DPS)

The Differential Pressure Sensor (DPS) ensures the reverse flow protection by sensing the differential pressure between Precooler hot side inlet and outlet.

It also provides to the BMC an indication of the PRV and OPV position.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
FAV
OPV
BPS
TO
SAV
PRV
BMPS
HPV
IPCV
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
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MOTOR
FAV
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MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
BMC 2

BLEED TEMPERATURE SENSOR (BTS)

The dual Bleed Temperature Sensor (BTS) installed downstream the Precooler provides to the BMC the actual EBAS temperature.

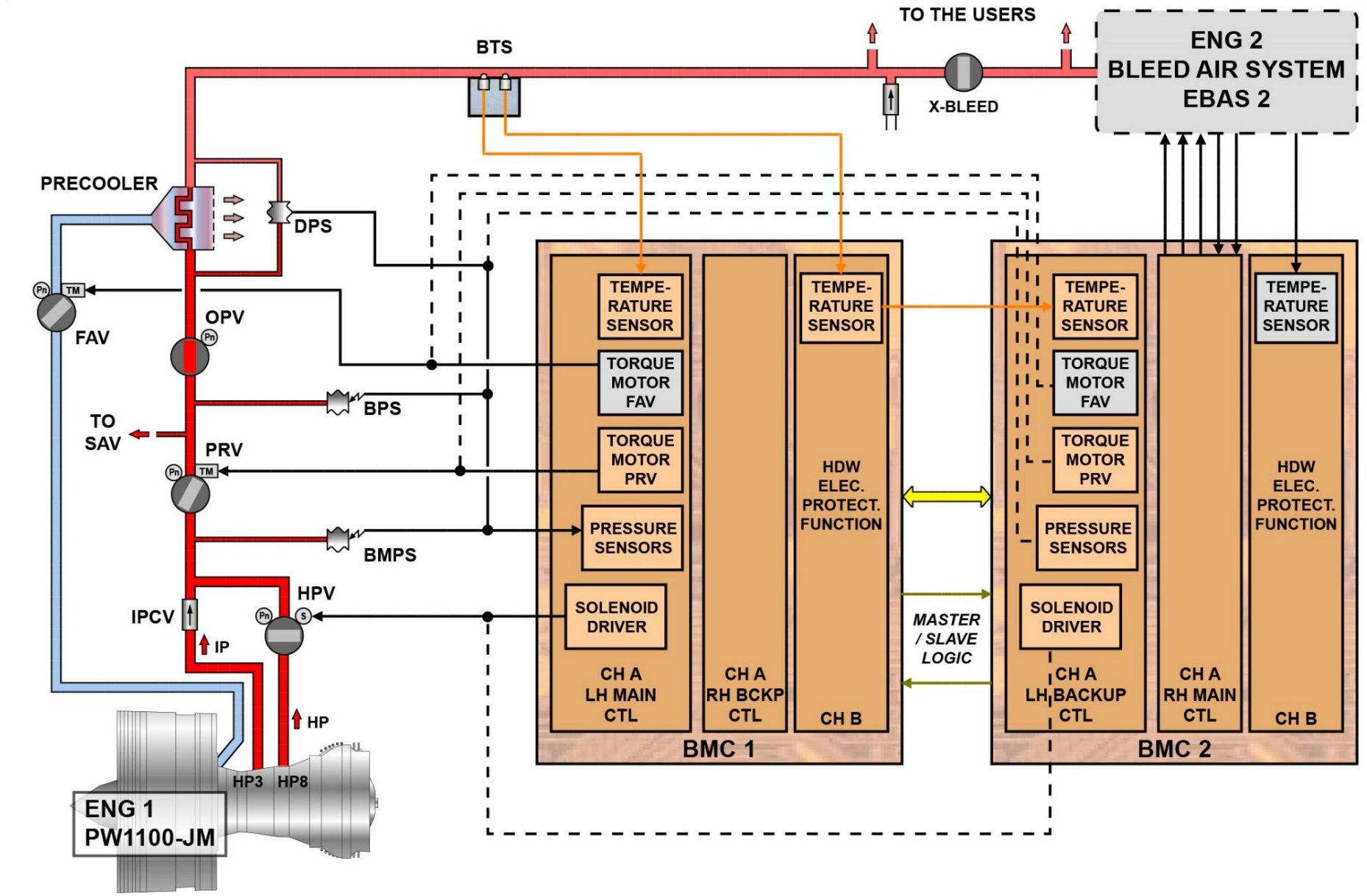
The BMC uses EBAS temperature to position the Fan Air Valve (FAV).

The wiring connected to channel A of the BTS is fully segregated from the wiring connected to channel B.

Both BMCs interchange temperature measurements and can carry out both sides temperature regulation.

This dual sensor is also used by the BMCs for system monitoring (overtemperature and low temperature alarms).

NOTE: Channel B of one BMC is connected to Channel A of the other BMC, so that in case of loss of temperature monitoring and control in Channel A of one side, the opposite controller can take over control of the whole EBAS.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
Pn
TM
FAV
OPV
Pn
BPS
TO
SAV
PRV
Pn
TM
BMPS
HPV
IPCV
Pn
S
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
TEMPE-
RATURE
SENSOR
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
TEMPE-
RATURE
SENSOR
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 2

TEMPERATURE REGULATION

FAN AIR VALVE (FAV)

The FAV pneumatically regulates the fan airflow to the Precooler for bleed air temperature regulation.

The FAV butterfly valve actuator rod is adjusted by the BMC via a torque motor servo-control depending on BTS input.

The BMC set point is 200°C (392°F) in normal operations and 160°C (320°F) in Climb and Hold with 2 bleeds and Wing Anti-Ice (WAI) off.

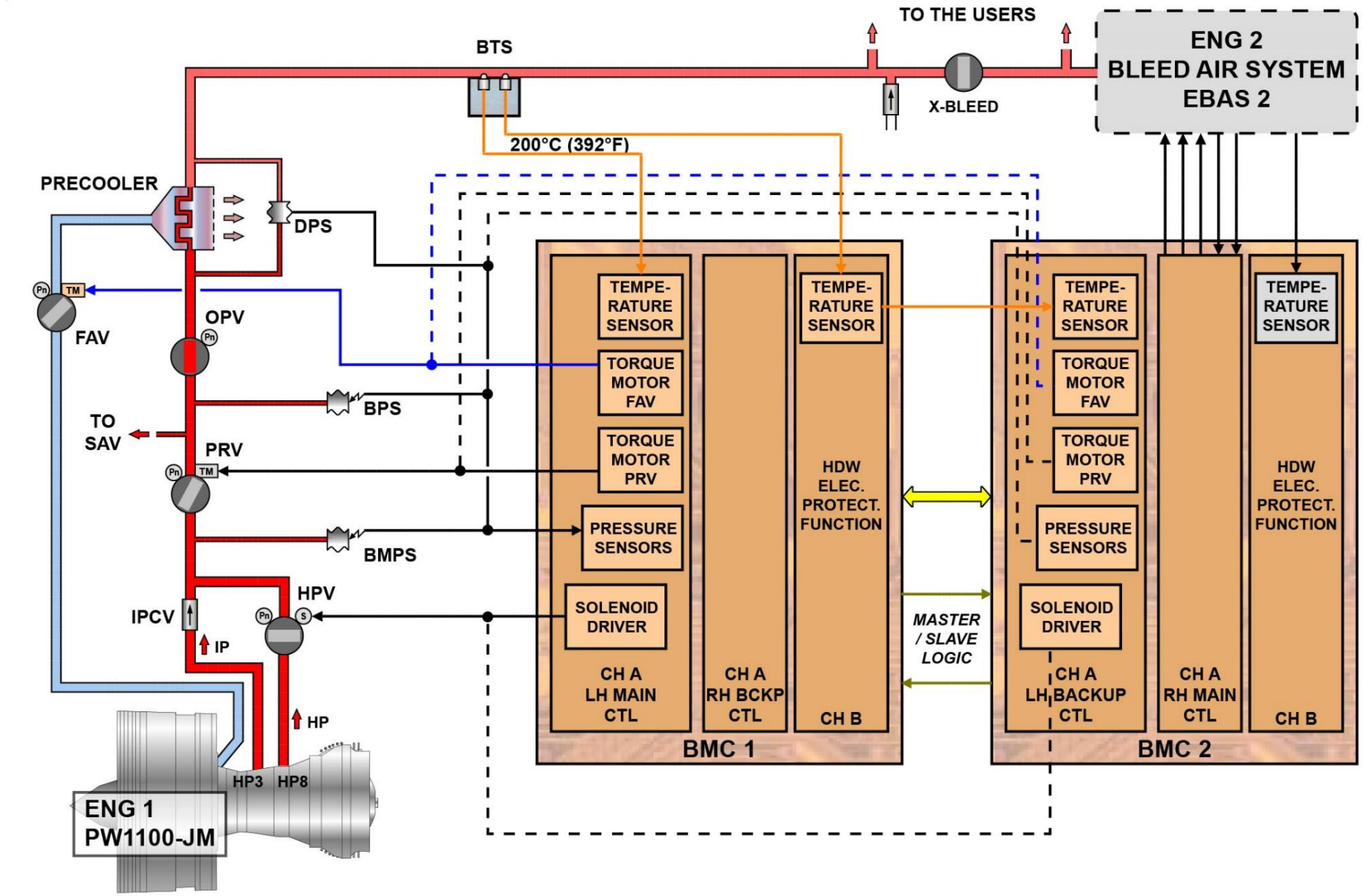
With no electrical power and enough muscle pressure, the FAV valve is fully open.

The valve has a test port for pneumatic test in-situ.

PRECOOLER EXCHANGER

The Precooler is a stainless steel and nickel alloy air-to-air heat exchanger.

It cools down the hot air supplied from the engine HP compressor stage by a heat exchange process with cooling flow taken from the engine fan.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
200°C (392°F)
PRECOOLER
DPS
FAV
OPV
BPS
TO
SAV
PRV
BMPS
HPV
IPCV
IP
HP
HP3
HP8
ENG 1
PW1100-JM
TEMPE-
RATURE
SENSOR
TORQUE
MOTOR
FAV
TORQUE
MOTOR
PRV
PRESSURE
SENSORS
SOLENOID
DRIVER
CH A
LH MAIN
CTL
CH A
RH BCKP
CTL
HDW
ELEC.
PROTECT.
FUNCTION
CH B
BMC 1
MASTER
/ SLAVE
LOGIC
CH A
LH BACKUP
CTL
CH A
RH MAIN
CTL
BMC 2

PROTECTION - ISOLATION

The PRV operates as a shut-off valve.

It is commanded to close in the following conditions:

Over-temperature downstream of the Precooler (BTS):

257°C (495°F) < T 270°C (518°F) during 55s,
270°C (518°F) < T 290°C (554°F) for 15s,
T > 290°C (554°F) for 5s.

Overpressure downstream of the PRV > 60 ± 3 psig at BPS,

Engine fire (consequence of crew action on the ENG FIRE P/B),

Leak detection in pylon/wing/fuselage ducts surrounding areas,

APU bleed valve not closed & APU BLEED P/B selected:

Depending on the Crossfeed Bleed Valve (CBV) position, only one PRV (left engine PRV if CBV is closed) or both (if X-Bleed is open).

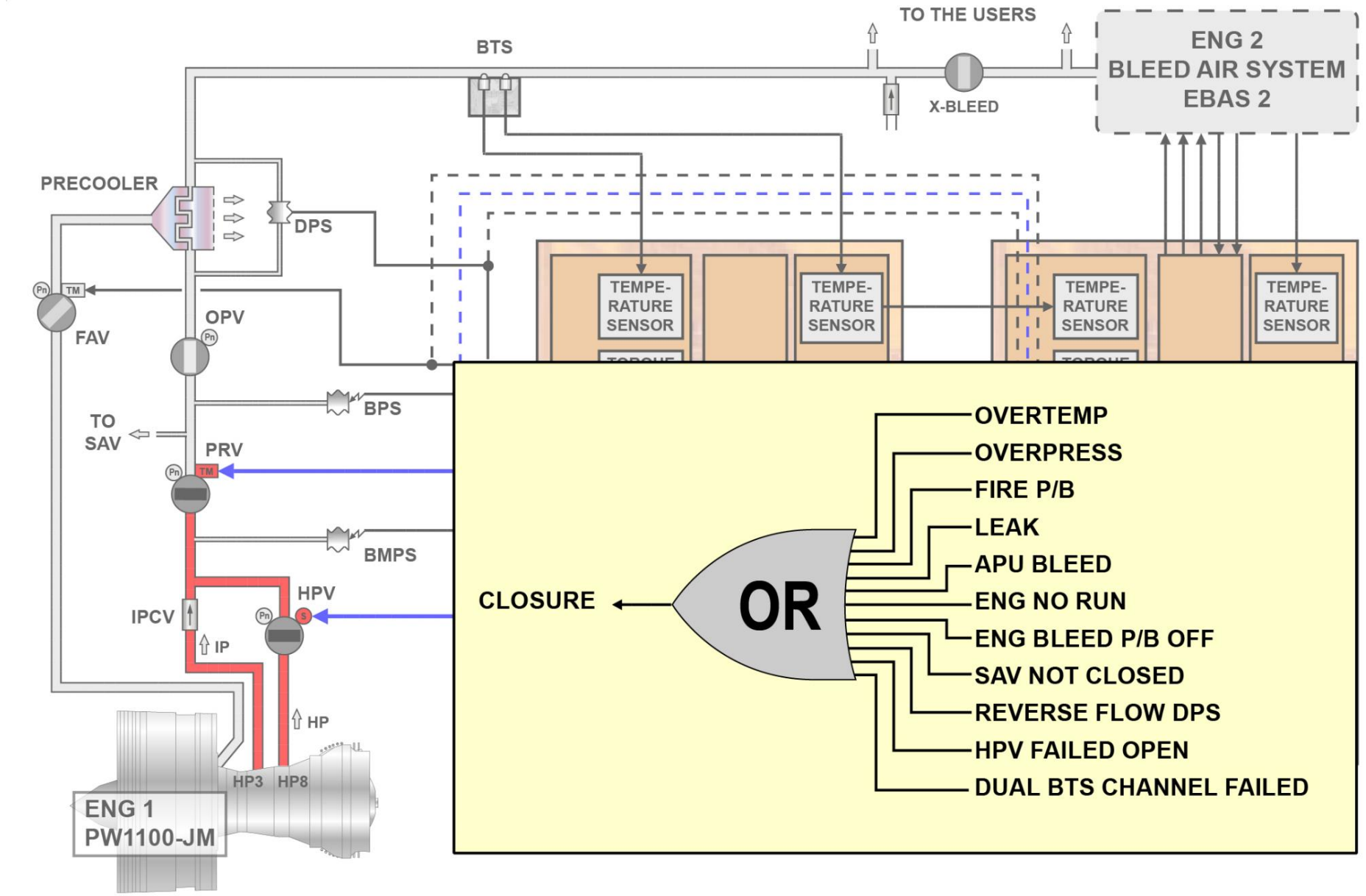
Reverse flow detected by DPS,

ENG BLEED P/B selected OFF or ENG not running,

Associated Starter Air Valve (SAV) not closed,

HPV failed open,

Dual BTS channels failed.


TO THE USERS
BTS
X-BLEED
ENG 2
BLEED AIR SYSTEM
EBAS 2
PRECOOLER
DPS
TEMPE-
RATURE
SENSOR
TEMPE-
RATURE
SENSOR
TEMPE-
RATURE
SENSOR
TEMPE-
RATURE
SENSOR
FAV
OPV
BPS
TO
SAV
PRV
BMPS
HPV
IPCV
IP
HP
HP3
HP8
ENG 1
PW1100-JM
CLOSURE
OR
OVERTEMP
OVERPRESS
FIRE P/B
LEAK
APU BLEED
ENG NO RUN
ENG BLEED P/B OFF
SAV NOT CLOSED
REVERSE FLOW DPS
HPV FAILED OPEN
DUAL BTS CHANNEL FAILED

APU BLEED AIR SPLY/X-BLEED SYSTEM

APU BLEED

The APU bleed air supplies the pneumatic system, through the APU bleed valve, if the APU is running.

