CHAPTER 7D

POWERPLANT

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ILLUSTRATIONS

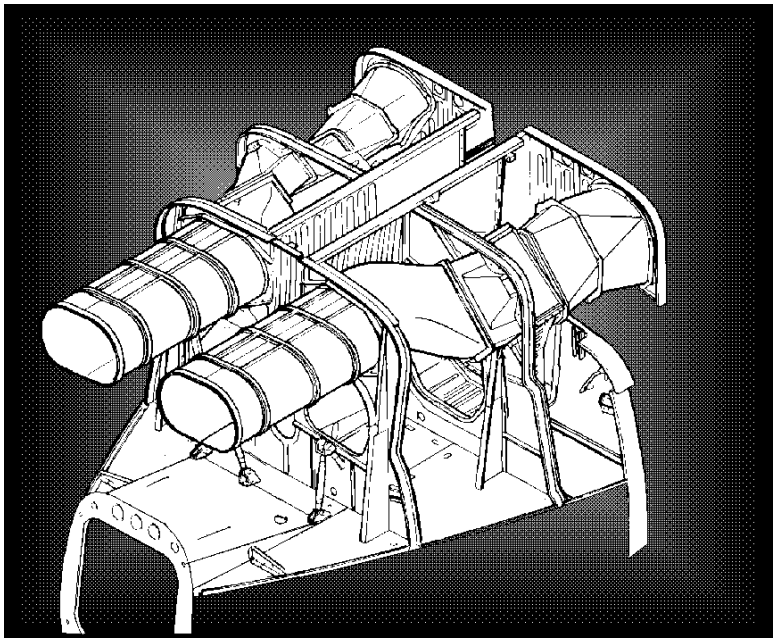


Figure 7-49 Air Management System

AIR MANAGEMENT

Each engine on the Bell 212 is equipped with an independent particle separator system (PSS). The PSS is designed to protect the engine from damage that would be caused by ingestion of foreign matter such as sand, dust, ice, and vegetation. The PSS prolongs the life of critical engine components and allows helicopter operation from unimproved areas. The PSS also provides a degree of engine air inlet anti-ice protection by preventing water droplets and ice from being ingested into the engine

GENERAL

Each particle separator system uses an inertial bypass arrangement to exclude approximately 93% of foreign particles larger than 100 microns in diameter and approximately 80% of particles larger than 20 microns.

The PSS functions any time the engine is operating above 51% N1 rpm. Operation of the system terminates automatically when engine N1 rpm decreases below 51% or when the FIRE PULL handle for that engine is actuated. Automatic termination of PSS operation associated with low engine N1 rpm may be overridden by using the cockpit PART SEP switches.

Each PSS consists of an engine air inlet, a shaped air inlet/bypass duct, an electrically actuated bypass door, and the engine exhaust ejector and duct. DC electrical power and signals from the rpm warning and control unit are used to automatically control PSS operation (Figure 7-50).

SYSTEM OPERATION

Prior to engine start, with the FIRE PULL handle pushed in and the PART SEP switch in the NORM position, the PSS is off, the bypass door is closed, and the

PART SEP OFF caution panel light is illuminated. During engine starting, the compressor draws air in through the air inlet and down to the engine air intake through a slot on the floor of the forward duct. The closed bypass door ensures that all air entering the air inlet is available for engine starting (Figure 7-51).

As engine N1 speed accelerates, N1 rpm is monitored by the rpm warning and control unit. When the N1 rpm reaches 51% ± 3%, the rpm warning and control unit sends DC electrical power to an actuator which opens the PSS bypass door. Engine exhaust, exiting the engine through the exhaust duct, creates a low pressure which draws air from the inlet, past the open bypass door, and back through the ejector duct, where it passes out to the atmosphere along with the engine exhaust.

The convergent shape of the PSS inlet duct creates a venturi effect for the air entering the inlet. This effect accelerates the air, and any foreign matter it contains, as the air mass approaches the engine air inlet slot. The accelerated mass inertia of any foreign matter causes it to bypass the engine air inlet slot and prevents particles from entering the engine. The inertia of the foreign matter carries it past the open bypass door and out through the exhaust ejector. The shaped duct and the exhaust ejector work together to provide only clean air for engine use. In flight, the effect of ram air as a result of forward airspeed enhances PSS efficiency (Figure 7-50).

