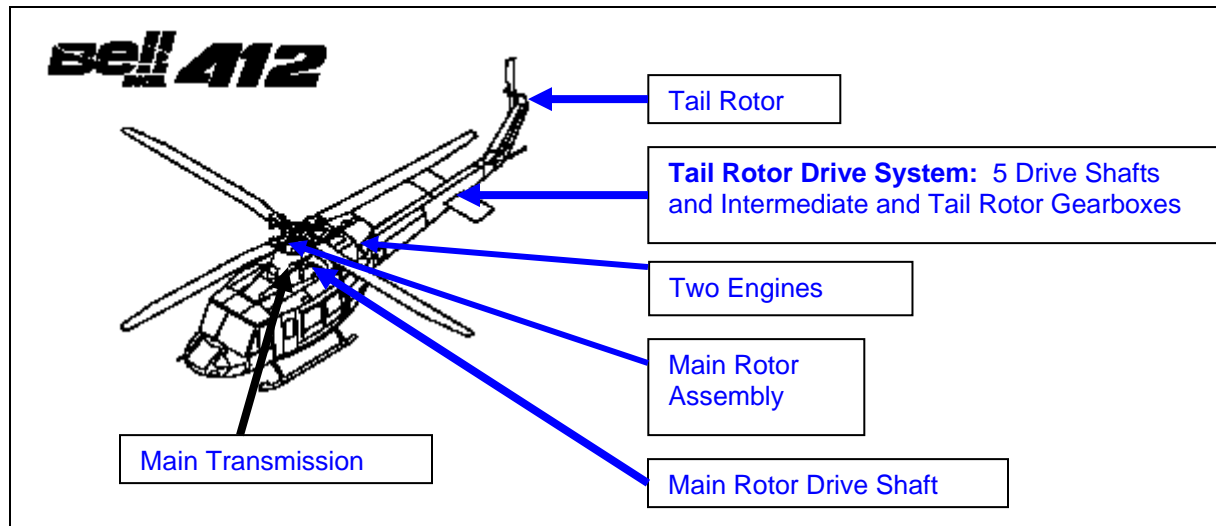


Systems Lesson 5.0

POWERTRAIN REVIEW

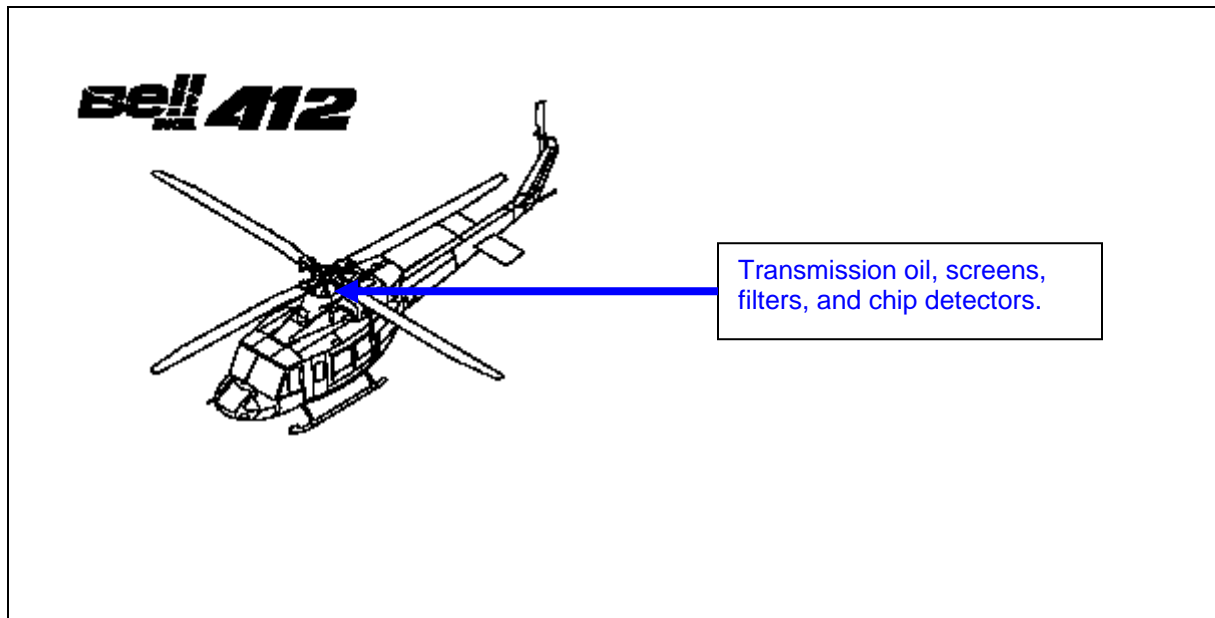


Powertrain Overview

The Bell 412 Powertrain is driven by the **TWO ENGINES**, and distributes engine power to the **MAIN ROTOR ASSEMBLY** by the **MAIN ROTOR DRIVE SHAFT**, and to the **TAIL ROTOR** and other subsystems. The Powertrain includes the **main drive shaft, main transmission, main rotor mast, and tail rotor drive system**.

The **MAIN TRANSMISSION** reduces engine/C-box drive shaft RPM from approximately 6,600 rpm to the main rotor's 324 rpm. It also drives the **tail rotor system, both hydraulic pumps and the main transmission oil pump**.

The **TAIL ROTOR DRIVE SYSTEM** consists of **five drafts shafts and intermediate and tail rotor gearboxes**.



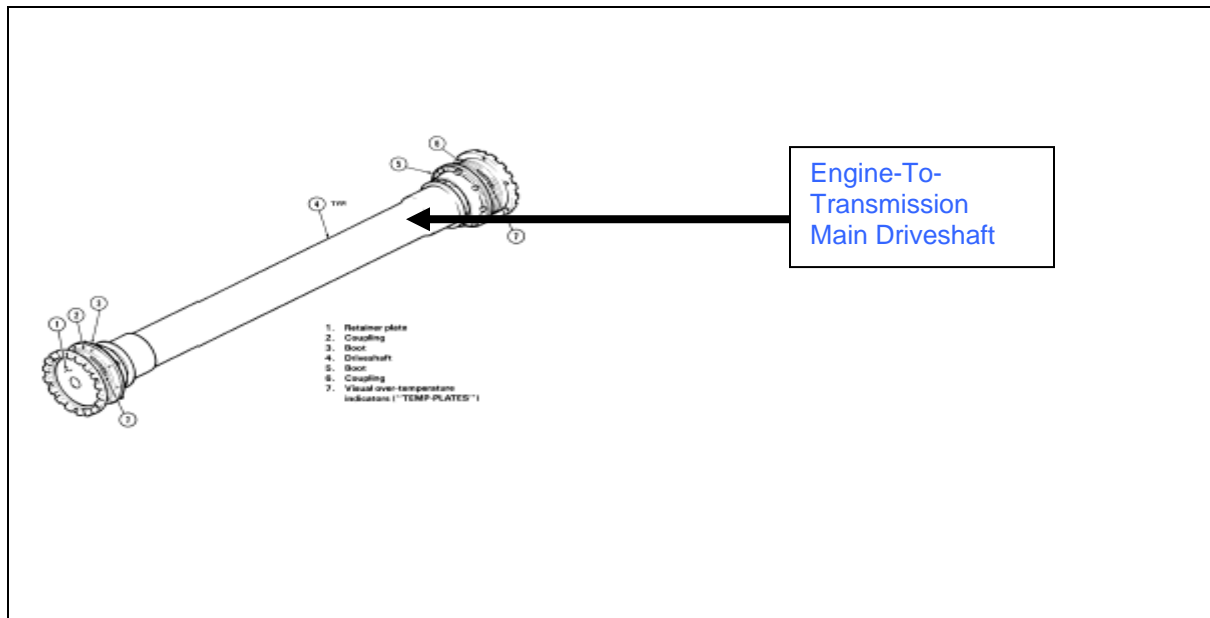
Metal Particle Contamination

Metal particles found in the **TRANSMISSION OIL, SCREENS, FILTERS**, or accumulated on **CHIP DETECTORS** may indicate impending failure of an internal part of the transmission.

The presence of metal particles is not necessarily an indication the transmission, or component part, is no longer serviceable. The quantity, source, form, and type of metal, together with the service history of the particular component, must be taken into consideration.

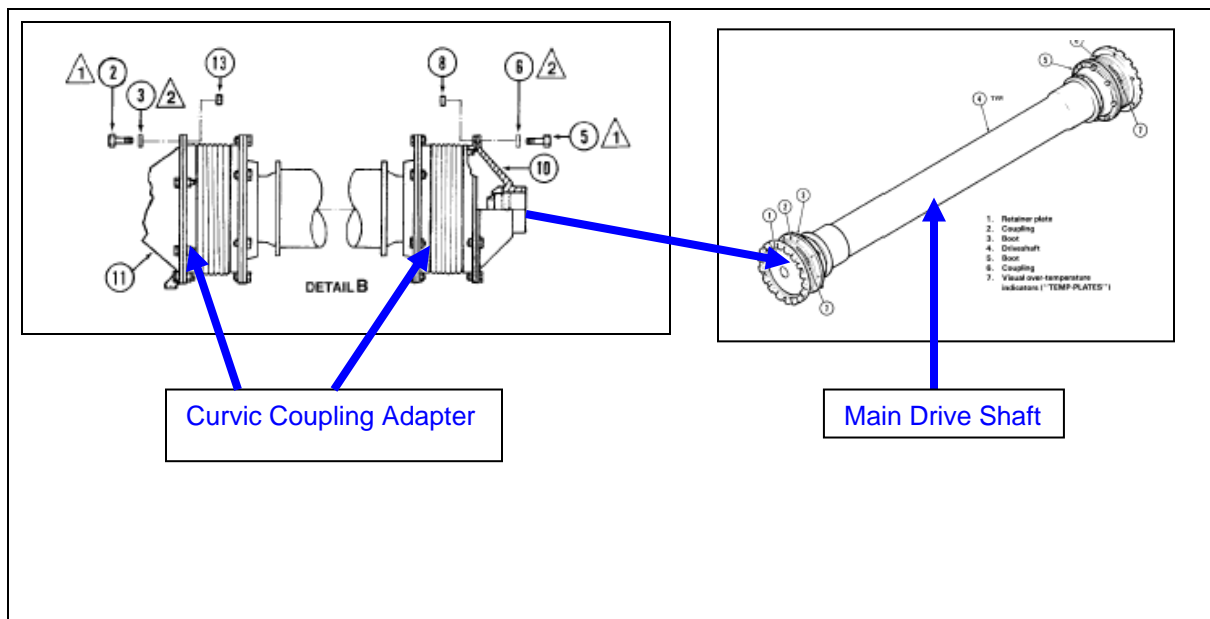
The time accumulated since the gearbox was new or overhauled, previous failures, and type of operation are important factors in determining further serviceability.

The particles found may be steel, aluminum, magnesium, or phenolic in various shapes and quantities.



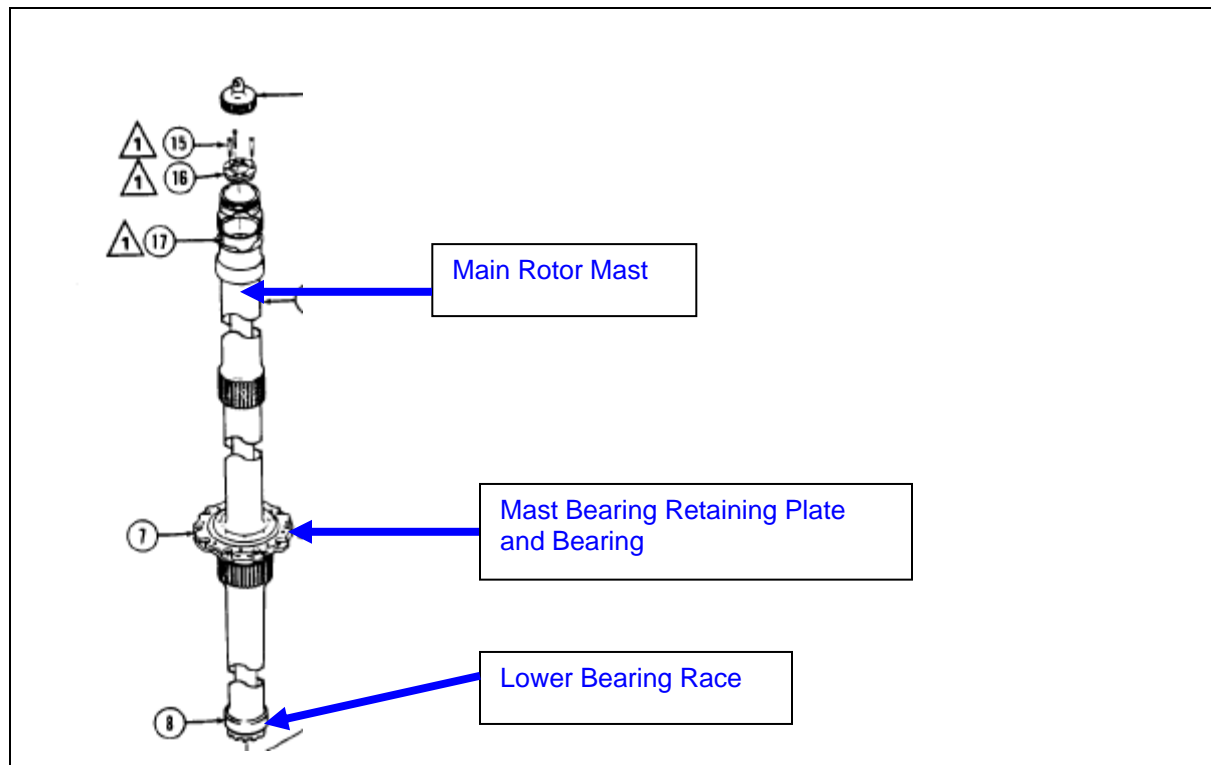
Main Rotor Drive

The Main Rotor Drive components transmit power from the engine to the main rotor assembly and to transmission mounted accessories. This includes the **ENGINE -TO -TRANSMISSION (MAIN) DRIVESHAFT**, transmission and related components, and the main rotor mast assembly.



