

Gulfstream IV

OPERATING MANUAL

ENGINE OIL

2A-79-10: Engine Oil System

1. General:

A. Description:

The oil system is a self-contained, full flow re-circulatory type that gives lubricating and cooling oil flow to the engine bearings, gears and splines throughout the starting, stopping and operational sequence.

B. Operation:

Oil is drawn from the oil tank by a pressure pump. The pump feeds the engine via an oil cooler and a pressure oil filter, each of which contain a bypass valve. A relief valve incorporated in the pressure filter ensures that oil pressure does not exceed a pre-determined value. An oil filter differential pressure indicator assembly (mounted at the rear of the oil tank) indicates a blockage in the oil filter.

Oil is returned to the tank by five scavenge pumps and discharged on to a de-aerator tray. The oil tank vents into the high-speed gearbox which exhausts through a centrifugal breather.

Feed oil filtration is given by a pressure oil filter, thread and gauze filters. Return oil filtration is given by gauze strainers and scavenge filters.

C. Subsystems, Units and Components:

- Engine Oil Tank
- Oil Pressure Transmitter
- Low Oil Pressure Switch
- Oil Pump Assembly
- Oil Filter Assembly
- Fuel Cooled Oil Cooler (FCOC)
- Engine Oil Remote Replenishing System

2. Description of Subsystems, Units and Components:

A. Engine Oil Tank:

(See Figure 2.)

The oil supply for engine lubrication is in an oil tank mounted below the oil cooler on the accessory suspension bracket.

The capacity of each engine oil tank is as follows:

- Left Engine: 6.87 Liters
- Right Engine: 7.3 Liters

A calibrated sight glass, installed on the left-hand wall, shows the amount of oil necessary to fill the tank to its correct level. The FULL mark shows the oil capacity of the tank. The sight glass has two graduated scales, one for the left-hand engine (colored red) and one for the right-hand engine (colored green).

The oil supply to the pressure pump is drawn from the tank by suction induced through the rotation of the pump gears. The oil flows from the bottom of the tank through the supply tube connector on the right-hand wall

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of the tank. The strainer in the supply connector prevents any foreign matter contamination in the oil system.

Return oil from the engine main bearings and internal gearbox scavenge pumps goes into the tank by way of a common tube from the oil pump. Return oil from the high-speed gearbox scavenge pump goes into the tank by a separate tube. Both of these tubes discharge the scavenge oil, as an oil/air mixture, onto the de-aerator tray. The oil flows along the tray which allows the entrapped air to vent through a tube into the high-speed gearbox.

B. Oil Pressure Transmitter:

(See Figure 2.)

The oil filter outlet pressure is sensed by the oil pressure transmitter. The oil pressure transmitter converts oil pressure into an electrical signal and sends it to a dual-signal conditioner. From there, signal outputs are routed to the EICAS through their respective DAU. Power for the signal conditioner is derived from the Essential No. 1, 26V AC transformer bus via the L ENG OIL PRESS circuit breaker and the Essential No. 2, 26V AC transformer bus via the R ENG OIL PRESS circuit breaker.

(1) The engine oil pressure parameters (on ground and during takeoff) are as follows:

- On Ground = Weight On Wheels (WOW)
- Takeoff = Up To Four Minute Period Following WOW Transition

HP RPM Ranges (%)	Oil Pressure (PSIG)	
	White Indication	Red Indication
< 76.0	> 16	< 15
78.4 ≥ HP > 76.0	> 17	< 16
80.0 ≥ HP > 78.4	> 18	< 17
> 80	> 30	< 29

(2) The engine oil pressure parameters (air mode) are as follows:

- Air Operation = Greater Than Four Minutes Following WOW Transition

HP RPM Ranges (%)	Oil Pressure (PSIG)	
	White Indication	Red Indication
< 76.0	> 16	< 15
78.4 ≥ HP > 76.0	> 17	< 16
80.8 ≥ HP > 78.4	> 18	< 17
83.2 ≥ HP > 80.8	> 19	< 18
85.6 ≥ HP > 83.2	> 20	< 19
88.0 ≥ HP > 85.6	> 21	< 20
90.4 ≥ HP > 88.0	> 22	< 21
92.8 ≥ HP > 90.4	> 23	< 22
95.2 ≥ HP > 92.8	> 24	< 23
> 95.2	> 25	< 24

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C. Low Oil Pressure Switch:

(See Figure 2.)