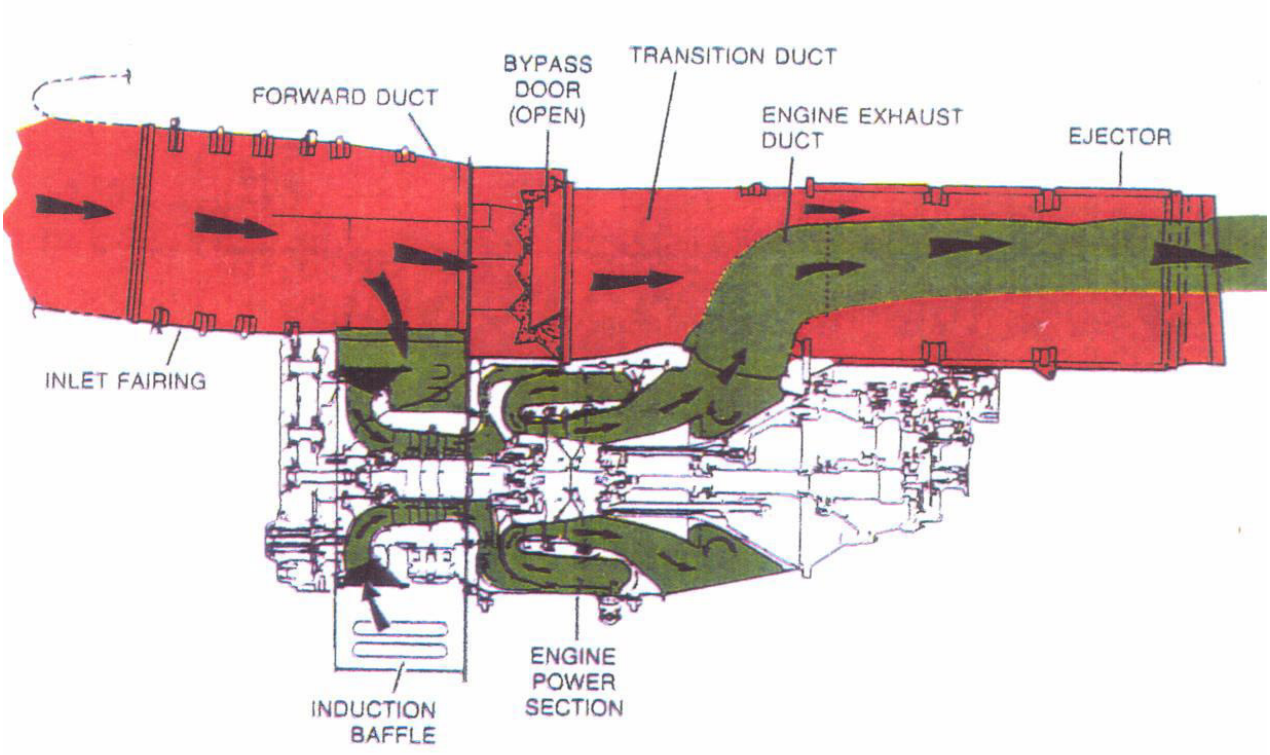


Figure 7-50 Air Management System Schematic

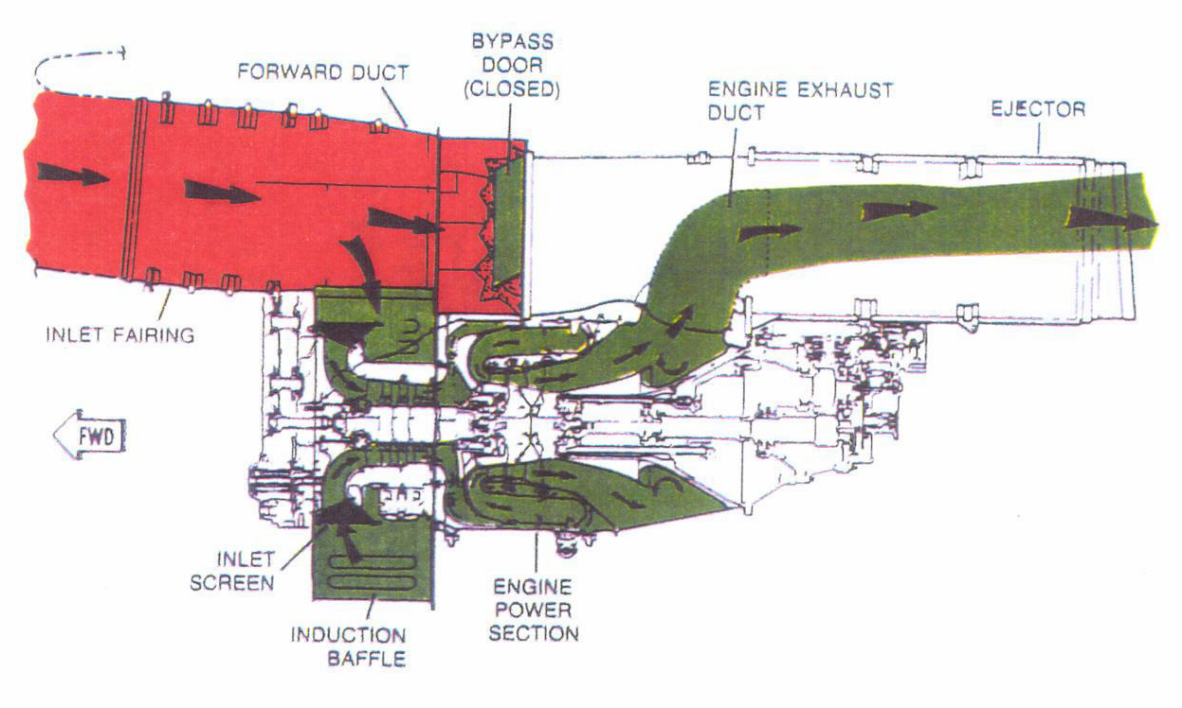


Figure 7-51 Particle Separator System Operation below 52.5% N1

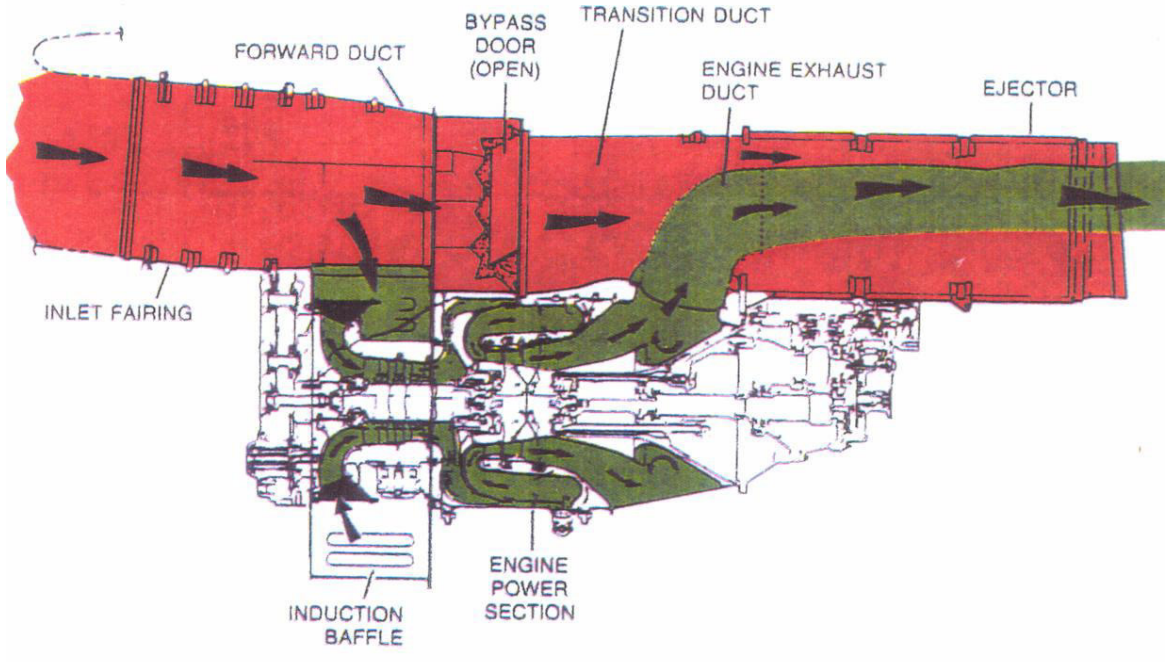


Figure 7-52 Particle Separator System Operation above 52.5% N1

CONTROLS AND INDICATIONS

Normally, proper operation of each engine's PSS is totally automatic and requires little pilot attention. Two caution lights marked "PART SEP OFF," located on the caution panel, are illuminated prior to engine starting and advise the pilot that each engine's PSS is off (bypass door closed). Following engine start and above 51% N1 rpm, the pilot checks the **PART SEP OFF** caution light to verify it is extinguished. The extinguished light indicates that the bypass door has opened and the PSS is operating normally.

Should the PART SEP OFF caution **light remain** illuminated after an engine is started and N1 rpm is above 51%, the pilot may manually open the bypass door by moving the respective PART SEP switch from NORM to OVRD ON (override on) position. The switch is located on the engine/fuel control panel on the center pedestal. Moving the switch to OVRD ON bypasses the automatic circuit of the rpm warning and control unit and manually activates the bypass door actuator to the open position. DC