Engine-To-Driveshaft Curvic Coupling Adapter

The **CURVIC COUPLING ADAPTER** connects the transmission to the **MAIN DRIVE SHAFT**. The curvic coupling adapter needs to be inspected for grease leakage. If any is found, the main driveshaft must be removed and inspected.

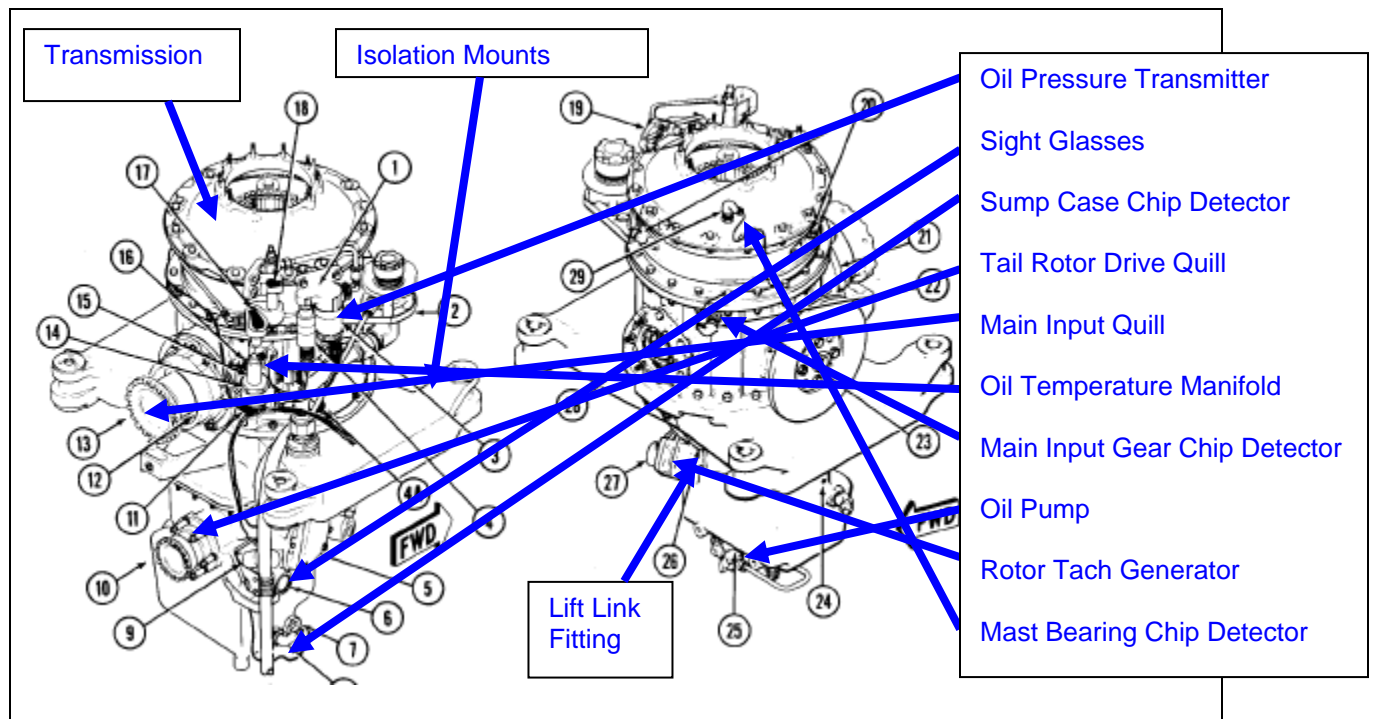


Main Rotor Mast

The **MAIN ROTOR MAST** is a tubular steel shaft.

The main rotor mast includes a **MAST BEARING RETAINING PLATE AND BEARING** for attachment to the top of the transmission.

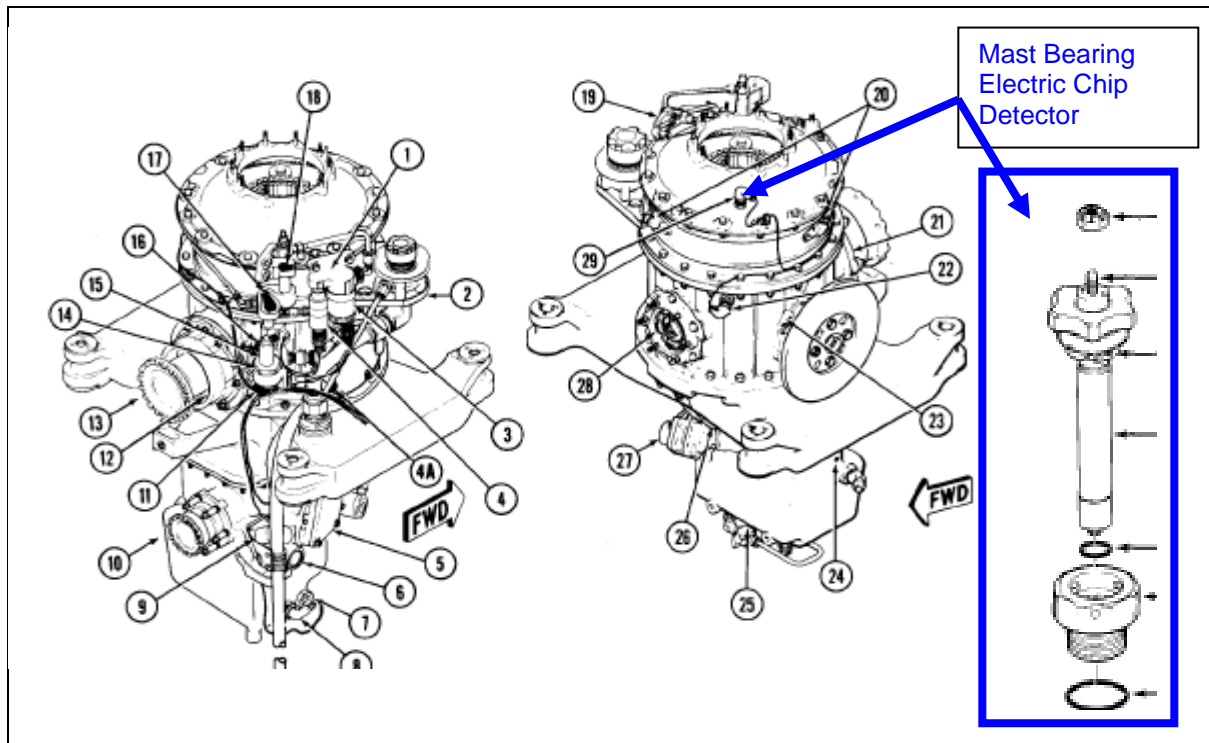
A **LOWER BEARING RACE** is installed on the lower end of mast. The lower bearing race mates with a roller bearing that is located in the transmission.



Transmission

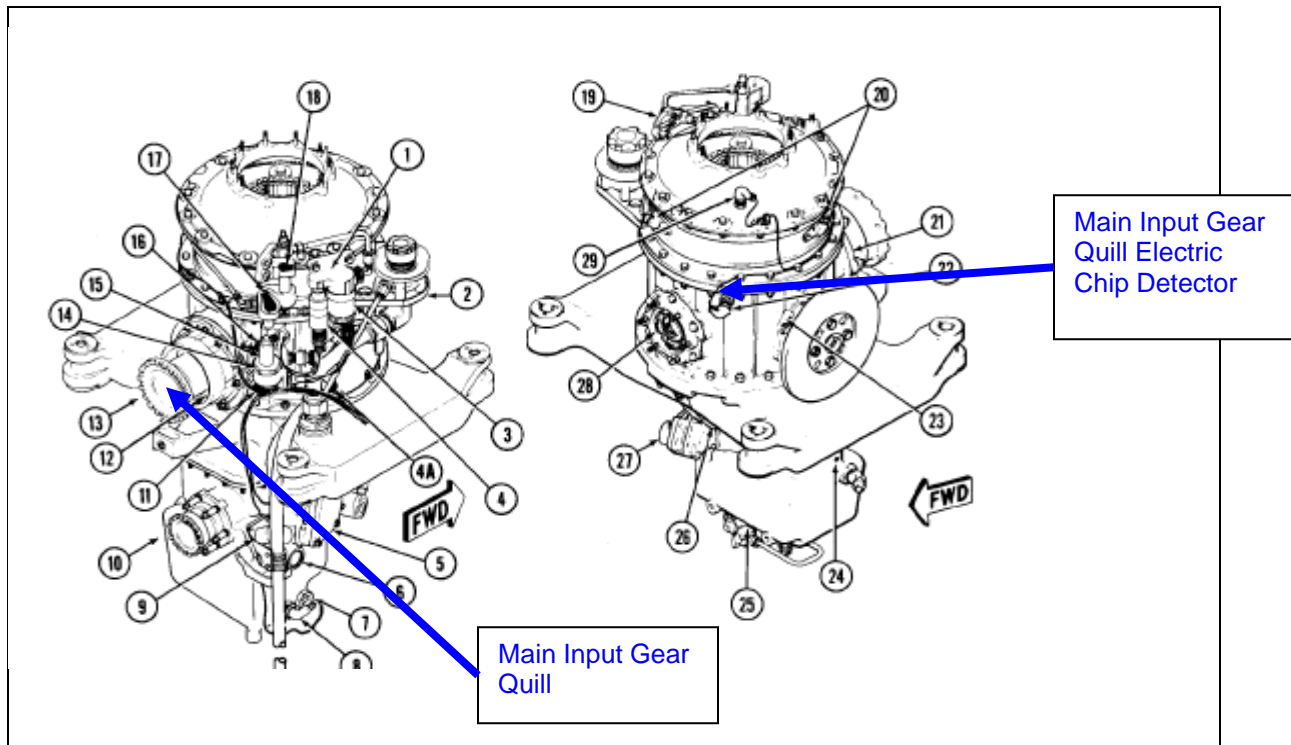
The **TRANSMISSION** is a mechanical reduction gearbox attached to fuselage structure by four **ISOLATION MOUNTS** at the corners of transmission support case and by the **LIFT LINK** which is the main load bearing component. The two aft isolation mounts attach to helicopter structure and also to friction dampers. The lift link is attached to transmission support case and helicopter lift beam.

Other important components include: **OIL PRESSURE TRANSMITTER, SIGHT GLASSES, SUMP CASE CHIP DETECTOR, TAIL ROTOR DRIVE QUILL, MAIN INPUT QUILL, OIL TEMPERATURE MANIFOLD, MAIN INPUT QUILL CHIP DETECTOR, OIL PUMP, ROTOR TACH GENERATOR,** and the **MAST BEARING CHIP DETECTOR.**



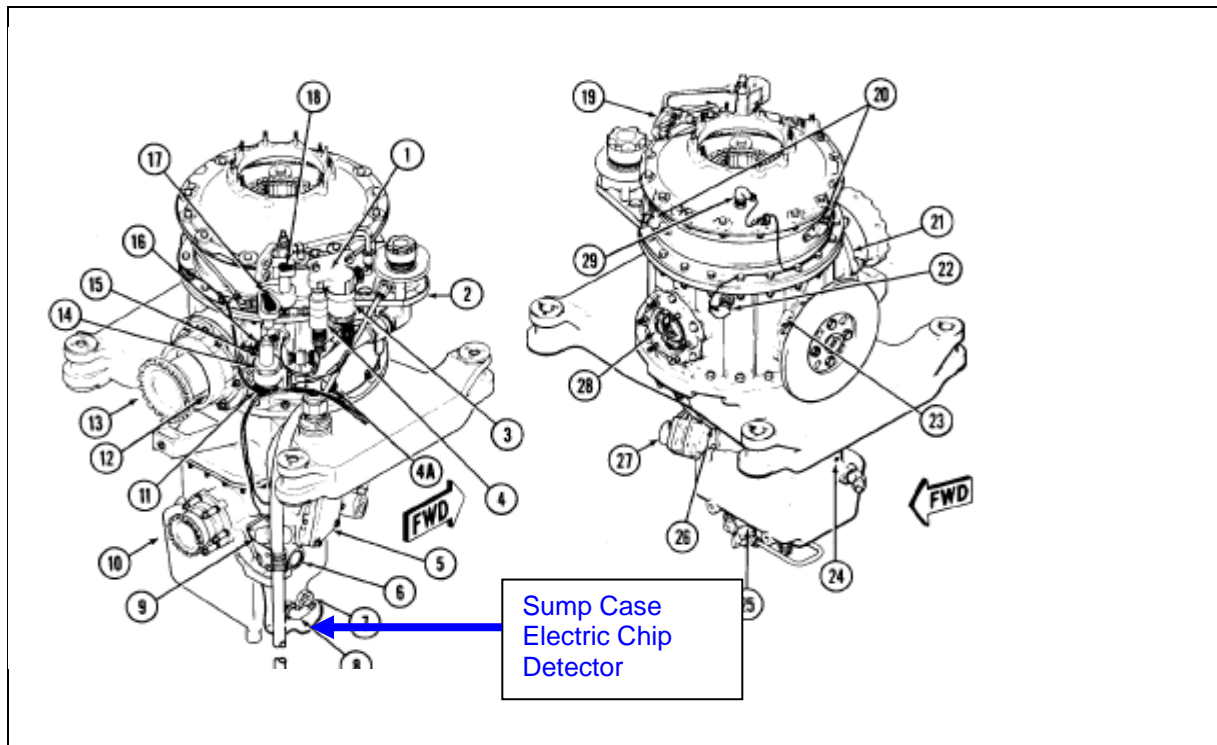
Mast Bearing Electric Chip Detector

The **MAST BEARING ELECTRIC CHIP DETECTOR** is installed in the transmission top case to detect foreign particles in the transmission oil originating from the main rotor mast upper bearing.



