Section - III
SYSTEMS DESCRIPTION

Sub-section 2
ENGINES

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GENERAL

The airplane is powered by two Garrett AiResearch Model TFE 731-5BR-1H turbofan engines installed in pods mounted on pylons; one each side of, and integral with, the rear fuselage.

Firewalls divide each pod into two fire zones which are ventilated by ram air; both zones incorporate a fire/overheat warning system. The two shot fire extinguishing system discharges only into zone 1, the forward zone.

For more information on the engine fire protection system refer to Sub-section 4, FIRE PROTECTION.

Hot air is bled from the engine to pressurize and air condition the airplane, to operate the rudder bias system and for engine anti-icing. Each engine has a combined starter/generator and can be started from either the airplanes batteries or an external power supply. Each engine has an AC alternator which provides deicing to the pilot's windshields.

The engine consists of five major components:

- Fan
- Low Pressure (LP) Spool
- High Pressure (HP) Spool
- Annular Combustion Chamber
- Transfer and Accessory Gearboxes

Engine power and fuel shut off controls for each engine are operated by separate thrust and high pressure (HP) cock levers on the pilot's central control pedestal with engine starting, ignition and antice controls being located on the flight compartment overhead roof panel.

Indications of N_1, N_2, ITT, oil pressure, oil temperature and fuel flow are displayed on the pilot's Multi Function Display. Annunciators associated with the engine are on the main MWS and overhead roof panel.

DESCRIPTION

The engine is a two-spool-transonic-stage-compressor, front fan jet engine. It is a light weight modular design for ease of maintenance. The simplicity of the design eliminates the need for variable geometry inlet guide vanes. This minimizes the weight of the engine, the possibility of the inlet vanes icing up is reduced and the noise is also reduced. Use of a reverse flow combustion chamber reduces the overall length of the engine and provides a cool skin concept for the external surfaces of the turbine section.

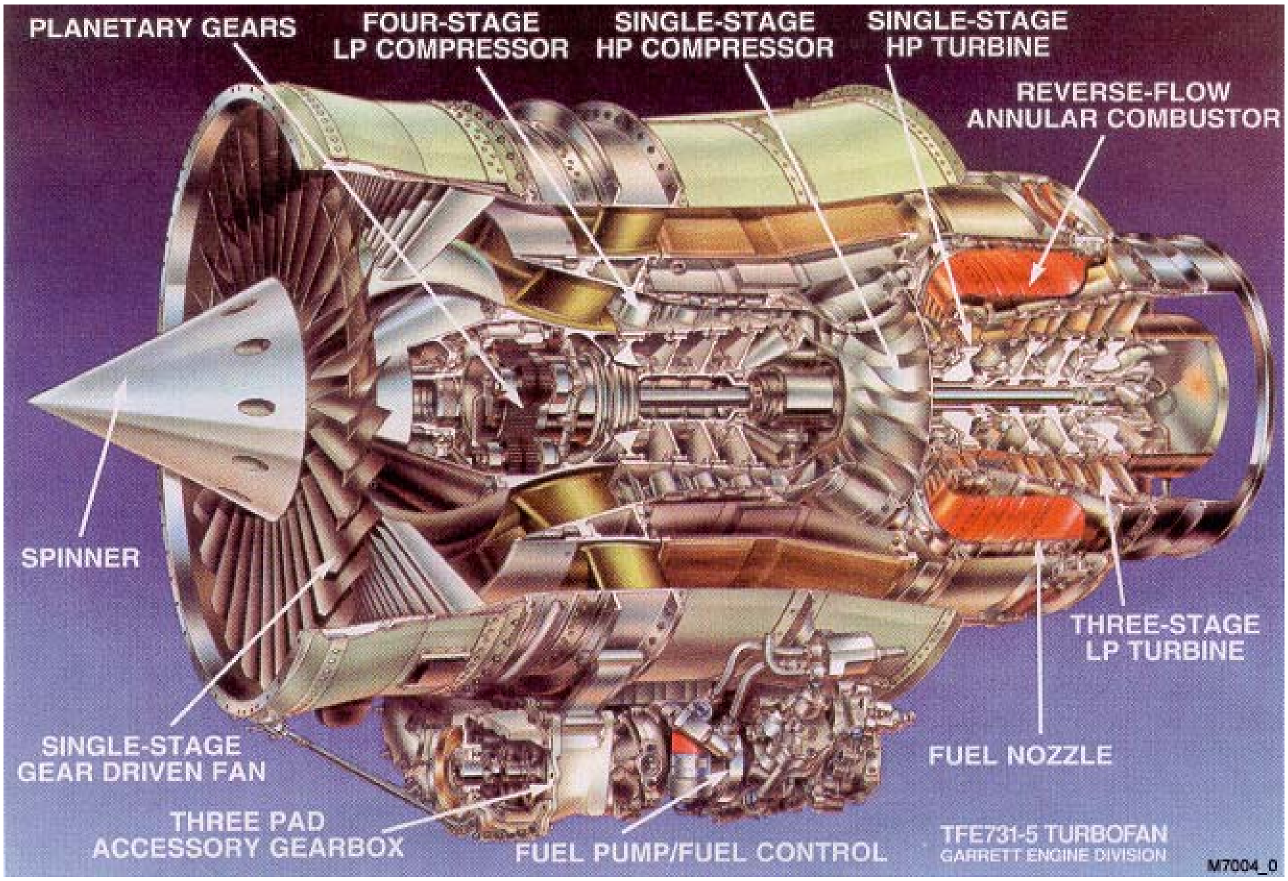


Figure 1
Engine Cutaway View

FAN

The fan is an axial flow unit that moves large quantities of air into the bypass and core inlets. The bypass section consists of the fan spinner support, fan rotor assembly, fan bypass stator, fan duct assembly and the bypass fan support and shaft section. The fan is driven by the low pressure N_1 spool through the planetary gear section.

COMPRESSOR SECTION

Air enters the engine through the air inlet section located immediately aft of the fan bypass section and continues on to the LP compressor where it is compressed and forced through the interstage diffuser assembly to the HP compressor where it is further compressed and discharged into the combustion chamber.

Low Pressure Spool N_1

The LP N_1 spool consists of a four stage, low pressure, axial flow compressor and a three stage, low pressure turbine. Both the compressor and the turbines are mounted on a common shaft.

NOTE: A stage is one rotor (rotating blades) and one stator (non rotating vanes).

Each stage of the axial flow compressor utilizes rotating compressor blades to accelerate the air, followed by static stator vanes which decelerate the air, converting kinetic energy into pressure. This provides a steady rise in pressure through the compressor stages, without significant change to overall velocity.

High Pressure Spool N_2

The high pressure spool N_2 consists of a single stage centrifugal compressor driven by a single stage turbine through an outer concentric shaft. The centrifugal compressor consists of an impeller (rotor), a diffuser and a compressor manifold.

As in axial flow compressors, air is picked up and accelerated outwards towards the diffuser. When the accelerating air reaches the diffuser its velocity is reduced, converting kinetic energy into pressure. The high pressure spool also drives the accessory gearbox through a tower shaft and transfer gear reduction system.

COMBUSTION CHAMBER

The compressed air flows into a single reverse flow annular combustion chamber in the turbine section where it is mixed with atomized fuel supplied by twelve duplex fuel nozzles. The twelve duplex fuel nozzles consists of primary nozzles used for starting and secondary nozzles used in conjunction with the primary nozzles for all other phases of engine operations.

The fuel-air mixture is ignited by the two igniter plugs located at the six and seven o'clock positions within the combustion chamber. After the ignition cuts-out, combustion is self sustaining and the combustion gases are then directed to the turbine by the transition liner. The hot gases pass through both the high and low pressure turbines, driving both rotating compressor assemblies and then exiting through the exhaust nozzles with the bypassed air.

TURBINE SECTION

The turbine section contains four (one high pressure, three low pressure) axial flow turbine wheels and four stator assemblies. On leaving the turbine, the exhaust gases enter a mixer compound-thrust-nozzle system, where they mix with the bypass air before discharging through a convergent-divergent nozzle.

The high pressure turbine rotor assembly is air cooled to allow an increased turbine inlet temperature.

ACCESSORY DRIVE

An accessory drive gearbox and transfer gearbox are driven from the high pressure N_2 spool. The transfer gearbox is driven by a vertical shaft and in turn drives the accessory gearbox through a horizontal gearshaft.

The accessory drive gearbox provides shaft power for airplane accessories (hydraulic pump, starter/generator and alternator) which are mounted on the forward face of the accessory gearbox. The fuel pump, fuel control unit and oil pump are all mounted on the rear face of the accessory gearbox.

OPERATION

When the engine is operating, the single-stage fan draws air through the nacelle inlet duct. The outer diameter of the fan accelerates a moderately large air mass at a low velocity into the full-length bypass duct. At the same time, the inner diameter of the fan accelerates an air mass into the engine core.

The pressure of this air is increased by the LP compressor and directed to the HP compressor where the air pressure is further increased and ducted aft to the combustor. A precise amount of this air enters the reverse-flow combustor where fuel is injected by twelve spray nozzles.

The mixture is initially ignited by two igniter plugs and expanded through the turbine. The HP turbine extracts enough energy to drive the HP compressor and the transfer and accessory gears. The LP turbine extracts enough energy to drive the LP compressor, the planetary gear and the fan.

The remaining gas energy is accelerated aft through the exhaust pipe and joins the fan airflow from the bypass duct to provide the total direct thrust.

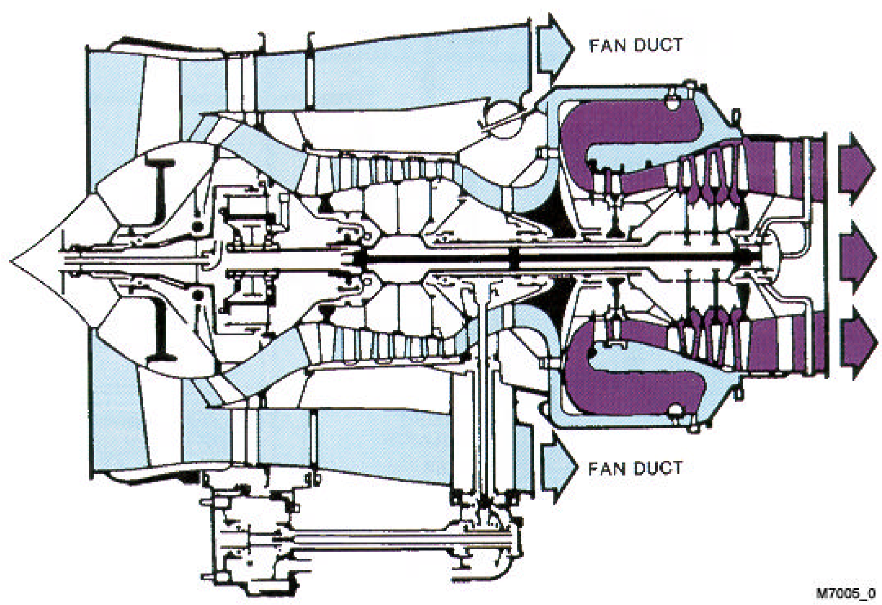


Figure 2
Gas Flow During Engine Operation

ENGINE INDICATING SYSTEM (EIS)

The EIS provides full time displays of engine Fan RPM N_1, ITT and a part time, pop-up or pilot-selectable display of engine RPM N_2, fuel flow, oil pressure and oil temperature on the left MFD.

Fuel quantity for each wing tank and ventral tank status are normally displayed on the right MFD. The EIS also displays alerts and warnings for operation outside normal limits.

The digital read-outs for the engine parameters and the pointers for N_1 and ITT will flash for 5 seconds when they first turn yellow and stop flashing if they turn green (white for ITT) in less than the 5 second time period. The digital read-outs and pointers will flash for 5 seconds when they first turn red, continue to flash if they turn yellow within the 5 second period, but stop flashing if they turn green (white for ITT) in that 5 second time period.

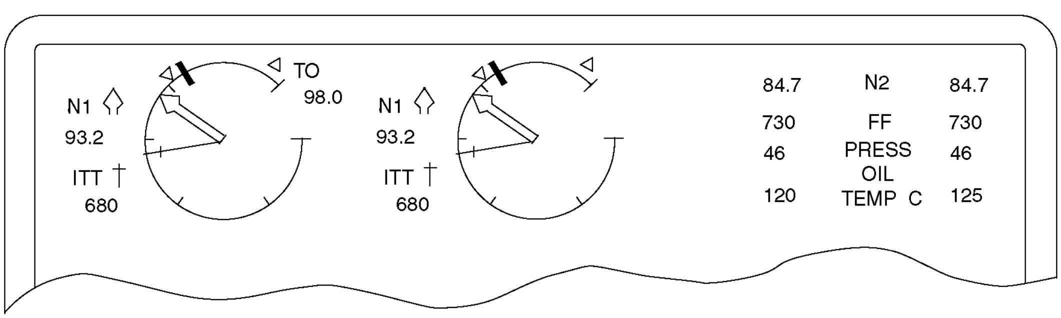
The part time engine parameters (N_2, fuel flow, oil temperature, oil pressure and fuel temperature read-outs and legends) are automatically displayed when an out of limit or engine miscompare condition occurs.

The ENGINE button on the Display Control Panel (DCP) is used to manually control the display of the part time engine parameters. The first push of the DCP ENGINE button removes the parameters, provided that all read-outs are within normal operating limits. The last change by either pilot controls the EIS on all currently enabled displays. Declutter is not allowed when an engine miscompare is active.

Two sources for N_1, N_2 and ITT exist for each engine. One is the Data Concentrator Unit (DCU) and the other is the Engine Data Concentrator (EDC). The left DCU is the priority source for the left engine, and the right DCU is the priority source for the right engine with the cross-side DCU being the secondary source.

The EDC is the third priority source with automatic selection between data sources being provided. The DCU is the source for fuel flow, oil pressure, oil temperature and engine fire warning data. The DCU is the interface between the avionics and the airplane subsystems. The primary function of the DCU is acquisition, concentration, and transmittal of analog and discrete engine data. The EDC provides partial control of the respective engine when it is ON (active). In the event of loss of either EDC data, the current declutter state remains until manually changed or an out of limit condition automatically calls up the parameters.