electrical power for each engine's PSS is provided from the respective essential bus through a circuit breaker marked "PART SEP" on the overhead console. If DC electrical power to the PSS should fail, the PART SEP OFF caution light illuminates regardless of bypass door or PART SEP switch position (Figure 7-53).

EMERGENCY SYSTEM OPERATION

In the event of an engine fire, as indicated by the illumination of a FIRE PULL handle, it is essential that all engine inlet air be directed into the engine for cooling. A separate electrical circuit is incorporated into each engine's FIRE PULL handle which, when actuated by pulling the handle, overrides all other controls, rpm signals, and switches, actuating the PSS bypass door to the closed position.

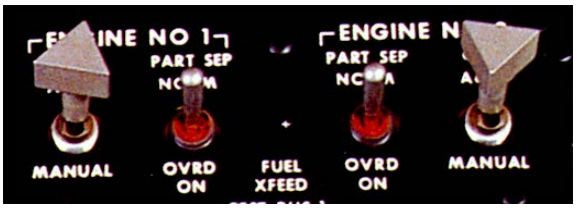
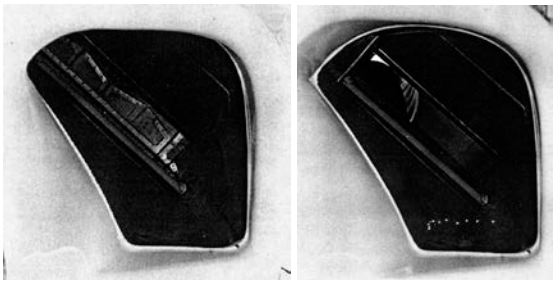


Figure 7-53 Particle Separator Switches

GROUND CHECKS

Operation of the PSS can be checked prior to flight, if desired. Prior to engine start, with DC power applied to the helicopter and the PART SEP switches in the NORM position, the PSS bypass door can be seen in the closed position by looking straight into each engine's air inlet duct. Moving the PART SEP switches to OVRD ON actuates the bypass doors to the open position, and an observer is able to see straight through the length of the PSS.