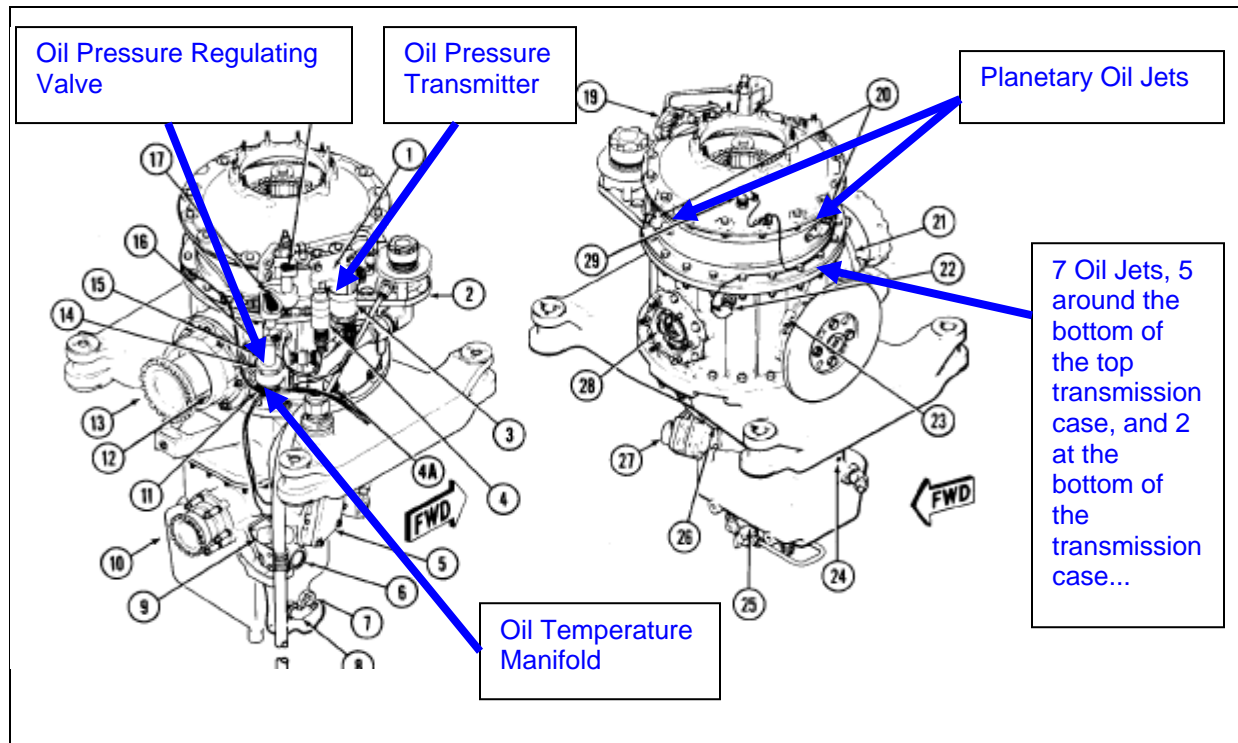
Main Input Gear Quill Electric Chip Detector

The **MAIN INPUT GEAR QUILL ELECTRIC CHIP DETECTOR** is installed to detect metal particles in the transmission oil originating from the **MAIN INPUT GEAR QUILL**.



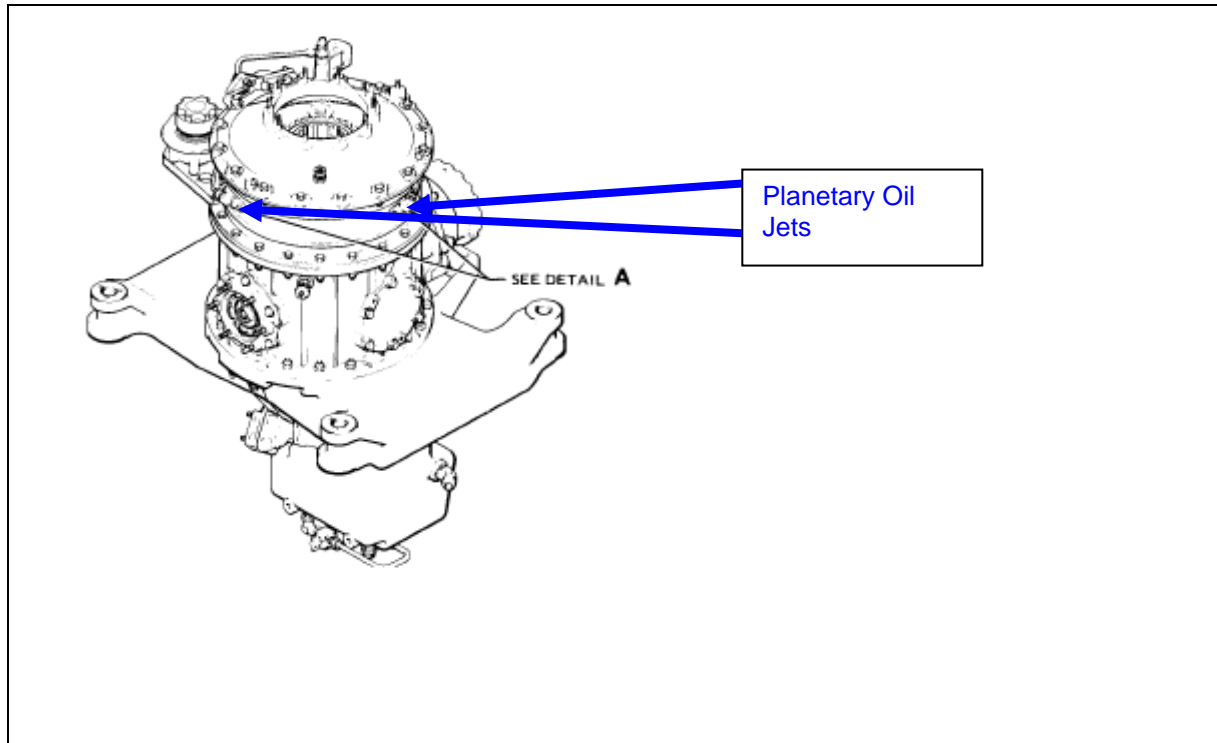
Sump Case Electric Chip Detector

The **SUMP CASE ELECTRICAL CHIP DETECTOR** is installed to detect metal particles which collect in the transmission sump.



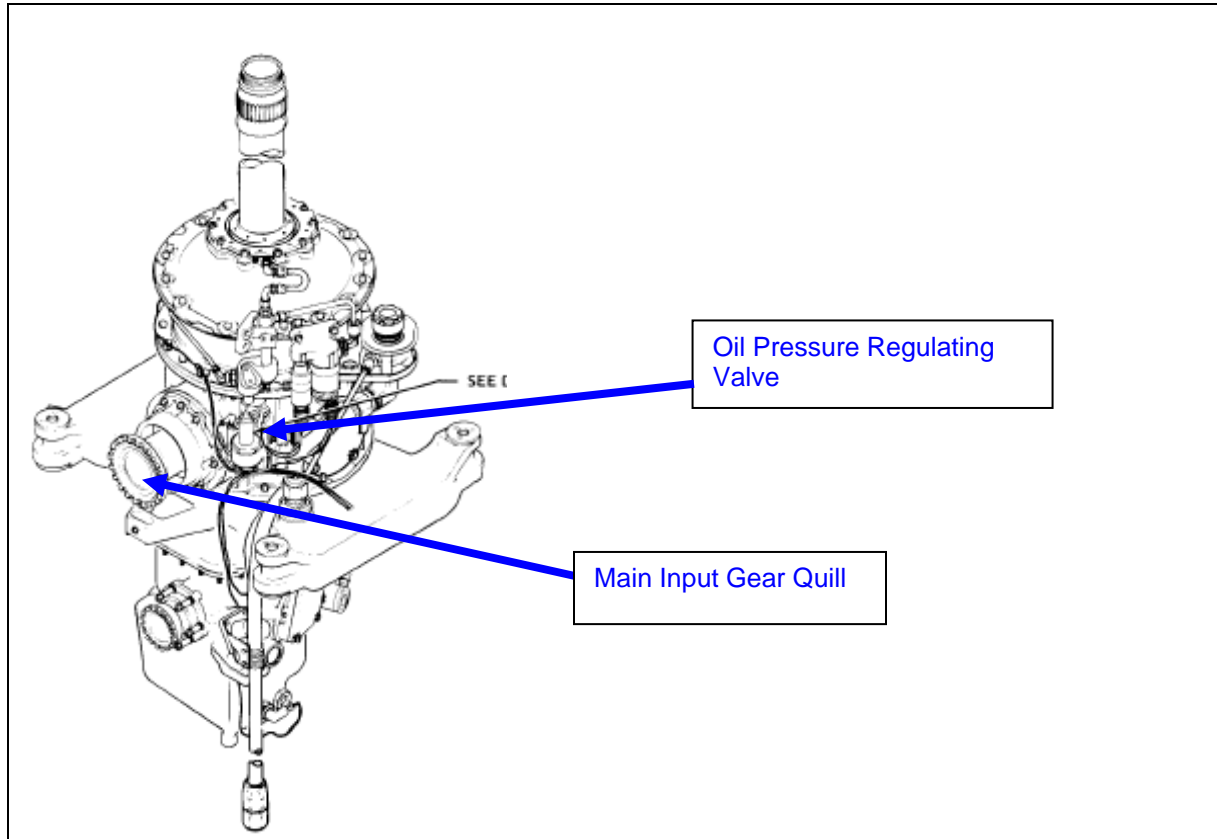
Transmission Oil System Components

The transmission oil system components include the **PLANETARY OIL JETS, SEVEN ADDITIONAL OIL JETS**, 5 around the top transmission case, and two at the bottom of the transmission case, **OIL PRESSURE REGULATING VALVE, OIL TEMPERATURE MANIFOLD**, and the **OIL PRESSURE TRANSMITTER**.



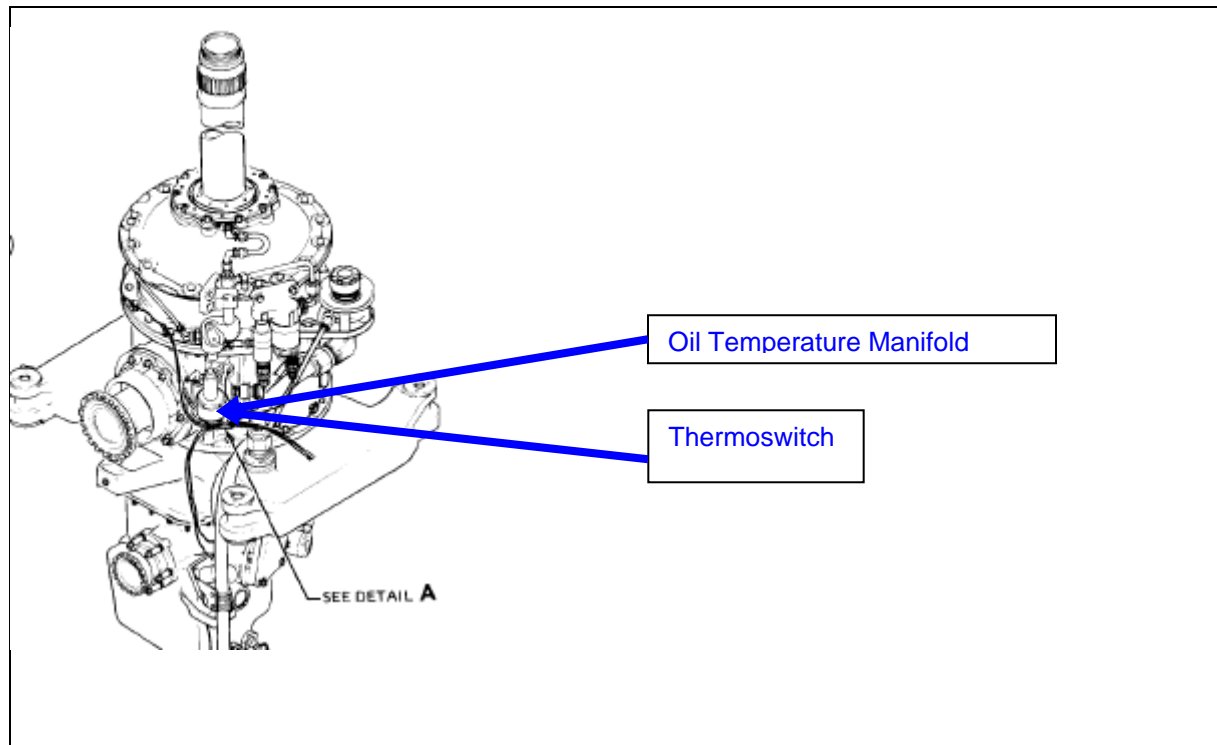
Planetary Oil Jets

Two **PLANETARY OIL JETS** are installed in the planetary gear case of the transmission to provide positive lubrication to the planetary gearing.