The low oil pressure switch is a 15 ± 0.4 PSI switch that activates the low oil pressure warning system if the pressure falls below its set parameter.

When the oil pressure is less than the lowest acceptable limit, the contacts stay closed. This causes the low pressure warning indicator in the crew compartment to illuminate. Oil fills the diaphragm chamber through holes in the circular base plate of the switch assembly. As the pressure increases, the diaphragm causes a pushrod to move to the moving contact. When the pressure is more than the setting limit the contacts open and the warning indicator in the crew compartment extinguishes.

The electrical contacts attach to the bottom of the terminal block. A setting adjustment assembly is attached to the terminal block molding. This assembly permits the contacts to operate at any specified oil pressure within the setting range.

The top cover assembly contains a flame trap. This flame trap will stop the spread of fire if the contacts arc when oil vapor is in the switch.

D. Oil Pump Assembly:

(See Figure 4.)

The oil pump unit, driven by the right gearbox, consists of six internal oil pumps, consisting of one oil pressure pump and five oil scavenge pumps. These internal pumps affect the following components:

- LP Turbine Bearing
- Internal Gearbox
- Thrust Bearings
- HP Turbine Bearing
- Right Gearbox

(1) Oil Pressure Pump:

The oil pressure pump supplies pressurized engine oil to the components (listed above). The pump is a gear-driven positive-displacement pump and incorporates a 200 PSI pump pressure relief valve. If the pump output exceeds 200 PSI, the excess pressure is returned back to the pump inlet.

(2) Oil Scavenge Pumps:

The oil scavenge pumps return engine oil from the engine components (listed above) back to the oil tank. The return oil output from four of the pumps (all except the right gearbox return oil) is directed into a common oil return tube to the tank.

The right scavenge pump return oil is pumped through a separate tube to prevent oil from siphoning from the oil tank to the right gearbox when the engine is not operating.

E. Oil Filter Assembly:

(See Figure 2.)

The oil filter assembly mounts on the front wall of the engine oil tank. The oil flows from the oil cooler into the filter housing, flowing from the outside to the inside of the element. If the pressure difference across the element is

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more than 50 PSI, the bypass valve opens to let the oil bypass the element. The system relief valve is subjected to the pressure downstream of the element. If this pressure is more than 50 PSI, the valve opens to allow the oil flow back into the tank below the de-aerator tray.

An oil filter differential pressure indicator assembly (mounted on the rear wall of the oil tank) will indicate if there is a blockage in the pressure oil filter. When the differential pressure across the filter is more than 18 ± 3.0 PSID, the indicator button compression spring forces a red button to extend (approximately 0.187 inch) from the body of the indicator. When the differential pressure exceeds 30 ± 4.5 PSID, the differential pressure switch closes, which illuminates a blue L-R OIL FILT BPASS message on the EICAS.

After passing through the element, the oil is directed through two tube connectors. One tube conveys oil to a two-way connector on the bypass duct, from where the oil passes to the turbine bearings and central feed oil tube. The other tube moves oil to the high-speed gearbox.

F. Fuel Cooled Oil Cooler:

(See Figure 3.)

Oil from the pressure pump passes into the rear of the oil cooler. It flows around the outside of the tubes and is directed by the baffle plates to pass numerous times through the matrix assembly. On reaching the forward end of the cooler, the oil passes to the pressure oil filter for distribution throughout the system. The fuel, which flows through the tubes, is of a moderately low temperature and extracts a proportion of the heat from the oil.

At low temperatures, the viscosity of the oil is high, restricting its flow around the tubes. When the pressure drop reaches 50 PSI, the bypass valve opens to allow oil to pass directly to the outlet connection. This ensures adequate oil supply for engine lubrication.