DOOR CLOSED DOOR OPEN

Figure 7-54 Particle Separator Doors

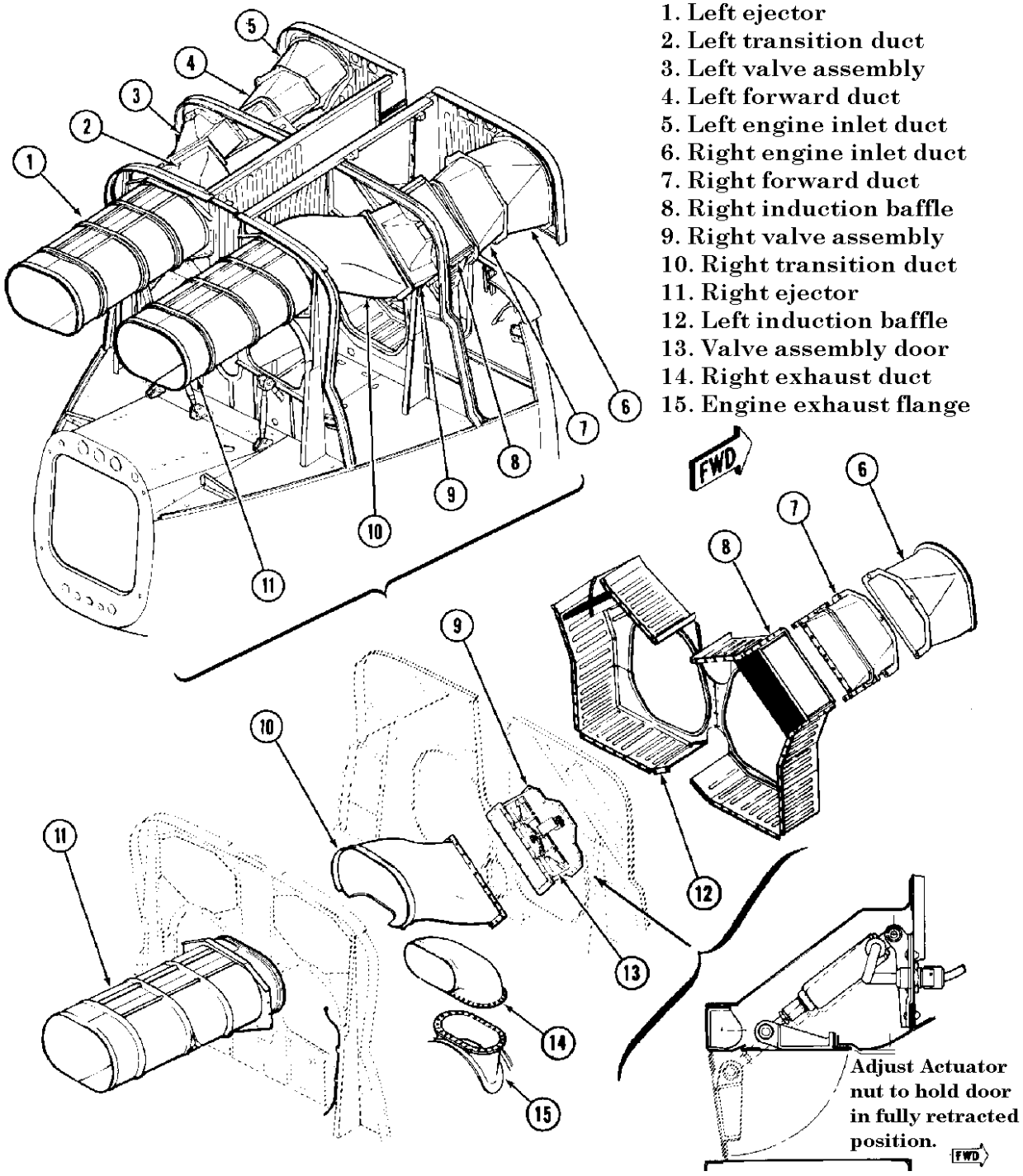
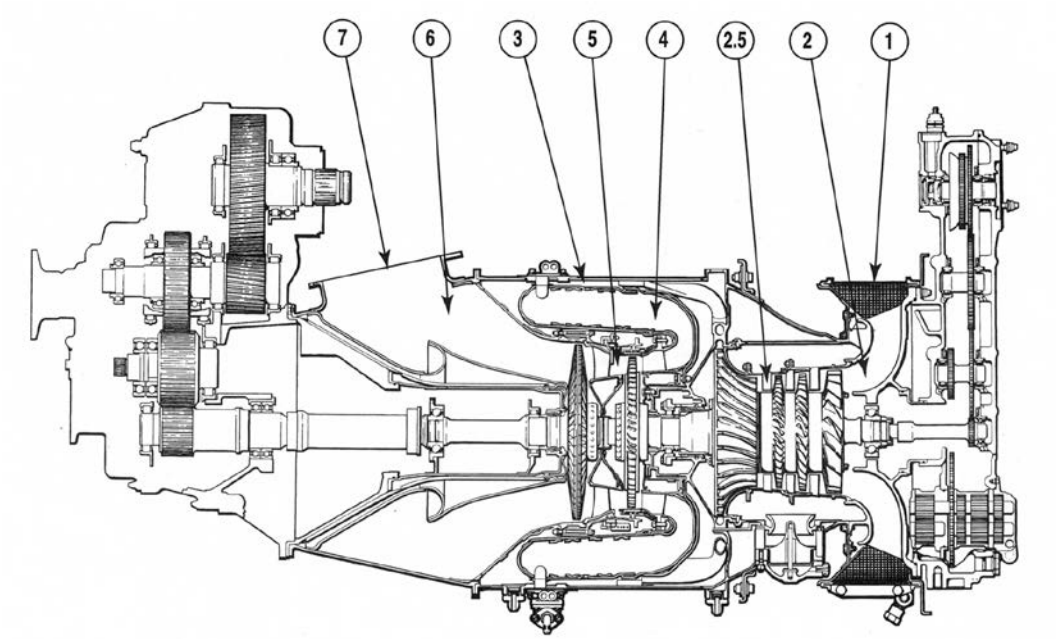