Engine information normally appears only on the Multi-Function Display (MFD). If display reversion switching causes the MFD to become a Primary Flight Display (PFD), the engine information remains displayed on that MFD (now a PFD). When display reversion switching shuts off the MFD display, then the engine information shows on the on-side PFD.



Left MFD Engine Display

N_1 RPM DISPLAYS

The N_1 indication provides engine RPM measured against a fixed 100% value and shares the same scale with the ITT indication.

Normal scale range for the N_1 portion of the scale is 20 to 100% with an overlimit scale to 110%. Gray tick marks are at 20, 40, 60, 80 and 110%. There is a red radial tick mark at the 100% normal redline.

The N_1 digital display appears below the N_1 legend and pointer icon, to the left of the N_1 indication. The N_1 digital display has a range of 0 to 110%.

The normal limit for N_1 is 100% and the N_1 pointer and digital read-out are green when N_1 is within 100%. If N_1 is between 100.1% and 103.0% (Transient Limit) for less than 5 seconds, the N_1 pointer and digital read-out turn yellow. If N_1 exceeds 103.0% (Redline) or exceeds the Transient time limit, the N_1 pointer and digital read-out turn red.

The N_1 pointer is removed and four yellow dashes and a decimal point are displayed for the digital read-out if all sources of N_1 are flagged.

NORMAL LIMIT (Green)	***TRANSIENT LIMIT (Yellow)***	***REDLINE LIMIT (Red)***
$N_1 \leq 100.0\%$	$100.1\% \leq N_1 \leq 103.0\%$ for less than 5 seconds	$100.1\% \leq N_1 \leq 103.0\%$ for 5 seconds or longer **or** $N_1 \geq 103.1\%$

N_1 REFERENCE DISPLAYS

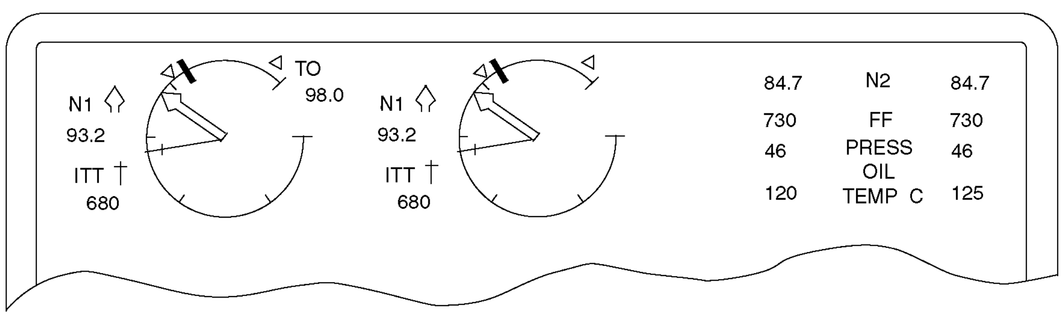
The N_1 reference consists of a single digital N_1 REF read-out and individual N_1 REF bugs on each N_1 scale. N_1 REF may be set manually by the pilot using the REFS menu or it may be provided by the FMS.

The REFS menu on the PFD automatically selects N_1 REF to OFF MODE upon initial power-up on the ground and maintains the last selected state and last active value thereafter. The N_1 REF FMS MAN selection and manual N_1 REF values are synchronized between the PFDs so when either pilot changes the on-side controls, the N_1 REF state/values on all displays are set the same.

When the REFS menu is appearing on the PFD, pushing the line select key, next to the N_1 REF legend, controls the N_1 REF. The first push of the N_1 REF key selects MAN mode and the flashing cyan colored box appears around the last active manually set N_1 REF value. The FMS legend becomes smaller and white, while the MAN legend becomes larger cyan colored text.

The N_1 REF value can now be changed using the MENU ADV knob on the DCP. The second push of the N_1 REF line select key removes the flashing box and places a solid box around the FMS MAN legend.

Pushing the N_1 REF line select key when MAN control is ON, reselects FMS control. The FMS legend becomes the larger cyan colored text, the MAN legend becomes the smaller white text and the manual N_1 REF read-out is removed from the menu. The current valid N_1 REF supplied by the FMS shows in a magenta color beneath the FMS legend.



Left MFD Engine Display

When MAN control is ON, pushing and holding the N_1 REF line select key for more than one second will select MAN control to OFF. The larger cyan colored MAN legend turns to smaller white text, the manual N_1 REF is removed and the cyan colored N_1 read-out and bugs are removed from the N_1 display.

When displayed, the N_1 REF appears between the N_1/ITT scales and consists of a 3 or 4 digit read-out with a decimal preceding the tenths digit. A triangular N_1 REF icon precedes the digital read-out. The icon and read-out are cyan colored in MAN control.

The thrust limit legend TO, GA, MCT, CLB, CRZ and TGT immediately follow the N_1 REF icon, with the digital display beneath, and are magenta colored in FMS control.

The triangular N_1 REF bug is positioned on the perimeter of each N_1 scale with the apex of the triangle at the point that corresponds with the N_1 REF digital read-out. The bug is the same color as the digital read-out and is removed when the read-out does not appear. In the FMS mode, each bug is placed at the position corresponding to the lower of the two FMS inputs.

In FMS control, the N_1 REF icon, thrust limit legend and digital read-out are placed in a yellow box and the N_1 REF value shows in yellow when:

- N_1 thrust limit values from the FMSs differ by more than 1%.
- Data input from one FMS is reported invalid when airspeed is less than 50 KIAS.

The N_1 miscompare annunciation will flash for 5 seconds when first displayed, then remains steady.

In FMS control, if neither FMS is sending a selected thrust limit or the N_1 REF data from both FMS's is failed, not received or outside the N_1 REF display ranges:

- The N_1 REF digital read-out and bugs are removed.
- The REFS menu FMS read-out and the thrust limit legend on the EIS display are replaced by three magenta colored dashes.

ITT DISPLAYS

Ten thermocouples, two pairs of five thermocouples connected in parallel to create an averaging circuit, are located in the gas path between the high pressure turbine and the first stage of the low pressure turbine. These thermocouples measure the Interstage Turbine Temperature (ITT) and send signals to the Engine Data Concentrator (EDC) and the fuel computer.

The ITT display indicates the temperature between the first and second turbine stages in °C. The ITT display consists of a scale, pointer and digital read-out for each engine. The ITT and N_1 share a scale for the same engine.

The ITT scale range is 200 to 1100° C. The gray tick marks on the ITT scale represent 200, 400, 600, 800 and 1100° C. There is a red radial tick mark at the ITT Normal Limit, as listed in the following table, for the respective Operating Condition. In order to present the Normal Limit at the same scale position for all Operating Conditions, the scaling between 800° C and 1100° C changes slightly for each Operating Condition. Therefore, a small ITT pointer movement may occur when transitioning between Operating Conditions.

The ITT pointer is positioned at the ITT digital display value, except the ITT pointer only appears when ITT is above 200° C. The ITT pointer is the same color as the digital display and flashes when the display flashes. The ITT digital display appears below the N_1 digital read-out, to the left of the N_1/ITT indication with a range of 0 to 1100° C.

The ITT digital read-out and pointer are white when ITT is within the normal limit and red when ITT is above the normal limit.

If all sources of ITT are flagged or missing, the ITT pointer is removed and four yellow dashes with a decimal point are displayed for the digital read-out. The following lists the ITT normal and redline limits for engine start and engine operation.

OPERATING CONDITION	*NORMAL LIMIT (Green)*	*REDLINE LIMIT (Red)*
START	ITT ≤ 978° C	ITT ≥ 980° C
RUN	ITT ≤ 968° C	ITT ≥ 970° C
RUN APR - ARM APR Not Active	ITT ≤ 978° C	ITT ≥ 980° C
RUN APR - ARM APR Active	ITT ≤ 996° C	ITT ≥ 998° C

N_2 RPM DISPLAYS

N_2 RPM appears in the top right corner of the display. N_2 is a standardized display of engine RPM measured against a fixed 100% value. The N_2 displays consist of digital read-outs for each engine. A gray N_2 legend appears between the left and right digital read-outs. Display range is 0 to 120%.

The N_2 digital read-out is green when N_2 is within the normal limit, yellow when N_2 is within the transient limit and red when N_2 is in the redline.

Four yellow dashes and a decimal point replace the N_2 read-out if all sources of N_2 are flagged or missing. The following lists the normal, transient and redline limits for N_2

NORMAL LIMIT (Green)	*TRANSIENT LIMIT (Yellow)*	*REDLINE LIMIT (Red)*
$N_2 \leq 100\%$	$100.1\% \leq N_2 \leq 103.0\%$ for less than 5 seconds **or** $100.1\% \leq N_2 \leq 100.8\%$ for less than 5 minutes when the APR is active	$100.1\% \leq N_2 \leq 103.0\%$ for 5 seconds or longer **or** $N_2 \geq 103.1\%$ **or** $100.1\% \leq N_2 \leq 100.8\%$ for 5 minutes or longer when the APR is active **or** $N_2 \geq 100.9\%$ when the APR is active

FUEL FLOW DISPLAYS

Fuel flow appears below the N_2 display in the top right corner of the MFD. The fuel flow display consists of digital read-outs for each engine and a FF legend. The gray FF legend separates the left and right digital read-outs. The read-outs, up to 4 digits, are green and normally in pounds per hour (PPH), but may be displayed in kilograms per hour (KPH). Range is 0 to 2800 PPH or 0 to 1500 KPH.

A fuel flow volume sensor and fuel flow temperature sensor for each engine are interfaced with the on-side Data Concentrator Unit. Four yellow dashes are displayed if fuel flow from all sources is flagged or missing.

OIL PRESSURE DISPLAYS

Oil pressure appears below fuel flow in the top right corner of the MFD. The oil pressure display can appear up to 3-digits for each engine. A gray OIL PRESS legend, with OIL placed below PRESS, appears between the left and right digital read-outs. Range is 0 to 150 PSI. Oil pressure is normally displayed in green, but changes colors as listed in the following information.

The oil pressure digital read-out is green when OP is within the normal limits, yellow when OP is within the transient limits and red when OP is in the redline.

A single oil pressure sensor from each engine interfaces with its on-side Data Concentrator Unit. Three yellow dashes are displayed if oil pressure from all sources is flagged or missing.

OPERATING CONDITION	***NORMAL LIMIT (Green)***	***TRANSIENT LIMIT (Yellow)***	***REDLINE LIMIT (Red)***
$N_2 < 80\%$	$25 \leq OP \leq 46$ **or** $OP \leq 24$ Engine Not Running	$47 \leq OP \leq 55$ for less than 3 minutes	$OP \leq 24$ Engine Running **or** $47 \leq OP \leq 55$ for 3 minutes or longer **or** $OP \geq 56$
$N_2 \geq 80\%$	$38 \leq OP \leq 46$	$47 \leq OP \leq 55$ for less than 3 minutes **or** $25 \leq OP \leq 37$	$OP \leq 24$ **or** $47 \leq OP \leq 55$ for 3 minutes or longer **or** $OP \geq 56$

OIL TEMPERATURE DISPLAYS

Oil temperature for each engine appears below oil pressure for each engine in the top right corner of the MFD. The oil temperature display is a digital read-out for each engine with a gray TEMP legend, placed below the gray OIL legend. Range is 0 to 150° C.

The oil temperature digital read-out is green when the temperature is within the normal limits, yellow when within the transient limits and red when in the redline.

A single oil temperature sensor from each engine interfaces with its on-side Data Concentrator Unit. Three yellow dashes are displayed if oil temperature data from all sources is flagged or missing.

OPERATING CONDITION	***NORMAL LIMIT (Green)***	***TRANSIENT LIMIT (Yellow)***	***REDLINE LIMIT (Red)***
Altitude ≤ 30,000 ft **or** Altitude Invalid	0° C ≤ OT ≤ 127° C	128° C ≤ OT ≤ 149° C for less than 2 minutes	128° C ≤ OT ≤ 149° C for 2 minutes or longer **or** OT ≥ 150° C
Altitude > 30,000 ft	0° C ≤ OT ≤ 140° C	141° C ≤ OT ≤ 149° C for less than 2 minutes	141° C ≤ OT ≤ 149° C for 2 minutes or longer **or** OT ≥ 150° C

ENGINE FIRE WARNING ANNUNCIATIONS

A fire annunciation displays when the Data Concentrator Unit receives a signal indicating an engine fire condition exists.

The red FIRE legend appears in the lower center of the applicable N_1/ITT scale. The FIRE legend flashes for 5 seconds when first displayed, then remains steady. The FIRE legend will display for at least 5 seconds.

CLIMB ANNUNCIATION

Maximum Climb Thrust is set by adjusting the thrust levers until the green CLIMB annunciation appears at the lower center of the N_1/ITT scales. CLIMB shares the display location with the FIRE annunciation; the FIRE annunciation takes priority over CLIMB.

AUTOMATIC POWER RESERVE (APR) DISPLAYS

An APR ARM or active annunciation appears when the Data Concentrator Unit receives a signal indicating automatic power reserve APR - ARM or active condition exists. A white APR ARM legend appears in the lower center between the left and right N_1/ITT scales.

APR appears above the ARM legend and will appear at any time except when the APR active annunciation is displayed. The APR active annunciation consists of a green boxed APR legend in the same location as the APR ARM annunciation. The box and APR legend flash for 5 seconds when first displayed, then remain steady.

Control for the automatic power reserve is via an APR ARM and APR OVRD switch on the center instrument panel.

ENGINE SYSTEMS and COMPONENTS

- ENGINE OIL
- IGNITION
- FUEL CONTROL
- POWER CONTROLS

ENGINE OIL (Figure 3)

Oil under pressure lubricates the engine bearings and the transfer, accessory and planetary gearboxes. The system consists of:

(a) Oil Tank and Sight Gauge

(b) Oil Pump and Chip Detector

(c) Oil Filter and Bypass Valve

(d) Air/Oil Cooler and Bypass Valve

(e) Fuel to Oil Cooler

(f) Oil to Fuel Cooler

(g) Breather Pressurizing Valve

(h) Pressure and Temperature Transmitters and Indicators

Rotation of the engine-driven oil pump draws oil from the reservoir. Oil under pressure flows through a pressure regulator, filter and temperature control components to the engine bearings, the transfer gearbox, accessory gearbox and the front fan planetary gear assembly.