G. Engine Oil Remote Replenishing System:

(See Figure 1.)

The engine oil can be replenished from a self-contained engine oil reservoir located in the aft equipment bay on the left side. The system consists of a 16 pint reservoir, oil pump, left and right solenoid valves and associated plumbing.

The replenishing pump receives electrical power from the 28V DC essential bus through the ENGINE OILER circuit breaker. The pump is also controlled by the tail compartment door switch, an engine oiler switch located near the reservoir and an engine oiler switch located on each engine. The switches on each engine are spring-loaded to OFF. When selected ON, each switch activates the replenishing pump and opens the solenoid valve for its respective engine.

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3. Controls and Indications:

NOTE:

A detailed description of the Engine Instruments and Crew Alerting System (EICAS) can be found in Section 5 of Honeywell's SPZ-8000 (or SPZ-8400) Digital Automatic Flight Control System Pilot's Manual for the Gulfstream IV.

A. Circuit Breakers (CBs):

The engine oil system is protected by the following circuit breakers:

Circuit Breaker Name:	CB Panel:	Location:	Power Source:
ENGINE OILER	P	L-9 or G-10 (1)	ESS DC Bus
L ENG OIL PRESS	CP	A-12	ESS AC Bus
R ENG OIL PRESS	CP	B-12	ESS AC Bus

NOTE(S):

(1) Depending on effectivity.

B. Crew Alerting System (CAS) Messages:

Warning (Red) Messages:

CAS Message:	SWLP Indication:	Cause or Meaning:
L-R OIL PRESS LOW	L-R OIL PRESS	Indicated oil pressure below 16 PSI

Advisory (Blue) Messages:

CAS Message:	Cause or Meaning
L-R OIL FILT BPASS	Engine oil filter has clogged

4. Limitations:

A. Flight Manual Limitations:

(1) Oil Inlet Temperature:

- Maximum: 105°C (Oil temperature up to 120°C for maximum of fifteen (15) minutes is permissible)
- Minimum for Starting: -40°C
- Minimum for opening power lever: -30°C

NOTE:

External heating will be required to raise oil temperature to -40°C for cold weather starting. If oil temperature is less than -30°C, the engine should be idled until at least -30°C temperature is reached.

(2) Oil Pressure:

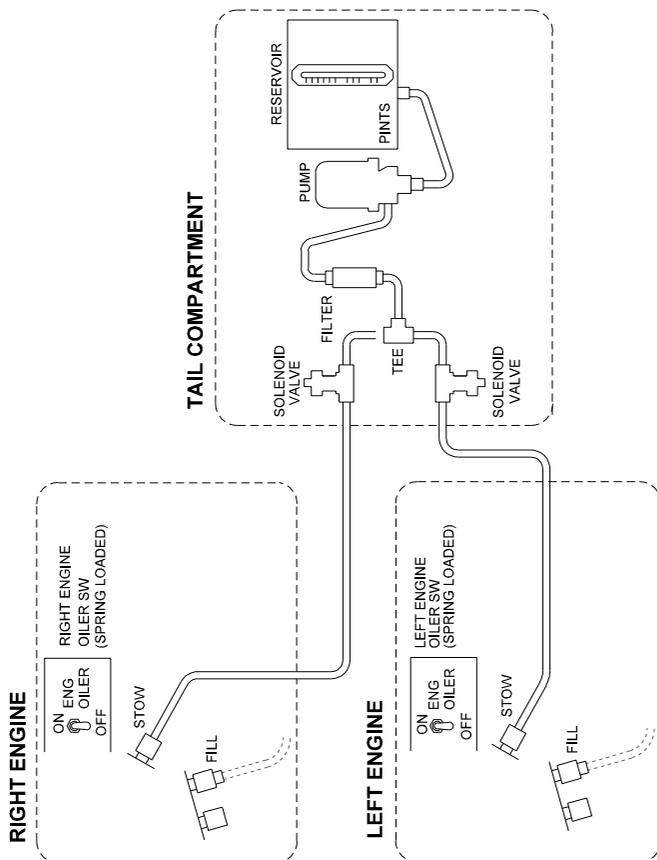
- Minimum at Idle: 16 PSI
- Minimum acceptable for takeoff (at takeoff power): 30 PSI