Figure 7-55 Air Management System Installation

Additional Engine Diagrams



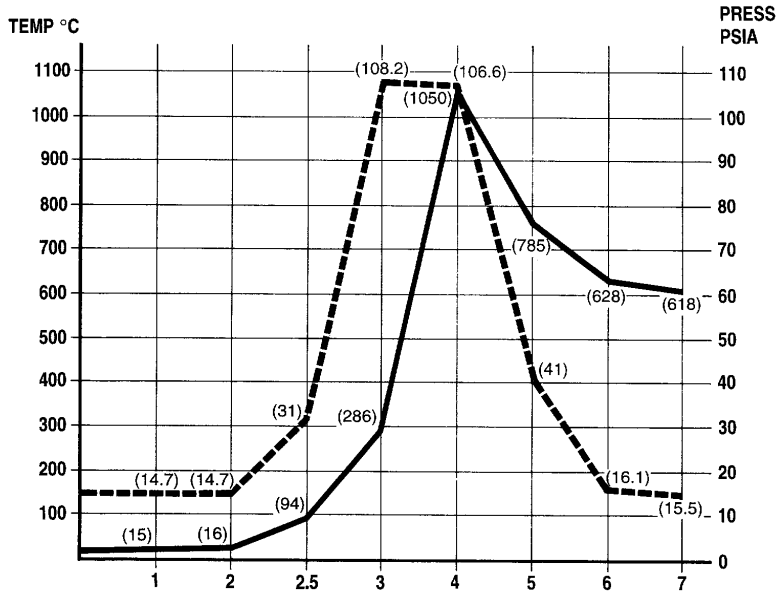


Figure 7-56 Stations

Note: Pressures and temperatures listed are taken on standard day.

Temperature ▬▬

Pressure ▪▪▪▪▪▪▪▪

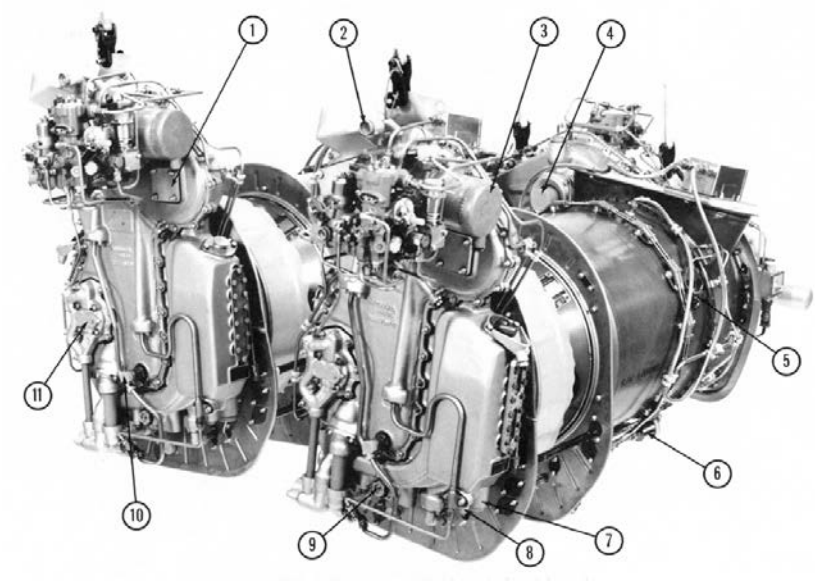


Figure 7-57 Engine Left Front

1- Ng Tachometer Generator Pad Ng
2- Fuel System Inlet
3- Reduction Gearbox Output Shaft
4- Reduction Gearbox Output Shaft
5- T5 System Terminal Block
6- Fuel Accumulator
7- Power Section Oil Pressure Port
8- Power Section Oil Temperature Port
9- Power Section Oil Tank Drain
10-Accessory Gearbox Chip Detector
11- #2 Bearing Oil Scavenge Pump