The Bleed Load Valve for the APU GTCP 36-300A (GARRETT) and the Load Control Valve of Honeywell APU 131-9A are electrically controlled by the ECB (solenoid) and pneumatically operated.

In the absence of air pressure or electrical power, the valves are spring-loaded closed.

The APU Bleed Control Valve for the APIC APU is electrically controlled and fuel operated by a servo valve.

The Electronic Control Box (ECB) controls the servo valve and fuel muscle pressure opens or closes the APU bleed valve.

In the absence of fuel pressure or electrical power, the valve shuts off the bleed supply to the aircraft pneumatic system.

NOTE: These valves are of the ON/OFF type.

X-BLEED SYSTEM

The crossbleed (X-BLEED) valve is an electrically controlled shut-off valve operated by two electrical DC motors.

The X-BLEED valve is used to isolate or connect the left and right bleed air systems:

The primary motor is used for AUTOmatic mode. The Bleed Monitoring Computer (BMC) controls the position of the valve according to the APU bleed configuration,

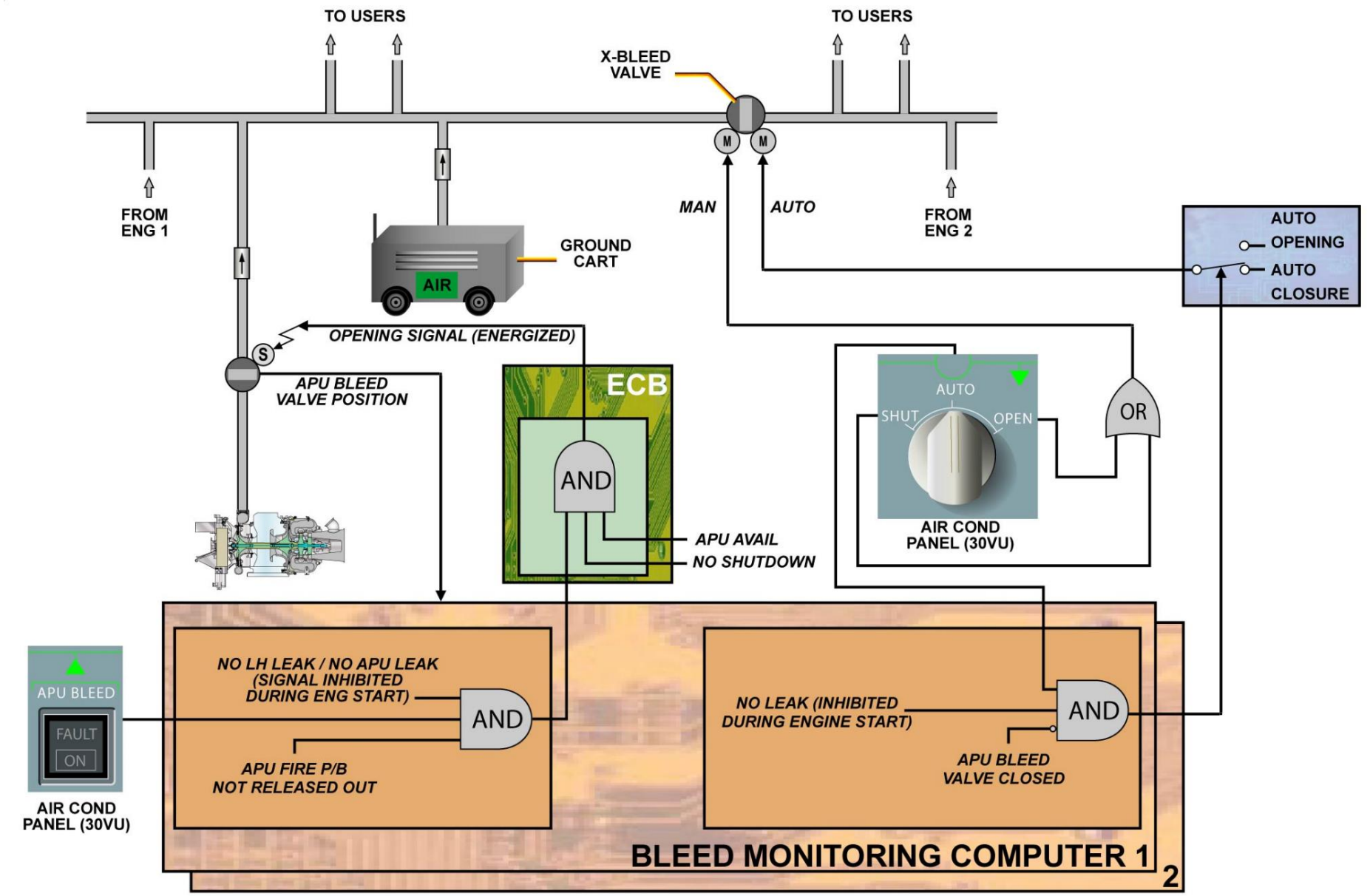
The secondary motor is used for manual operation. The X-BLEED selector on the overhead panel controls the position of the valve.

OPEN position is used for:

left and right pack supply using single engine bleed,
left and right Wing Anti-Ice supply using single engine bleed,
left and right pack supply using ground air supply,
Engine crossbleed start using opposite engine bleed,
Engine 2 start using ground air supply.

SHUT position is used to:

confirm automatic closure during bleed leak detection.


TO USERS
TO USERS
X-BLEED VALVE
M
M
FROM ENG 1
MAN
AUTO
FROM ENG 2
AUTO
OPENING
AUTO
CLOSURE
GROUND CART
AIR
OPENING SIGNAL (ENERGIZED)
S
APU BLEED VALVE POSITION
ECB
AND
APU AVAIL
NO SHUTDOWN
AUTO
SHUT
OPEN
OR
AIR COND PANEL (30VU)
APU BLEED
FAULT
ON
AIR COND PANEL (30VU)
NO LH LEAK / NO APU LEAK (SIGNAL INHIBITED DURING ENG START)
AND
APU FIRE P/B NOT RELEASED OUT
NO LEAK (INHIBITED DURING ENGINE START)
AND
APU BLEED VALVE CLOSED
BLEED MONITORING COMPUTER 1
2

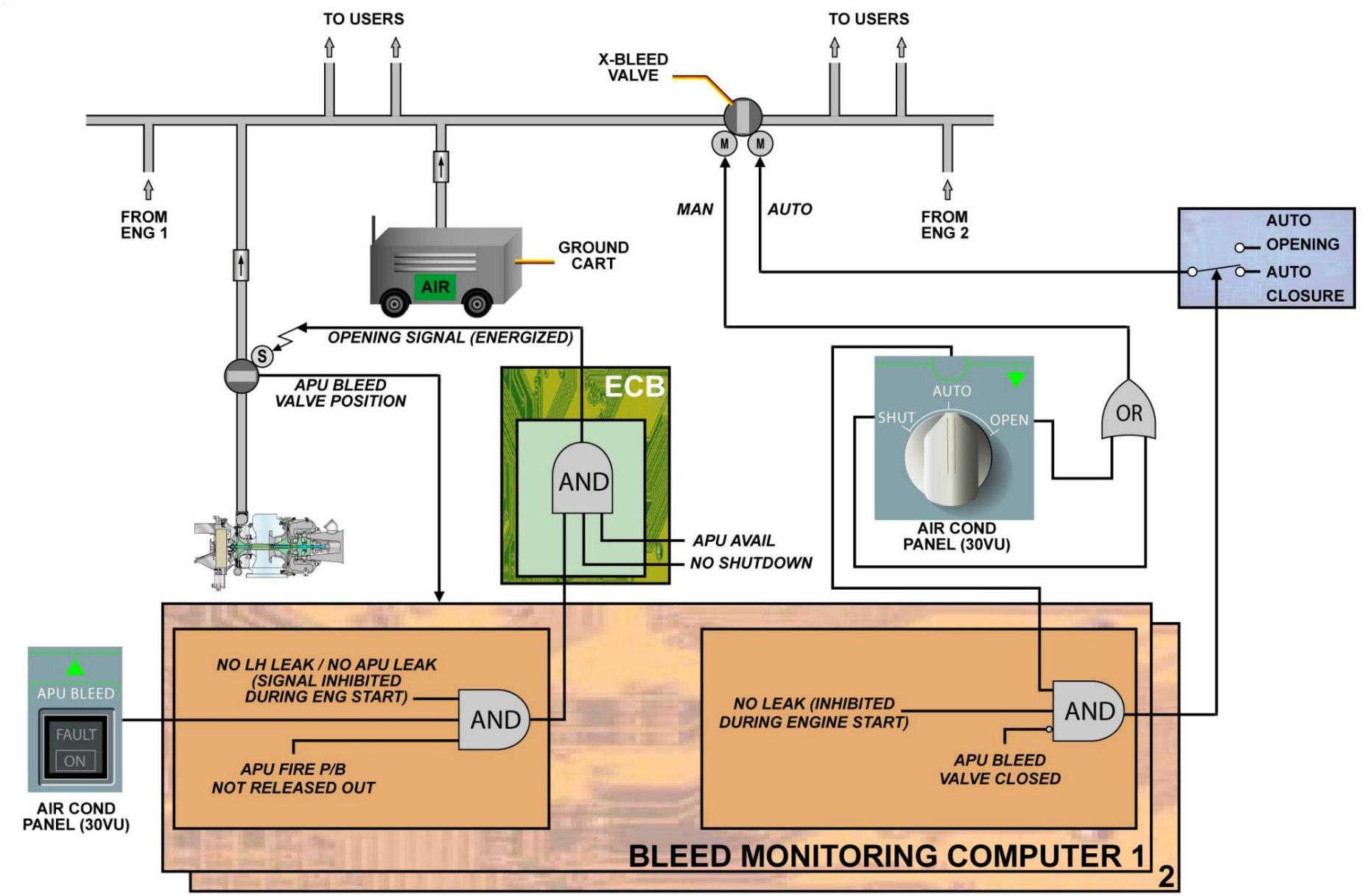
HP GROUND CONNECTION

A ground cart may supply the pneumatic system.

The supply duct is located on the left-hand side of the cross-bleed valve.

Only the LH bleed system is supplied.

When the X-BLEED selector is in the OPEN position, the ground air supply will be available to supply the LH and RH system together.

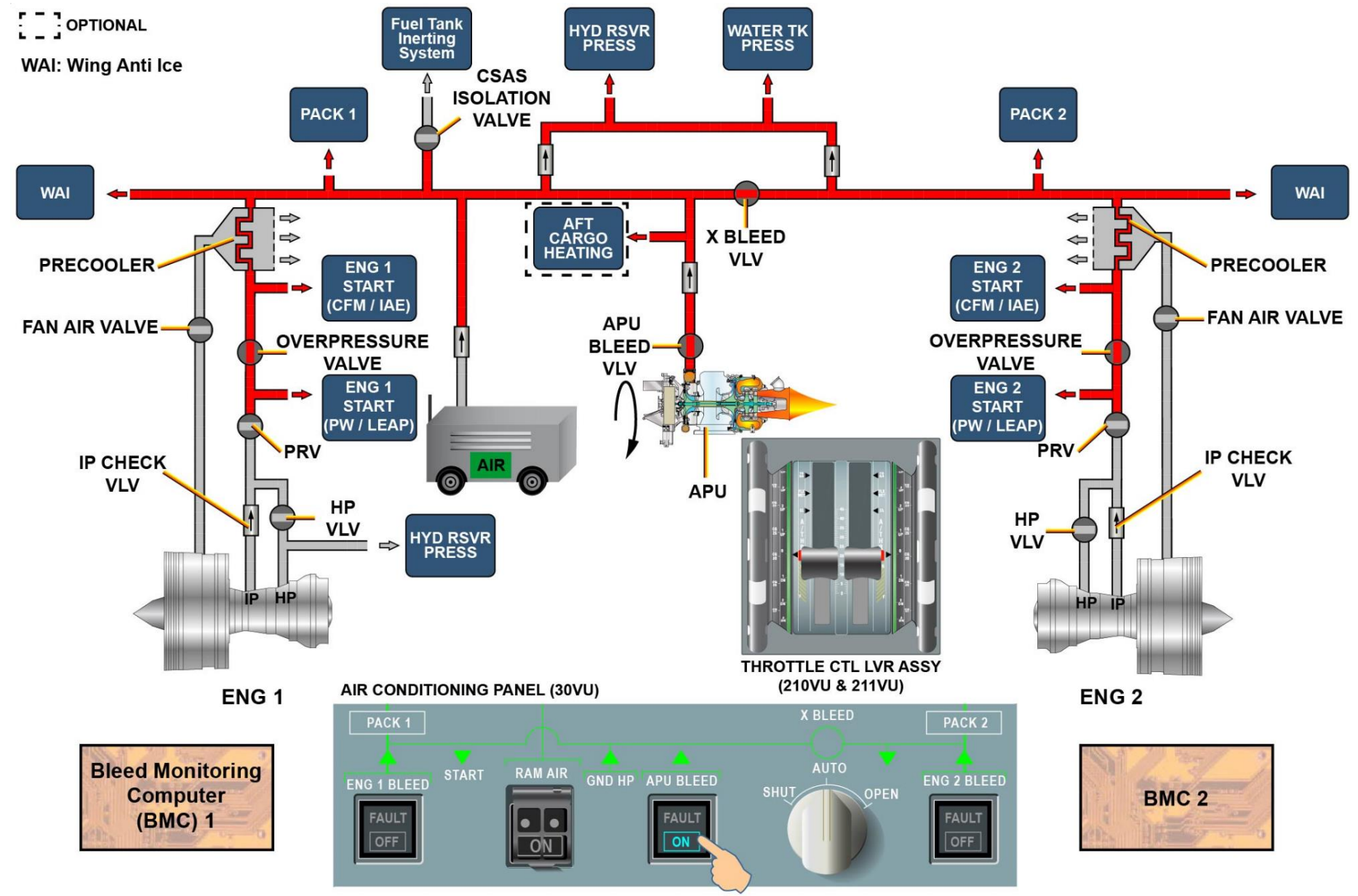

TO USERS
TO USERS
X-BLEED VALVE
M
M
FROM ENG 1
MAN
AUTO
FROM ENG 2
AUTO
OPENING
AUTO
CLOSURE
GROUND CART
AIR
OPENING SIGNAL (ENERGIZED)
S
APU BLEED VALVE POSITION
ECB
AND
APU AVAIL
NO SHUTDOWN
AUTO
SHUT
OPEN
OR
AIR COND PANEL (30VU)
APU BLEED
FAULT
ON
AIR COND PANEL (30VU)
NO LH LEAK / NO APU LEAK (SIGNAL INHIBITED DURING ENG START)
AND
APU FIRE P/B NOT RELEASED OUT
NO LEAK (INHIBITED DURING ENGINE START)
AND
APU BLEED VALVE CLOSED
BLEED MONITORING COMPUTER 1
2

PNEUMATIC SYSTEM OPERATION

APU AIR BLEED SELECTION

Let's see the different pneumatic system configuration.

When the APU runs and the APU BLEED P/BSW is selected in the ON position, the APU bleed valve opens, the Pressure Regulator Valves (PRVs) are maintained electrically closed and the X BLEED valve is automatically opened, provided the X BLEED valve selector is in the AUTOmatic position.