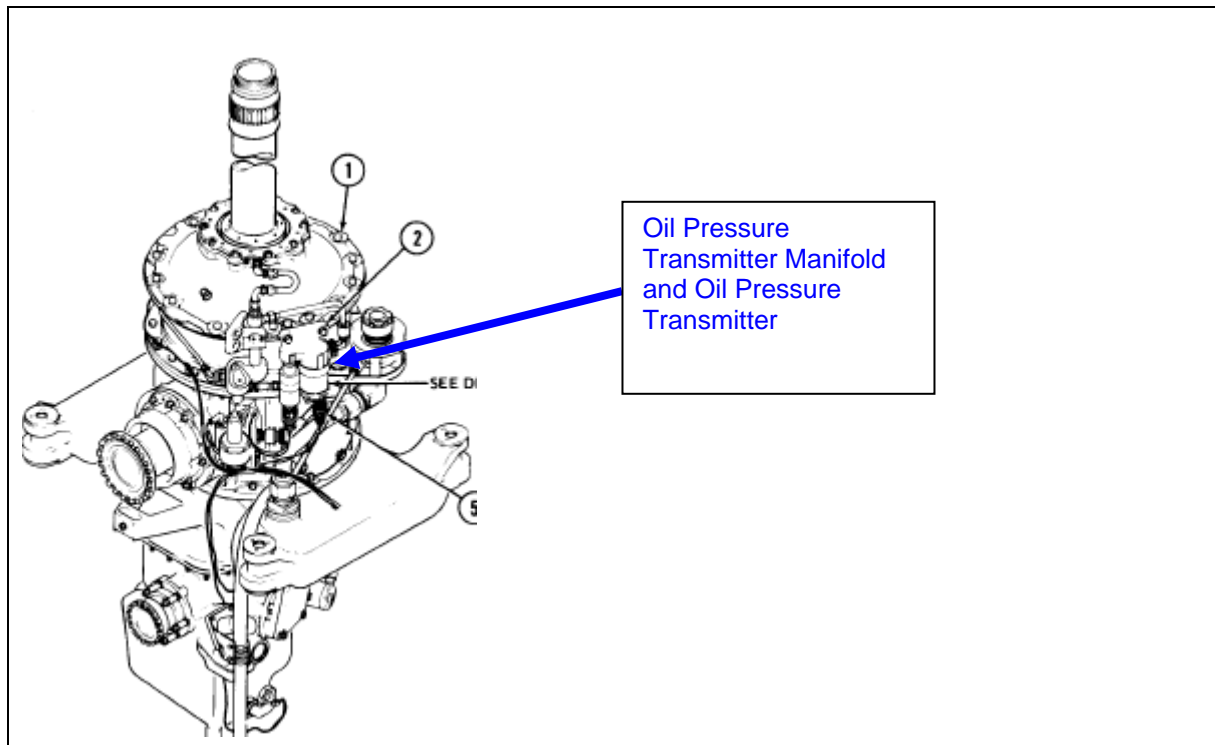
Oil Pressure Regulating Valve

The **OIL PRESSURE REGULATING VALVE**, located near the **MAIN INPUT GEAR QUILL**, regulates the oil pressure for the transmission gearing.



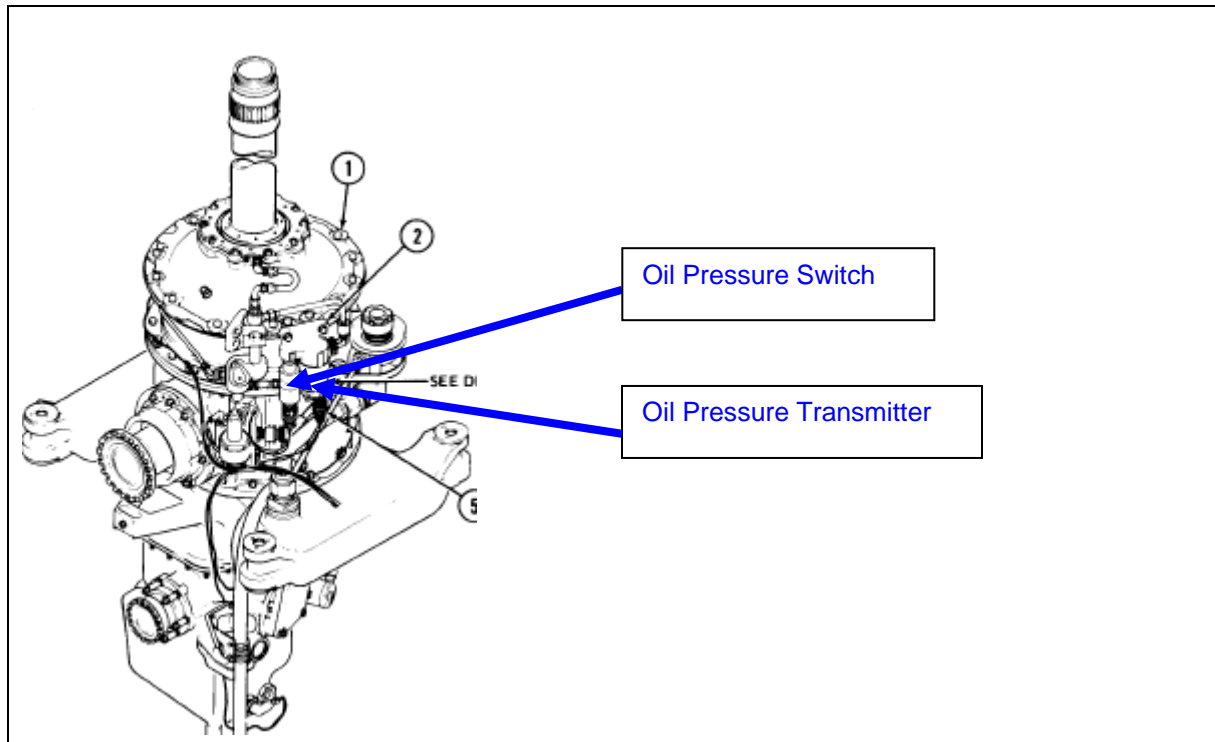
Oil Temperatue Manifold

The **OIL TEMPERATURE MANIOLD** contains a **THEMOSWITCH** to record transmission oil temperature.



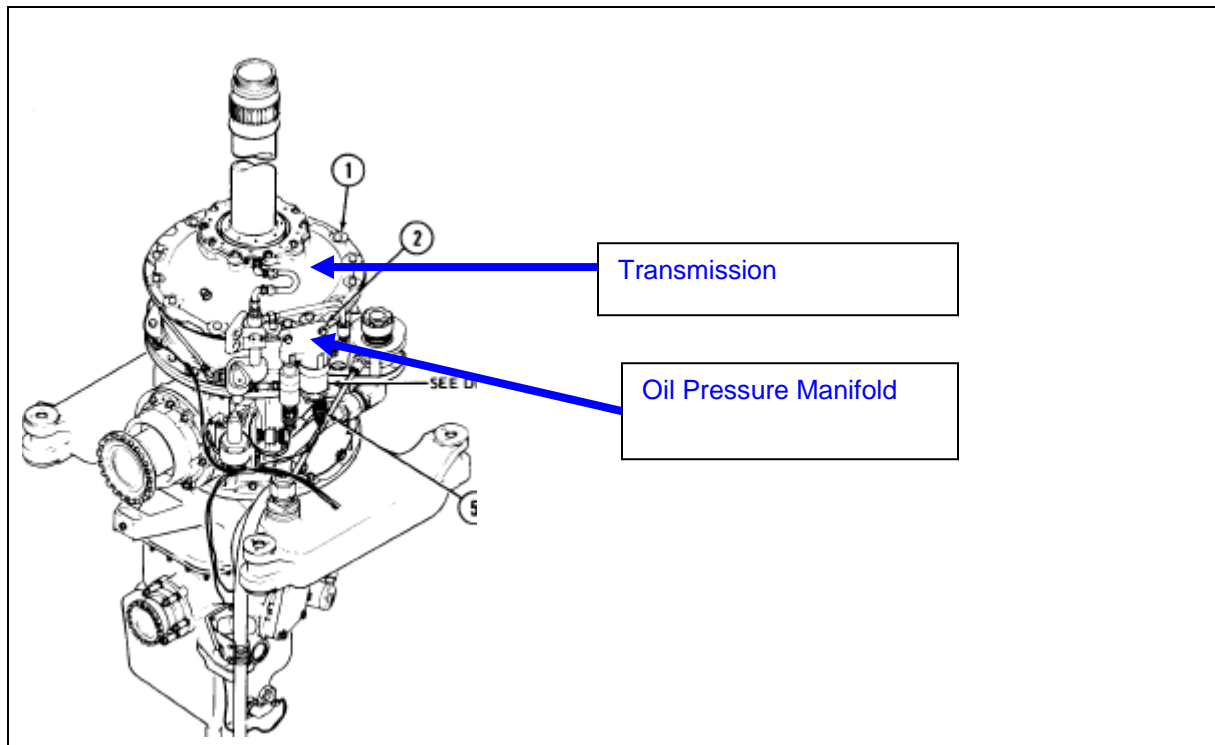
Oil Pressure Transmitter

The **OIL PRESSURE TRANSMITTER** is located in the **OIL PRESSURE TRANSMITTER MANIFOLD**.



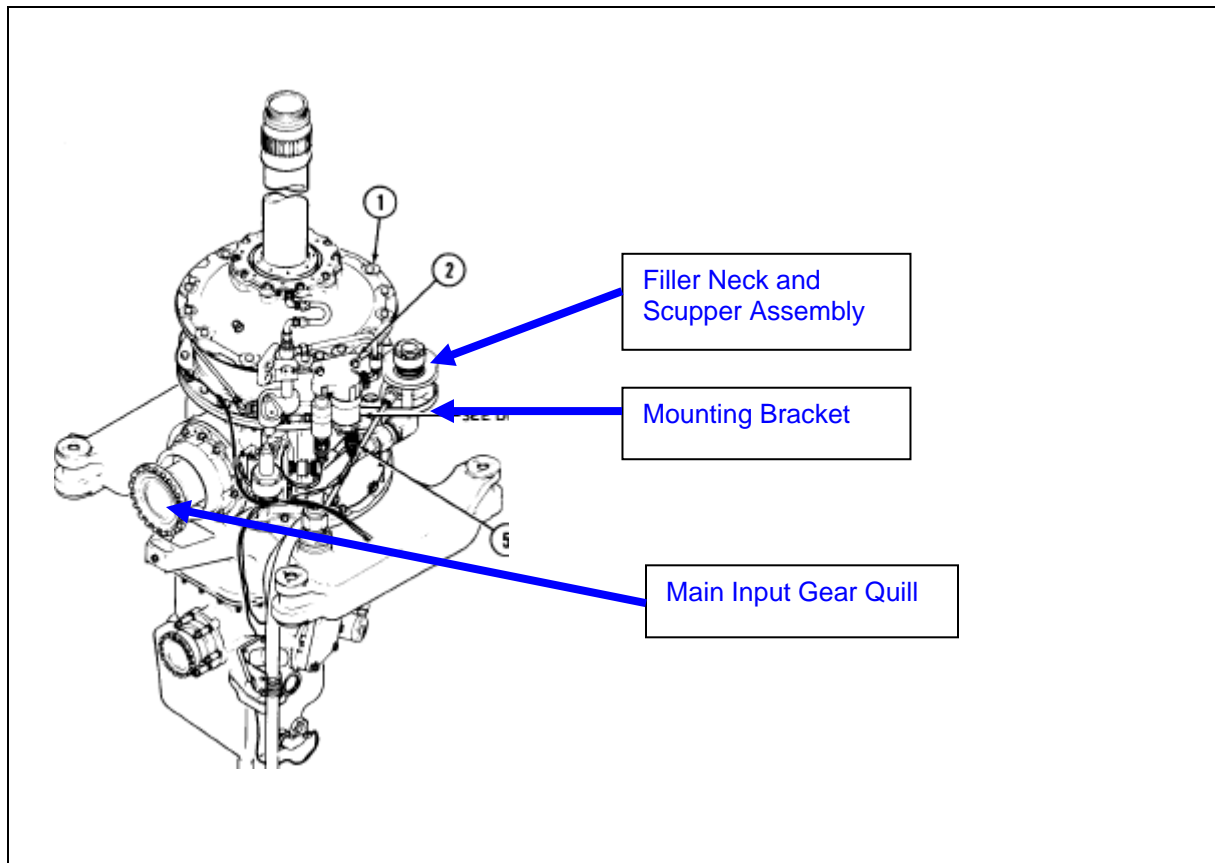
Oil Pressure Switch

The **OIL PRESSURE SWITCH** is located next to the **OIL PRESSURE TRANSMITTER**, and detects the transmission oil pressure.