Oil Pump Assembly

An oil pump assembly is located on the accessory drive gearbox. It contains a single oil pressure pump and four scavenge pumps. The pressure pump draws oil from the reservoir and supplies sufficient pressure to force the oil through the engine components that require lubricating.

The scavenge pumps collect oil from the planetary gear assembly and the forward engine bearings, the aft engine bearings, the transfer gearbox and the mid engine bearings, and the accessory drive gearbox. A common discharge line connects the four scavenge pumps to the engine oil reservoir.

An adjustable pressure regulator in the pumps helps to provide a constant oil pressure by compensating for changes in the airplane altitude.

A magnetic chip detector is on the aft housing of the pump. All oil scavenged from the engine flows past the detector. The detector catches any magnetic particles present in the oil due to engine wear for inspection purposes.

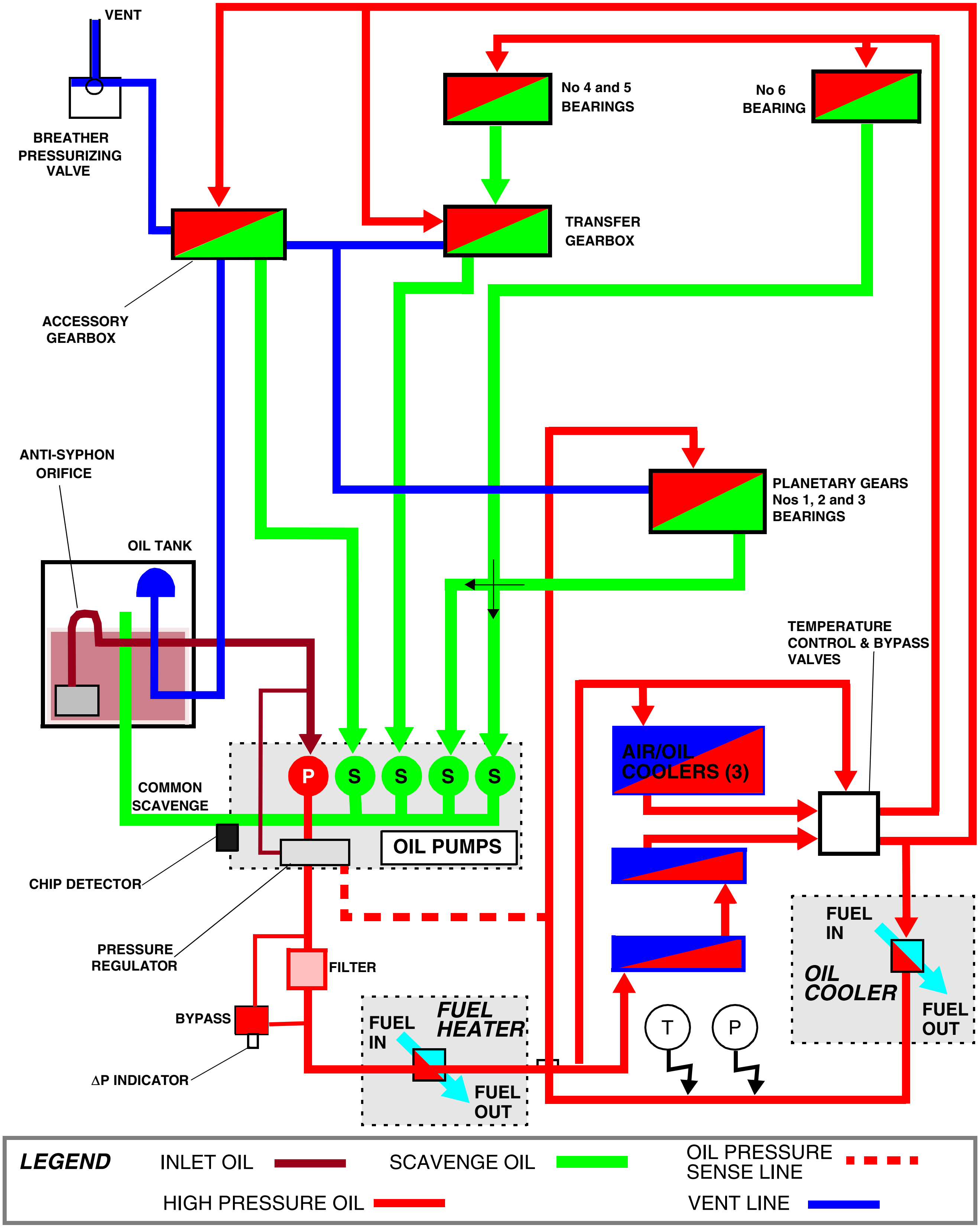


Figure 3
Engine Lubrication System

Oil Filter

A filter is provided to remove impurities from the oil. The oil filter consists of a disposable element enclosed in a metal housing on the right side of the accessory drive gearbox.

Engine protection against filter clogging is provided by an oil filter bypass indicator valve located adjacent to the oil filter. The valve opens when the pressure drop across the filter is excessive to bypass lubricating oil around the filter.

An integral differential ΔP pressure indicator on the valve visually flags a clogged filter condition before bypassing occurs. A thermal lockout device on the ΔP indicator prevents actuation under cold oil conditions although the bypass valve will bypass oil under these conditions.

Oil Tank

A 1.65 US gallon capacity oil reservoir is located on the right side of the engine fan bypass housing.

The reservoir has a liquid level sight gauge and a filler cap on the right side of the tank. A filler tube and cap are located on the left side of the tank which allows for oil tank replenishing when access to the right side is restricted. Viewing ports are provided on the right side of the engine. (Figure 4)

Fuel Heater

An externally mounted fuel heater is located on the left side of the engine. The fuel heater provides oil-to-fuel heat exchanging to prevent ice formation in the fuel system from clogging the fuel filter and any other components.

Fuel flow through the fuel heater is thermostatically controlled to provide the optimum operating temperature. Excess oil pressure with cold oil is prevented by a pressure bypass valve.

Air/Oil Cooler

After oil leaves the fuel heater, it passes through the air/oil coolers in the engine bypass duct. The air/oil cooler consists of three segments: one half segment and two quarter segments.

Each segment is a finned unit with oil lines running through it. Together the three segments form the inner surface of the fan duct.

A temperature controlled integral bypass valve directs oil that is hotter than 65° C through the three segments of the air/oil cooler. Air flowing through the duct cools the oil that passes through the cooler. Below this temperature, the valves bypass the oil around the air/oil cooler.

If the heat exchangers become obstructed, the temperature control valve bypasses the oil around them.

After the oil leaves the air/oil coolers, the flow splits. Part of the oil flows to the engine bearing sumps (HP rotor shaft), the transfer gearbox assembly and the accessory gearbox. The remaining oil flows through the oil temperature regulator (fuel/oil cooler) and then on to the planetary gear assembly.

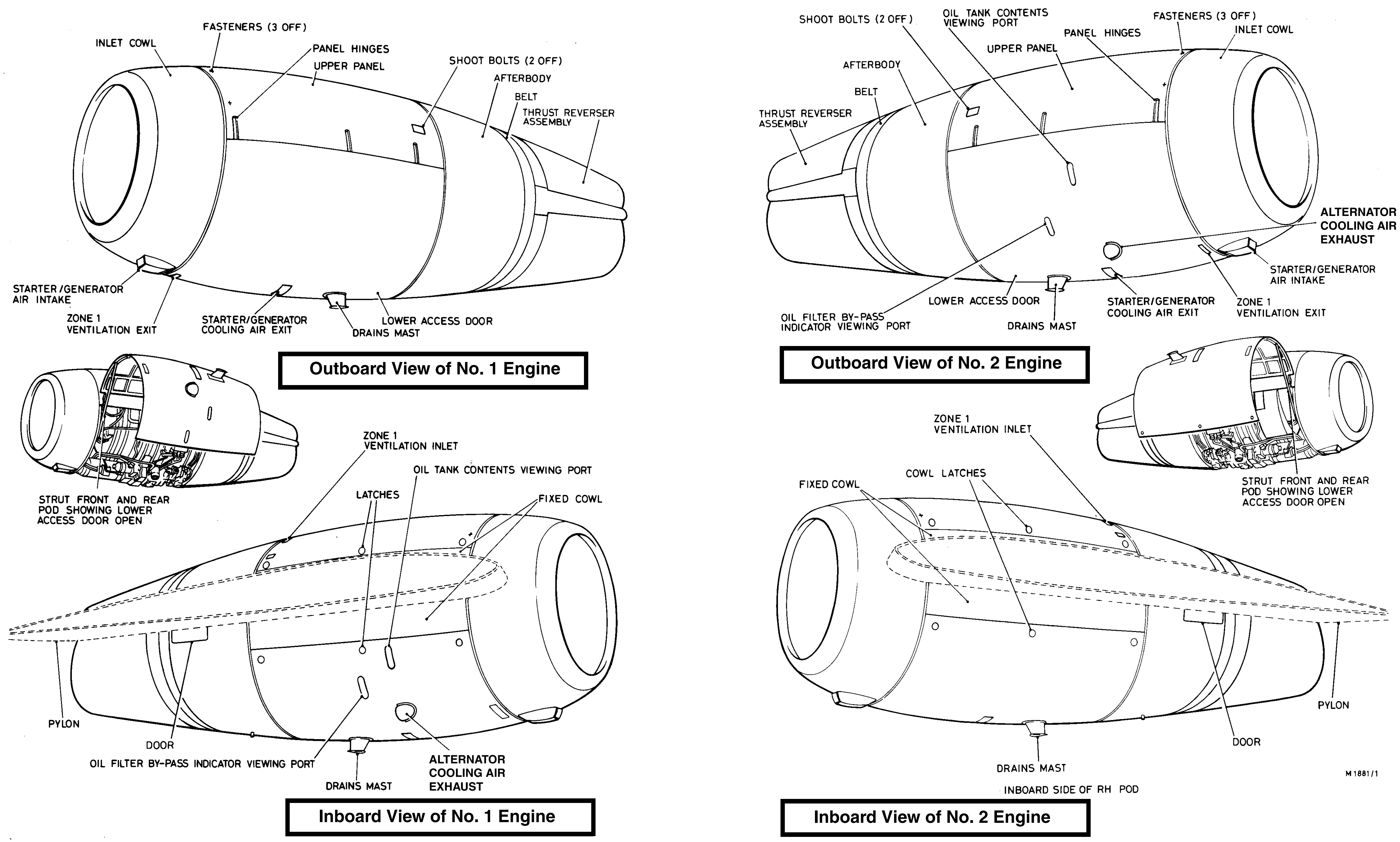


Figure 4
Engine Views

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Fuel/Oil Cooler

The fuel/oil cooler (oil temperature regulator) uses airplane fuel to maintain the oil at a constant temperature and consists of a temperature control valve and a heat exchanger. Fuel constantly flows through the unit and oil only flows through the unit if it is above a set temperature.

If the oil temperature exceeds 99° C the control valves open to route the oil through the cooler. From the fuel/oil cooler, oil then lubricates the fan shaft bearings and the front LP spool bearings.

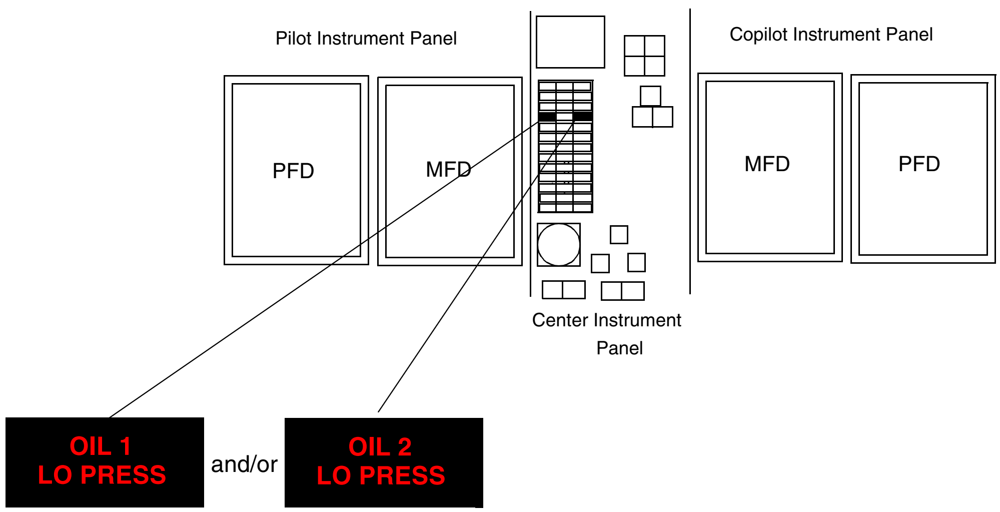
After travelling to all the main sump areas, oil then drains by gravity to the lowest point of each sump and is then drawn back to the engine oil reservoir by the scavenge pumps.

Oil Venting

Vent lines interconnect the oil sumps to the oil tank assembly and the breather pressurizing valve. The breather pressurizing valve provides an ambient vent for the oil system at low altitudes and at high altitude increases the internal engine vent and tank pressure to ensure proper oil pump operation.

Low Oil Pressure Annunciators

A pressure switch, located in each engine oil supply line, operates the red OIL 1 LO PRESS and OIL 2 LO PRESS annunciators on the MWS.



Normally, engine oil pressure holds the switch open. If the pressure drops below 23 PSI, the switch closes to complete a circuit which will cause the respective annunciator to illuminate. Once the pressure exceeds 25 PSI, the switch will open to break the circuit and extinguish the annunciator.

IGNITION

Each engine has an independent ignition system that consists of:

- Ignition Unit
- Igniter Plugs and Leads
- ENG IGNITION Switches
- IGN ON Annunciators

Ignition Unit

An ignition unit on the upper left side of the fan bypass housing is a high voltage, capacitor discharge, radio noise-suppressed, intermittent sparking type unit that uses a 10 to 30 VDC power supply. The ignition system receives power from the PE busbar. Each unit provides separate and independent outputs of 18,000 to 24,000 volts to the igniter plugs.

During the engine start cycle, a micro switch on each HP fuel lever provides ignition unit activation once the engine reaches 10% N_2.

Once the engine reaches self-sustaining speed, the relays de-energize to remove power from the ignition units. Manual operation of the ignition unit is through the ENG IGNITION switch in the ON position. If required, the unit can be operated continuously.