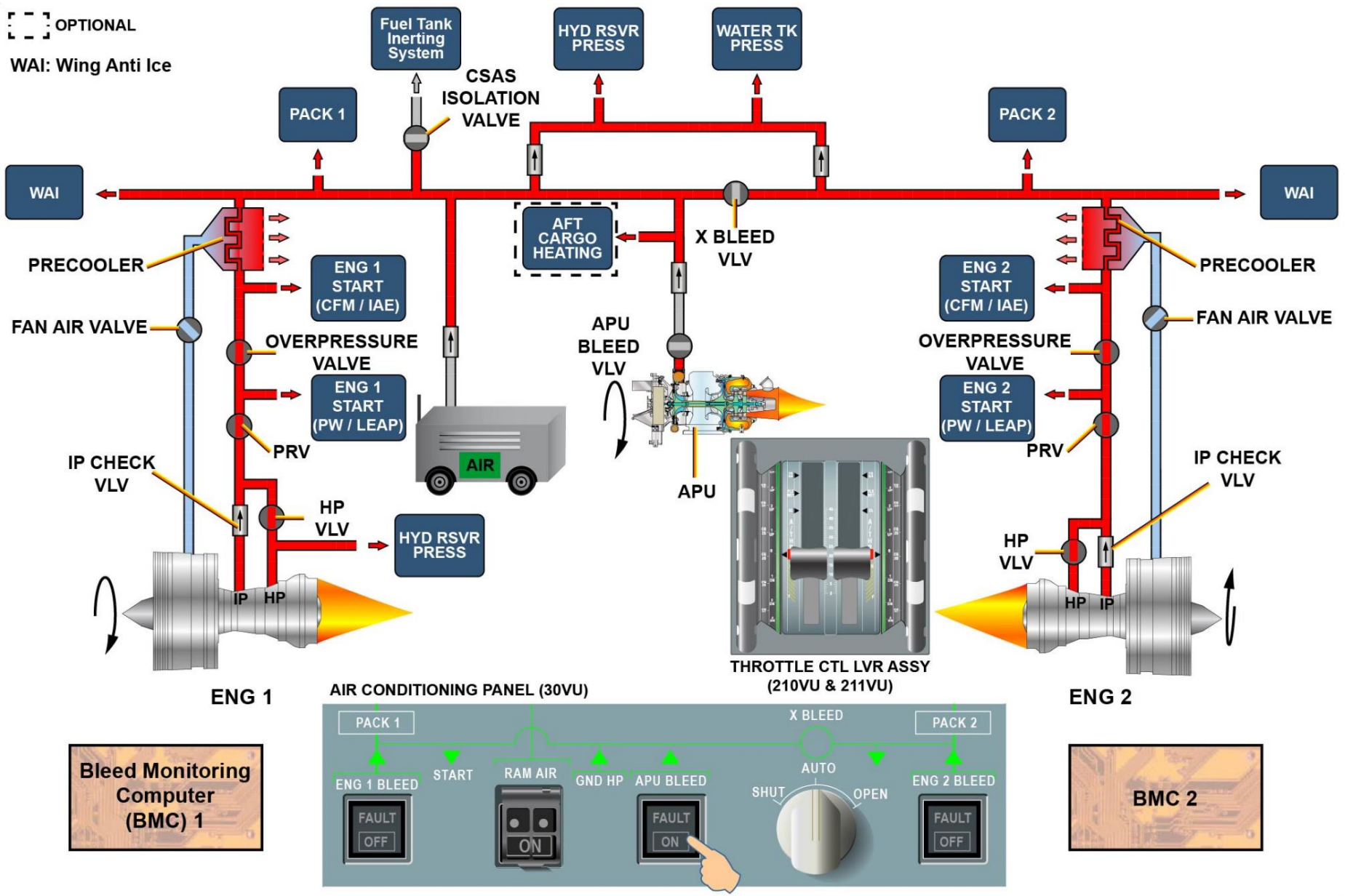

OPTIONAL
WAI: Wing Anti Ice
Fuel Tank Inerting System
HYD RSVR PRESS
WATER TK PRESS
CSAS ISOLATION VALVE
PACK 1
PACK 2
WAI
WAI
AFT CARGO HEATING
X BLEED VLV
PRECOOLER
PRECOOLER
ENG 1 START (CFM / IAE)
ENG 2 START (CFM / IAE)
FAN AIR VALVE
FAN AIR VALVE
OVERPRESSURE VALVE
OVERPRESSURE VALVE
APU BLEED VLV
ENG 1 START (PW / LEAP)
ENG 2 START (PW / LEAP)
PRV
PRV
IP CHECK VLV
IP CHECK VLV
AIR
APU
HP VLV
HP VLV
HYD RSVR PRESS
IP
HP
HP
IP
THROTTLE CTL LVR ASSY (210VU & 211VU)
ENG 1
ENG 2
AIR CONDITIONING PANEL (30VU)
PACK 1
X BLEED
PACK 2
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
ON
FAULT
OFF
Bleed Monitoring Computer (BMC) 1
BMC 2

ENGINE AIR BLEED SELECTION

When one or both engines run, the APU continues to supply air as long as the APU bleed valve remains open.

Each PRV is commanded electrically closed by the Bleed Monitoring Computer (BMC).

When the APU BLEED valve P/BSW is released out, the APU bleed valve closes, the X BLEED valve closes automatically and the PRVs open.

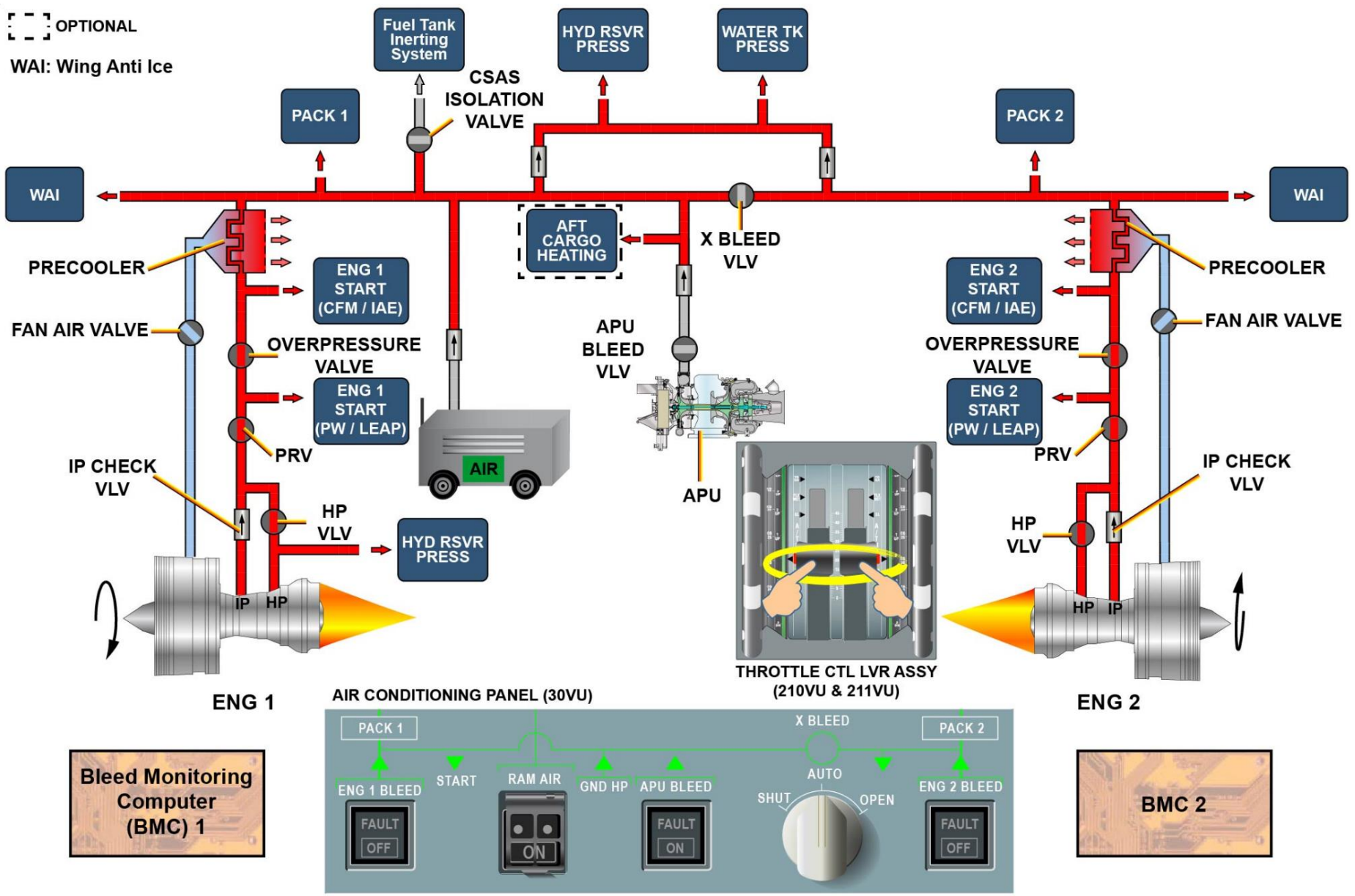

OPTIONAL
WAI: Wing Anti Ice
Fuel Tank Inerting System
HYD RSVR PRESS
WATER TK PRESS
CSAS ISOLATION VALVE
PACK 1
PACK 2
WAI
WAI
AFT CARGO HEATING
X BLEED VLV
PRECOOLER
PRECOOLER
ENG 1 START (CFM / IAE)
ENG 2 START (CFM / IAE)
FAN AIR VALVE
FAN AIR VALVE
OVERPRESSURE VALVE
OVERPRESSURE VALVE
APU BLEED VLV
ENG 1 START (PW / LEAP)
ENG 2 START (PW / LEAP)
PRV
PRV
IP CHECK VLV
IP CHECK VLV
AIR
APU
HP VLV
HP VLV
HYD RSVR PRESS
IP
HP
HP
IP
THROTTLE CTL LVR ASSY (210VU & 211VU)
ENG 1
ENG 2
AIR CONDITIONING PANEL (30VU)
PACK 1
X BLEED
PACK 2
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
ON
FAULT
OFF
Bleed Monitoring Computer (BMC) 1
BMC 2

HP/IP ENGINE STAGE PRIORITY

The APU is shut down and both engines are running.

THROTTLE LEVERS IN IDLE POSITION

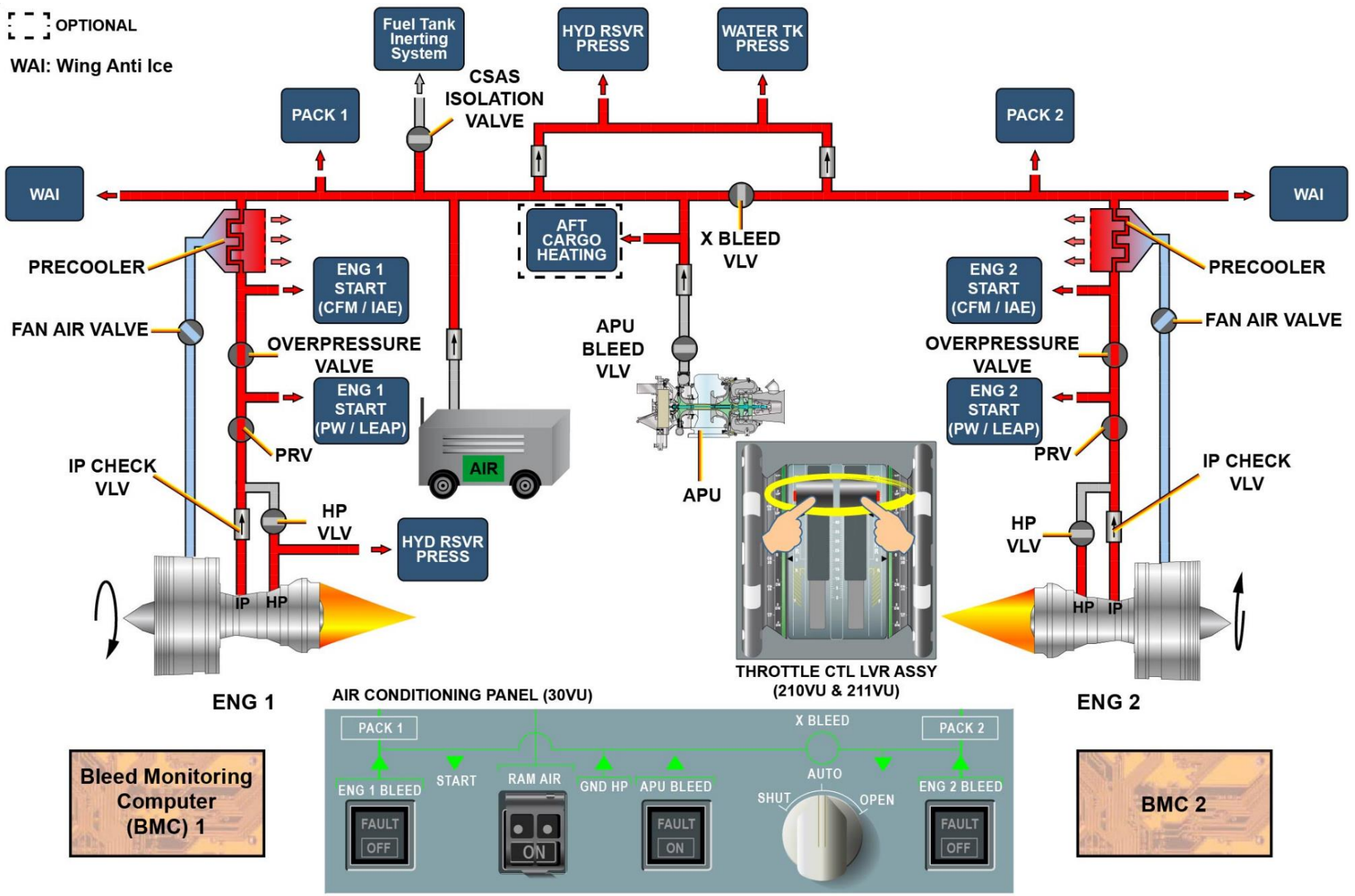
With both throttle levers in the idle position, the HP (High Pressure) Valves (VLVs) are open and supplying air.