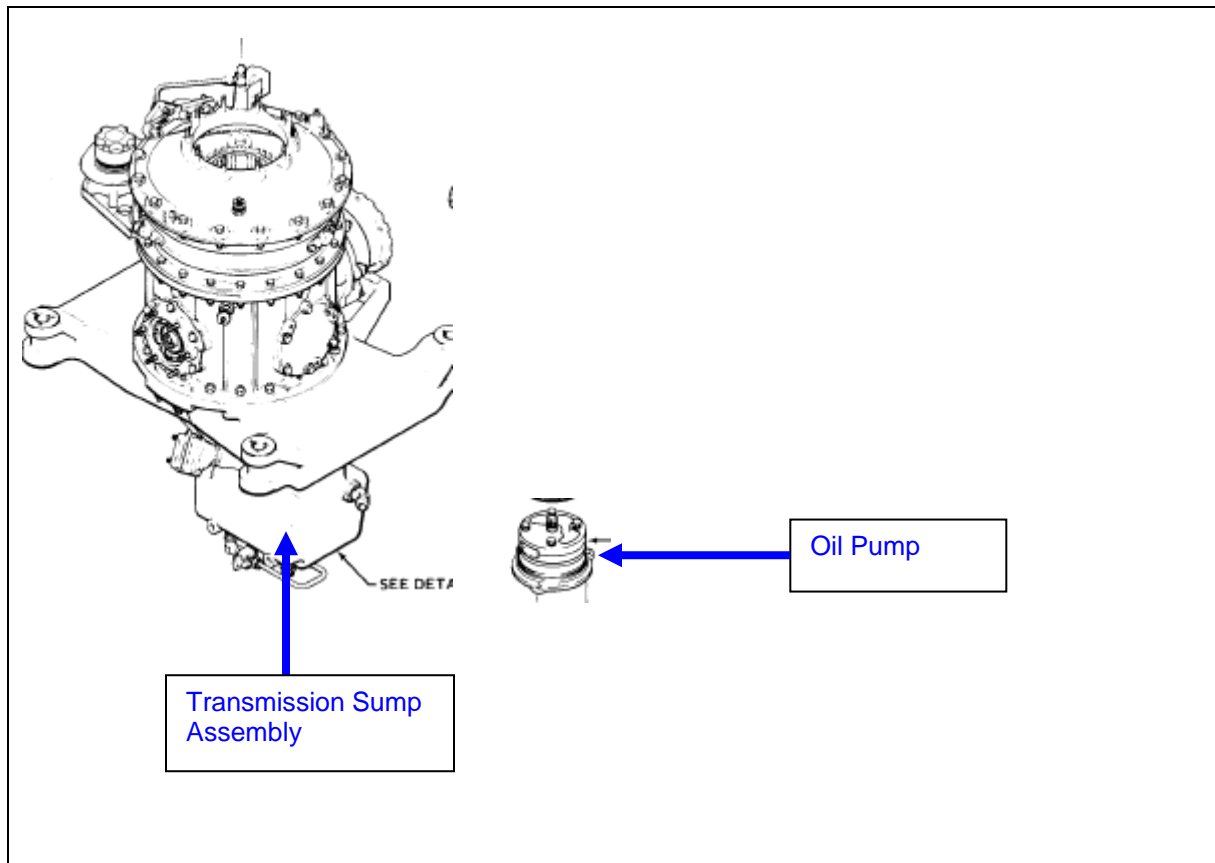
Oil Pressure Manifold

The **OIL PRESSURE MANIFOLD** contains a tube assembly that transmits the **TRANSMISSION** oil pressure.



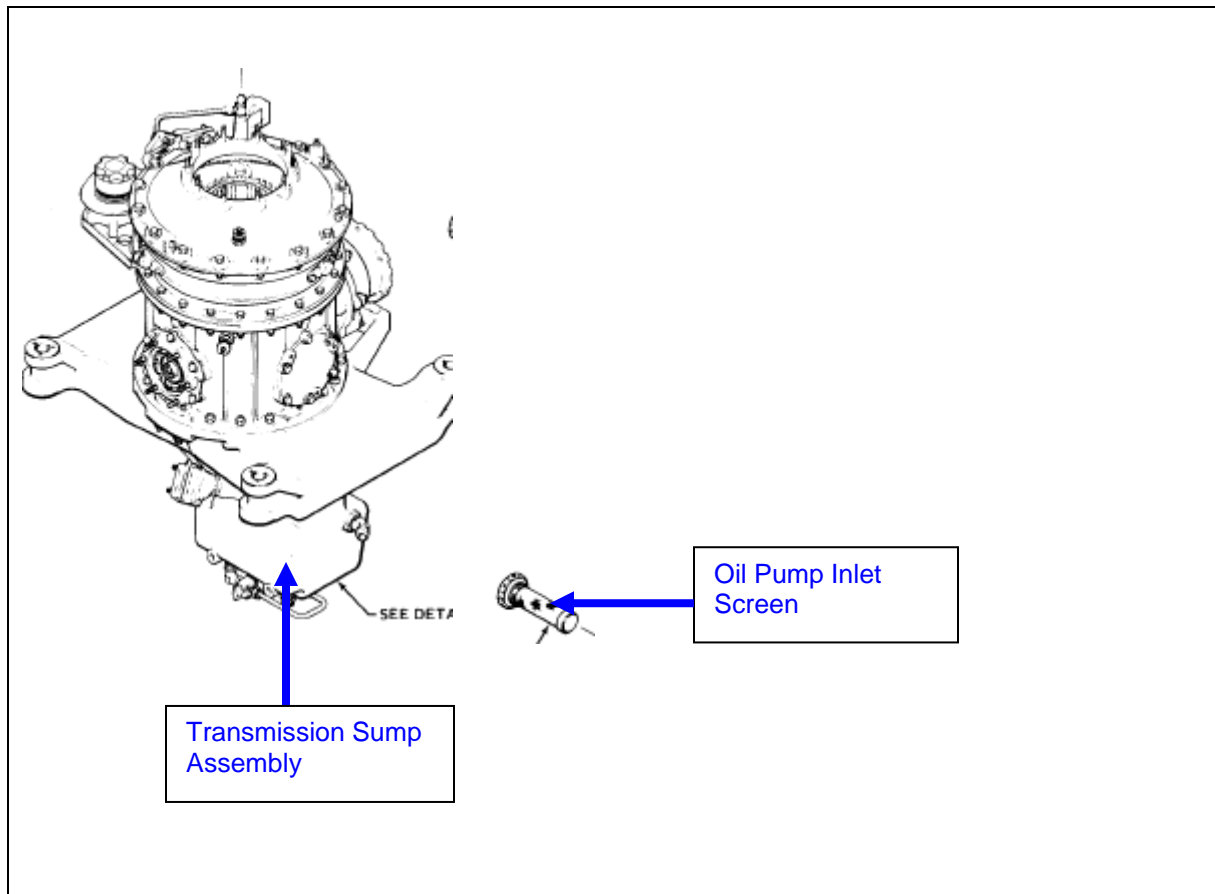
Filler Neck, Scupper, and Mounting Bracket

The **FILLER NECK and SCUPPER ASSEMBLY** for filling the transmission is mounted on a **MOUNTING BRACKET** on the rear of the transmission case opposite the **MAIN INPUT GEAR QUIL**.



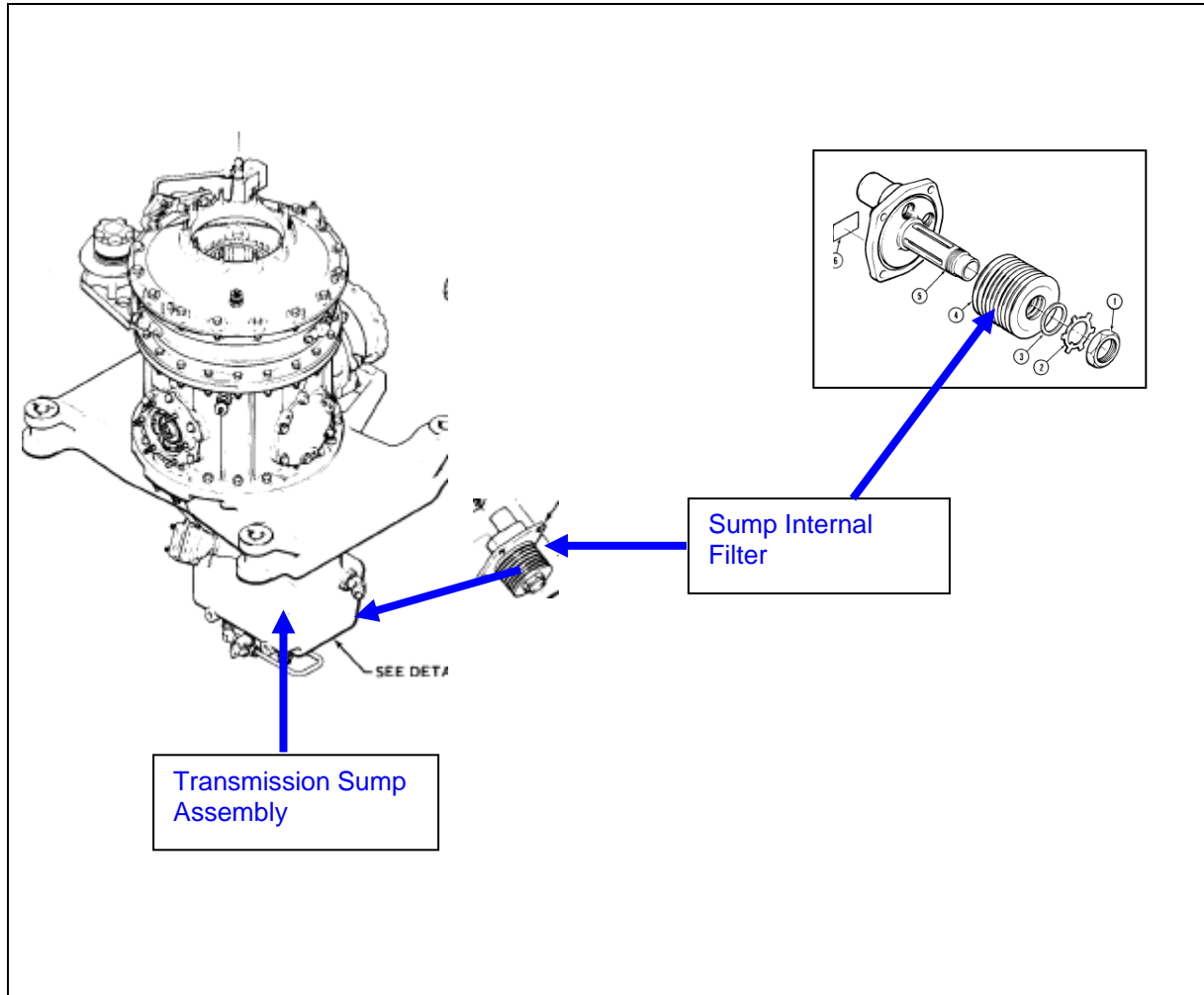
Oil Pump

The transmission **OIL PUMP** is located in the **TRANSMISSION SUMP ASSEMBLY**.



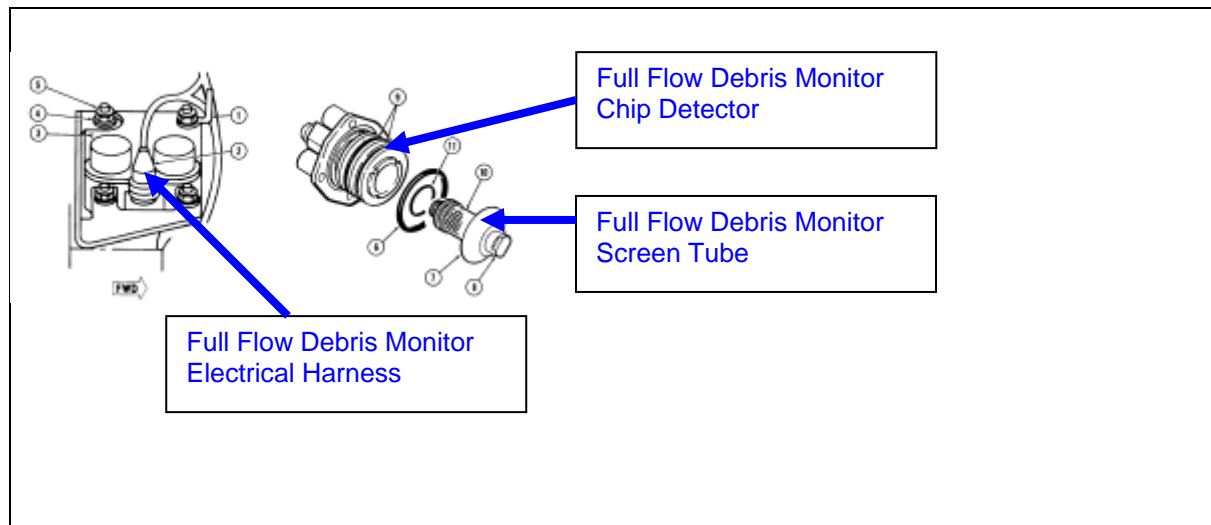
Oil Pump Inlet Screen

The transmission **OIL PUMP INLET SCREEN** is located in the **TRANSMISSION SUMP ASSEMBLY**.