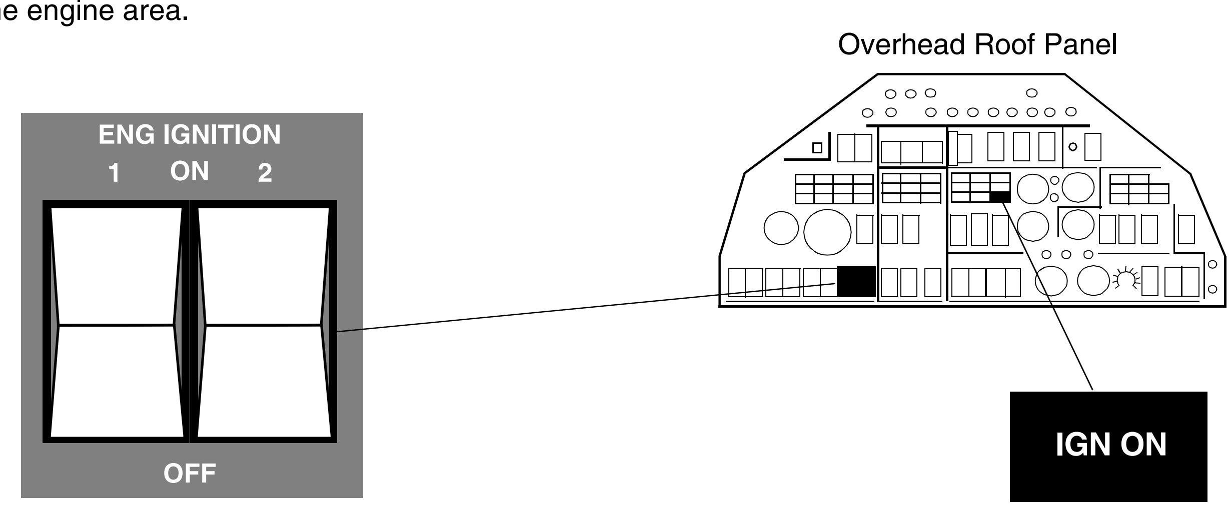
Igniter Plugs and Leads

The igniter plugs, on the annular combustion chamber at the six and seven o'clock positions, operate independently of each other. Each receives power from the ignition unit through separate high-tension leads. Each plug fires at a rate of approximately two sparks per second when triggered by the ignition unit.

Ignition Switches

Each engine has a two-position (ON/OFF) ENG IGNITION switch on the flight compartment overhead roof panel. In the ON position, the switch will illuminate an IGN ON annunciator on the flight compartment overhead roof panel and will supply the ignition unit with 28 VDC from the PE busbar through the No. 2 start auxiliary relay.

The annunciator only indicates that power is available to the ignition unit. Verification of the igniter firing requires the ENG IGNITION switch to be turned to the ON position and listening for two distinct snaps in the engine area.



FUEL CONTROL

The engine fuel control system consists of:

- Fuel Pump Assembly (Figure 5)
- Hydro-mechanical Fuel Control Unit (FCU)
- Digital Electronic Engine Control (DEEC)
- Fuel Flow Divider Assembly
- Fuel Atomizers

The fuel control system pumps, filters, meters and atomizes the airplane fuel before the ignition system ignites it to produce thrust.

Fuel Pump (Figure 5)

An engine-driven fuel pump on the rear of the accessory gearbox provides high pressure fuel to the fuel control system. The pump assembly consists of:

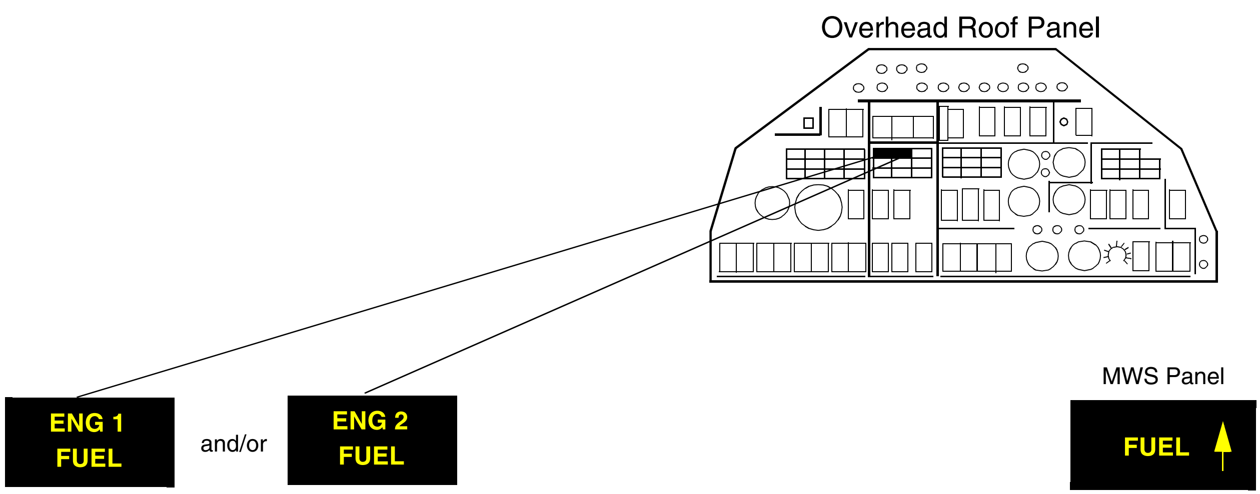
- Booster Pump Element
- Fuel Filter
- Filter Bypass Valve
- High Pressure Pump Element
- Relief Valve
- FCU - attached to the rear of the pump

Anti-Ice Valve

An anti-icing valve is provided within the fuel pump assembly to mix warm fuel from the fuel heater with the discharge flow of the booster pump to prevent icing of the fuel filter element.

Filter Bypass

The filter bypass valve allows fuel to bypass the filter if an excessive pressure drop across the filter occurs. When an excessive differential pressure condition exists, an electrical pressure switch will cause the respective annunciator on the overhead roof panel to illuminate, accompanied by a repeater annunciator on the MWS panel.



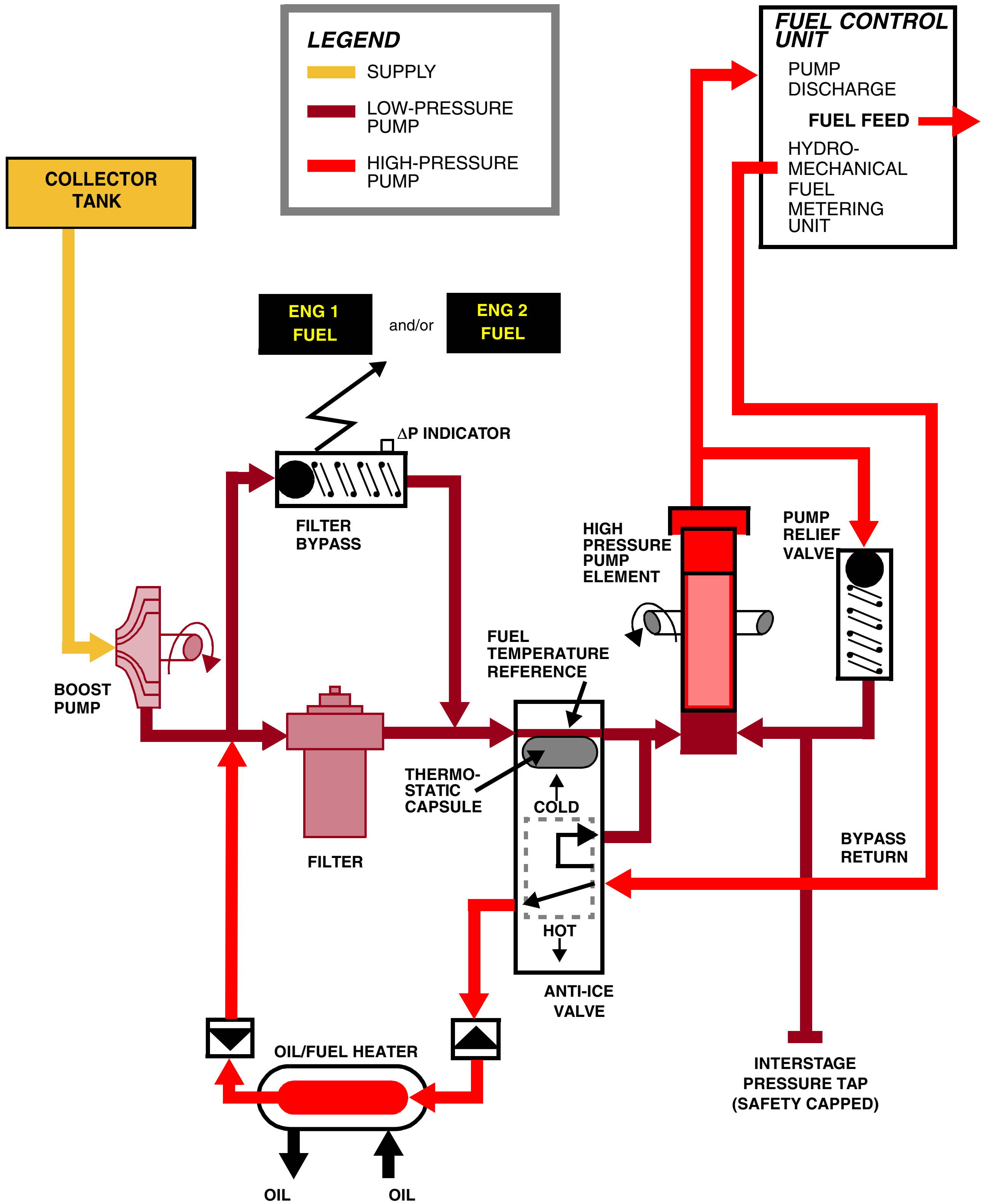


Figure 5
Engine-Driven Fuel Pump Assembly

Filter Clogged

If the filter begins to clog, the following events will occur:

- At 6 to 8 psi Δp the amber annunciator will illuminate on the MWS.
- At 9 to 12 psi Δp the filter bypass valve opens to deliver fuel to the high pressure pump.

The annunciator will remain illuminated for as long as the fuel filter remains clogged.

Fuel Control Unit

The fuel pump-driven FCU contains:

- Fuel Metering Section
- Power Lever Input Pot
- Shutoff Valve
- Outlet Pressurizing Valve
- Ultimate Overspeed Solenoid
- Mechanical Governor (N_2)

The mechanical governor functions has two modes:

- An overspeed governor for the HP rotor if the fuel computer is operative.
- A hydro-mechanical control when the fuel computer is inoperative.

An operating fuel computer (DEEC) electrically controls fuel flow scheduling by setting the FCU metering section pressure drop according to thrust lever and engine inputs. The FCU has two shutoff valves in series.

The thrust lever actuates one valve and the electronic engine computer actuates the other valve. If the computer senses an ultimate overspeed condition, the computer closes the shutoff valve, fuel flow stops, and the engine shuts down.

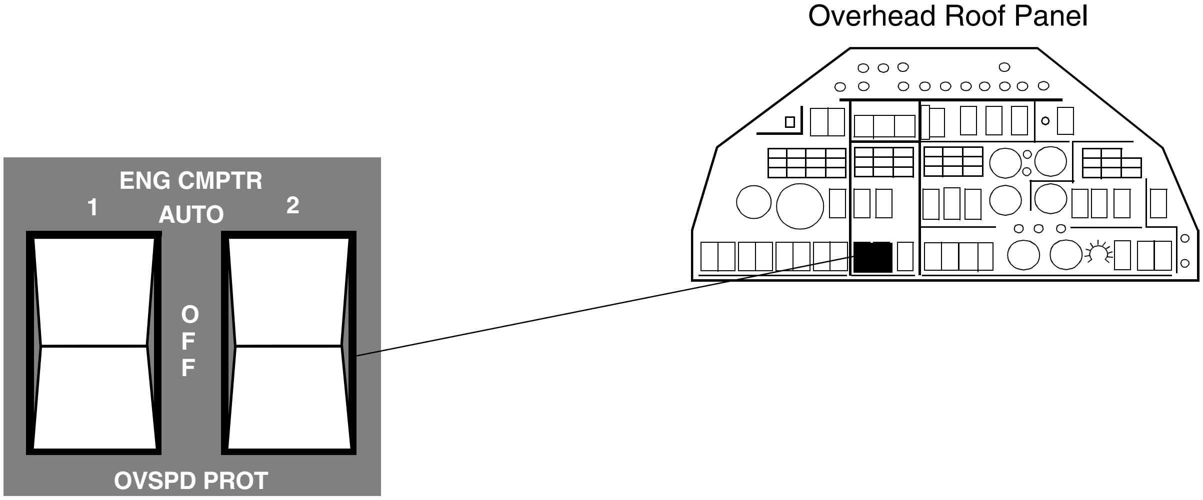
Inlet Pressure and Temperature Sensor

An inlet pressure and temperature sensor is located on the cowling forward of the fan inlet. The sensor contains electrical elements for sensing inlet air temperature (Tt_2) and a pressure tap for sensing inlet air pressure (Pt_2). Both inlet parameters are required by the fuel computer and an electrical anti-icing element is contained in the sensor.

Digital Electronic Engine Control (Fuel Computer)

Two Digital Electronic Engine Controls (DEECs) are located in the rear equipment bay.

Each DEEC controls the engine acceleration and deceleration. Separate ENG CMPTR switches on the flight compartment overhead roof panel allow automatic (AUTO) or overspeed protection (OVSPD PROT) mode selection. Both DEECs receive 28 VDC from the PE busbar in the automatic mode.