Minimum to complete flight:

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- At maximum continuous (97.5% HP): 25 PSI
- 92% HP RPM: 22 PSI
- 84% HP RPM: 19 PSI
- 76% HP RPM or lower: 16 PSI



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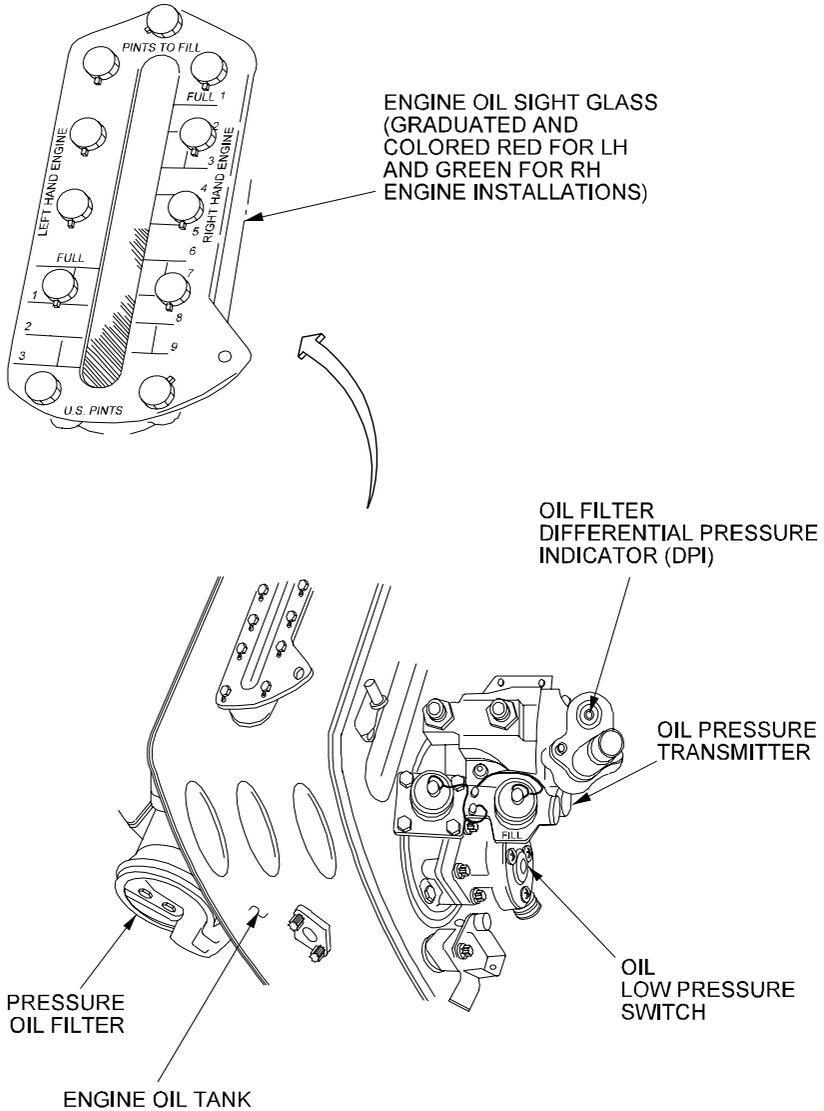
Engine Oil Remote Replenishing System Simplified Diagram
Figure 1

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Engine Oil Tank and Associated Components
Figure 2