OPTIONAL
WAI: Wing Anti Ice
Fuel Tank Inerting System
HYD RSVR PRESS
WATER TK PRESS
CSAS ISOLATION VALVE
PACK 1
PACK 2
WAI
WAI
AFT CARGO HEATING
X BLEED VLV
PRECOOLER
PRECOOLER
ENG 1 START (CFM / IAE)
ENG 2 START (CFM / IAE)
FAN AIR VALVE
FAN AIR VALVE
OVERPRESSURE VALVE
OVERPRESSURE VALVE
APU BLEED VLV
ENG 1 START (PW / LEAP)
ENG 2 START (PW / LEAP)
PRV
PRV
IP CHECK VLV
IP CHECK VLV
HP VLV
HP VLV
HYD RSVR PRESS
AIR
APU
IP
HP
HP
IP
THROTTLE CTL LVR ASSY (210VU & 211VU)
ENG 1
ENG 2
AIR CONDITIONING PANEL (30VU)
PACK 1
X BLEED
PACK 2
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
ON
FAULT
OFF
Bleed Monitoring Computer (BMC) 1
BMC 2

THROTTLE LEVERS IN TAKE-OFF POSITION

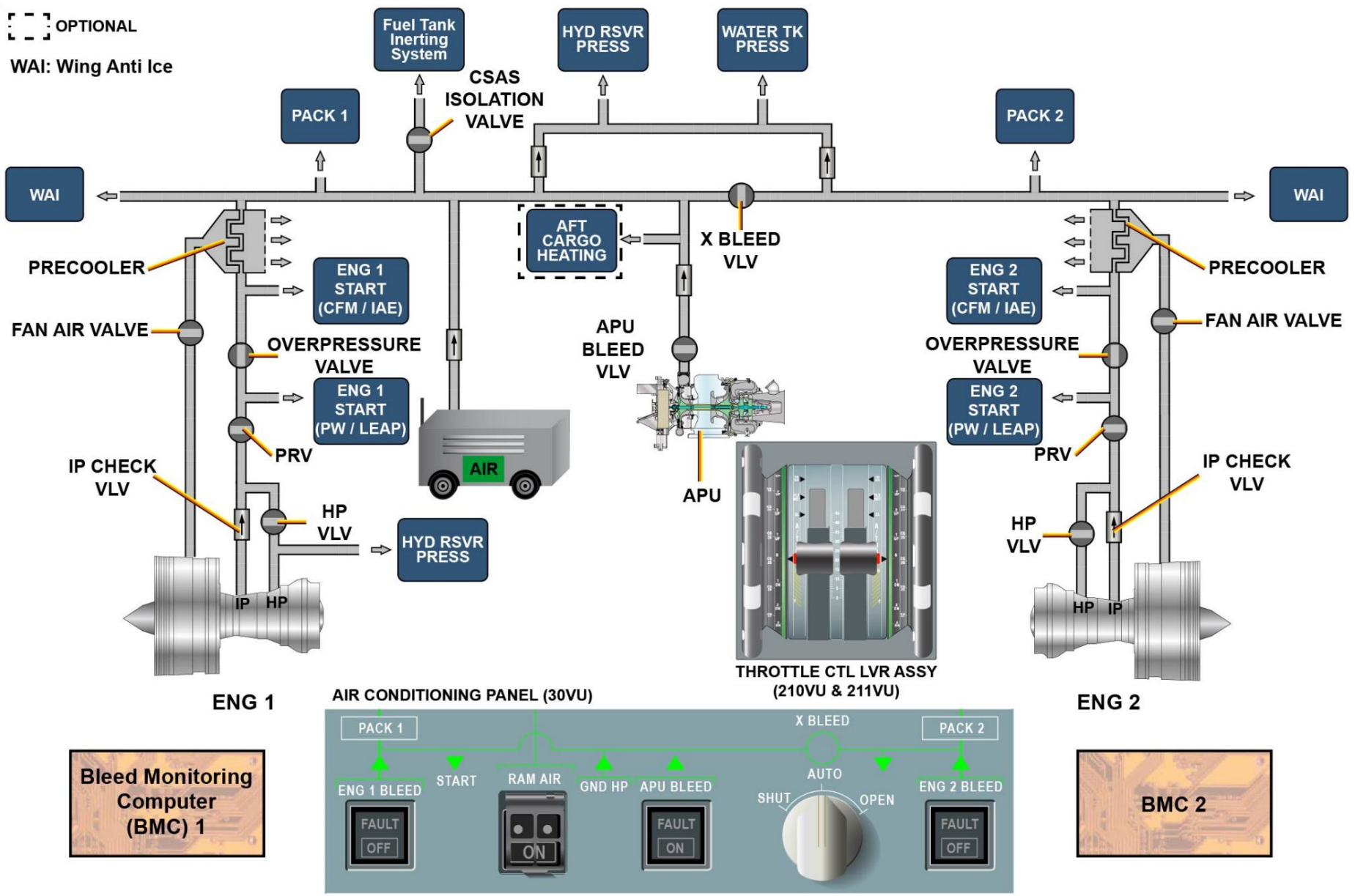
When the power of the engines is increased to the Take-off (TO) position, the HP VLV is closed, and the bleed air is supplied by the Intermediate Pressure (IP) stage.

NOTE: Note: if you set again the throttle levers in the idle position, the HP VLV opens again.


OPTIONAL
WAI: Wing Anti Ice
Fuel Tank Inerting System
HYD RSVR PRESS
WATER TK PRESS
CSAS ISOLATION VALVE
PACK 1
PACK 2
WAI
WAI
AFT CARGO HEATING
X BLEED VLV
PRECOOLER
PRECOOLER
ENG 1 START (CFM / IAE)
ENG 2 START (CFM / IAE)
FAN AIR VALVE
FAN AIR VALVE
OVERPRESSURE VALVE
OVERPRESSURE VALVE
APU BLEED VLV
ENG 1 START (PW / LEAP)
ENG 2 START (PW / LEAP)
PRV
PRV
AIR
IP CHECK VLV
IP CHECK VLV
HP VLV
HP VLV
HYD RSVR PRESS
APU
IP
HP
HP
IP
THROTTLE CTL LVR ASSY (210VU & 211VU)
ENG 1
ENG 2
AIR CONDITIONING PANEL (30VU)
PACK 1
X BLEED
PACK 2
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
ON
FAULT
OFF
Bleed Monitoring Computer (BMC) 1
BMC 2

ENGINES SHUT DOWN

When the engines are shut down, the PRV, Fan Air Valve (FAV) and HP VLV are spring-loaded closed due to the lack of air pressure.


OPTIONAL
WAI: Wing Anti Ice
Fuel Tank Inerting System
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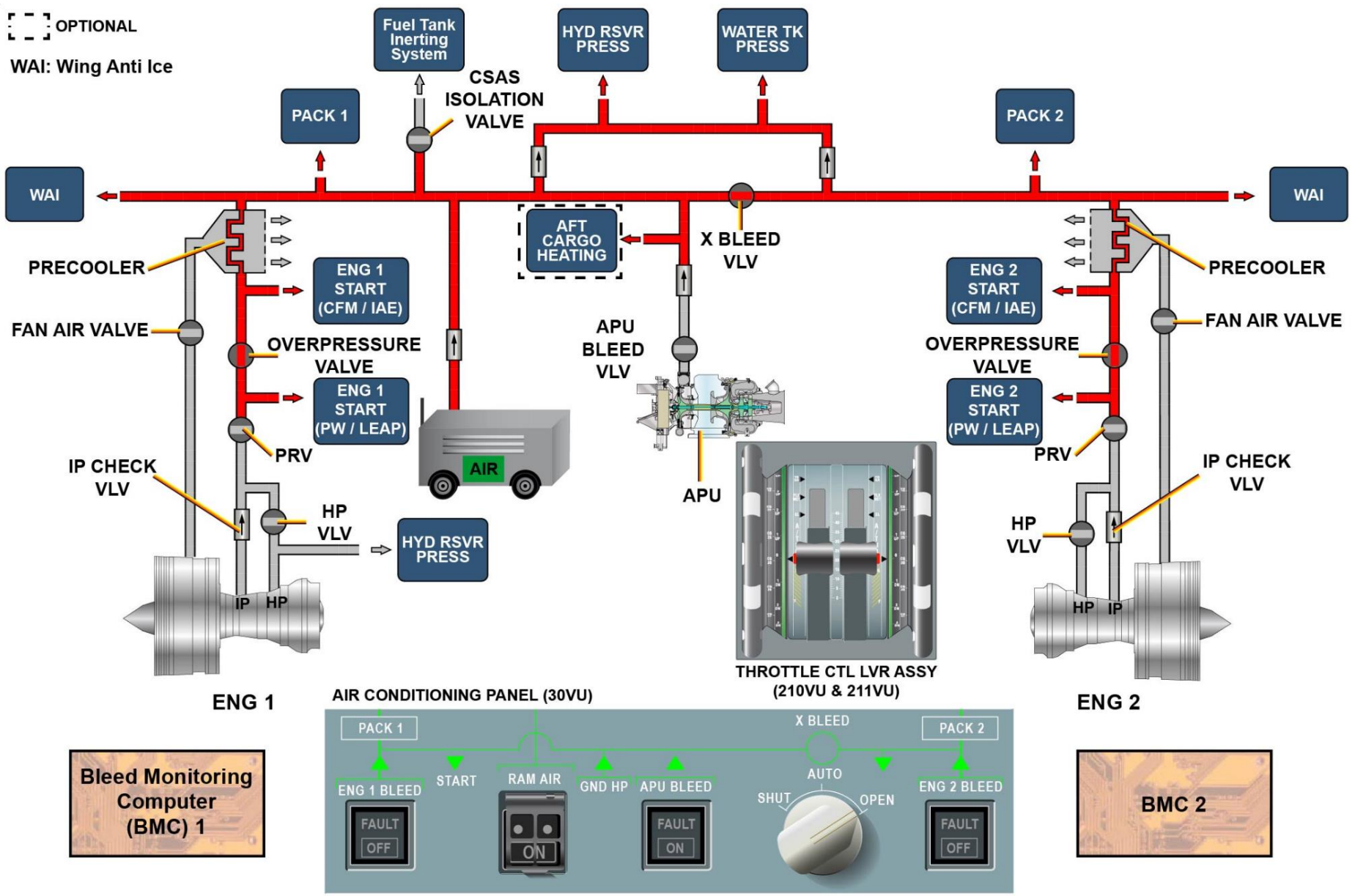
WATER TK PRESS
CSAS ISOLATION VALVE
PACK 1
PACK 2
WAI
WAI
AFT CARGO HEATING
X BLEED VLV
PRECOOLER
PRECOOLER
ENG 1 START (CFM / IAE)
ENG 2 START (CFM / IAE)
FAN AIR VALVE
FAN AIR VALVE
OVERPRESSURE VALVE
OVERPRESSURE VALVE
APU BLEED VLV
ENG 1 START (PW / LEAP)
ENG 2 START (PW / LEAP)
PRV
PRV
AIR
IP CHECK VLV
IP CHECK VLV
HP VLV
HP VLV
HYD RSVR PRESS
APU
IP
HP
HP
IP
THROTTLE CTL LVR ASSY (210VU & 211VU)
ENG 1
ENG 2
AIR CONDITIONING PANEL (30VU)
PACK 1
X BLEED
PACK 2
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
ON
FAULT
OFF
Bleed Monitoring Computer (BMC) 1
BMC 2

GROUND AIR SUPPLY

The ground air supply is provided by a ground air cart connected to the HP ground connector.

Only the LH bleed system is supplied. When the X BLEED valve selector is selected in the OPEN position, the ground air supply is available to feed the LH and RH bleed system.


OPTIONAL
WAI: Wing Anti Ice
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WATER TK PRESS
CSAS ISOLATION VALVE
PACK 1
PACK 2
WAI
WAI
AFT CARGO HEATING
X BLEED VLV
PRECOOLER
PRECOOLER
ENG 1 START (CFM / IAE)
ENG 2 START (CFM / IAE)
FAN AIR VALVE
FAN AIR VALVE
OVERPRESSURE VALVE
OVERPRESSURE VALVE
APU BLEED VLV
ENG 1 START (PW / LEAP)
ENG 2 START (PW / LEAP)
PRV
PRV
AIR
IP CHECK VLV
IP CHECK VLV
HP VLV
HP VLV
HYD RSVR PRESS
APU
IP
HP
HP
IP
THROTTLE CTL LVR ASSY (210VU & 211VU)
ENG 1
ENG 2
AIR CONDITIONING PANEL (30VU)
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X BLEED
PACK 2
ENG 1 BLEED
START
RAM AIR
GND HP
APU BLEED
AUTO
SHUT
OPEN
ENG 2 BLEED
FAULT
OFF
ON
FAULT
ON
FAULT
OFF
Bleed Monitoring Computer (BMC) 1
BMC 2

BMC INTERFACES (PW1100G)

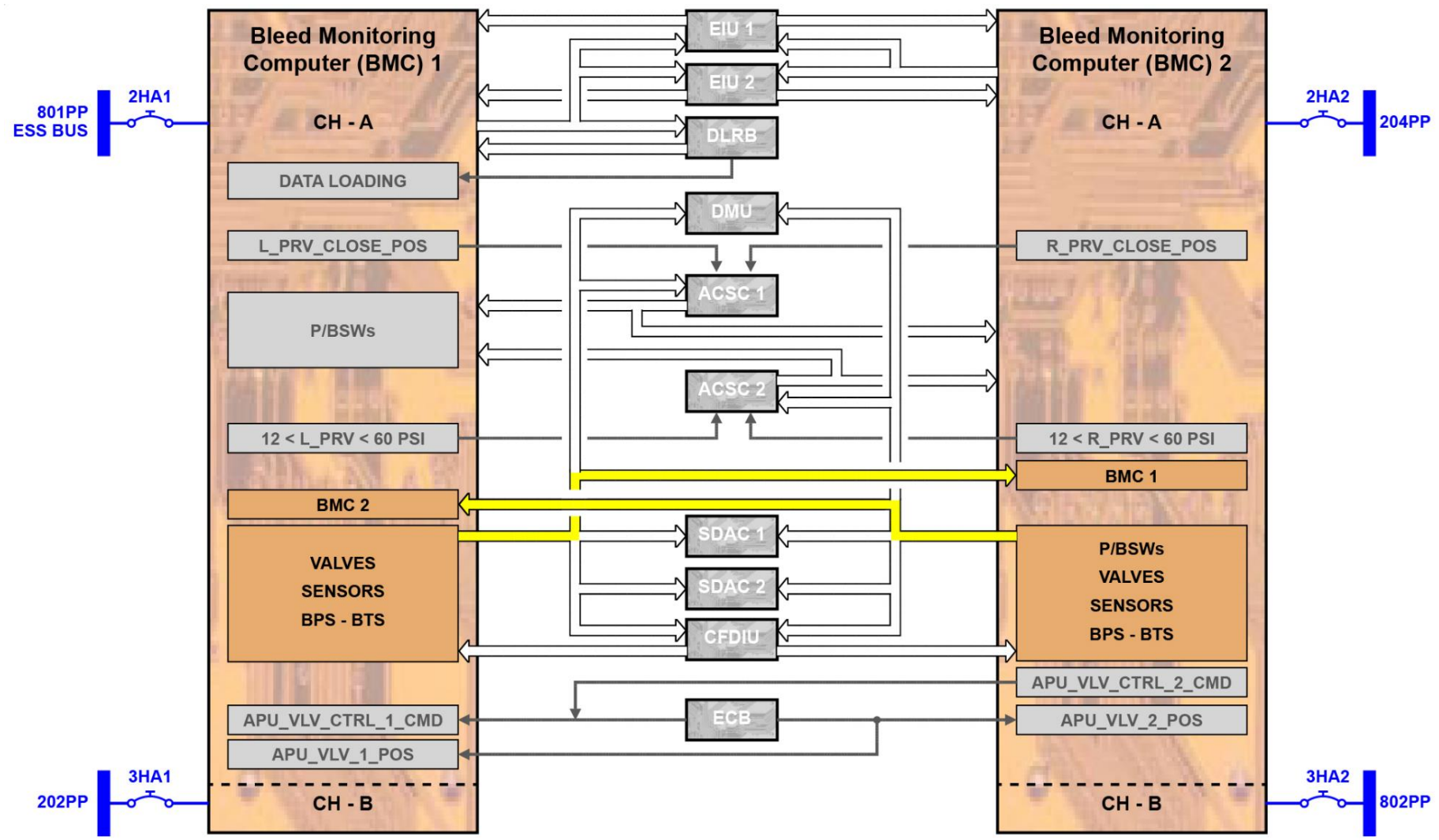
BMC

The pneumatic system uses 2 identical controllers with a microprocessor and command channel A and a back-up channel B.

Each channel is supplied by a different 28V DC bus bar.

Both Bleed Monitoring Computers (BMCs) will work as MASTER/SLAVE so long as the ARINC429 cross communication is working properly.

If one ARINC429 bus is lost from one BMC to the other, the BMC receiving no data will take over control and would inform to the opposite BMC.