During acceleration and deceleration, the DEECs provide governing, limiting and scheduling response to the thrust lever and engine inputs. Inputs to each computer are:

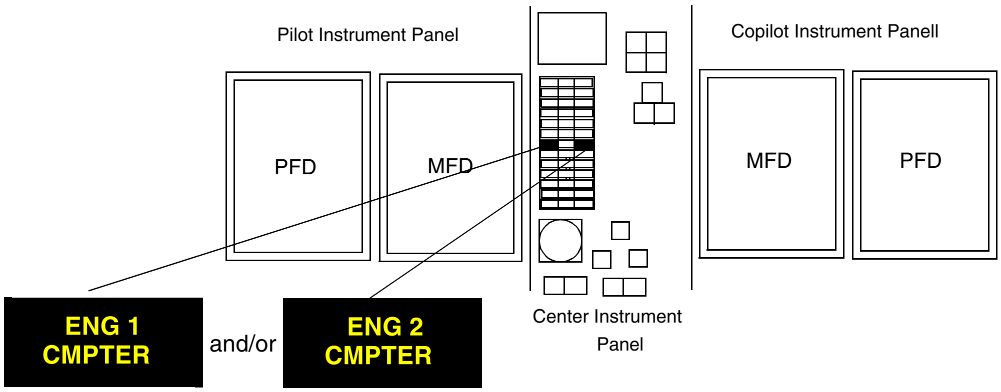
- Engine Inlet Pressure (Pt_2)
- Engine Inlet Temperature (Tt_2)
- Interstage Turbine Temperature (ITT)
- N_2 speed
- N_1 speed
- Thrust Lever Position

Each DEEC provides appropriate output current to the torque motor of the associated FCU based on the various inputs. Circuits within the DEEC monitor N_1 and N_2 continuously to provide overspeed protection. The computer commands the engine to shut down if the engine speed exceeds 109 or 110% N_2.

If an overspeed occurs, the primary overspeed circuit arms an electronic switch which energizes the overspeed solenoid that cuts fuel to the engine. This function is called the *ultimate overspeed protection*.

A MANUAL/NORMAL switch on the front of the DEEC CASE (rear equipment bay) and the flight compartment overhead roof panel ENG CMPTR switches control the overspeed protection.

The DEEC MANUAL/NORMAL switch must be in the NORMAL position and the ENG CMPTR switch must be in the AUTO position for the system to function. If the electronic engine control malfunctions, the FCU on the engine automatically switches to the manual mode and the respective ENG CMPTER annunciator will illuminate.



The DEEC compensates the engine operating parameters for different fuel types. Failure to adjust fuel specific gravity increases the possibility of the engine surging and high turbine temperatures during start, acceleration and deceleration.

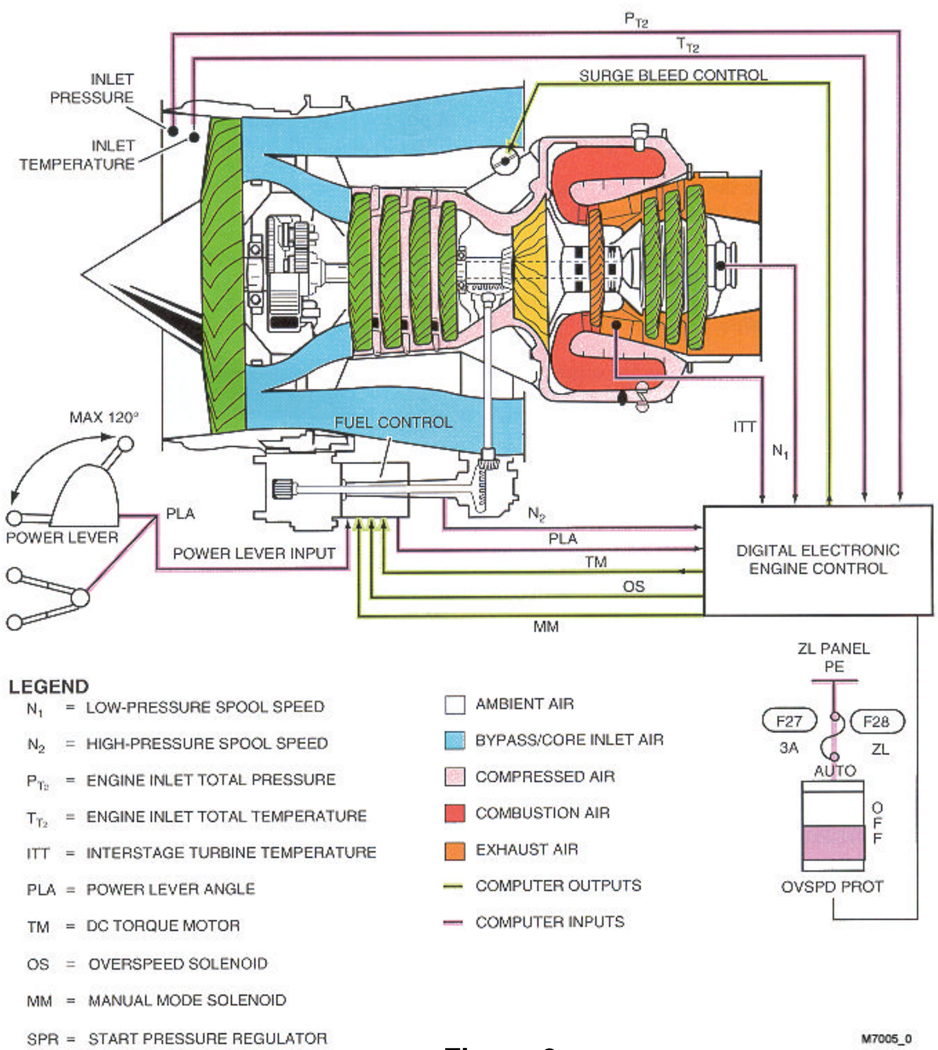


Figure 6
DEEC - Engine Interface

Surge Bleed Valve

Under certain conditions, gas turbine engines tend to surge and stall. For each compressor RPM, there is a relationship between the amount of air flow and the pressure gradient; a disturbance results in the engine surging. A surge bleed valve protects against this problem. The DEEC controls the position of the surge bleed valve which is located between the LP compressor and the HP compressor, to prevent compressor stalls and surges. If the valve opens, compressed air flows into the bypass duct smoothing out the pressure gradient throughout the engine.

The DEEC normally positions the surge bleed valve fully open for start and idle conditions and fully closed for high RPM conditions. For transient RPM conditions, however, the DEEC modulates the surge bleed valve in response to impending stall conditions. With the DEEC off or failed, the surge bleed valve remains 1/3 open.

Fuel Flow Divider Assembly

The fuel flow divider is between the fuel control unit and the fuel atomizers. During the engine start, the divider routes fuel at a reduced pressure to the primary atomizers.

As the start sequence continues and the RPM increases, the fuel flow and pressure difference across the divider orifice increases; fuel passes into the secondary lines that supply the fuel atomizers.

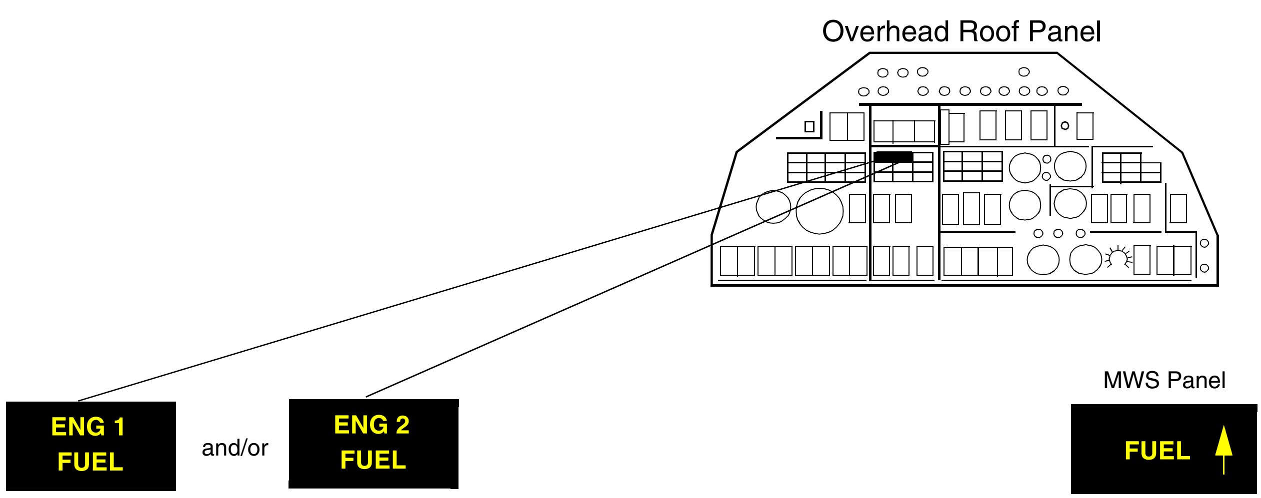
Fuel Nozzles

Each engine uses twelve duplex (primary and secondary) fuel nozzles on two manifold assemblies; each manifold contains six duplex nozzles. Fuel swirls and breaks into microscopic droplets as it passes through the atomizer orifice into the combustion chamber. The primary and secondary fuel nozzles provide a finely atomized fuel spray pattern.

Fuel Heating

The fuel heater permits oil-to-fuel heat exchange to maintain the desired temperature and prevents ice formation in the fuel system from clogging the fuel pump assembly fuel filter.

A portion of the engine fuel supply is diverted through the fuel heater by the thermostatically operated anti-ice valve located in the fuel pump. An appropriate amber ENG 1 FUEL or ENG 2 FUEL annunciator, located on the roof overhead panel and a repeater annunciator located on the MWS panel, will illuminate when the temperature of the fuel in the associated fuel pump becomes excessive.



Fuel Flow Indicating

Each engine fuel flow indicating system consists of:

- Fuel Flow Transmitter
- Data Concentrator Unit (DCU)
- Flow Rate Indication

The transmitter is a turbine-driven motor that rotates and generates an AC electrical signal as fuel flows past it. The AC voltage passes through a converter where DC voltage is supplied to the Data Concentrator Unit (DCU) which supplies the data to the MFD for the fuel flow indications.

The fuel flow indicating system uses 28 VDC power from the PS1 and PS2 busbars. The left system receives power from the PS1 busbar, and the right system receives power from the PS2 busbar.

Additional Fuel System Components

Additional fuel system components are the associated fuel lines and plenum drain valves. No fuel is allowed to drain from the plenum in normal operations, but any fuel accumulation during a false start is drained.

POWER CONTROLS

Engine Thrust Levers

Each thrust lever on the center control pedestal mechanically connects through cables and a teleflex control to a fuel control unit. Movement of the thrust lever directly drives the fuel control unit from idle to full power. In response to thrust lever movements and engine parameters, the electronic engine computer (DEEC) provides an electric signal to the hydro-mechanical fuel control unit torque motor. The fuel control unit either decreases or increases the flow of fuel to the engine to provide overspeed and over-temperature protection.

With the DEEC failed and OVSPD PROT selected, or OFF selected, through the ENG CMPTR switch on the overhead panel, the thrust lever directly controls the engine power through the fuel control governor. The thrust lever positions are in relationship to the angle of rotation of the control shaft on the FCU. The full aft (0°) position is the engine fuel cutoff position. The idle (or engine start) position is forward at 20°. To move the fuel valve from idle to cutoff or from cutoff to idle, the HP fuel cock lever must be lifted. The fuel valve has unrestricted travel from idle to full thrust.

Audible Warnings and Interlocks

The thrust levers operate two micro-switches through a cam on the thrust lever cable drum shaft. Reducing power below 65% N_1 RPM with the landing gear not locked down below 150 kts completes a circuit that sounds a warning horn.

Increasing power with the air brakes extended while the landing gear is down will complete a circuit that sounds a warning horn. A mechanical locking device interconnects both thrust levers to prevent simultaneous application of engine power above 60% N_1 with the elevator gust lock installed. Although one thrust lever at a time can be advanced to any setting.

High Pressure (HP) Fuel Cock Levers (Figure 7)

Each high pressure (HP) fuel cock lever connects mechanically through cables and teleflex controls to the fuel control unit. The levers control the opening and closing of the fuel control units from off (no fuel flow) to the idle fuel valve setting. The levers also connect mechanically with the hydraulic supply valves. Closing of a HP fuel cock lever simultaneously isolates the respective engine's hydraulic fluid supply.

A cam and spring at the OFF and ON positions of each HP fuel cock control lever mechanically lock the levers in either position. Before moving the lever, the knob must be pulled out to unlock it. The lever automatically locks once it reaches the OPEN or CLOSED positions.

Microswitches within each lever control power to the engine igniter units. In OFF, a circuit opens to remove power to the igniter unit. In ON, the switch closes to supply power to the respective unit. A red warning light is above the ON position of each HP fuel cock control lever. The light will illuminate in combination with the fire warning system as a reminder to close the respective cock.

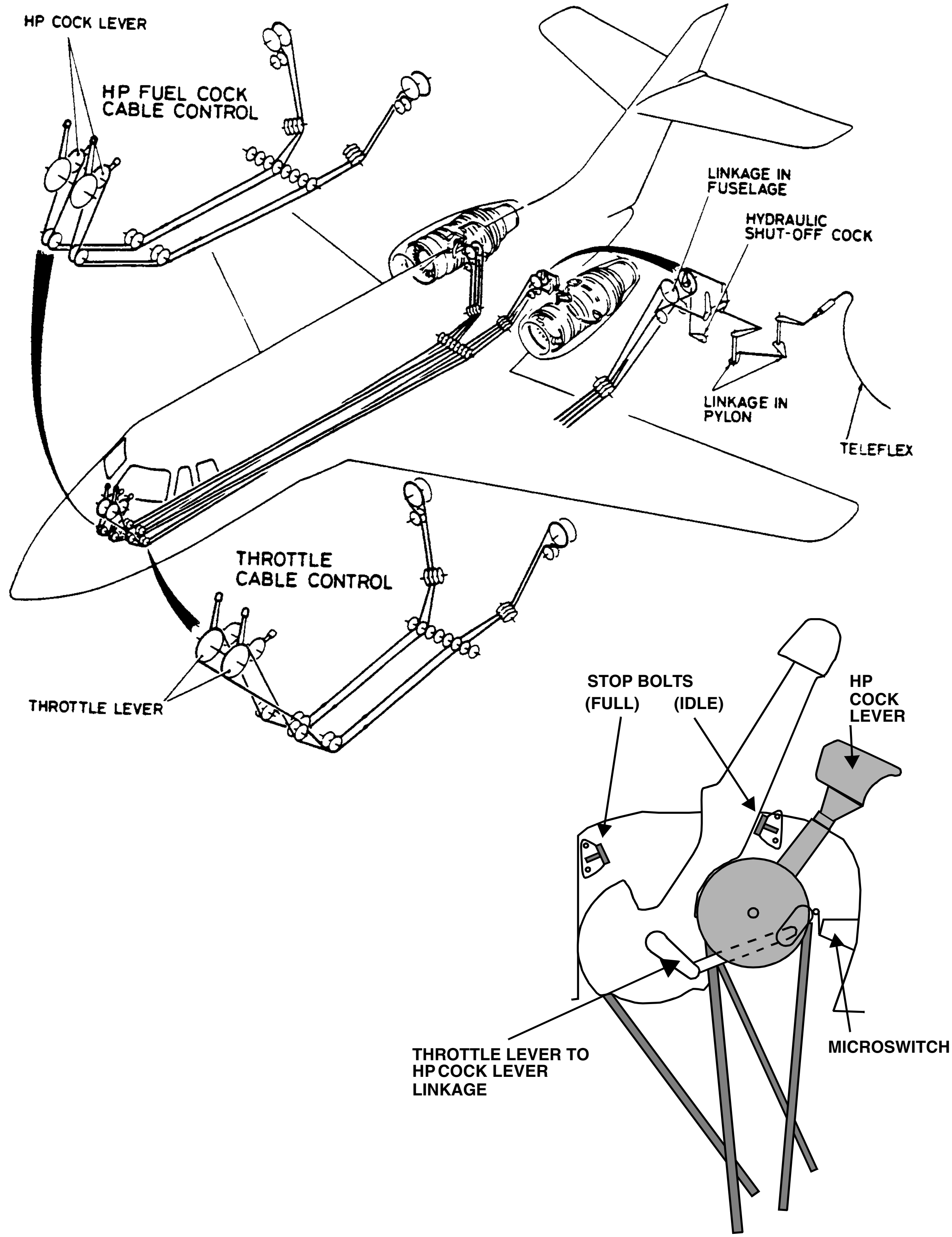


Figure 7
Fuel Controls

Engine Synchronizer

The engine synchronizer provides synchronization of the engines. Using the three position ENG SYNC switch, synchronization of either the low pressure fan N_1 or the high pressure turbine N_2 speeds can be selected in the cockpit.

