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OIL - DESCRIPTION AND OPERATION

1. General

The engine integral lubrication system contains an integrally formed oil tank in the compressor inlet case that provides a constant supply of clean oil to the engine bearings, reduction gears, accessory drives, torquemeter and propeller governor. The oil lubricates and cools the bearings and carries any extraneous matter to the oil filter where it is prevented from further circulation. Oil indication comprises of oil quantity dipstick/gage which forms an integral part of the oil tank filler cap. Ports in the accessory and reduction gearboxes are provided for installation of airframe supplied temperature and pressure sensing devices (Ref. Aircraft Maintenance Manual). A chip detector is located in the reduction gearbox to detect impending component failure; depending on the installation, it may be connected to airframe-mounted instrumentation. The system consists of a pressure system, scavenge system, and a breather system.

2. Description and Operation (Ref. Fig. 1)

A. Pressure Oil System

Pressure oil is delivered to the oil filter outlet where the oil separates into several paths. Lubrication of the accessory drives and bearings is received through cored passages and transfer tubes in the compressor inlet case, accessory diaphragm and gearbox housing and into the gearbox bearing areas. The No. 1 bearing is lubricated by pressure oil from the filter outlet through a cored passage in the compressor inlet case, to a nozzle at the centerbore and to the rear of the compressor rear hub. The nozzle, incorporating a fine strainer, directs the calibrated oil flow into a collector ring mounted on the rear of the compressor rear hub and through passages in the split inner race to the bearing.

A cored passage at the main oil filter outlet conducts a portion of the pressure oil to a minimum pressurizing valve installed in the compressor inlet case at the 2 o'clock position. Oil is then applied to the oil-to-fuel heater where, depending upon temperature of the fuel, the oil is utilized to preheat the fuel. Oil from the heater is returned to the oil tank via a check valve and adapter at the 12 o'clock position on the compressor inlet case.

A common supply is provided to lubricate the No. 2 bearing, the reduction gearbox and front accessories, power turbine No. 3 and 4 bearings, and the propeller installation. Oil from the filter outlet is directed through a cored passage and transfer tube to an outlet boss at the 4 o'clock position on the compressor inlet case. An external oil transfer tube connected to the boss directs the oil forward to a tee coupling at the gas generator case. An internal oil transfer tube directs the oil to an oil transfer gallery in the No. 2 bearing compartment. The gallery houses two nozzles which are protected by a fine strainer. The nozzles direct the oil flow on to the front and rear faces of the bearing. A second external oil transfer tube directs the oil forward from the tee coupling on the gas generator case to a boss on the front case of the reduction gearbox.

From the boss, the oil is directed internally via cored passages and transfer tubes to three areas. One, to the first-stage reduction gears, the torquemeter, and the No. 3 and 4 bearings. Oil to the torquemeter flows through a metering valve which controls the flow into the torquemeter chamber. The position of the metering valve is controlled by the torquemeter piston which reacts in direct proportion to engine torque. Oil is directed to

three nozzles in the No. 3 bearing oil tube in the power turbine shaft housing via a transfer tube in the rear case of the reduction gearbox. Two nozzles direct oil to the front and rear faces of the No. 3 roller bearing, while the third nozzle directs the oil flow to the rear face of the No. 4 bearing.

The second oil delivery line directs oil to the propeller shaft front roller and ball thrust bearings, the second-stage reduction gears and the No. 4 bearing. The oil flow is directed through the rear annulus of an oil transfer sleeve mounted on the propeller shaft, and, via the rear section of the propeller oil transfer tube in the shaft, to the No. 4 bearing oil nozzle installed at the rear end of the transfer tube. The oil is sprayed into the hollow front section of the power turbine shaft; centrifugal force directs the oil through a drilled annulus in the shaft to passages between the No. 4 bearing inner races and into the sun gear coupling. Oil from the rear section of the propeller shaft oil transfer tube is also directed via radially drilled holes in the propeller shaft and cored passages in the second-stage gear carrier, to the shaft/second-stage gearpins and propeller shaft roller bearing.