ACSC: Air Conditioning System Controller
APU: Auxiliary Power Unit
BPS: Bleed Pressure Sensor
BTS: Bleed Temperature Sensor
CFDIU: Centralized Fault Display Interface Unit

CMD: Command
CTRL: Control
DLRB: Data Loading Routing Box
DMU: Data Management Unit
ECB: Electronic Control Box

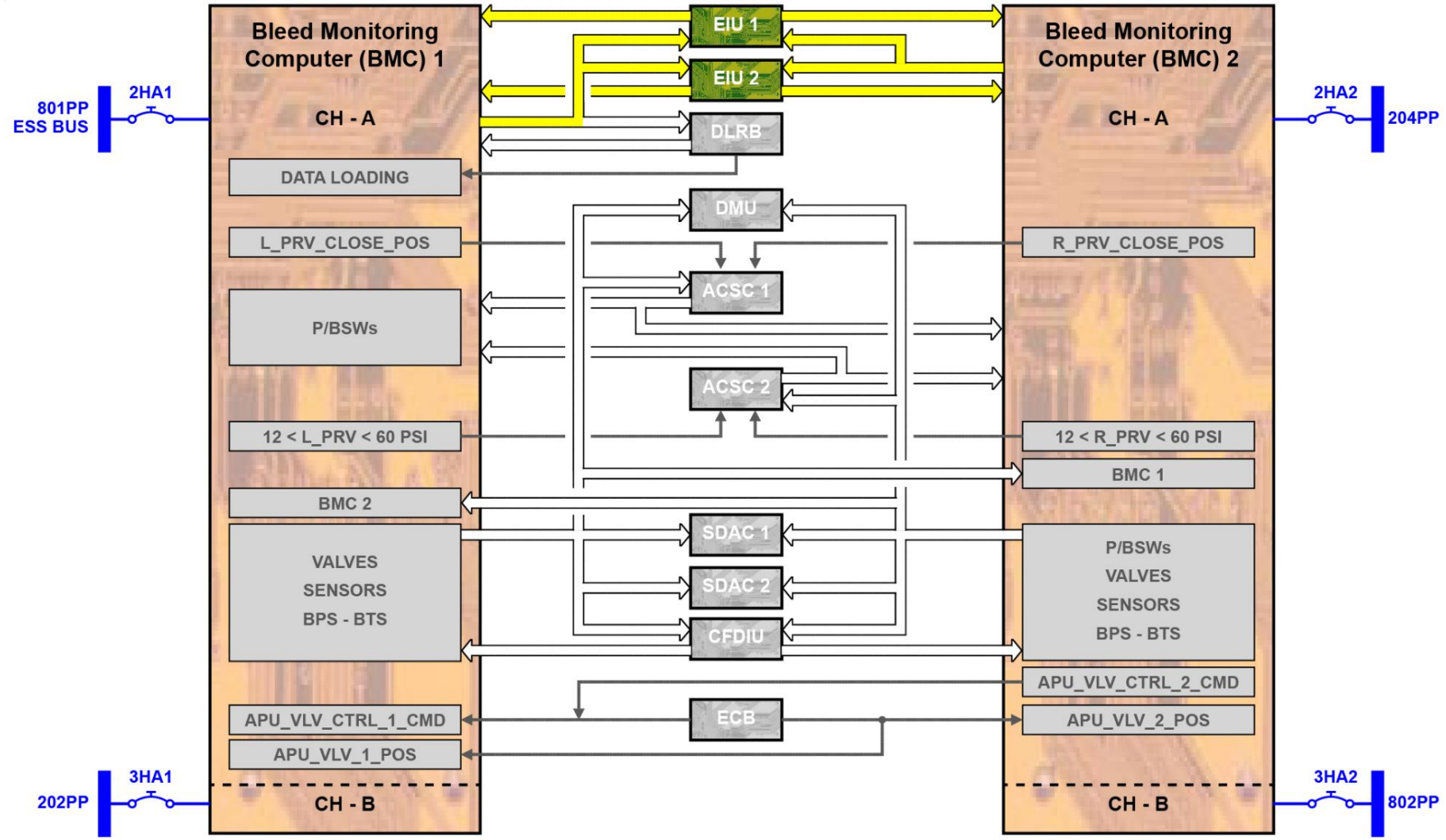
EIU: Engine Interface Unit
PRV: Pressure Regulating Valve
SDAC: System Data Acquisition Concentrator
VLV: Valve

EIU

The Propulsion Control System (PCS) informs both BMCs via both Engine Interface Units (EIUs) when engines start/run.

The Electronic Engine Control (EEC) will need information relative to the Aircraft Environmental Control System (ECS) from the EIU ARINC data bus as system bleed pressure, bleed and anti-ice configuration.

The EIUs receive positions of ENG BLEED P/Bs ON, APU BLEED P/B OFF, Crossbleed valve status.



ACSC: Air Conditioning System Controller
APU: Auxiliary Power Unit
BPS: Bleed Pressure Sensor
BTS: Bleed Temperature Sensor
CFDIU: Centralized Fault Display Interface Unit
CMD: Command
CTRL: Control
DLRB: Data Loading Routing Box
DMU: Data Management Unit
ECB: Electronic Control Box
EIU: Engine Interface Unit
PRV: Pressure Regulating Valve
SDAC: System Data Acquisition Concentrator
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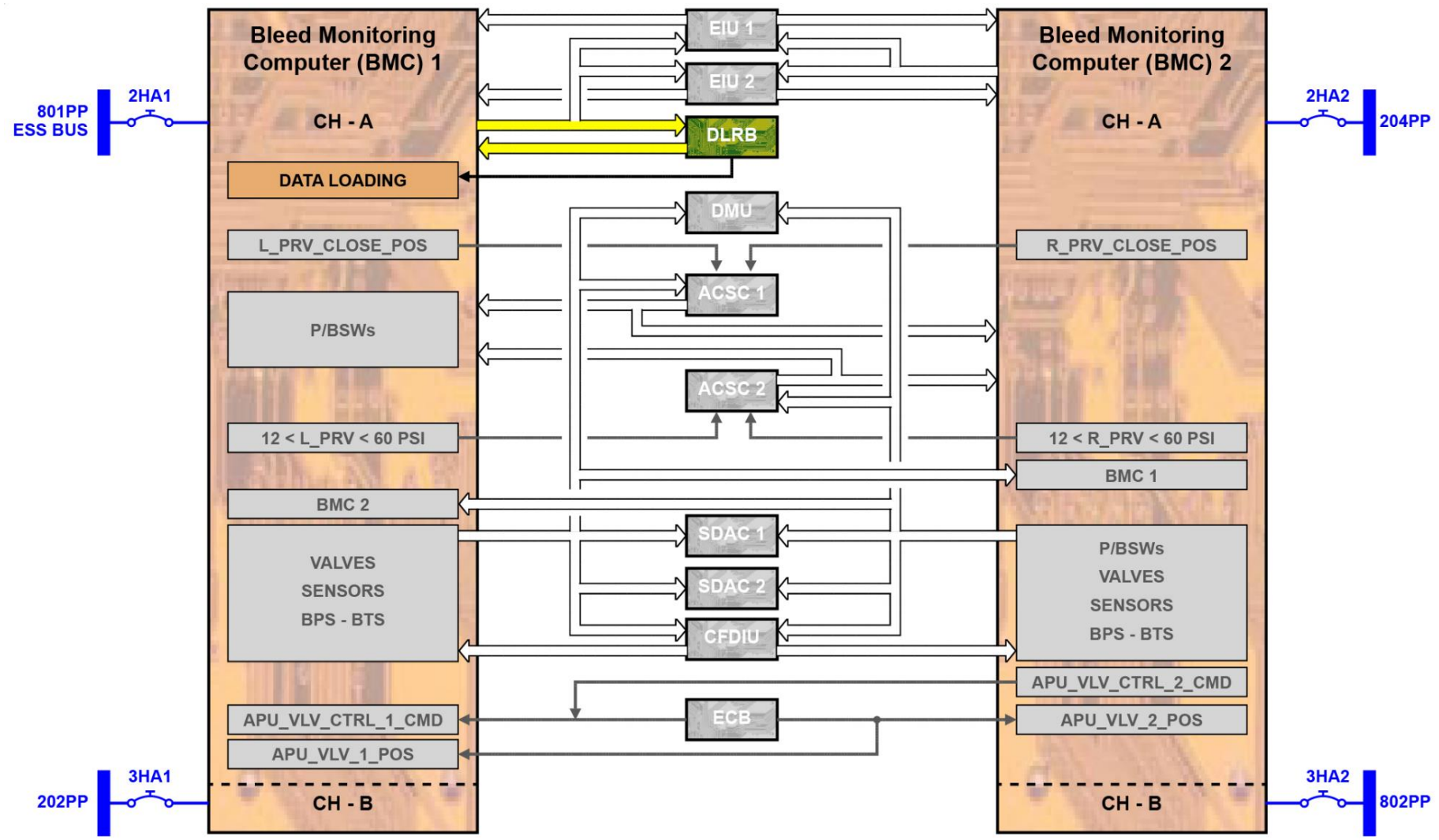
DATA LOADING

The up and down data loading system is an interface between the onboard computers as BMCs and the ground-based data processing stations.

For data loading purposes, the BMC 1 Channel A is connected to Data Loading Routing Box (DLRB).

The BMC 2 Channel A will be loaded through BMC 1 Channel A.

The BMC 2 will be uploaded through the crosstalk bus from the BMC 1 once the BMC 1 has been fully uploaded from the data loader.



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ACSC

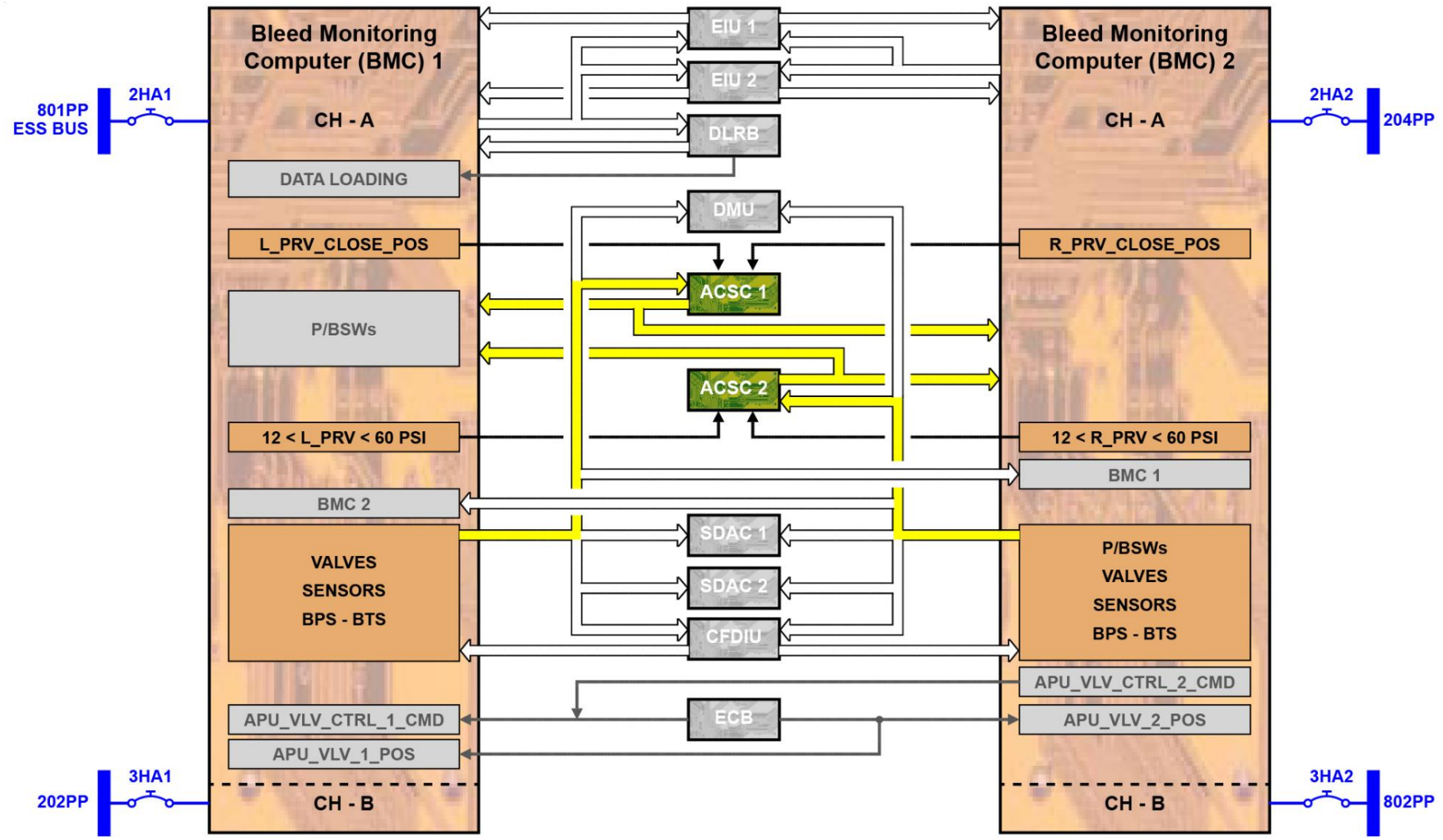
The BMC inform the Air Conditioning System Controller (ACSC) on the precooler outlet temperature for pack flow calculation.

The bleed pressure Sensor (BPS) and the wired Crossbleed valve position are used for Pack Inlet Pressure Sensor (PIPS) monitoring.

The BMC send a discrete input of its Pressure Regulating Valve (PRV) position.

Another discrete signal informs about the precooler delivered bleed pressure.

The ACSCs input the BMCs for Pack 1/2 P/B SW position, Pack Inlet Pressure and wing anti-ice valves position.



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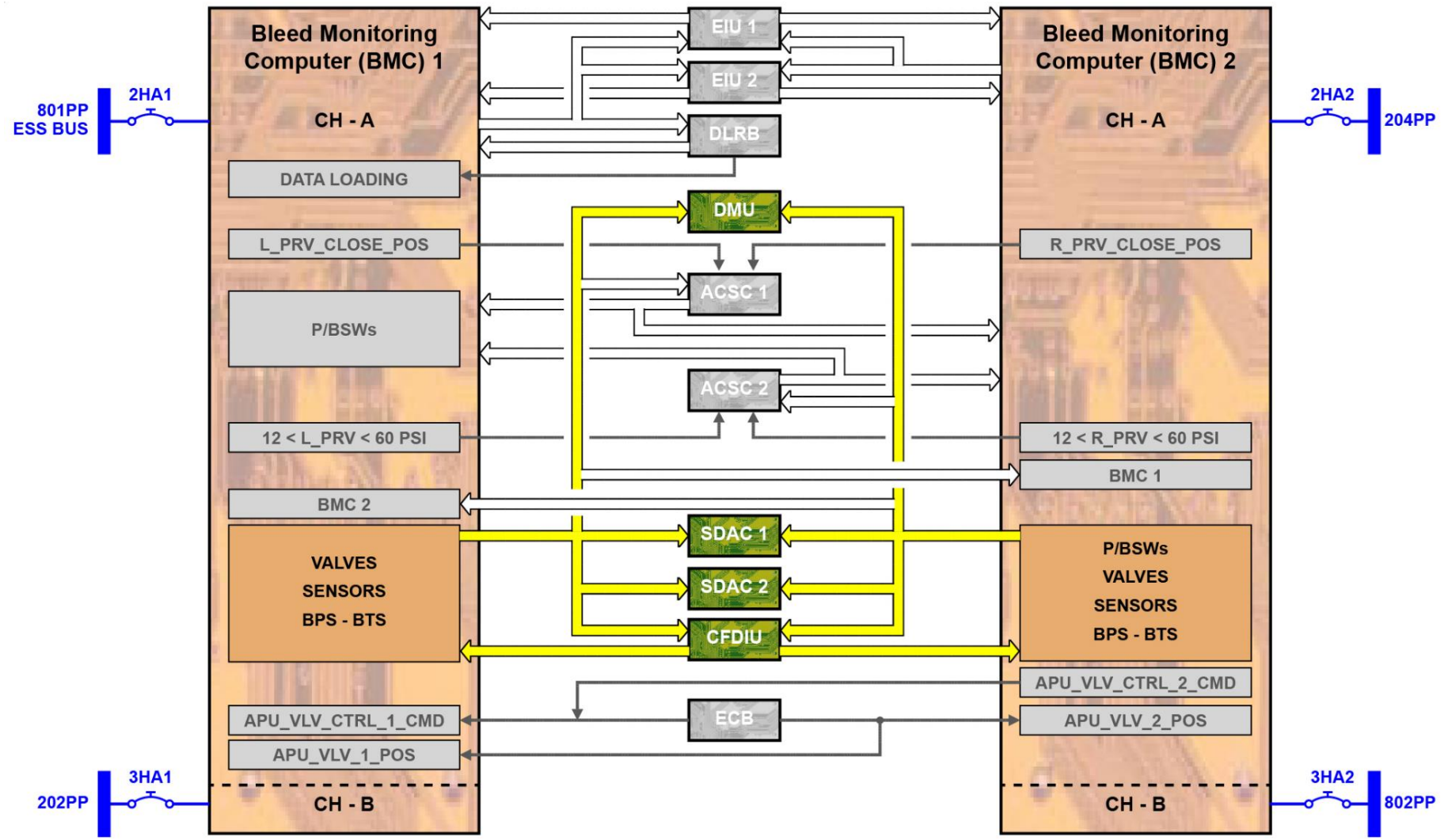
DISPLAY

The BMCs 1 and 2 transmit ARINC signals to the System Data Acquisition Concentrator (SDAC) for monitoring, fault indication, warning and data recording purposes by the Flight Warning Computer (FWC), Electronic Instrument System (EIS) and Digital Flight Data Recording System (DFDRS).