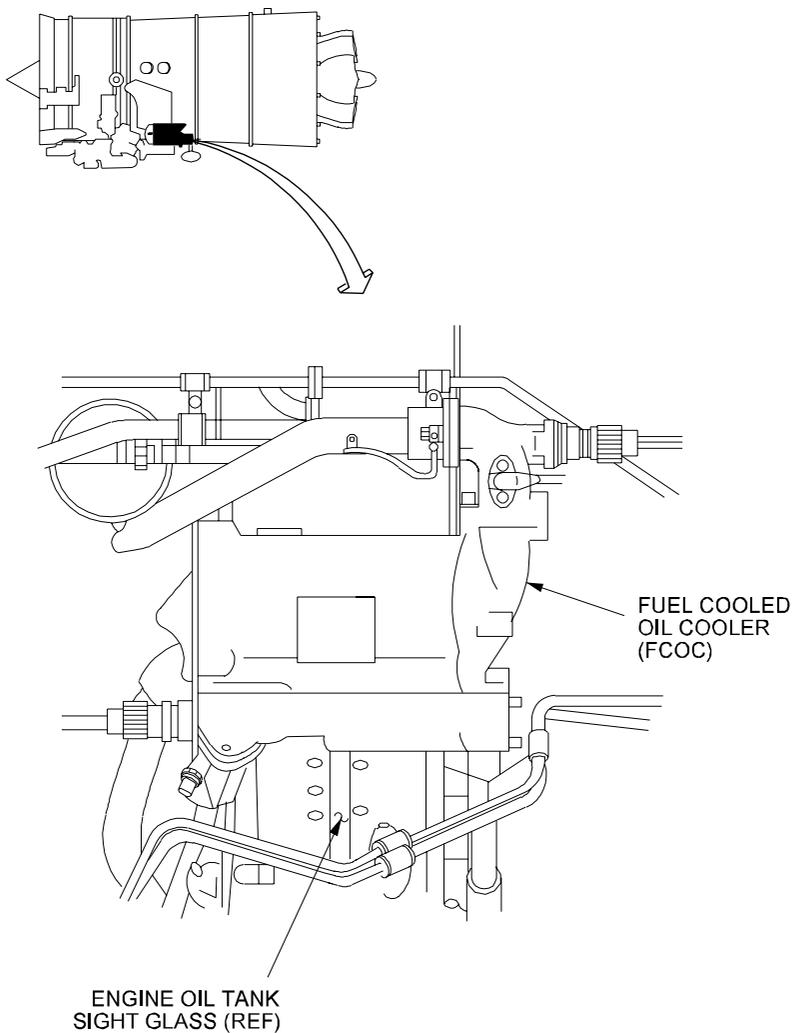
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Fuel Cooled Oil Cooler
Figure 3

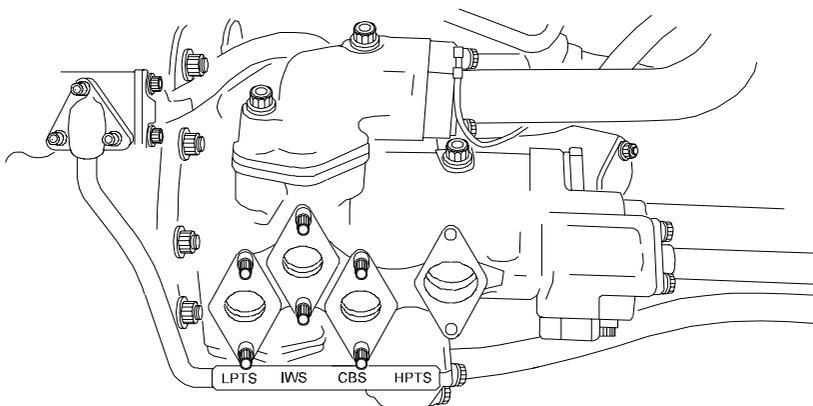
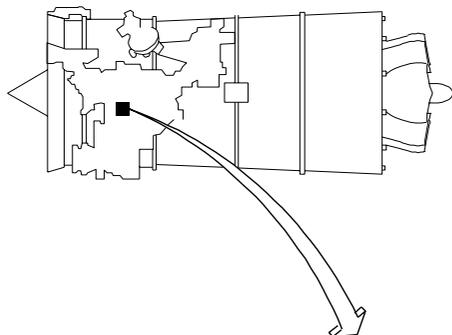
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Oil Pump Assembly
Figure 4

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