The left engine (No. 1) is the master engine and the right engine (No. 2) is the slave. The system compares either the N_1 or N_2 speeds of the engines. The synchronizer processes speed signals from each engine and provide a trim signal to the electronic engine computer of the slave engine to reduce any speed difference.

Synchronization has limited authority and can occur only when speed differential is within the authority range. The maximum authority range is 2.5% N_2 at thrust setting midrange; authority range decreases as engine speed increases or decreases from the thrust setting midrange. The synchronizer has no effect at the full thrust settings.

The OFF position of the switch removes the DC power from the synchronizer; the N_1 and N_2 positions select the spool that will be used for synchronization. Operation of the synchronizer requires both engine computer switches to be in the AUTO positions.

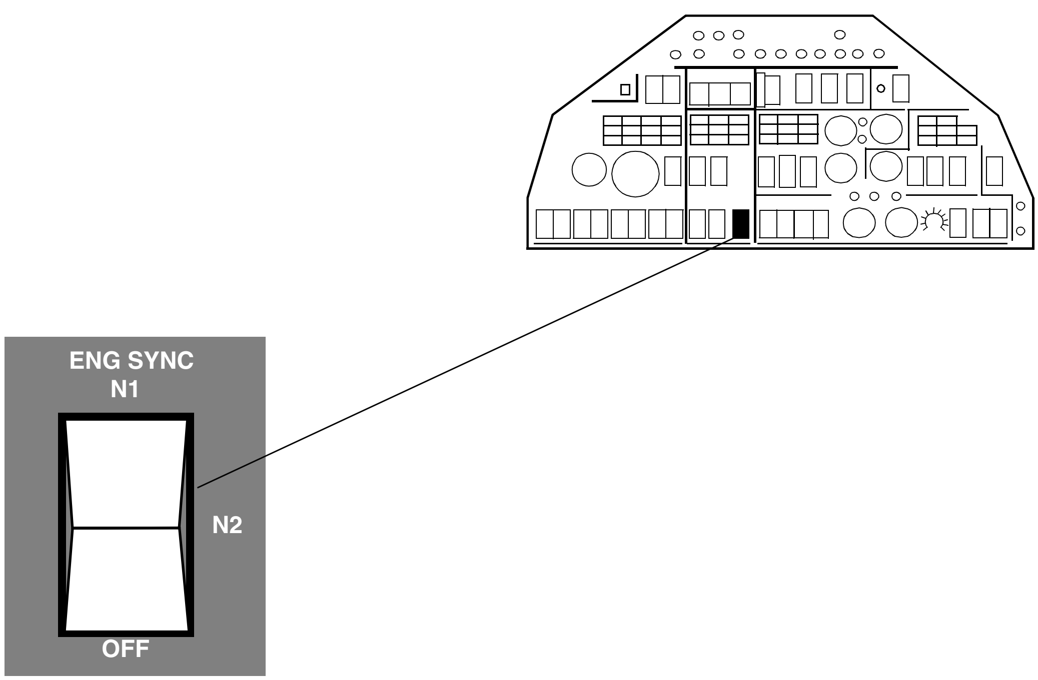
With APR armed the synchronizer is inoperative. When a synchronizer is switched off, the N_1 RPM indication displays N_1 RPM compensated for the thrust of the engine.

When the synchronizer is switched to N_1 or N_2, the N_1 RPM indication displays true N_1 RPM.

Power Supply

The engine synchronizer system uses 28 VDC from the PS1 busbar.

Overhead Roof Panel



BLEED AIR and VENTILATION

Air is bled from two stages of the engine compressor to provide supplies for:

- Nacelle Inlet Cowl Anti-icing
- Airplane Services

Ram air is used to ventilate the area of the cowling surrounding the engine compressor stages between the front and rear firewalls.

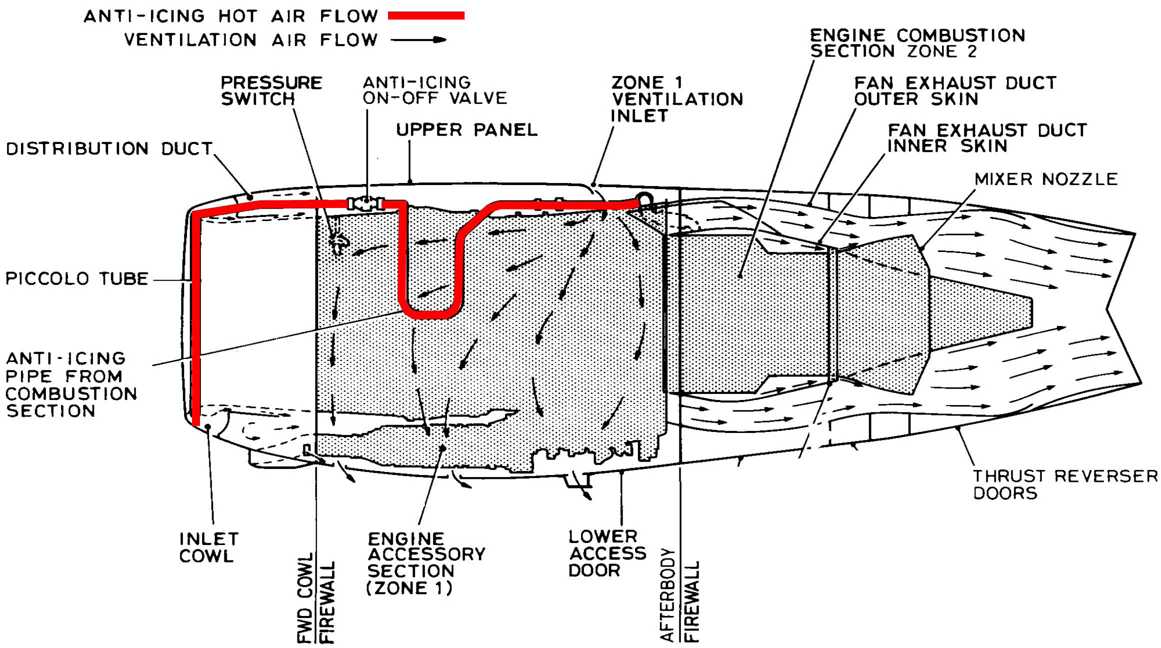
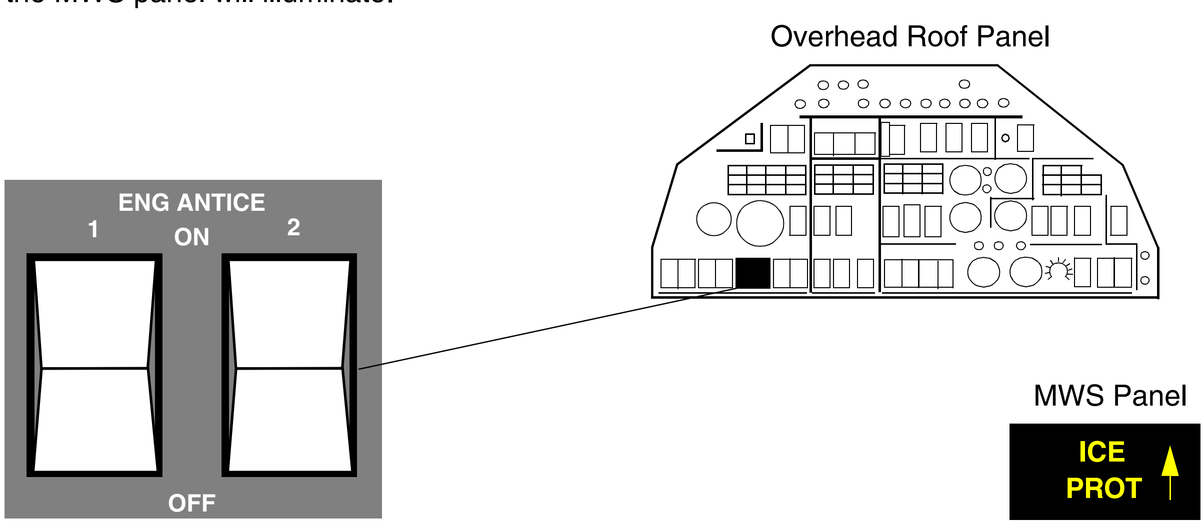


Figure 8
Engine Bleed Air and Ventilation

ANTI-ICING

An ENG ANTICE ON-OFF switch, located on the overhead roof panel ice protection section, is provided for each engine. With either or both switches selected to ON, an ICE PROT SELECTED annunciator on the MWS panel will illuminate.



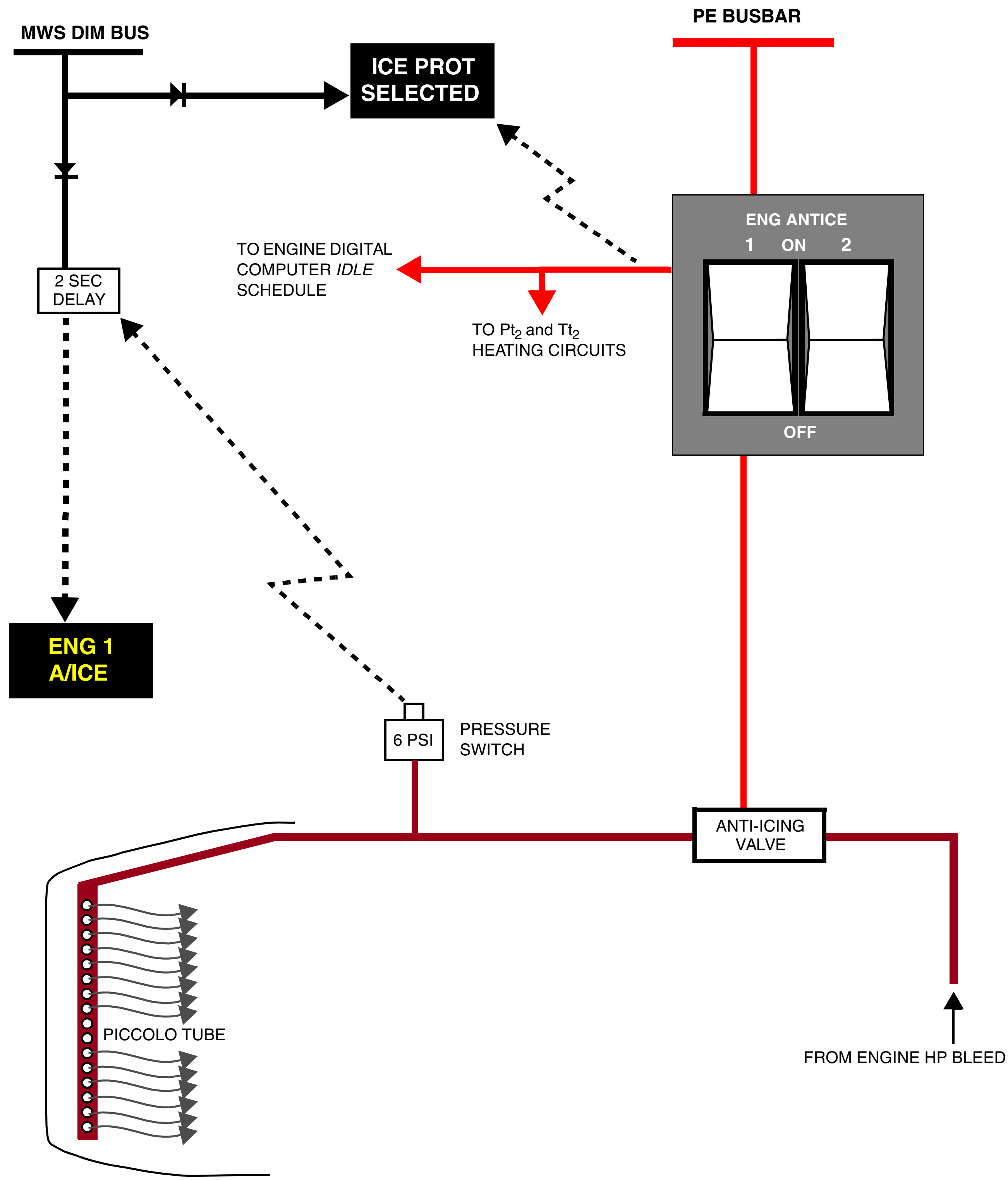


Figure 9
Engine Anti-icing System

The ENG ANTICE switches for the engine intake ice protection system may be selected ON at any engine speed including the use of maximum take-off thrust for takeoff and go-around.