The Centralized Fault Display Interface Unit (CFDIU) is connected to the BITE of the BMCs to centralize the pneumatic system data for maintenance via the Multipurpose Control and Display Units (MCDUs), printer and Aircraft Communication Addressing and Reporting System (ACARS).



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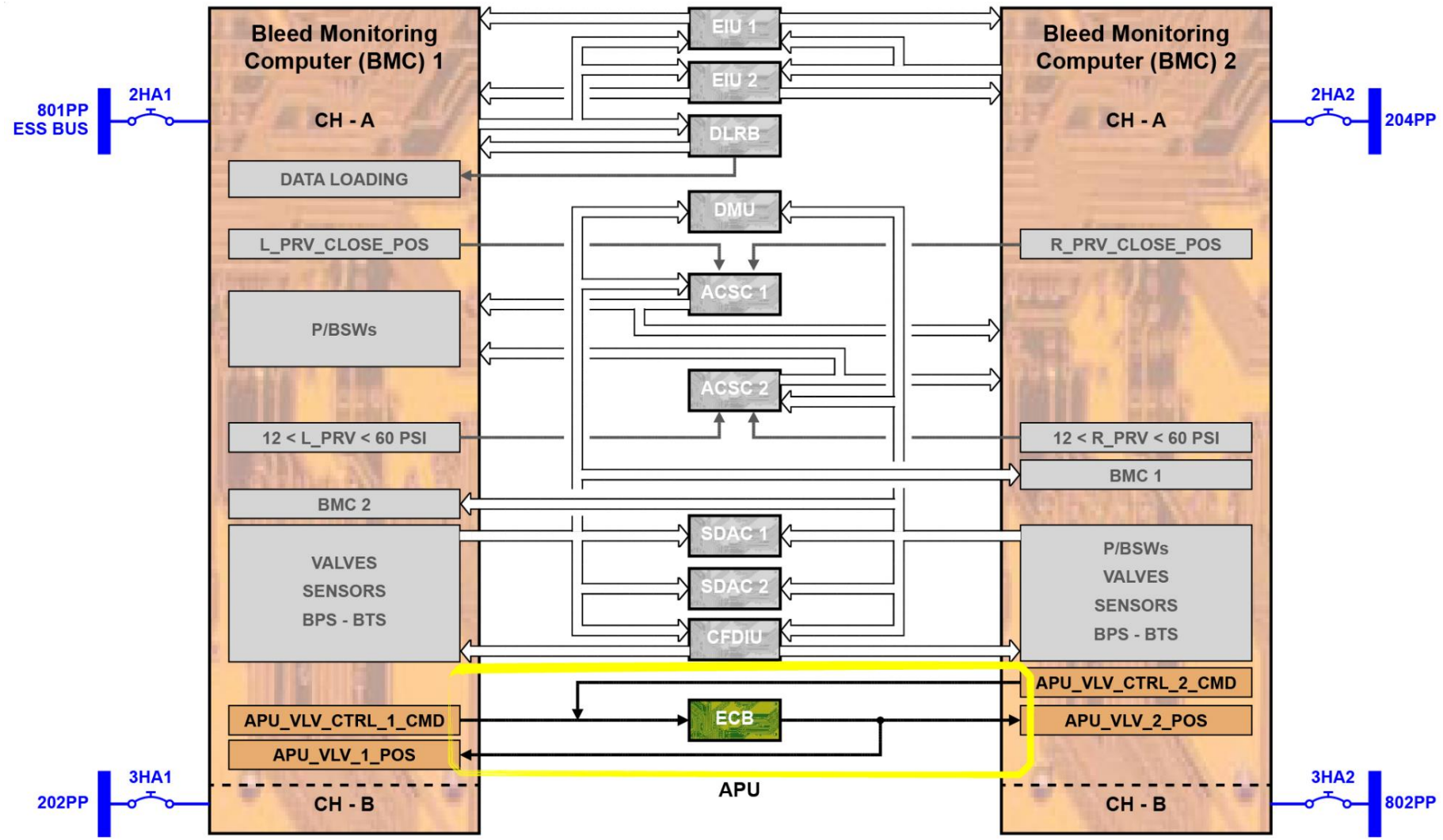
APU

The APU/Electronic Control Box (ECB) system sends to the Engine Bleed Air System EBAS/BMC the information about APU bleed valve position in order to command the PRV to close when APU BLEED P/B is ON.

The EBAS transmits to the ECB information related to the APU Bleed Valve open Command in order to provide APU Bleed valve control in when APU flow is required.



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PNEUMATIC LEAK DETECTION SYSTEM D/O (PW1100G)

ROUTING

The leak detection system is used to detect leaks in the vicinity of the packs, wings, pylons and APU hot air ducts.

There are two independent loops as redundancy in both pylons and both wing sides.

The APU hot air duct is monitored by a single loop.

Protected areas with double loop for:

Engine 1 and Engine 2 pylons,

RH wing and pack 2,

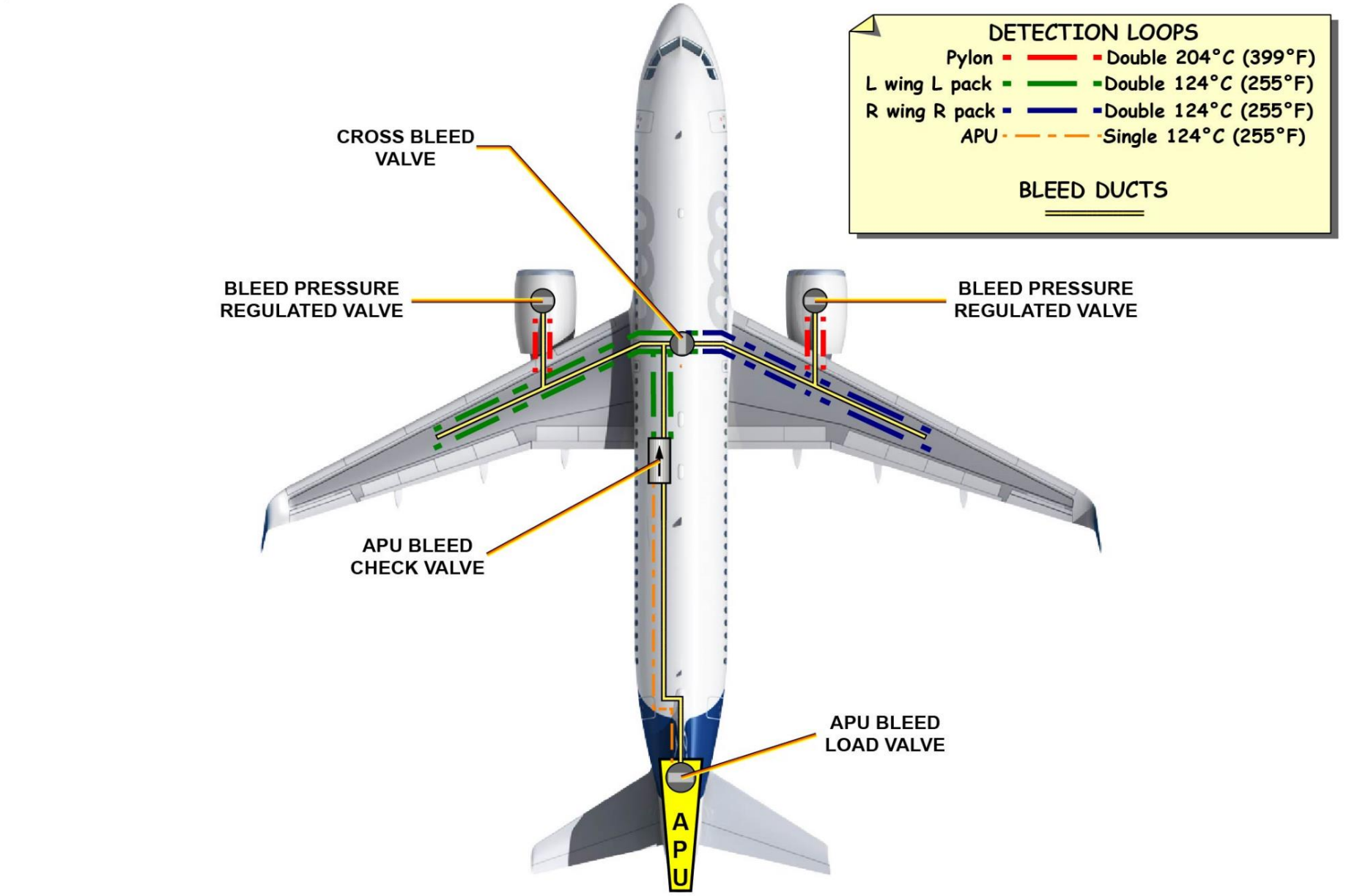
LH wing, pack 1 and mid fuselage APU duct.

Protected areas with single loop for:

APU duct.

NOTE: Each loop consists of sensing elements that are physically connected in series, but electrically connected in parallel.

Both extremities of the overheat detection loop are connected to the BMC.


DETECTION LOOPS
Pylon
Double 204°C (399°F)
L wing L pack
Double 124°C (255°F)
R wing R pack
Double 124°C (255°F)
APU
Single 124°C (255°F)
BLEED DUCTS
CROSS BLEED VALVE
BLEED PRESSURE REGULATED VALVE
BLEED PRESSURE REGULATED VALVE
APU BLEED CHECK VALVE
APU BLEED LOAD VALVE
APU

DETECTION LOGIC

Both Bleed Monitoring Computers (BMCs) permanently receive signals from the leak detection loops primarily tested at power-up.

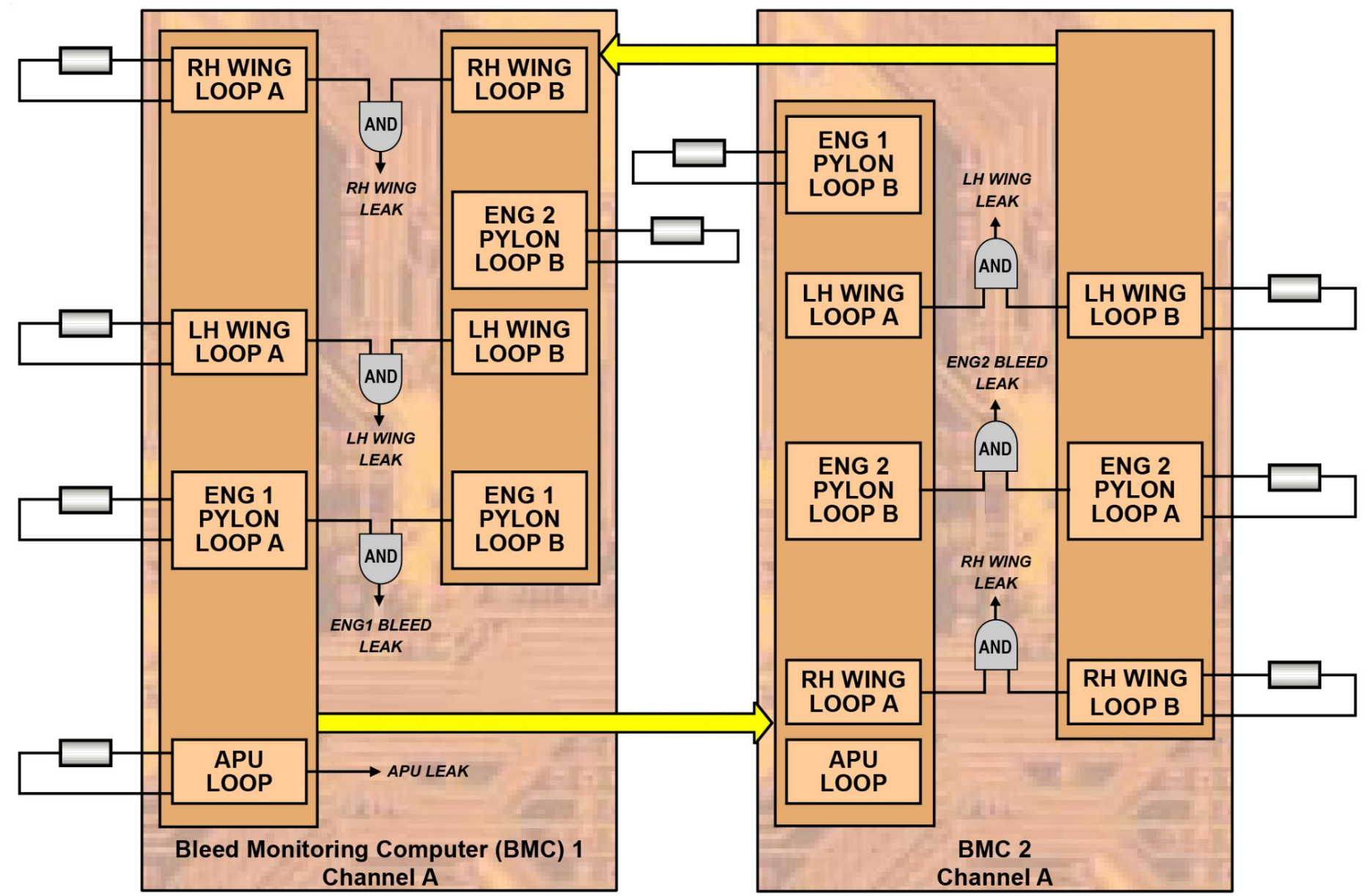
They exchange data via an ARINC bus for the double loop detection.

Each BMC channel A normally controls its side engine bleed air system, so monitors the OverHeat Detection System (OHDS).

NOTE: The wing and pylon loops A are connected to one BMC and wing and pylon loops B to the other BMC.

The crosstalk bus allows wing leak warnings to be activated through an AND logic.

The APU loop is connected to BMC 1 only.


RH WING LOOP A
RH WING LOOP B
AND
RH WING LEAK
ENG 2 PYLON LOOP B
LH WING LOOP A
LH WING LOOP B
AND
LH WING LEAK
ENG 1 PYLON LOOP A
ENG 1 PYLON LOOP B
AND
ENG1 BLEED LEAK
APU LOOP
APU LEAK
Bleed Monitoring Computer (BMC) 1 Channel A
ENG 1 PYLON LOOP B
LH WING LEAK
AND
LH WING LOOP A
LH WING LOOP B
ENG2 BLEED LEAK
AND
ENG 2 PYLON LOOP B
ENG 2 PYLON LOOP A
RH WING LEAK
AND
RH WING LOOP A
RH WING LOOP B
APU LOOP
BMC 2 Channel A

WARNING CONSEQUENCES

The ENG BLEED FAULT light comes on when a leak is detected by the wing loops A and B or by the pylon loops A and B.