Oil Pump Inlet Screen

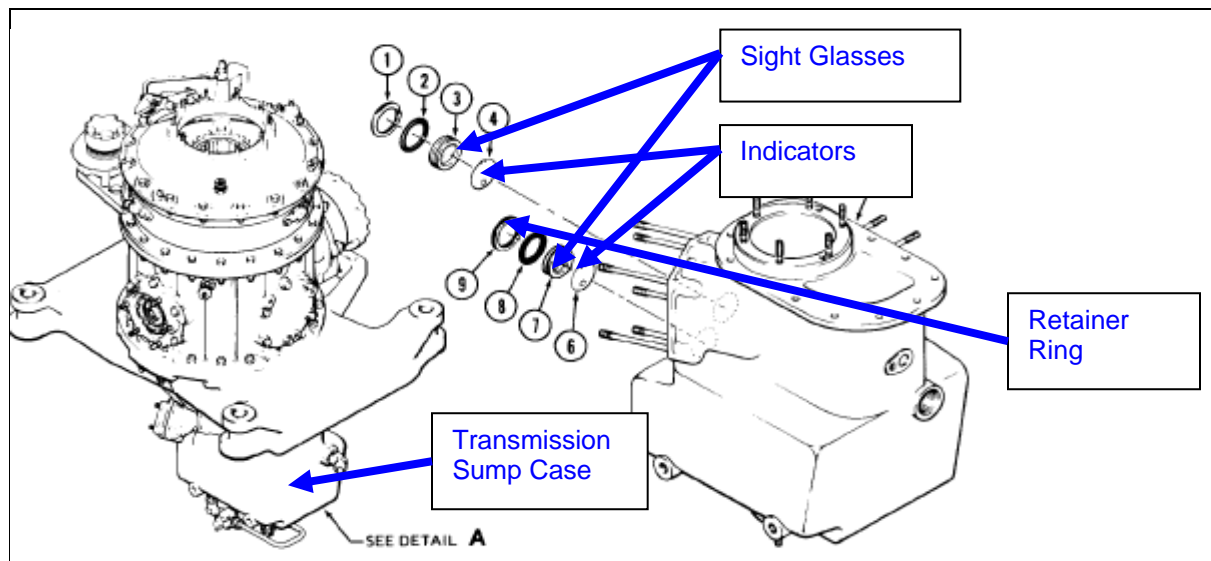
The **TRANSMISSION SUMP ASSEMBLY** contains a **SUMP INTERNAL FILTER** for the transmission oil.



Full Flow Debris Monitor

The **FULL FLOW DEBRIS MONITOR CHIP DETECTOR**, a **SCREEN TUBE**, and an **ELETRICAL HARNESS** are located in an **access panel on the right side of the pylon support in the cabin area**. The Full Flow Debris monitor is removed from the access panel, and the chip detectors are inspected for metal particles and/or other material.

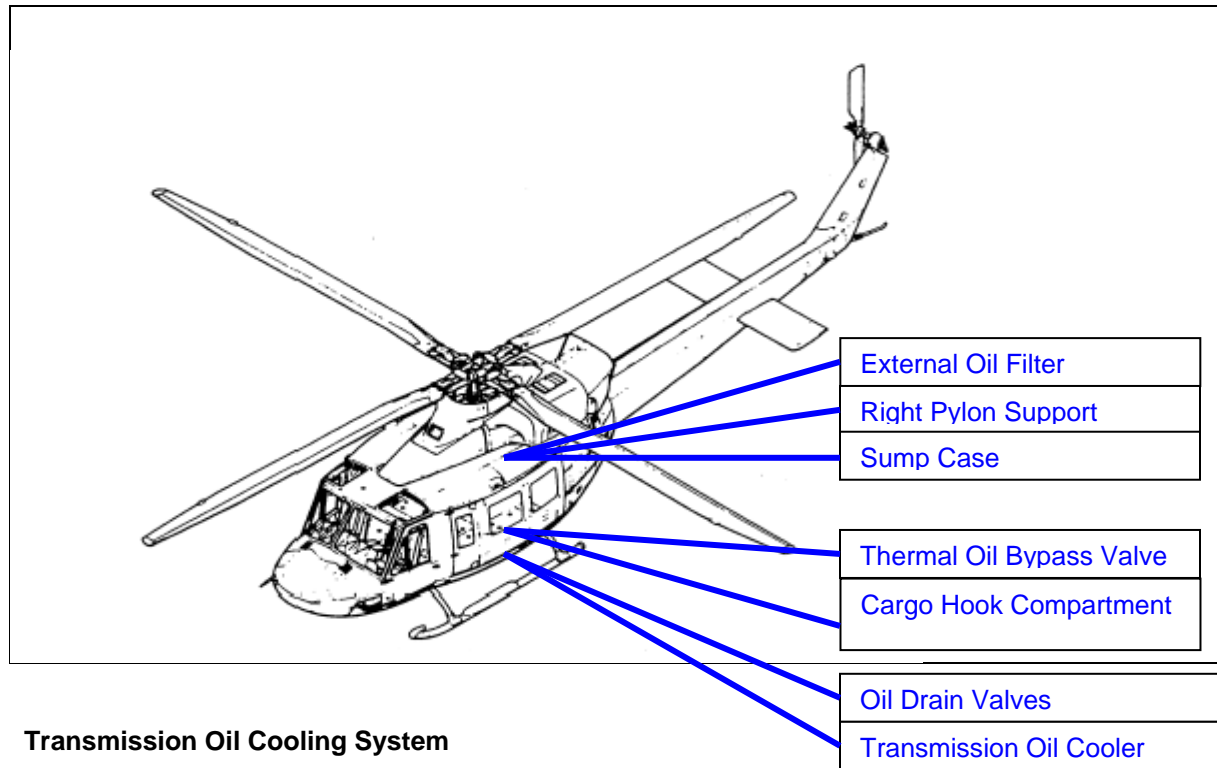
If metal particles are found, maintenance action is required. The chip detectors are also inspected for distortion or tears. Damage which can be detected visually is not acceptable. Nuts are inspected for corrosion and thread damage. Any damage in excess of superficial is not acceptable.



Sight Glasses

The **TRANSMISSION SUMP CASE** contains **SIGHT GLASSES** to check for transmission oil contaminants. The sight glasses are inspected for cracks, crazing, and stains which would prevent an accurate determination of transmission oil level. If any cracks, crazing, and stains are found, the glass must be replaced.

The INDICATORS are inspected for stains that might present a false oil level reading. If stains exist, the indicator must be replaced.



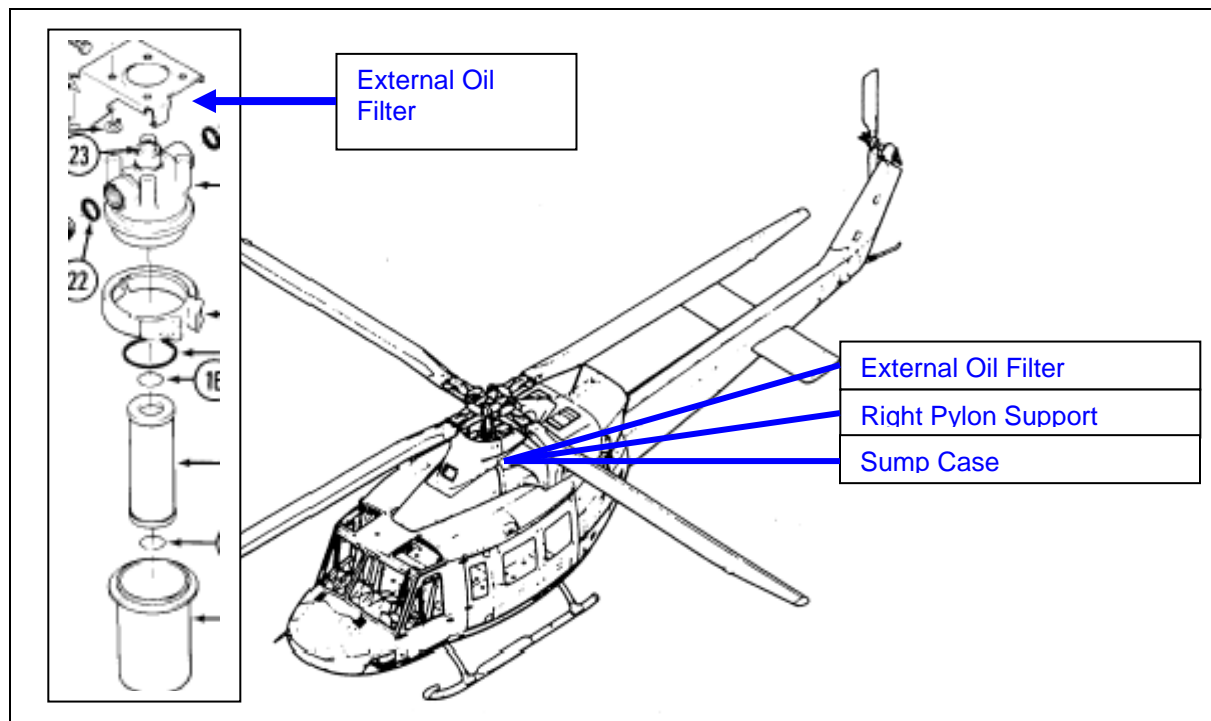
Transmission Oil Cooling System

The transmission oil cooling system consists of:

An **EXTERNAL OIL FILTER** located inside the **RIGHT PYLON SUPPORT** in the cabin area below the **SUMP CASE**.

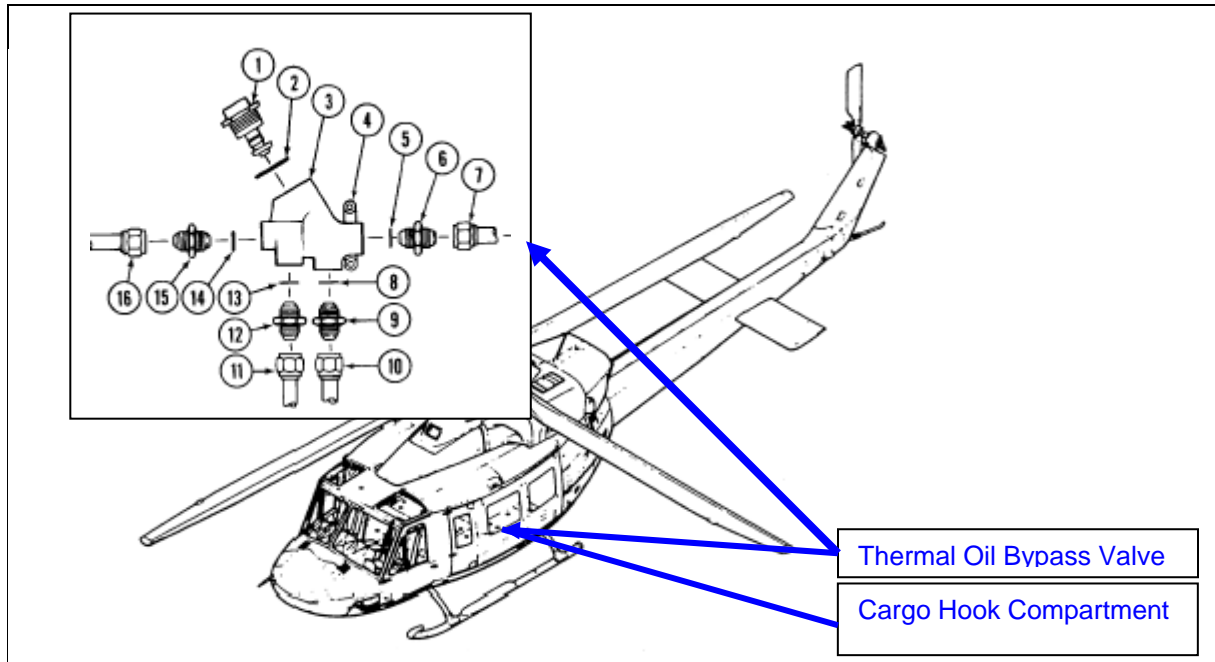
A **THERMAL OIL BYPASS VALVE** located on the rear bulkhead of the **CARGO HOOK COMPARTMENT**.

Two **OIL DRAIN VALVES**, with connecting tubes and cables, located at the lowest part of the oil system between the thermal oil bypass valve and the **TRANSMISSIOIN OIL COOLER**.



External Oil Filter

The **EXTERNAL OIL FILTER** is located inside the **RIGHT PYLON SUPPORT** in the cabin area below the **SUMP CASE**.