Engine inlet anti-icing should be used in flight continuously during expected icing conditions.

When icing conditions do not exist, the inlet anti-icing should not be used above 50° F (10° C) ambient conditions for more than 10 seconds.

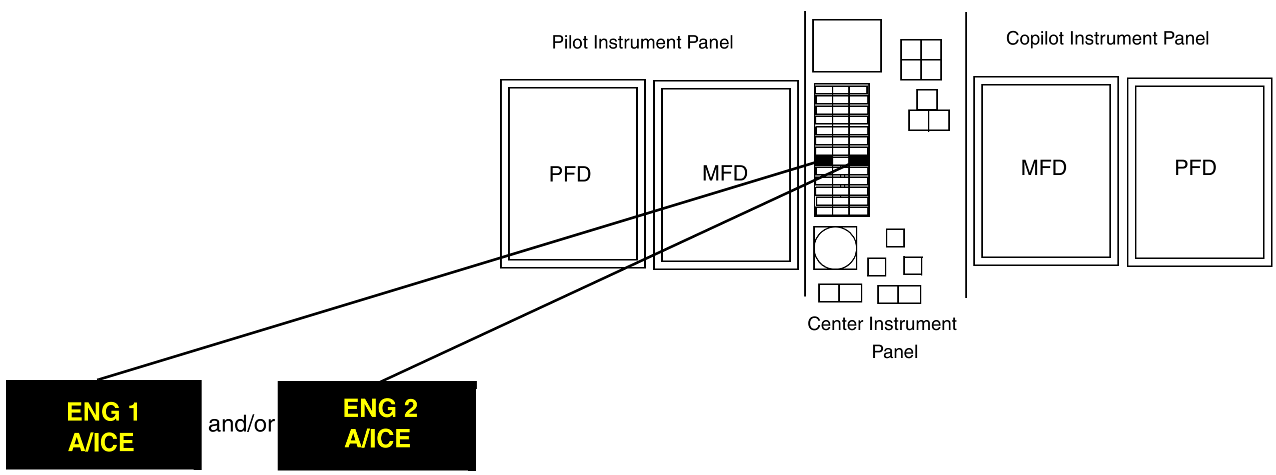
If anti-icing is required during takeoff, it should be turned ON prior to setting take-off power.

Each switch controls a servo-operated anti-icing on-off valve. When ON is selected, the following events occur:

- The anti-icing valve opens and high pressure air is bled from the HP compressor and ducted forward to anti-ice the nacelle inlet cowl.
- Electrical power is supplied to Pt_2 and Tt_2 sensor probe heaters.
- In flight, the digital fuel computers are reset to a schedule that incorporates a raised idle RPM.

A pressure switch, which operates at 6 psi, is tapped into the air bleed pipe from the engine. When the air pressure is low, the switch operates and illuminates ENG 1 or 2 A/ICE annunciator on the MWS panel. The anti-icing valve is energized to the closed position (with busbar energized and ENG ANTICE switch selected to OFF), spring-biased to the open position. This provides anti-icing fail-safe operation in the event of an electrical malfunction.

Prior to the opening of an anti-icing valve, or during any subsequent system failure, the pressure switch will register a low pressure condition and the appropriate ENG A/ICE annunciator will be illuminated at the MWS dim pre-set level.



The annunciator will remain illuminated at the dim level until the nacelle anti-icing air supply rises above 6 psi and the pressure switch contacts change over. Then the annunciator extinguishes. A timer in the circuit makes sure the annunciator will brighten to full intensity, should the pressure switch not operate within 2 seconds. The time delay also inhibits *nuisance* flashing of the annunciator during normal system operation.

Power Supplies

DC supplies for the engine anti-icing system are taken from the PE busbar. The supplies to the pressure switch are routed via the main gear weight-on wheels switch relay network.

AIRPLANE SERVICES

Each engine has two bleed ports used for the airplane services

- One low pressure (LP) bleed port on the inboard side of each engine takes bleed air aft of the last stage of the axial compressor.
- A high pressure (HP) bleed port takes air from downstream of the centrifugal compressor.

Each bleed air system contains check valves that prevent air from returning to the engines at low engine speeds or during engine shutdown. The airplane uses LP bleed air for air conditioning, normal pressurization, emergency pressurization and hydraulic reservoir pressurization. HP bleed air supplements LP bleed air supplying these services at low power settings. The rudder bias system receives power from the LP bleed air system only.

NOTE: For further information, refer to Sub-section 10 Environmental System and Sub-section 6 Flight Controls.

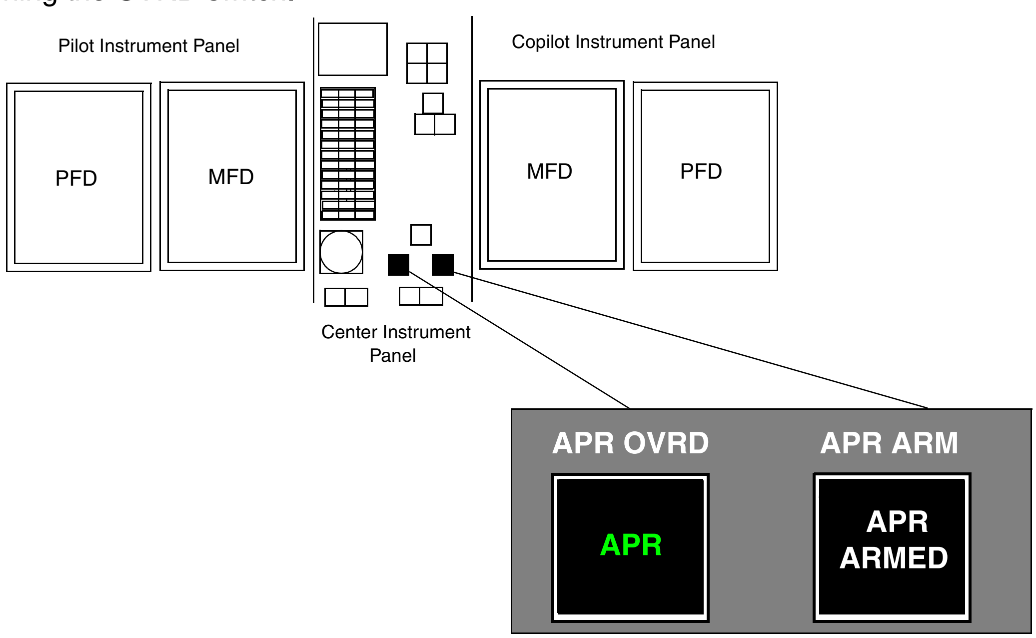
AUTOMATIC PERFORMANCE RESERVE (APR)

When armed, the APR system allows an automatic increase in engine performance in the event of an engine failure or transient fault during takeoff, or during a go-around following a single engine approach.

There will be no increase in thrust if the ambient conditions are such that the engines are N_1 RPM limited (at normal rating). The APR system is powered from the PE busbar and consists of two mechanically latching, push on/push off, control switches in the flight compartment plus an APR/ Sychronizer control unit in the rear equipment bay.

CONTROLS

Two control switches, the LH one labelled APR OVRD and the RH one APR ARM are mounted on the pilots center instrument panel. The ARM switch has an APR ARMED white annunciator which will be illuminated when the switch is pushed to arm the system and will not illuminate when the switch is pushed again to disarm the system. The APR OVRD switch has an APR green annunciator which will illuminate when the system is armed and triggered, either automatically by N_2 difference or manually by pushing and latching the OVRD switch.



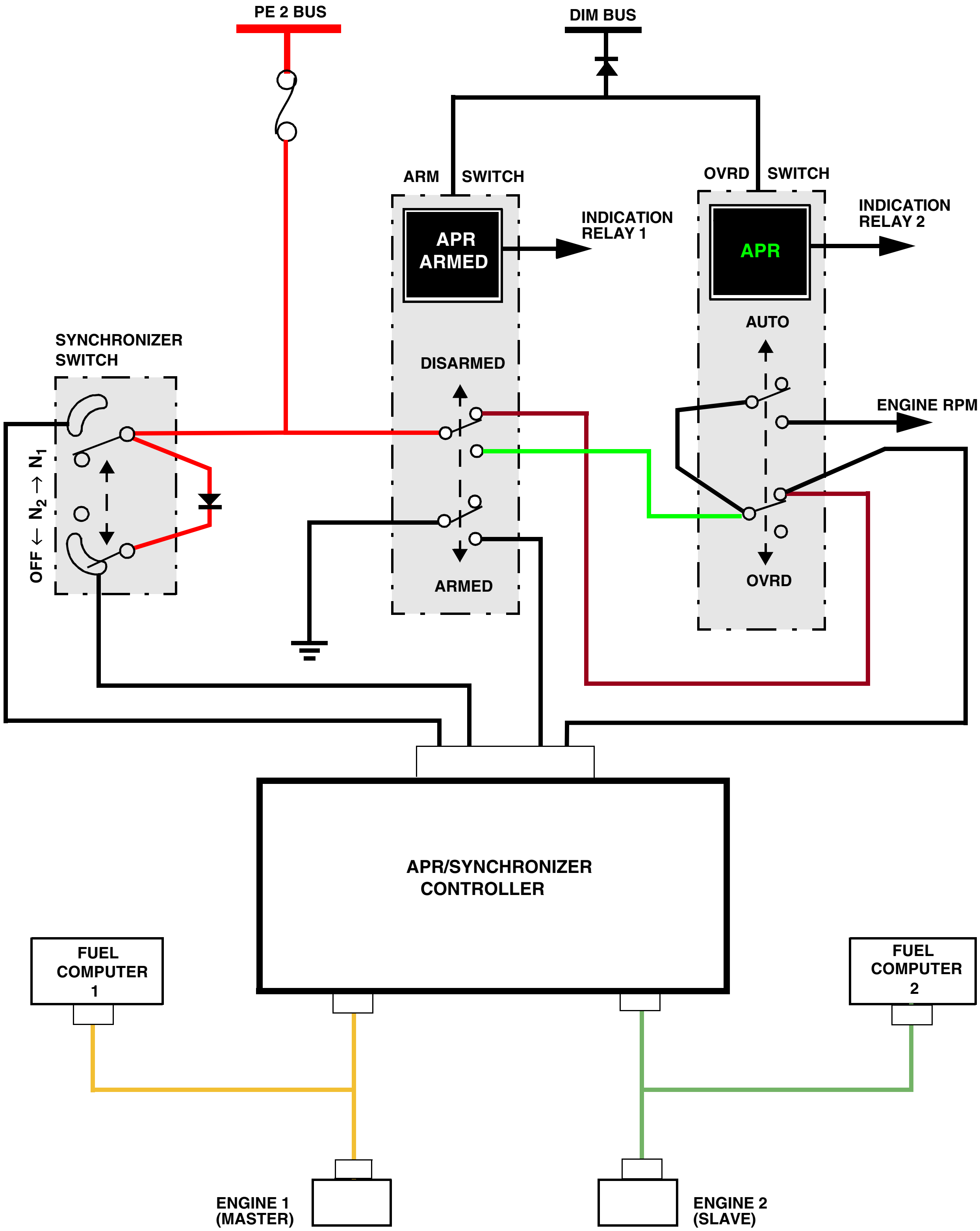


Figure 10
APR System

OPERATION

In both automatic and manual modes the engine fuel computers limit maximum takeoff power to the APR rating although under normal conditions, the APR control unit electrically trims down the settings to the lower normal ratings. When the APR is triggered the control unit allows the computers to reset to the APR ratings; normal engine response to the thrust lever movement is retained.

When armed, APR is triggered automatically if the engine N_2 signals, received from the synchronizer and compared by the APR controller, differ by more that 5% $N_{2.}$

Increase in thrust is obtained by allowing the engines to be run at higher operating limits; the N_2 rotor speed increasing approximately 0.75% (max) and the interstage turbine temperature (ITT) rising approximately 18° C (max).

Automatic Mode

In auto mode the system functions in conjunction with the engine synchronizer system.

Manual Mode

When armed, to cater for an auto mode malfunction, the system may also be triggered by manual selection of APR OVRD.

NOTE: There is a penalty in terms of engine life whenever an engine operates at APR levels - see the Airplane Flexible Maintenance Schedule for further details. Therefore manual selection of APR should only be made when it is essential to do so.

To cancel APR mode after manual selection, both the APR OVRD and APR ARM switches should be delatched. If only the APR ARM switch is delatched, APR will be cancelled but will be triggered again as soon as the APR ARM switch is pushed.

Failure Modes

Failure of electrical power to the APR/sychronizer controller will also result in both fuel computers resetting to the APR ratings.

The synchronizer must be serviceable to supply N_2 comparisons for the APR auto mode. Manual APR OVRD is independent of N_2 signals.

An engine fuel computer must be serviceable and selected to AUTO in order to respond to APR. Should an engine computer fail, or is selected to manual, with APR armed, APR will be triggered in the other engine if engine speed differences exceed 5% N_2.

THRUST REVERSERS

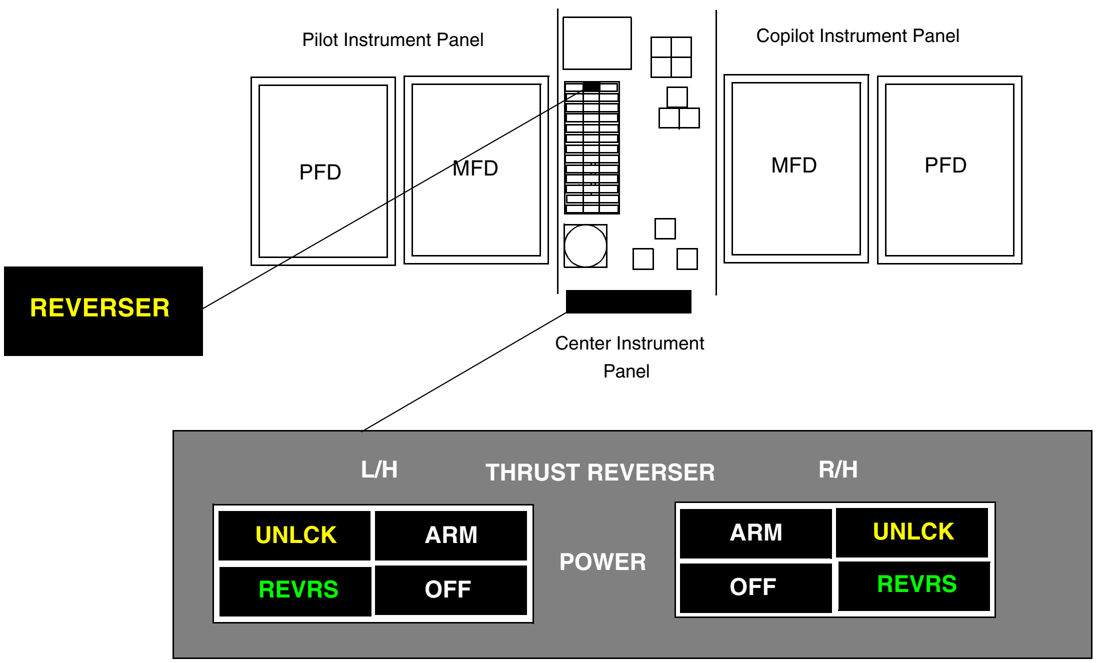
DESCRIPTION

The thrust reverser assembly consists of clamshell type doors which, when stowed, form the final section of the engine exhaust nozzle. The reverser doors are held in the stowed positions by a latching system until released by the sequenced actuation of a series of switches and relays.