The APU BLEED FAULT light comes on when an APU duct leak is detected.

When an overheat condition is detected by both loops, the following alerts are generated for the affected zone:

AIR ENG 1(2) LEAK for a leak/overheat detected in the Pylons,

AIR L(R) WING LEAK for a leak/overheat detected in the Wings,

AIR APU LEAK for a leak/overheat detected in the APU line,

AIR APU LEAK [APU LEAK FED BY ENG] for a leak/overheat detected in the APU line and the leak is automatically isolated.

A new warning alert has been introduced on the A320 NEO, the AIR BLEED LEAK to isolate a bleed leak in the opposite pylon to the operative bleed with manually open Crossbleed Valve.

The failure of a single loop for Pylon or Wing is identified by a MAINTENANCE message displayed on the STATUS SD page.

Dual engine loop failure is identified by the AIR ENG 1(2) LEAK DET FAULT and is NO GO.

If one BMC is failed, the other BMC takes over monitoring of the bleed system and triggers the ECAM warnings.

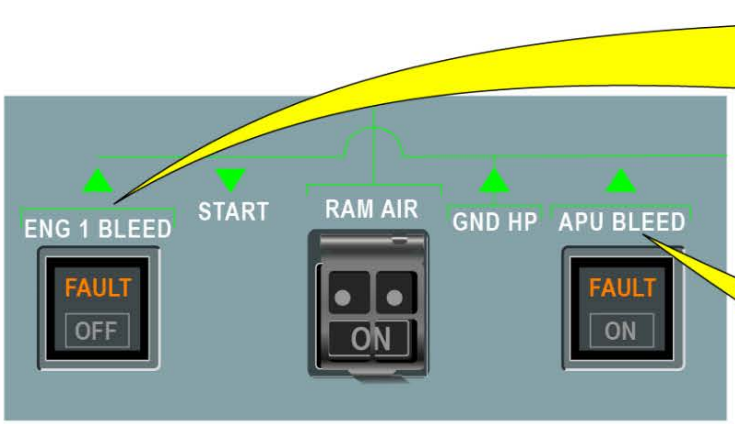
The aircraft dispatch is for 10 days with the BMC 1 or 2 inoperative for non-ETOPS operations provided that the Engine 1 (2) Bleed Air System (EBAS 1 (2)) is considered inoperative and the APU leak detection loop (BMC 1 Only) is considered inoperative.

LEAK CONSEQUENCE

A detected leak will close associated valves, as shown on the table.

These valves are automatically controlled to close if they were open.

NOTE: APU and cross bleed (X-BLEED) valves do not close during Main Engine Start (MES).



AIR CONDITIONING PANEL (30VU)

WARNING MESSAGES:

Related to leak:
- AIR: ENG 1(2) LEAK
- AIR: L(R) WING LEAK
- AIR: BLEED LEAK

Related to other failures (e.g. Overheat, overpressure...):
- AIR: ENG 1(2) BLEED FAULT

WARNING MESSAGES:

Related to leak:
- AIR: APU LEAK
- AIR: APU LEAK [APU LEAK FED BY ENG]

36-22-01	Pylon Leak Detection System

36-22-01E

Repair interval	Nbr installed	Nbr required	Placard
–	2	2	No

Must be operative.

Note: *Failure of one loop in one or both pylon is indicated by a MAINTENANCE message displayed on the STATUS SD page.*
Refer to Item 36-00-01 AIR BLEED MAINTENANCE Message

MINIMUM EQUIPMENT LIST (MEL)

TYPE OF FAILURE	ENG 1 FAULT (PYLON LEAK OR LH WING LEAK)	ENG 2 FAULT (PYLON LEAK OR RH WING LEAK)	APU LEAK (EXCEPT DURING ENGINE START)
AUTOMATIC RESPONSE/ VALVE CLOSURE	- PRV 1 - ANTI-ICE VALVE 1 - X BLEED VALVE (IN AUTO) - APU BLEED VALVE	- PRV 2 - ANTI-ICE VALVE 2 - X BLEED VALVE (IN AUTO)	- APU BLEED VALVE - X BLEED VALVE (IN AUTO)

MEL ITEMS

EBAS MEL

The aircraft dispatch is for 10 days with the Engine Bleed Supply System inoperative on one side provided that:

The associated bleed is isolated by setting the ENG BLEED P/BSW to OFF,

The X-BLEED valve is manually open to supply both sides,

The speed brakes are operative.

For an Extended Range Twin Engine Aircraft Operations (ETOPS) flight, Auxiliary Power Unit (APU) Bleed should be available.

One Engine Bleed Air System (EBAS) remaining available, it supplies both sides for Wing Anti-Ice (WAI) and air conditioning.

However, there is limitation on A320 NEO compared to A320 CEO due to lower capacity of the heat exchanger in case of single bleed operations.

NOTE: Only one PACK can be supplied.

Therefore, the associated operational procedure will ask to switch one PACK off.

HPV FAILURE

Failed closed High Pressure Valve (HPV) can lead to low bleed pressure or low bleed temperature when engine is at low power settings (in idle or in holding conditions).

HPV failed in open position, leads to Bleed overpressure or Bleed overtemperature identified by AIR ENG 1(2) BLEED FAULT.

In case of failure of one HPV, the aircraft can be dispatched for 10 days with the valve secured closed.

The consequence of having the HPV secured closed is that the bleed air from the Intermediate Pressure (IP) port will be insufficient at low engine power settings (taxi, descent, holding).

That is the reason why the crew procedure requests to switch off the associated EBAS at low power setting and to open the Crossbleed valve to supply both sides from the opposite EBAS which is operative.

HPV FAILED CLOSED: AIR ENG 1(2) HP VALVE FAULT

HPV FAILED OPEN: AIR ENG 1(2) BLEED FAULT

36-11-07	Engine Bleed HP Valve

36-11-07A Associated bleed considered inoperative

Repair interval	Nbr installed	Nbr required	Placard
C	2	1	No

One may be inoperative in the closed position provided that the associated engine bleed air supply system is considered inoperative.
Refer to Item 36-11-01 Engine Bleed Air Supply System

36-11-07B HP valve secured in the closed position

Repair interval	Nbr installed	Nbr required	Placard
C	2	1	No

(o) (m) One may be inoperative provided that:.
1) The affected engine bleed HP valve is secured in the closed position, and
2) The opposite engine bleed supply system is operative.

Reference(s)

(o) *Refer to OpsProc 36-11-07B Engine Bleed HP Valve*
(m) *Refer to AMM 36-11-00-040-XXX*

At low engine power settings, affected side ENG BLEED P/B is set to OFF and X BLEED selector is set to OPEN.

At higher power settings, affected side ENG BLEED P/B is set back ON and X BLEED selector is set to AUTO.

BLEED VALVE DEACTIVATION

In case of failure, Pressure Relief Valve (PRV) and HPV have to be deactivated CLOSED for dispatch under Minimum Equipment List (MEL).

The deactivation procedure is the same for both valves:

make sure pneumatic system in not pressurized, BLEED switches OFF,

deactivate the thrust reverser,

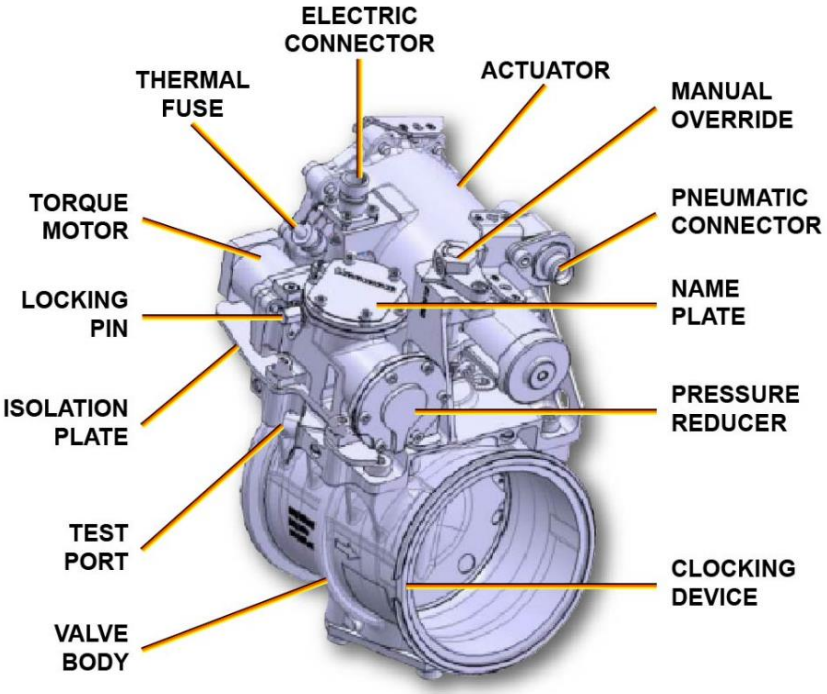
open the RH fan and reverser cowls,

move the manual override to the CLOSED position,

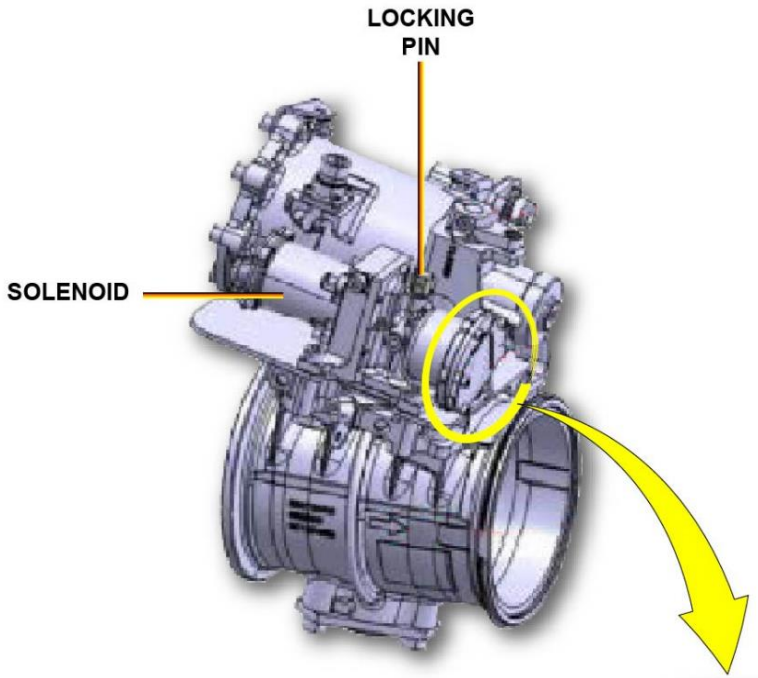
secure in CLOSED position with locking pin,

close cowlings,

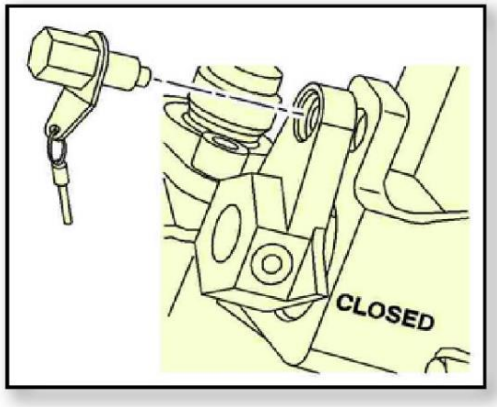
reactivate the thrust reverser.



PRESSURE REGULATING VALVE (PRV)



HIGH PRESSURE VALVE (HPV)



LOCKING PIN

IDENTIFICATION PLATE

WING LEAK DETECTION

The WING leak detection is a dual-loop system. To generate a WING LEAK warning, both A and B loops have to detect the overheat.

For dispatch, WING leak detection must be operational (at least one loop) on each wing.

If a single loop fails, the MAINTENANCE message AIR BLEED will be displayed on the STATUS page associated with a Centralized Fault Display System (CFDS) message L(R) WING LOOP (INOP).

The aircraft may be dispatched per MEL with the MAINTENANCE message displayed.

For troubleshooting it is important to understand that the WING detection elements monitor much more than just the wings alone.

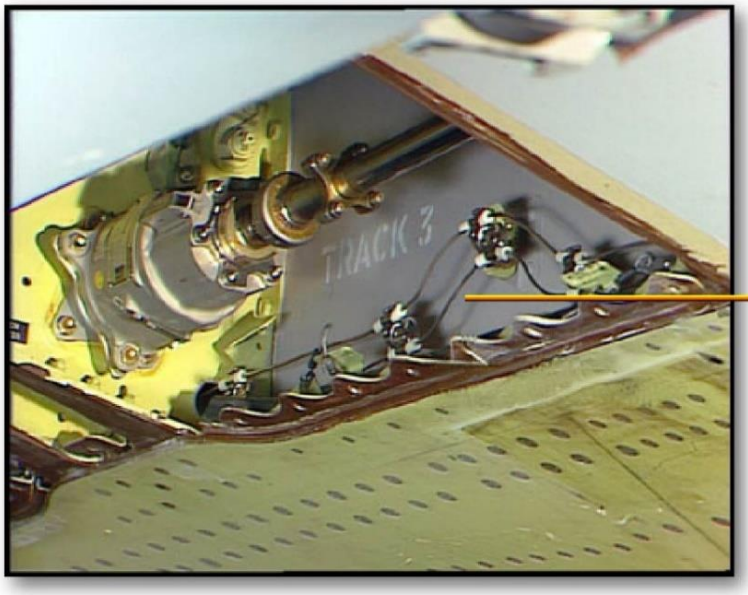
The protected areas are:

wing leading edge (wing anti-ice supply duct),

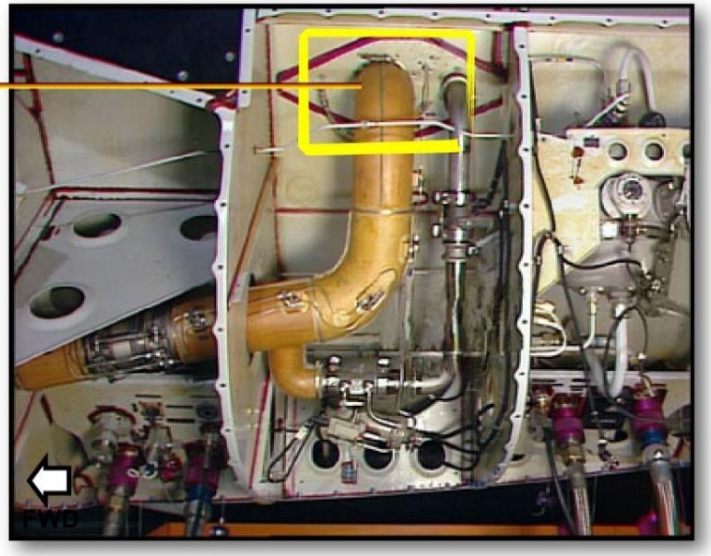
air conditioning compartment - belly fairing - (pack supply,

crossbleed manifold, APU supply, ground air supply),

APU forward supply duct (from the APU check valve through the wheel well).