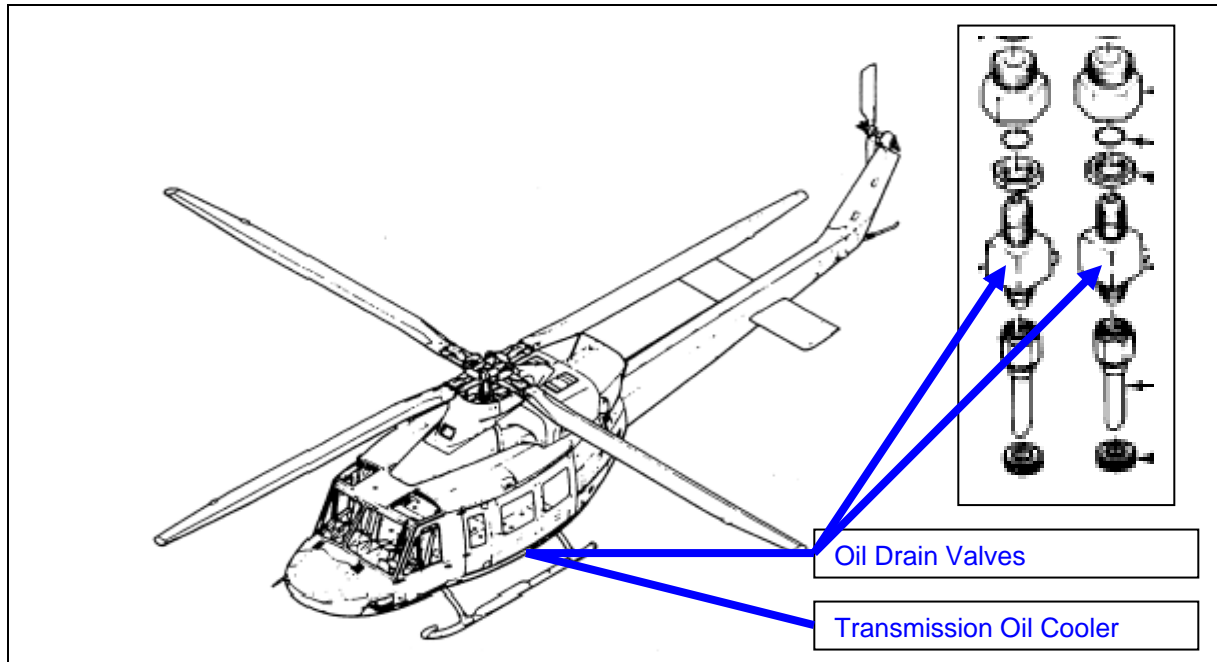
Thermal Oil Bypass Valve

A **THERMAL OIL BYPASS VALVE** located on the rear bulkhead of the **CARGO HOOK COMPARTMENT**.

The valve is located in oil lines between the transmission and oil cooler. The assembly consists of a valve body and a thermostat.

The thermostat will be completely open when transmission oil temperature is 130°F (55°C) or below causing oil to bypass cooler and flow directly to the transmission. The thermostat partially closes at temperatures between 130° and 175°F (55° and 79°C) passing some oil through oil cooler while allowing remainder to bypass directly to transmission.

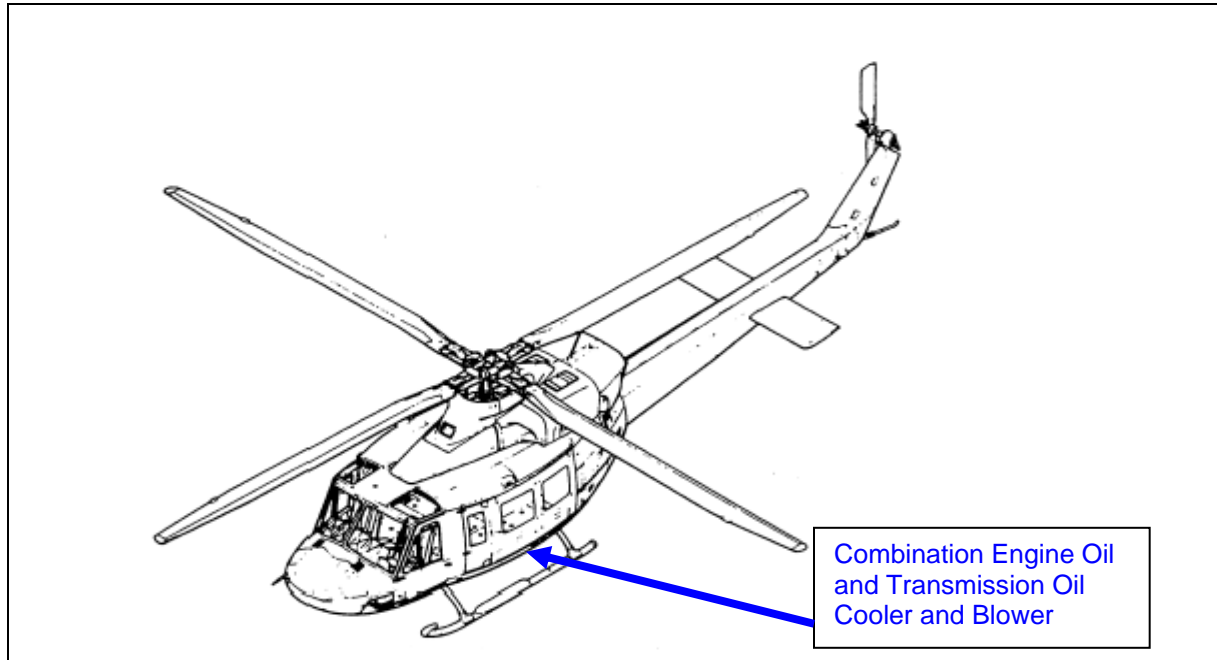
At higher temperatures, all oil flow is directed through the oil cooler before being routed to transmission.



Oil Drain Valves

Two ball type drain valves (one for inlet and one for outlet oil) are installed in lowest part of the oil system between the thermal oil bypass valve and the transmission oil cooler.

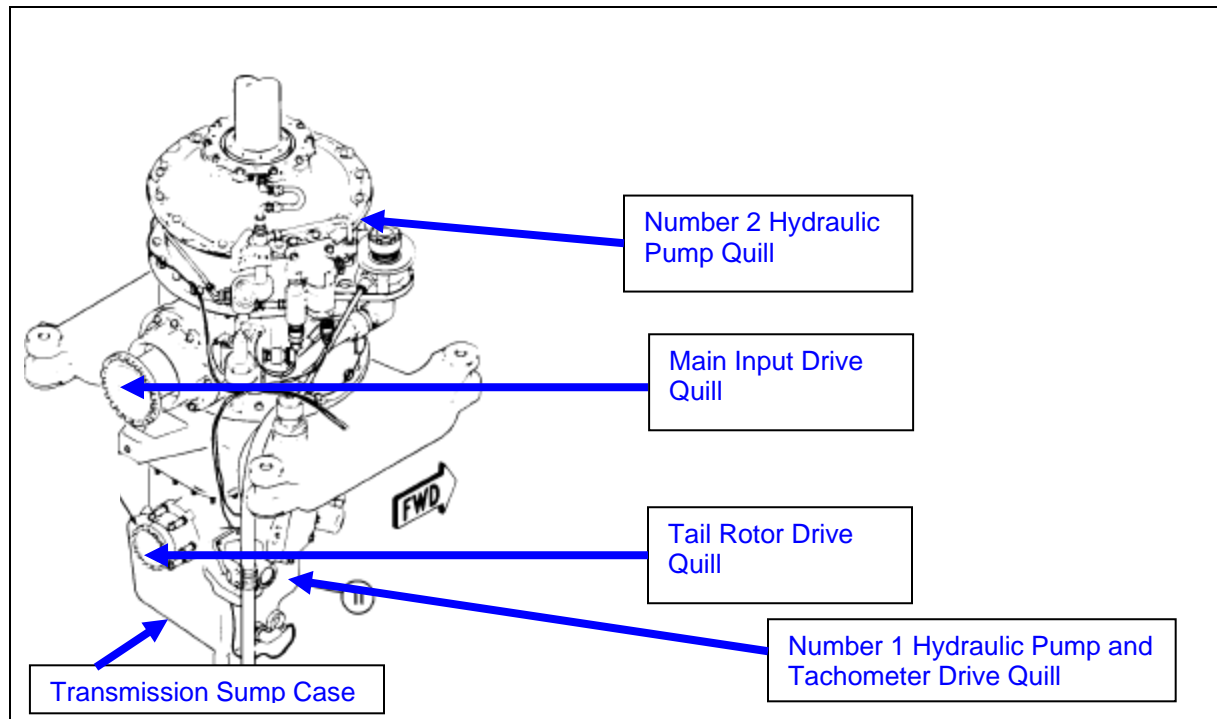
The valves are provided to drain oil trapped in the lines of the oil cooler to transmission system.



Transmission Oil Cooler and Blower

The transmission oil cooling system consists of an external oil filter, thermal oil bypass valve, an **oil cooler and blower**, two drain valves, and connecting tubes and hoses.

The BH 412 contains a **combination engine oil and transmission oil cooler blower** assembly.

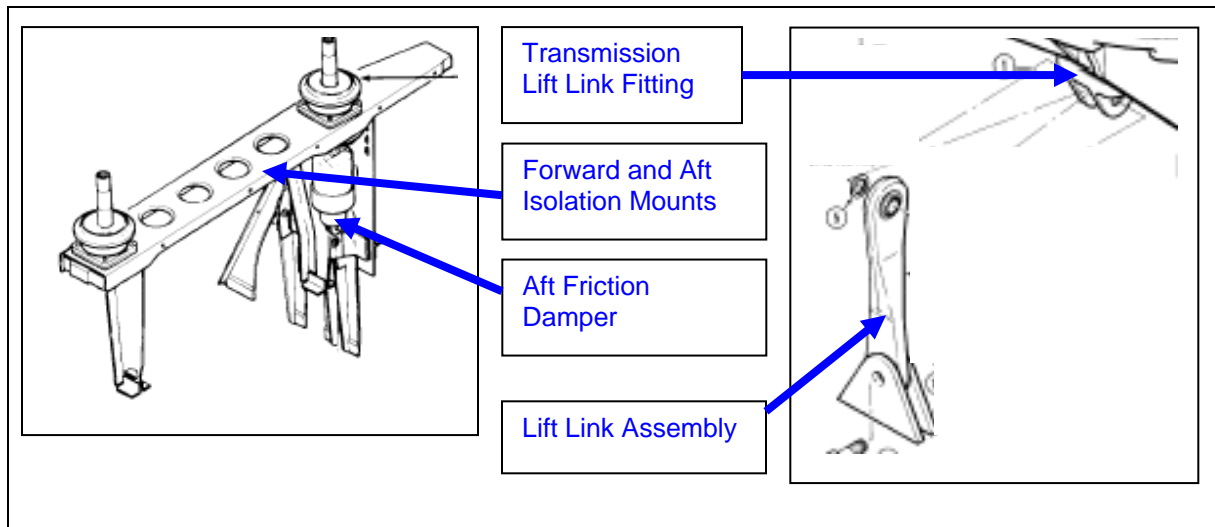


Transmission Quills

The transmission quills consist of the **MAIN INPUT DRIVE QUILL**, hydraulic system number 2 drive quill, hydraulic system number 1 drive quill, tachometer drive quill, rotor brake quill, and the **TAIL ROTOR DRIVE QUILL**.

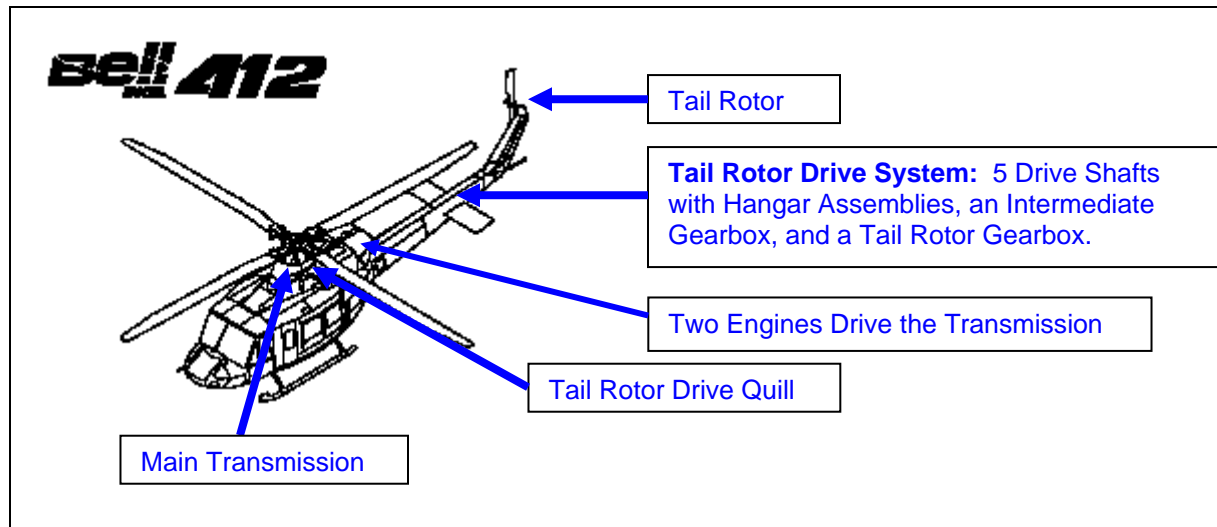
The **NUMBER 1 HYDRAULIC PUMP and TACHOMETER DRIVE QUILL** are located on the forward right side of the **TRANSMISSION SUMP CASE** and are driven by a chain-and-sprocket offset drive from the Number 1 Hydraulic Pump.