Two fan flaps within each installation are used to reduce the temperature at the clamshell doors while in reverse mode; these are stowed and deployed in conjunction with the clamshell doors. Each thrust lever has a solenoid operated baulk arrangement which mechanically prevents selection of reverse thrust until the reverser doors are fully deployed. Each reverse thrust selector lever has a stop to limit the thrust obtainable at the full reverse thrust position.

CONTROLS and INDICATORS

An electrical control panel, located on the lower section of the center instrument panel, provides L/H and R/H THRUST REVERSER POWER switchlights which illuminate ARM or OFF. Amber UNLCK and green REVRS annunciators are also provided on the panel. An amber REVERSER annunciator, located on the MWS panel, illuminates to indicate the existence of a malfunction of either reverser.



ARM

Pushing this switch initiates a sequence, which upon completion makes sure the thrust reverser is ready for deployment. The white ARM annunciator will illuminate when the ready for deployment sequence has been completed.

The white ARM annunciator will only illuminate when the following conditions are satisfied:

1. Weight on airplane wheels.
2. Thrust lever at idle.
3. Hydraulic pressure available at reverser control valves.

OFF

Power to the thrust reverser system is OFF and indicated by the illumination of this white annunciator.

UNLCK

An amber annunciator which illuminates if one or more thrust reverser door latches are not locked and when the doors are moving or deployed.

REVRS

A green annunciator which illuminates when the thrust reverser doors are fully deployed. Each thrust reverser is actuated through an independent and identical hydraulic sub-system powered from the airplane's main system. The two systems both share a common accumulator.

Thrust reverse levers are mounted in a *piggyback* configuration on the engine thrust levers and each thrust lever provides control for stow, deploy and reverse thrust for its respective engine.

Each engine thrust lever has a solenoid-operated baulk (lockout) which mechanically prevents selection of reverse thrust until the reversers are fully deployed. Each engine thrust lever also has a stop to mechanically limit the obtainable reverse thrust when the thrust reverser lever is increased to its maximum thrust position.

An automatic engine thrust lever retard system is incorporated in the event of a stow or deploy malfunction.

REVERSER ASSEMBLY and OPERATION

Each thrust reverser assembly is an electromechanically controlled, hydraulically operated, target-type thrust reverser consisting of:

- Upper and lower clamshell type doors located on the rear of each engine nacelle.
- Hydraulic actuators and associated linkages that position the reverser doors upon either stow or deploy commands.
- Latches which hold the reverser doors in the stowed position until released by sequentially actuated switches and relays.
- Fan flaps, located within each fan duct, assist in temperature reduction on the doors. They deploy and stow in conjunction with the doors.

The complete sequence of operation to cycle the reverse thrust system from stowed to deployed and return to stowed can be grouped into three main phases of initiate, deploy and stow.

Initiate

When the POWER switch is pushed, the ARM annunciator will illuminate and an isolation solenoid energizes to make pressure available to the latch, deploy and stow solenoid valves if the following conditions are met:

- Weight-on-wheels switches recognize an on-the-ground condition.
- Engine thrust lever is in the IDLE position.
- Hydraulic pressure is available (400 psi minimum).

Deploy

Initially the stow and latch isolation solenoids are simultaneously energized, which directs pressure to the stow side of the primary actuators, the latch actuators and the thrust lever retard actuator.

The thrust reverser doors will be driven to the overstow position, allowing the door latches to clear the latch receptacle. As the latch switches operate and the doors unlock, the UNLCK annunciator will illuminate.

NOTE: The tendency of the exhaust forces on the doors is toward deploy whenever the engine is running. When engaged, the latches cannot be disengaged unless the overstow condition can be realized.

When the unlatch switches operate, the stow solenoid is de-energized and the deploy solenoid energized retracting the primary actuators to deploy the reverser doors and extend the fan flaps into the engine bypass airstream. The UNLCK and REVRS annunciators will illuminate.

After initial deployment, the reverse thrust lever baulk is released and additional reverse thrust may be commanded by pulling the levers toward maximum reverse. A mechanical stop is set at a predetermined thrust setting.

A deploy command inhibits operation of rudder bias to prevent rudder movement due to asymmetric thrust. The airbrake warning horn and the ELEV/AIL trim annunciator is also inhibited.

Stow

Moving the reverse thrust lever to the stow position de-energizes the stow/deploy relay and closes the unlatched solenoid. Deploy power is removed from the latch switches, the stow valve solenoid is energized and hydraulic power is routed to the close side of the primary actuator, closing the reverser doors.

Fan flaps are spring-loaded closed and the engine thrust lever retard actuator is limited to IDLE. When the reverser doors reach fully locked, stow pressure is removed.

The stow valve solenoid is energized and hydraulic power operates the primary actuator to close the reverser doors. The fan flaps will return to the closed position under spring pressure from an internal system. Pressure is applied to the thrust lever retard actuator to limit it to the idle position. When the reverser doors reach the fully locked position, stow pressure is removed.

Pushing the POWER switch off removes hydraulic pressure from the deploy, stow and latch valves and the pressure switch in the control selector valve.

Autostow

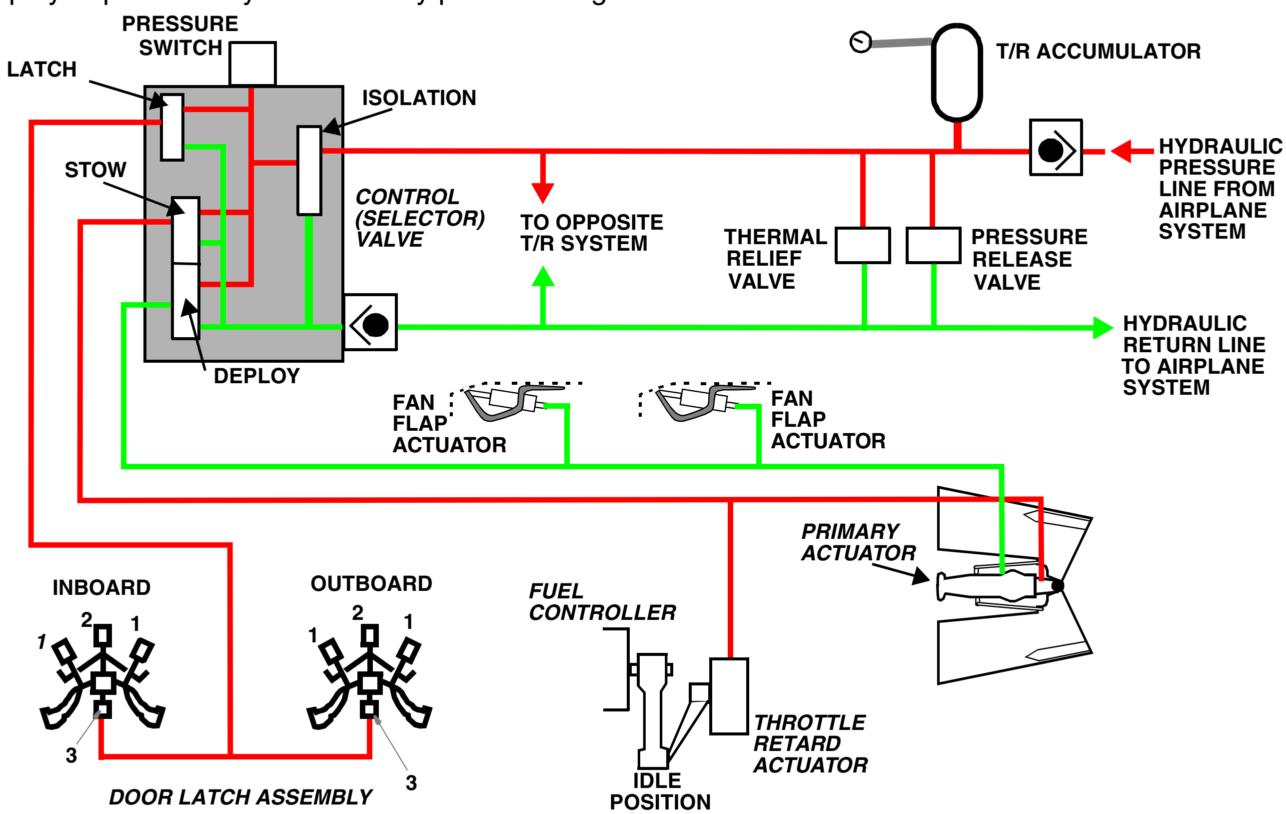
The stow sequence (autostow) will always be activated when at least one pair of door latches on the same side of the reverser is not locked and a valid deploy signal is not present, irrespective of the position of the POWER switch. If the POWER switch is off the reverser will stow.

Automatic Thrust Lever Retard/Autostow System

The thrust lever retard system will automatically move the engine FCU engine thrust lever arm to the idle position when a stow or overstow condition is recognized. If both door latches on the same side of the reverser move towards an abnormal position, both door latch microswitches will automatically ARM the reverser and initiate a stow cycle (autostow) which in turn activates the thrust lever retard system to force the engine thrust lever to move to the idle position.

SYSTEM SAFETY

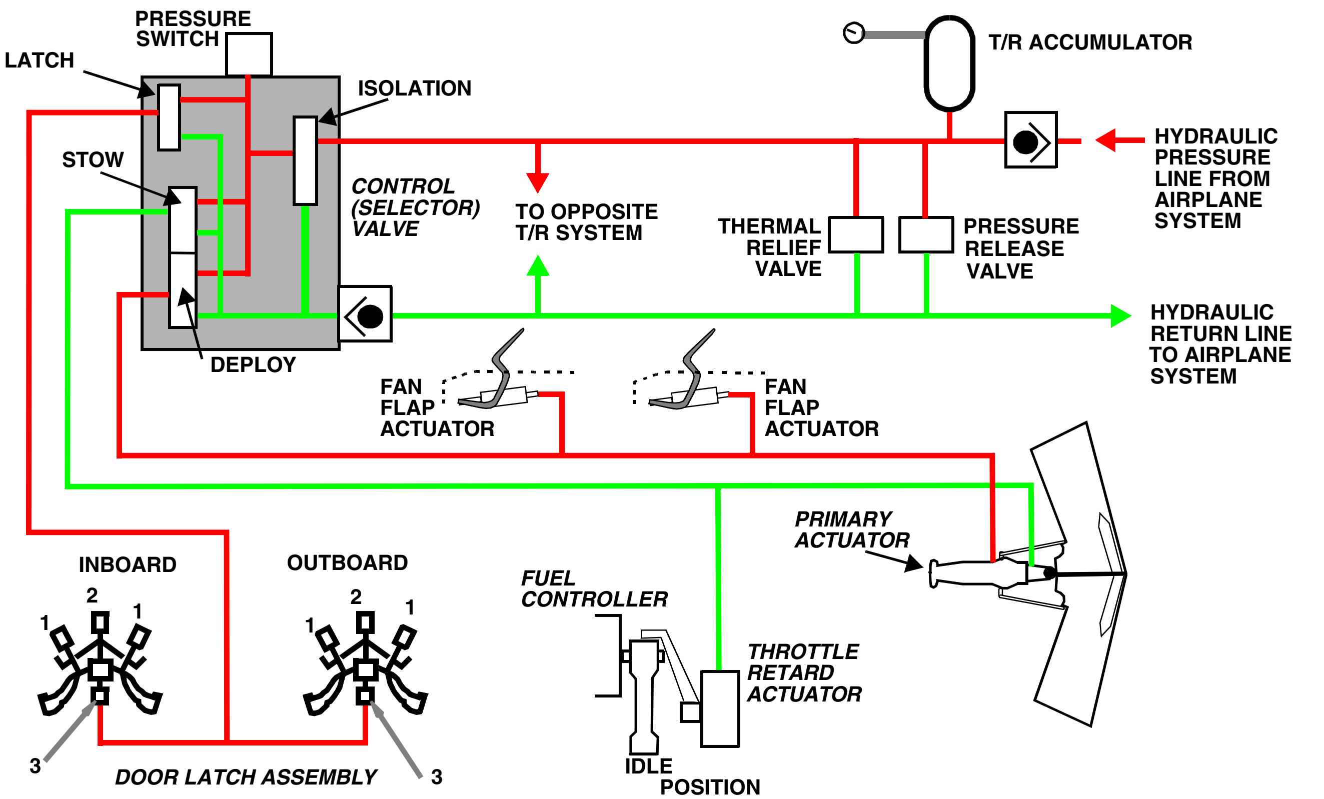
A reverse thrust selector installed to each engine thrust lever is operable only when the associated thrust lever is fully retarded to the engine idle position. Detents locate the selector in either the stow or deploy positions. When on the ground, the reverser doors may be secured in either the stowed or deployed positions by use of safety pins with flags attached.



Door Latch Assembly Legend

1. Latch Switch
2. Unlatch Switch
3. Latch Actuator

Figure 11
Thrust Reverser Operating Mode - Overstow and Latch



Door Latch Assembly Legend

1. Latch Switch
2. Unlatch Switch
3. Latch Actuator

Figure 12

Thrust Reverser Operating Mode - Deploy

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