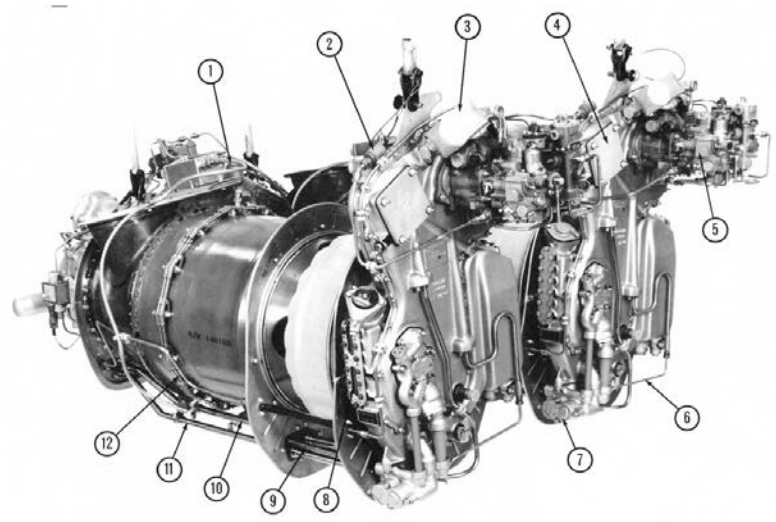
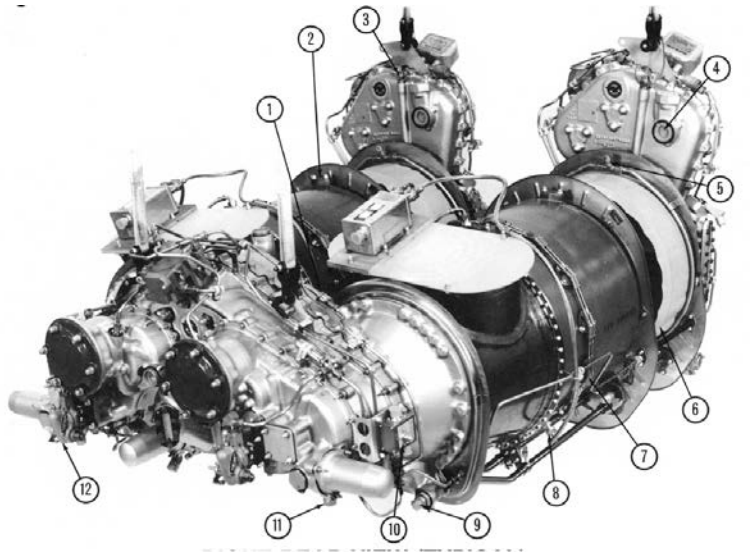


Figure 7-58 Engine Right Front

1- Reduction Gearbox Oil Pressure Port
2- Py Accumulator
3- Oil To Fuel Heater
4- Starter Generator Pad
5- Fuel Control Unit (AFCU+MFCU)
6- Oil Pressure Sensing Line
7- P.S. Oil Pressure Regulating Valve
8- P.S. Oil Level Sight Gage
9- #2 Bearing Scavenge Lie
10- #3 And #4 Bearing Scavenge Lines
11- Oil Pressure Line
12 Pg Line



1- Check Valve
2- P3 Air Cabin Bleed
3- P.S. External Oil Pressure Adjustment Valve
4- AGB Oil Breather Carbon Seal
5- Compressor Wash Ring Fitting
6- Air Inlet Screen
7- Fuel Nozzle
8- Spark Igniter
9- P.S. Oil Outlet (To Airframe Oil Cooler)
10- T5 Trim Compensator
11- P.S. Oil Inlet (From Airframe Oil Cooler)
12 NF Governor (N2)

Figure 7-59 Engine Right Rear

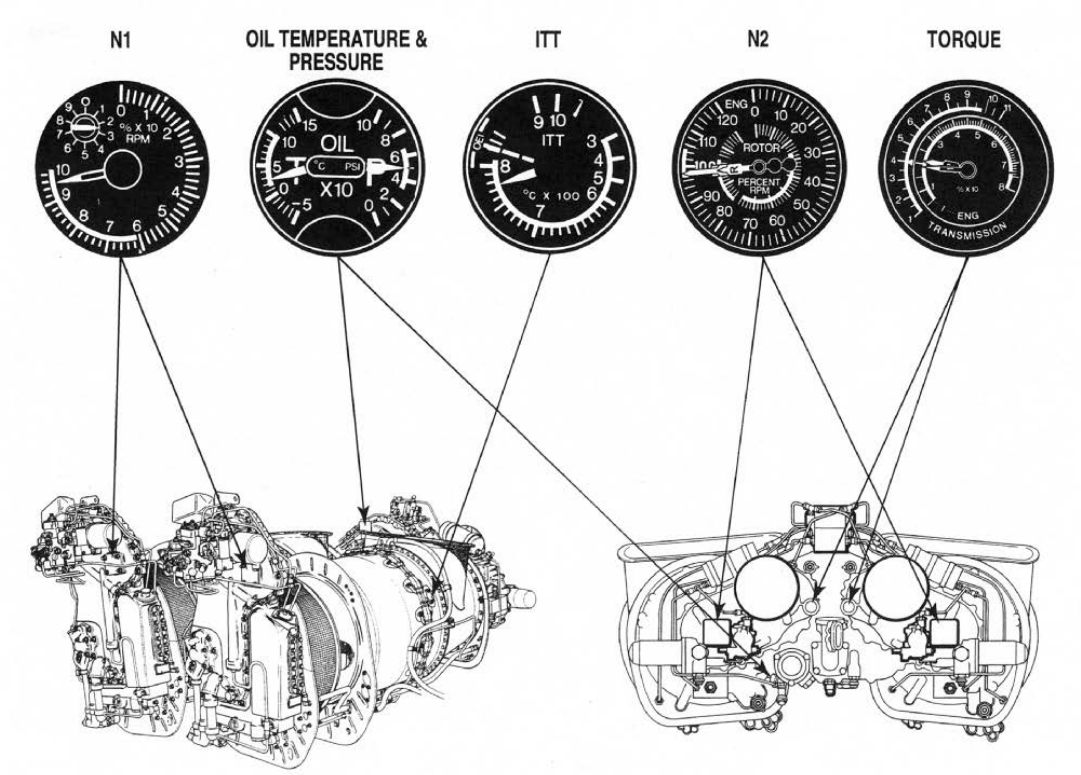
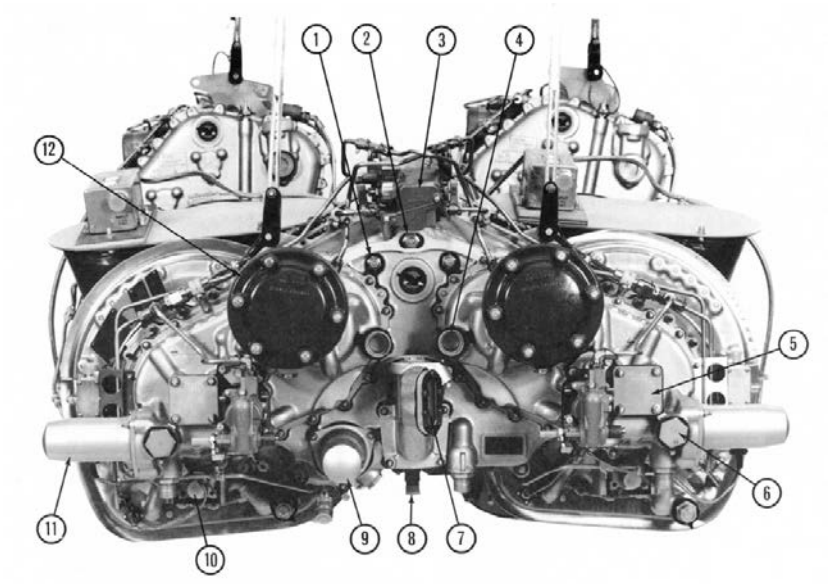