The third oil delivery line directs oil via an internal annulus and cored passages to the externally mounted propeller governor, the accessory drive gears and the propeller thrust bearing. Oil pressure from the propeller governor is directed via a port in the mounting flange and cored passages in the front case of the reduction gearbox to a transfer tube which connects to the front annulus in the oil transfer sleeve mounted on the propeller shaft. The oil in the annulus is then directed into the propeller shaft centerbore via the front section of the propeller oil transfer tube.

B. Scavenge Oil System

The scavenge system incorporates two double-element gear-type pumps contained in cast housings, and are driven by the accessory gearbox driveshafts. One pump is mounted within the accessory gearbox, while the other is externally mounted at the rear of the gearbox.

Oil from the No. 1 bearing compartment is returned by gravity via an internal cored passage to the bottom of the compressor inlet case. From there, it is directed through the oil tank compartment by a transfer tube and a port in the accessory diaphragm and is then discharged into the gearbox.

The No. 2 bearing oil drains via internal tubes to a boss at the 5 o'clock position on the gas generator case. A flanged transfer tube directs the oil rearward to a boss at the 6 o'clock position on the compressor inlet case; the oil then passes through cored passages and a transfer tube to the front element of the internal scavenge pump. Scavenged oil is dumped into the accessory gearbox.

Oil from the No. 3 and 4 bearings drains into the power turbine shaft housing. In level or climbing flight, this oil is scavenged by the front element of the external scavenge pump and combines with the discharge from the rear element. The oil is picked up by the No. 3 bearing scavenge oil tube located in the base of the shaft housing and is transferred to the pump via passages in the reduction gearbox housings and one of the dual external scavenge oil tubes. With the engine nose down, the oil drains by gravity into the reduction gearbox sump through holes in the gearbox rear housing.

Oil from the propeller governor, front thrust bearing, reduction gearbox accessory drives and torquemeter bleed orifice drains into the gearbox sump. From the sump, oil is scavenged by the rear element of the external scavenge pump via a strainer in the front case of the reduction gearbox and a second external oil transfer tube. The rear element of the scavenge pump forces the oil to an airframe-mounted cooler from where it is returned to the oil tank via an inlet adapter located at the 12 o'clock position on the compressor inlet case. Oil flows from the adapter into a de-aerator tray installed at the top of the tank, and drains into the tank.

Oil from the centrifugal breather, accessory gearshafts and bearings, input gearshaft and bearing drains into the accessory gearbox sump where it is scavenged by the rear element of the internal scavenge pump which forces the oil into an externally mounted airframe cooler. All oil supplied to the cooler is returned to the oil tank.

C. Breather System

Breather air from the engine bearing compartments and the accessory and reduction gearboxes is vented overboard through the centrifugal breather installed in the accessory gearbox. The bearing compartments are connected to the accessory gearbox by cored passages and existing scavenge oil return lines.