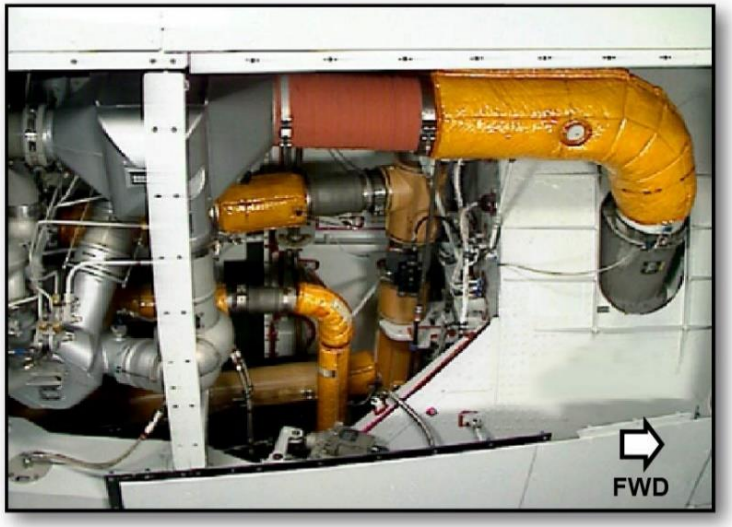


WING LEADING EDGE



FUSELAGE LEFT SIDE (AFT BELLY FAIRING)

The WING leak detection elements monitor more than the wings alone.
The protected areas are :
- Wing leading edge (wing anti-ice supply),
- Air conditioning compartment (pack supply, crossbleed manifold, APU supply, ground air supply)
- APU supply duct (from the APU check valve through the wheel well).



AIR CONDITIONING COMPARTMENT

MAINTENANCE TIPS CFDS

CFDS menus for all failure reports and interactive mode displays are generated by the Bleed Monitoring Computer (BMC) itself.

In normal mode, the BITE transmits maintenance messages (Standard A type 1) for detection results on level of:

OverHeat Detection System (OHDS),

Valves,

Precooler,

Sensors,

External communication,

Internal communication,

BMC (Hardware and Software).

The electrical test verifies the EBAS following functions:

Central Processing Unit (CPU) (microprocessor, RAM, ROM),

discrete outputs,

leak detection loops and interfaces,

discrete and analogue inputs,

digital Inputs/Outputs,

torque motors, solenoid,

pressure sensors failures,

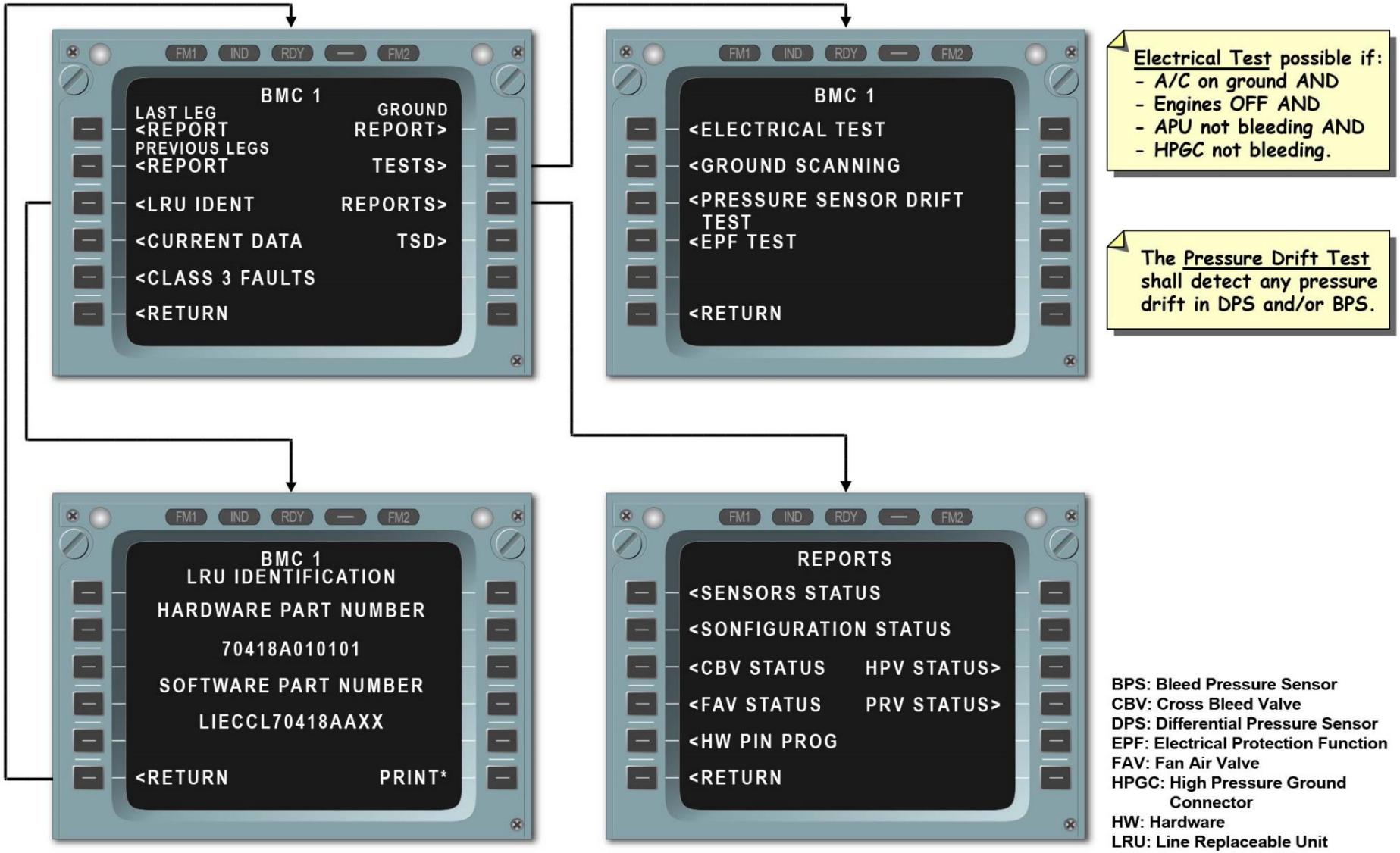
temperature sensors failures,

valves.

The pressure sensor drift test shall detect any pressure drift in Differential Pressure Sensor (DPS) and/or Bleed Pressure Sensor (BPS).

Electrical Protection System (EPS) corresponds to the channel B Electrical Protection Function (EPF) test.

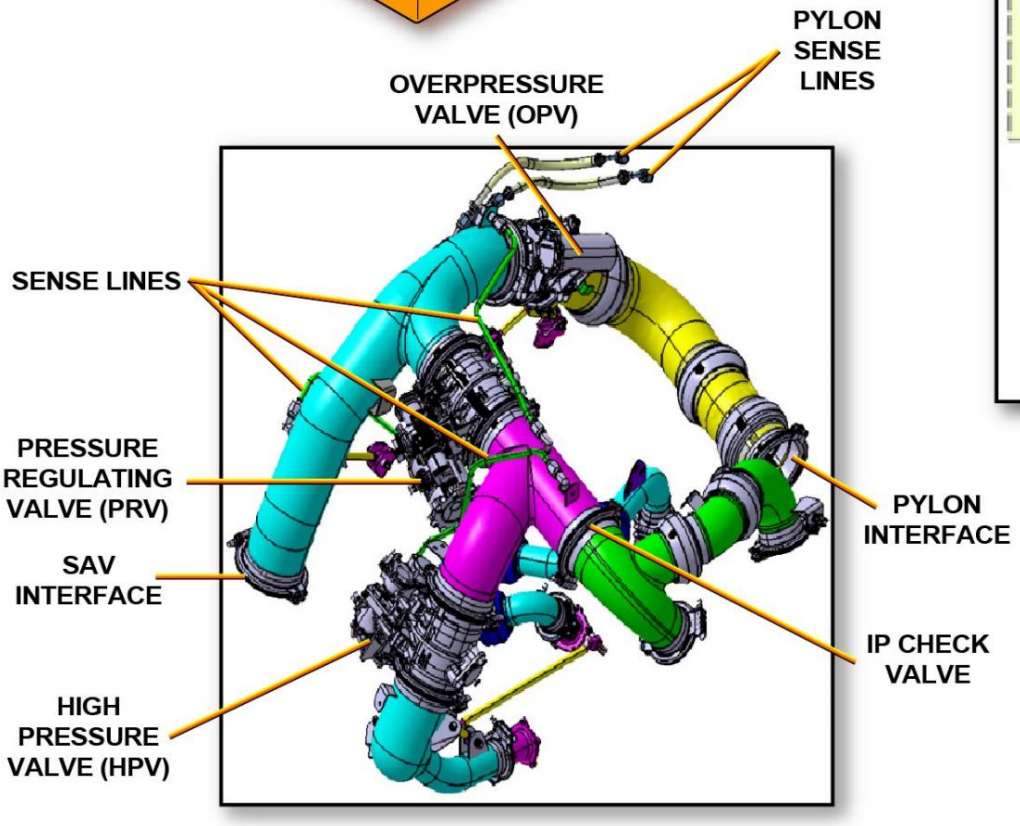
The reports menu displays the status in real time for all the system.

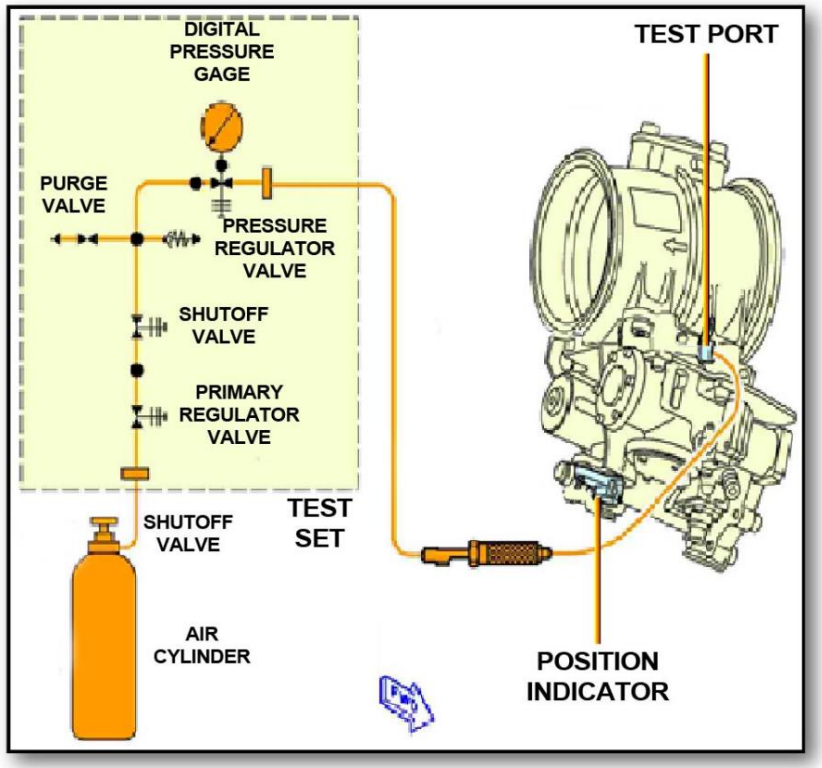

FM1 IND RDY FM2
BMC 1
LAST LEG
<REPORT
GROUND
REPORT>
PREVIOUS LEGS
<REPORT
TESTS>
<LRU IDENT
REPORTS>
<CURRENT DATA
TSD>
<CLASS 3 FAULTS
<RETURN
FM1 IND RDY FM2
BMC 1
<ELECTRICAL TEST
<GROUND SCANNING
<PRESSURE SENSOR DRIFT TEST
<EPF TEST
<RETURN
Electrical Test possible if:
- A/C on ground AND
- Engines OFF AND
- APU not bleeding AND
- HPGC not bleeding.
The Pressure Drift Test shall detect any pressure drift in DPS and/or BPS.
FM1 IND RDY FM2
BMC 1
LRU IDENTIFICATION
HARDWARE PART NUMBER
70418A010101
SOFTWARE PART NUMBER
LIECCL70418AAXX
<RETURN
PRINT*
FM1 IND RDY FM2
REPORTS
<SENSORS STATUS
<SONFIGURATION STATUS
<CBV STATUS
HPV STATUS>
<FAV STATUS
PRV STATUS>
<HW PIN PROG
<RETURN
BPS: Bleed Pressure Sensor
CBV: Cross Bleed Valve
DPS: Differential Pressure Sensor
EPF: Electrical Protection Function
FAV: Fan Air Valve
HPGC: High Pressure Ground Connector
HW: Hardware
LRU: Line Replaceable Unit
PRV: Pressure Relief Valve

TEST SET

The Test Set P/N 98L36103002000 is available to assist in troubleshooting the pneumatic system.

The test set enables calibrated pressure to be applied to individual valves, components and isolated parts of the system to check for normal operation and sense line integrity (i.e.: PRV, HPV, Overpressure Valve (OPV), Fan Air Valve (FAV), Bleed Pressure Regulated Transducer...).





FUNCTIONNAL TEST OF THE PRESSURE REGULATING VALVE (PRV) WITH THE TEST SET P/N 98L36103002000

IP: Intermediate Pressure
SAV: Strater Air Valve

ENGINE START WITH GROUND AIR

To perform an engine start with ground air, the connection is located on the lower fuselage.

The access door is on the belly fairing.

During a ground air start, the crossbleed valve must be operated manually.

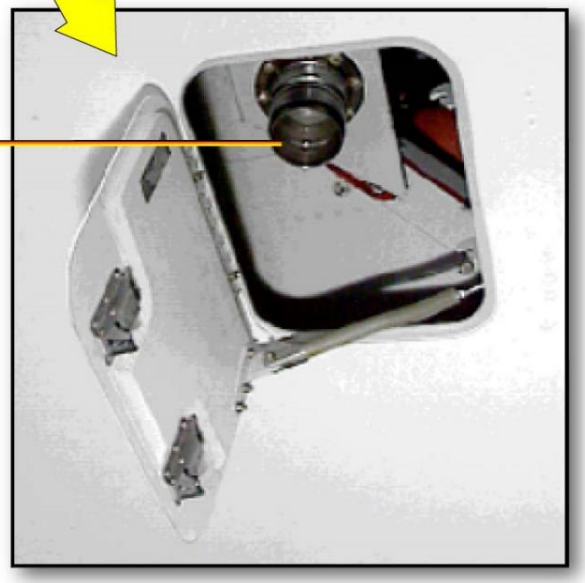
For safety, it is recommended to use the ground air supply to start the first engine.

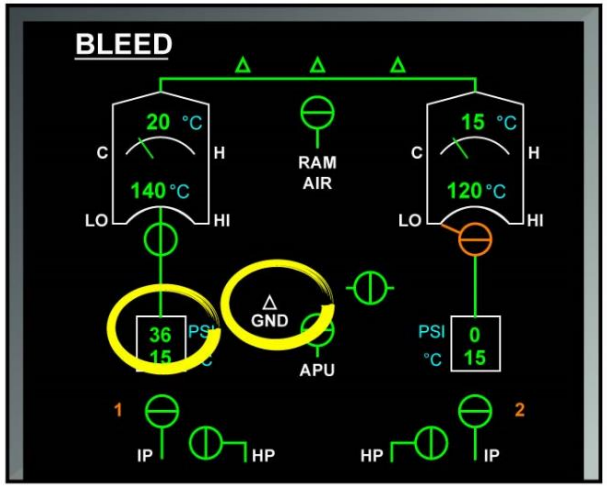
Then disconnect the ground air supply and perform a crossbleed start for the second engine.

On the ECAM BLEED page, the GND indication DOES NOT indicate ground air supply connected or available.

This indication appears when the aircraft is on the ground to show that the ground air is directly supplied to the LEFT side of the system only.

The left bleed system pressure indicator will indicate pressure when the ground air is supplied.


HP GROUND AIR
CONNECTOR


BLEED
20 °C
C
H
140 °C
LO
HI
RAM
AIR
15 °C
C
H
120 °C
LO
HI
GND
APU
36
15
PSI
PSI
°C
0
15
1
2
IP
HP
HP
IP

INTENTIONALLY BLANK