Figure 7-60 Engine Indicating System



1- RGB Static Pressure port (To Torque Transmitter)
2-RGB Breather Port
3- Torque Control Unit
4- Torquemeter Pressure Outlet Port (To Torque Transmitter)
5- IF Tachometer Generator Pad (N2)
6- P.S. Oil Filter Bypass Valve
7- Oil Level Sight Gage
8- RBG Chip Detector
9- RGB Oil Filter Cover
10- P.S. Chip Detector
11- P.S. Oil Filter Cover
12- Blower Drive Cover

Figure 7-61 Engine Rear

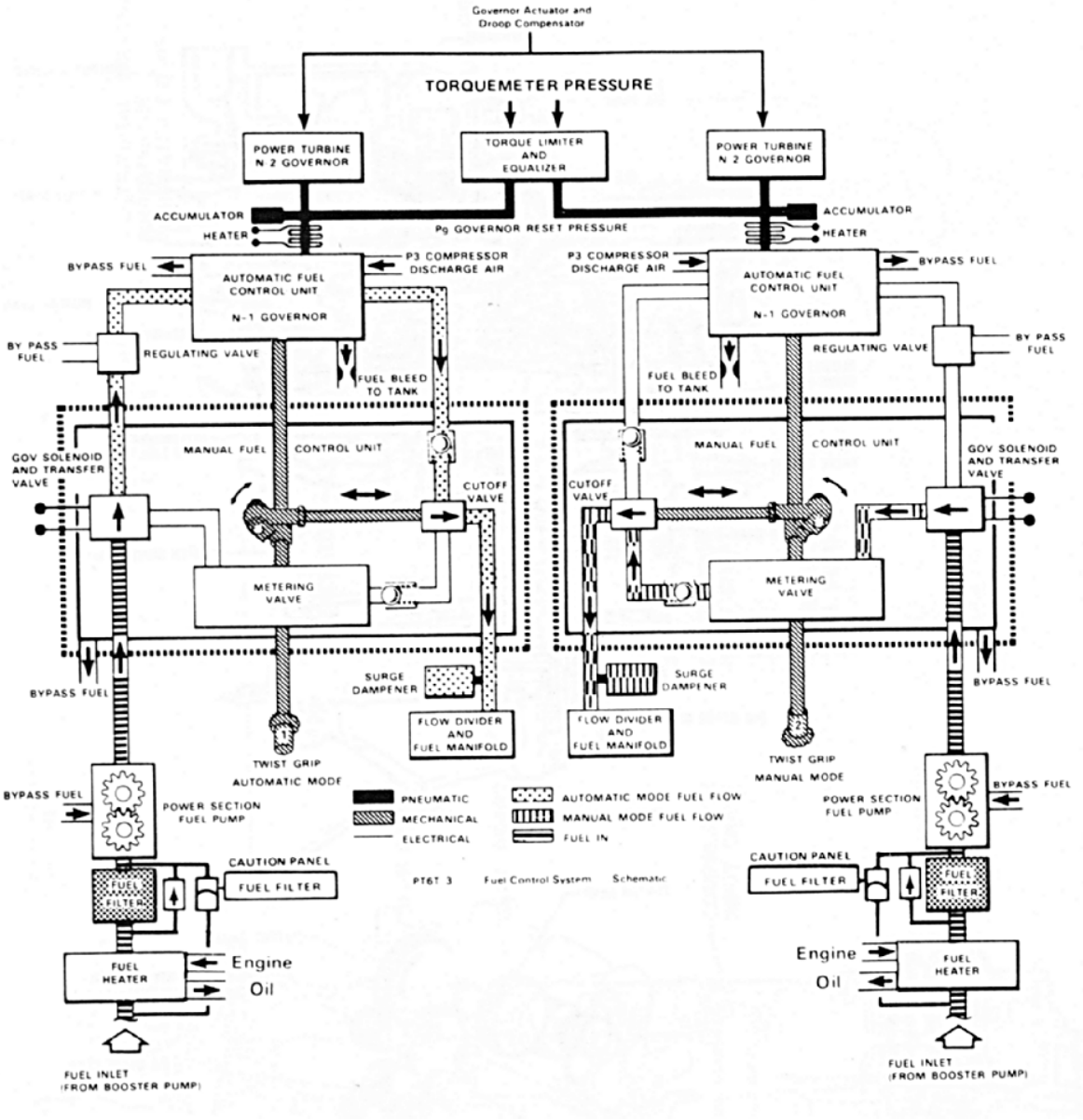
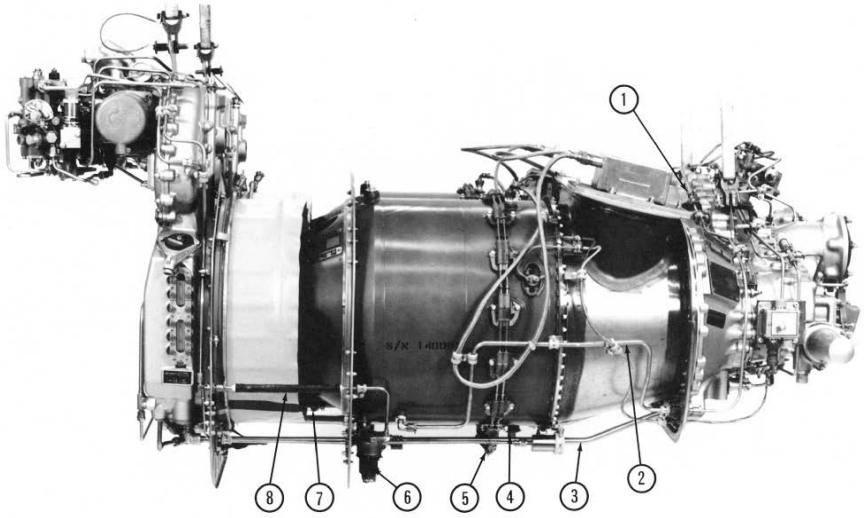