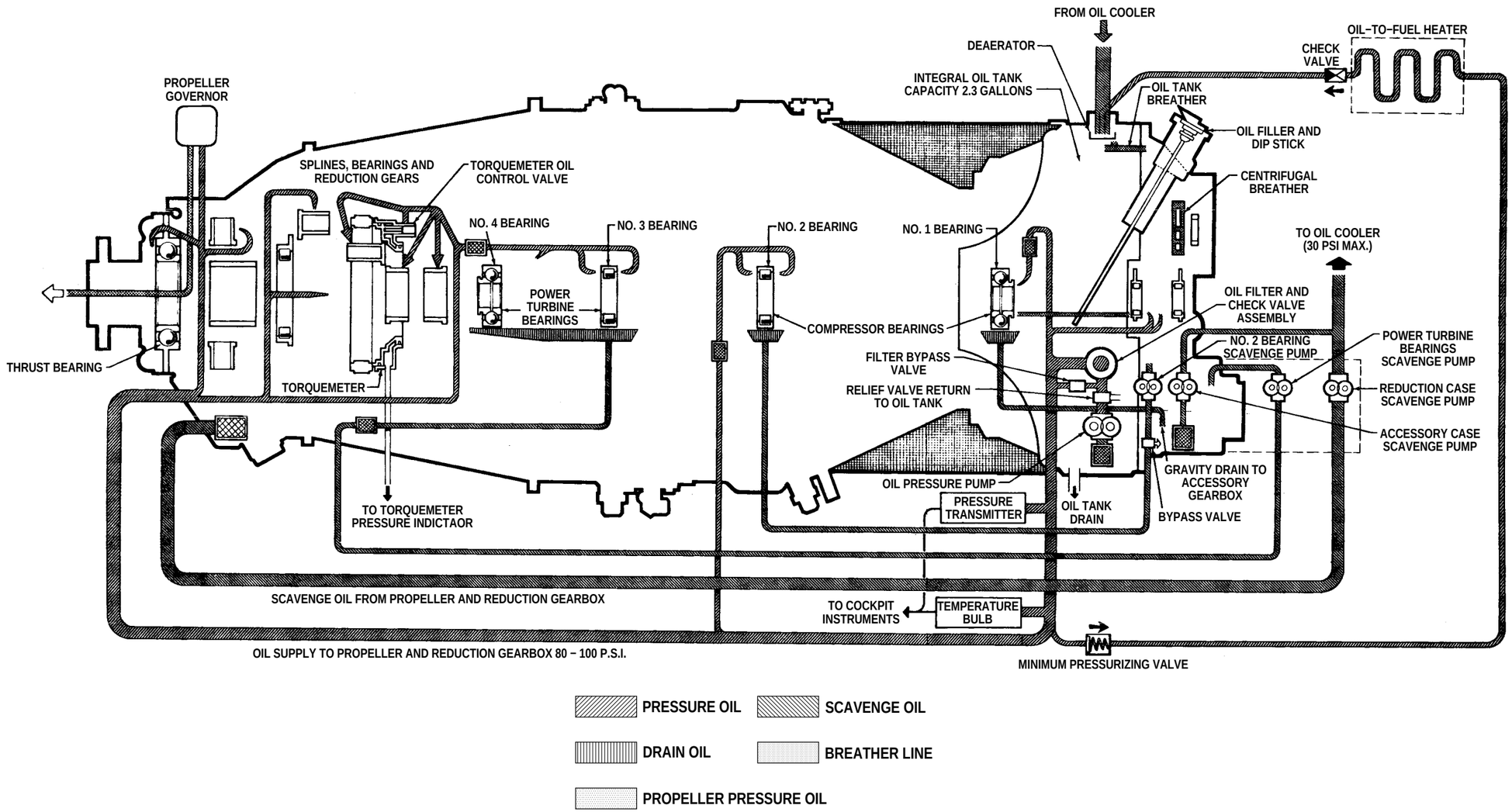
The No. 1 bearing compartment vents rearward through the rear bearing housing and oil tank center tube and into the accessory gearbox.

The No. 2 bearing compartment is vented via the scavenge oil transfer tube. A bypass valve, immediately upstream of the front element of the internal scavenge pump, allows oil and air to be vented into the accessory gearbox under certain transient operating conditions to prevent overpressurizing the No. 2 bearing area. Under normal operating conditions, the valve is closed to prevent oil flooding back into the tube assembly.

The No. 3 and 4 bearing compartment and the reduction gearbox areas vent to the accessory gearbox and oil tank respectively through their scavenge oil lines. The oil tank is vented to the accessory gearbox through the anti-flooding arrangement installed at the 11 o'clock position in the oil tank.

3. Fault Isolation

For detailed procedures on engine oil system, refer to Chapter 72-00-00, FAULT ISOLATION.



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Engine Lubrication Schematic
Figure 1