The **NUMBER 2 HYDRAULIC PUMP QUILL** is located on the forward side of the transmission.



Transmission Mounts

The transmission mounts consist of **FORWARD and AFT ISOLATION MOUNTS, AFT FRICTION DAMPERS, LIFT LINK ASSEMBLY,** and **TRANSMISSION LIFT LINK FITTING.**



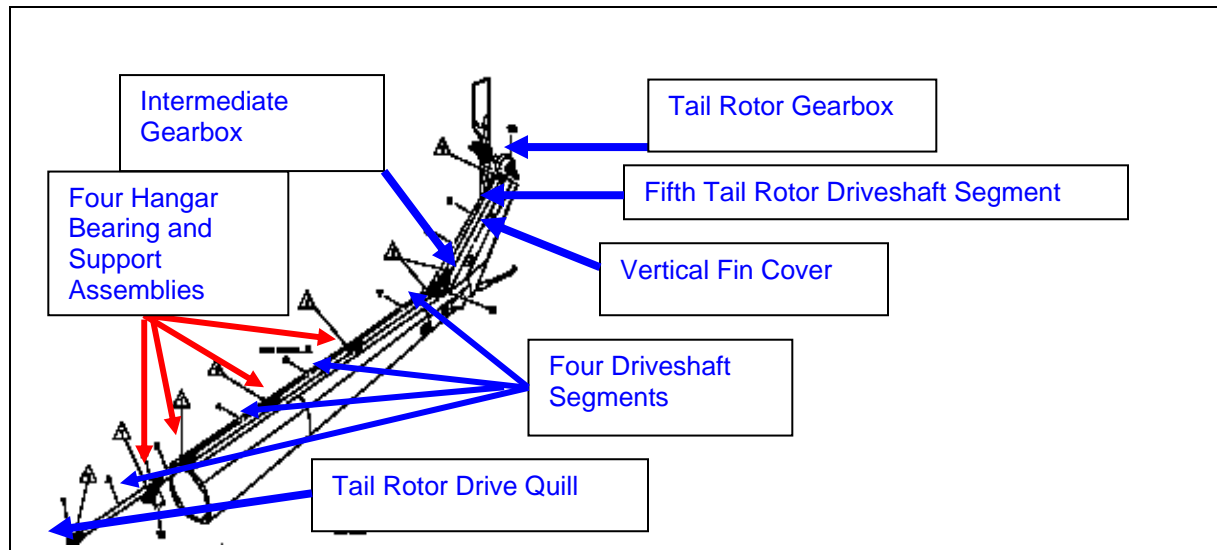
Tail Rotor Overview

The Tail Rotor Drive System part of the BH412 Powertrain consists of **TWO ENGINES** that drive the **MAIN TRANSMISSION**.

The transmission has a **TAIL ROTOR DRIVE QUILL** on the aft side of the transmission.

The Tail Rotor Drive Quill connects to the **TAIL ROTOR DRIVE SYSTEM** that consists of Five Driveshaft Segments with Hangar Assemblies, an Intermediate Gearbox, and a Tail Rotor Gearbox.

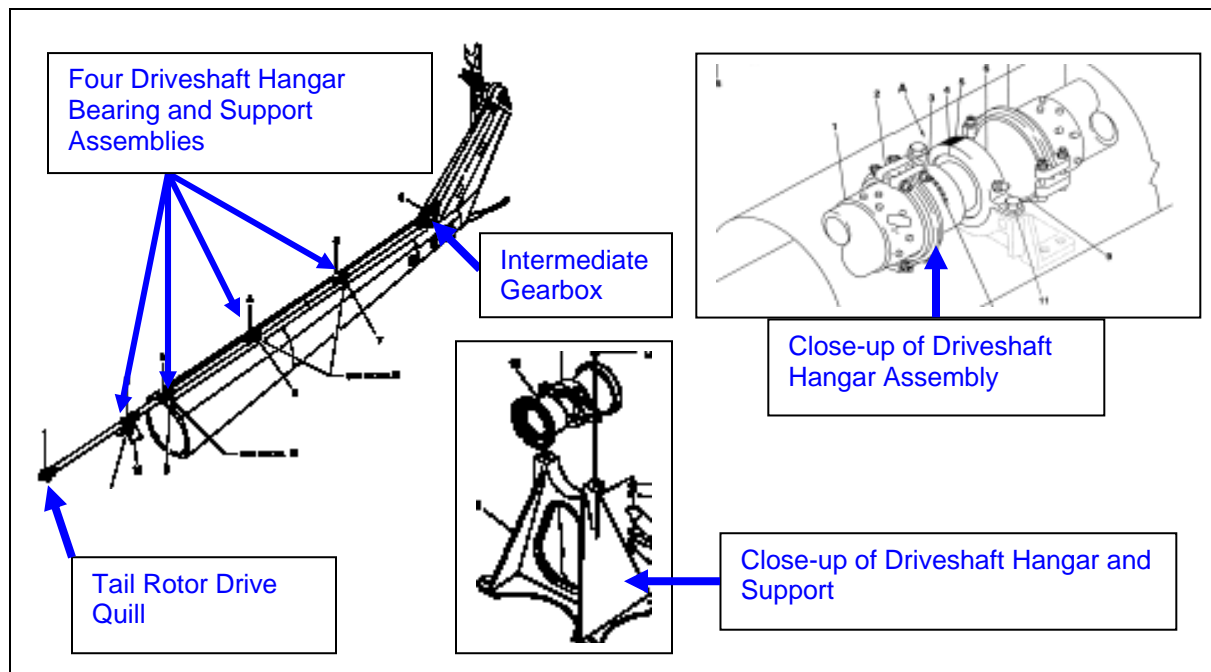
The Tail Rotor Drive System connects to the **TAIL ROTOR**.



Tail Rotor Driveshaft

The **TAIL ROTOR DRIVE QUILL** connects the **Tail Rotor Driveshaft** to the **Transmission**.

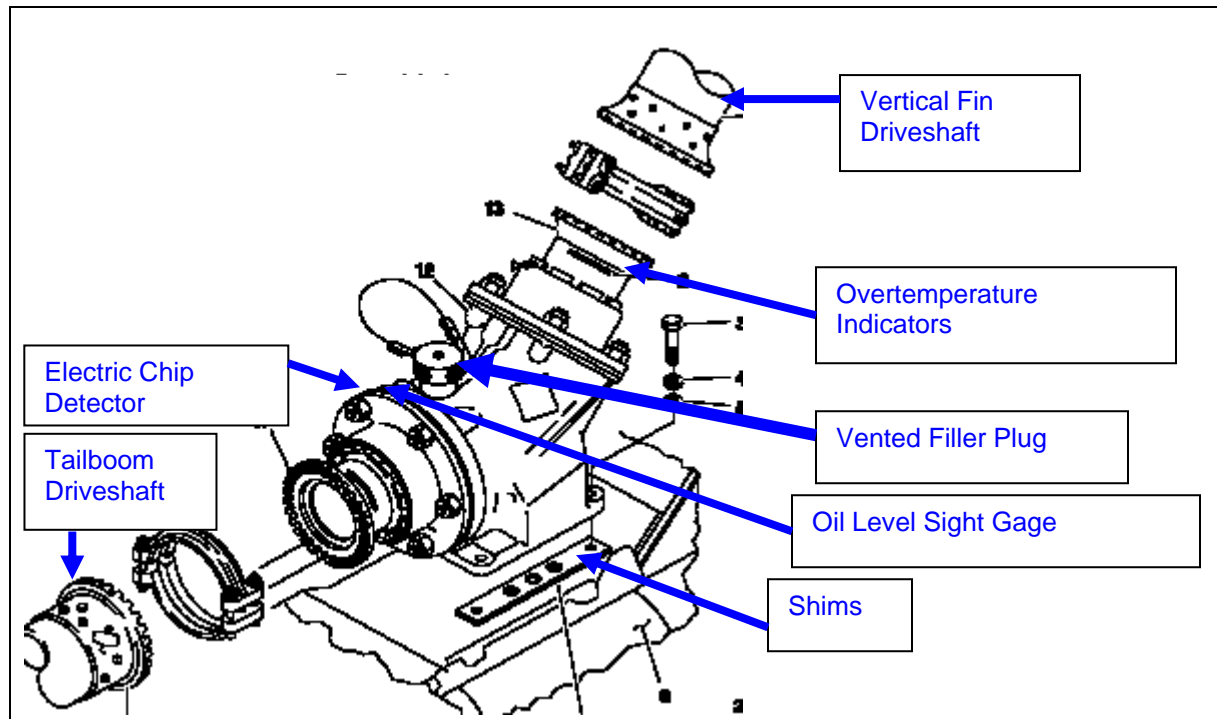
The **Tail Rotor Driveshaft** consists of **FOUR HANGAR BEARING and SUPPORT ASSEMBLIES**, **FOUR DRIVESHAFT SEGMENTS** that are supported by the **Four Hangar Assemblies**, an **INTERMEDIATE GEARBOX**, a **FIFTH TAIL ROTOR DRIVESHAFT SEGMENT**, and a **TAIL ROTOR GEARBOX**.



Driveshaft Hangar Assemblies

There are **FOUR DRIVESHAFT HANGAR BEARING and SUPPORT ASSEMBLIES** that support the **Tail Rotor Driveshaft** located between the **TAIL ROTOR DRIVE QUILL** and the **INTERMEDIATE GEARBOX**.

Clicking on **CLOSE-UP OF DRIVESHAFT HANGAR AND SUPPORT** and **CLOSE-UP OF DRIVESHAFT HANGAR ASSEMBLY** will provide additional component detail.

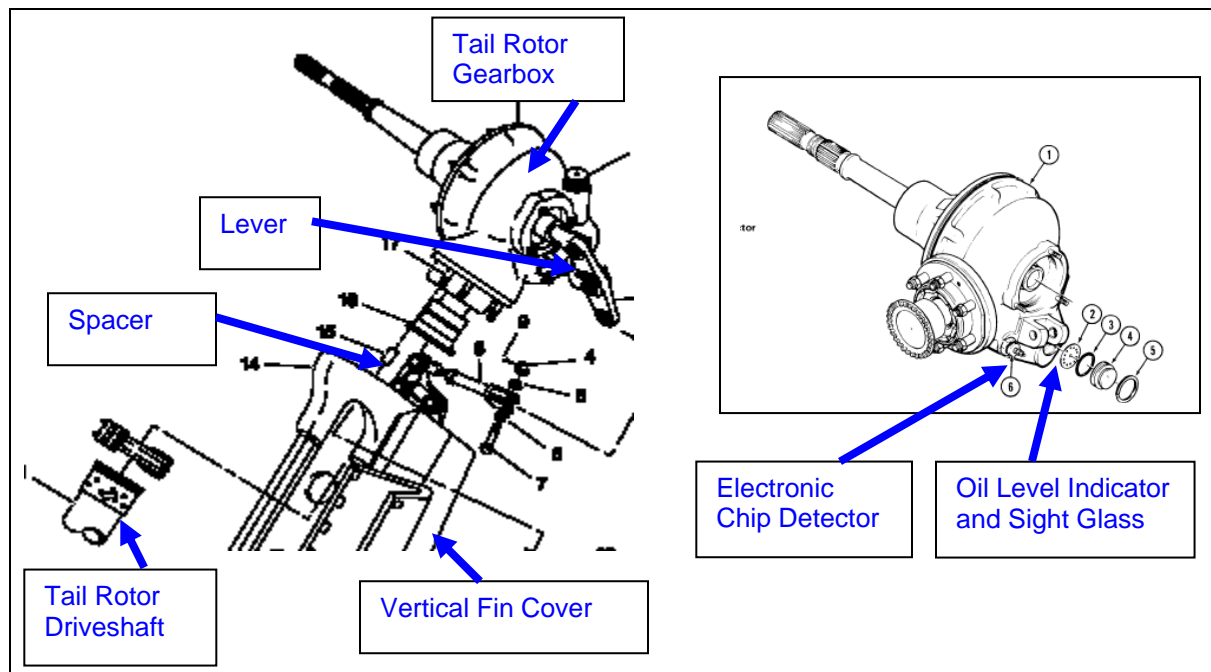


Intermediate Gearbox

The intermediate gearbox is installed on the **TAILBOOM DRIVESHAFT** forward of the **VERTICAL FIN DRIVESHAFT**. The gearbox is aligned by the use of **SHIMS** between the gearbox and the tailboom.

The intermediate gearbox has an **ELECTRIC CHIP DETECTOR** and an **OIL LEVEL SIGHT GAGE** located on the right side.

A **VENTED FILLER PLUG** is installed on top of the case. A cover with cowl fasteners provides access to the intermediate gearbox.



Tail Rotor Gearbox

The **TAIL ROTOR GEARBOX** is located at the end of the **TAIL ROTOR DRIVESHAFT** inside the **VERTICAL FIN COVER**. It is adjusted by a **SPACER** and a **LEVER** assembly.

The Tail; Rotor Gearbox contains an **ELECTRONIC CHIP DETECTOR** and an **OIL LEVEL INDICATOR and SIGHT GLASS**.