Figure 7-62 Engine Fuel System



1- Metering Tee Orifice
2- P3 Line To R.G.B. Carbon Seals
3- Oil Pressure Line
4- Drain Valve
5- Flow Divider Valve
6- P3 Air Filter
7- Compressor Bleed Valve
8- P3 Line To AFCU

Figure 7-63 Engine Left Side

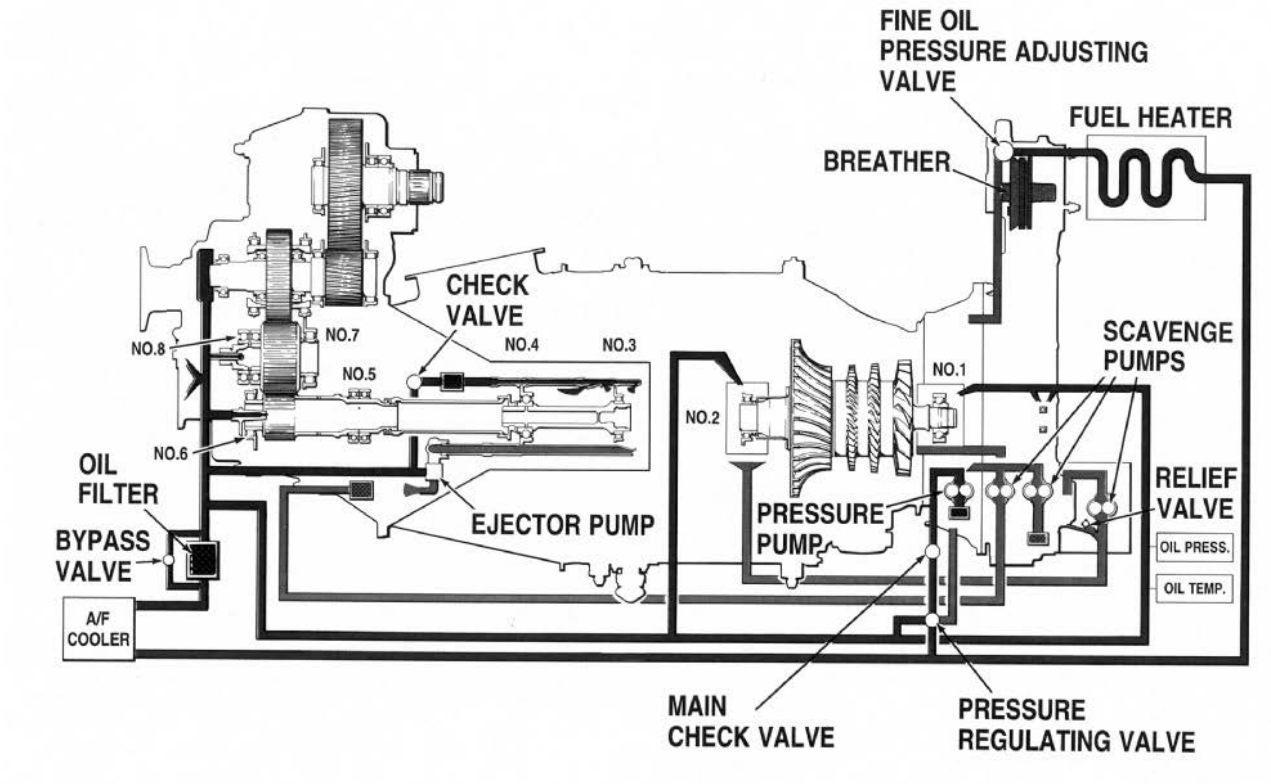


Figure 7-64 Engine Oil System

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