



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

ENGINE EXAMINATION

WPR18FA232

This document contains 17 embedded photos.

A. ACCIDENT

Location: Granger, Texas
Date: August 21, 2018.
Aircraft: Hughes 369FF, Registration: N530FU
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson Senior Aviation Accident Investigator National Transportation Safety Board	John Hobby Air Safety Investigator Boeing
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Joan Gregoire Chief Air Safety Investigator MD Helicopters, Inc	David Cobb Dallas Airmotive
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Nicholas Shepler
Air Safety Investigations
Rolls Royce

C. SUMMARY

Examination of the engine was conducted by the group at the facilities of Dallas Airmotive, Dallas, Texas on October 4, 2018. No anomalies were noted during the examination that required the retention and examination of additional components.

D. DETAILS OF THE INVESTIGATION

1.0 Examination

Rolls-Royce Model 250-C30
SN: CAE-895663

The engine exhibited indications of external thermal damage and was coated in light brown soot. The gearbox was coated in darker colored soot and oil residue (Photo 1). All ancillary lines were intact at their respective fittings. The N2 stage could be rotated by hand; N1 had a range of motion of about 20 to 30° in either direction movement was inhibited.

The engine gearbox oil had been drained prior to engine shipment. The upper chip detector was dry, brown, thermally damaged, and covered with about three hair-like strands (Photo 2). The lower chip detector was coated in dark oil and black debris (Photo 3).

The fuel filter remained partially attached to its housing assembly. The top of the filter can exhibited a 1 inch wide by two inches long opening, exposing the filter element. The element was removed and had a charred appearance charred, and no particles were observed between the pleats. (Photo 4).

The fuel pump and controller assembly remained firmly attached to its pad on the engine gearbox. The throttle linkage was still attached to the throttle arm, which could be moved freely throughout its range of travel. The controller assembly was removed; its drive shaft was intact and could be rotated freely.

The power turbine governor remained attached to its pad on the gearbox; its control arm and linkage were intact, and the arm could be moved freely. The governor assembly was removed, and its drive shaft was intact and rotated freely.

The fuel nozzle displayed even black and gray deposits around the circumference of its spray face (Photo 5). Both ignitors appeared to be coated in dark brown and black soot, and both exhibited chafing signatures about 3/8 inch short of their tips.

The ancillary lines and horizontal fire shield components were removed, and the engine was split at the exhaust collector support to facilitate internal inspection (Photo 6). The shims used for alignment of the turbine section and exhaust collector support were checked, and matched those found in the shim record card.

With the compressor section separated, the power turbine-to-pinion gear coupling shaft was exposed, along with the turbine-to-compressor coupling shaft ("pea shooter"). The pea shooter was coated in oil and brown deposits, and the power turbine-to-pinion gear coupling shaft was a dark shade and coated with oil. The teeth of all shafts and couplings were intact.

The outer combustion case was then removed, and the internal combustion liner examined. The inner surface of the liner was coated in an even pattern of dark brown and black soot, and the liner did not exhibit any indications of damage (Photo 7). The number one nozzle shield and nozzle were intact and exhibited even burn patterns and dark brown sooting deposits. (Photo 8). The power turbine assembly could be rotated smoothly by hand. The fourth stage turbine wheel was viewed through the exhaust collector shroud, all blades appeared intact and undamaged (Photo 9).

The inner surface of the compressor discharge tubes were coated in even dark brown deposits, and speckled with white dust-like particles (Photo 10).

The compressor section was removed from the gearbox. The alignment shims were checked and found to match those found in the shim record card. The impellor could be rotated by hand and no indications of binding within the scroll could be felt (Photo 11). The number 2 bearing was coated in oil and appeared intact. The spur adapter was intact, coated in oil and appeared

undamaged (Photo 12). The pressure oil filter was coated in oil and there were no visible particles within the pleats (Photo 13).

Drive train continuity throughout the gearbox was confirmed between the N2 tach generator output and power output drive. The N1 tach generator output could not be rotated by hand. The gearbox case was opened, and gears examined (Photo 14,15). All gears were intact and coated in oil. The case was free of debris or visible metal shavings. The oil pump input shaft could not be rotated. The oil pump was removed and disassembled; the pressure side gears were wet with oil, intact, and the pump cavity was free of gouges (Photo 16). The scavenge gears were all intact and undamaged, and coated in a black “baked” glaze that appeared to prevent rotation (Photo 17).

1.1 Examination Photos

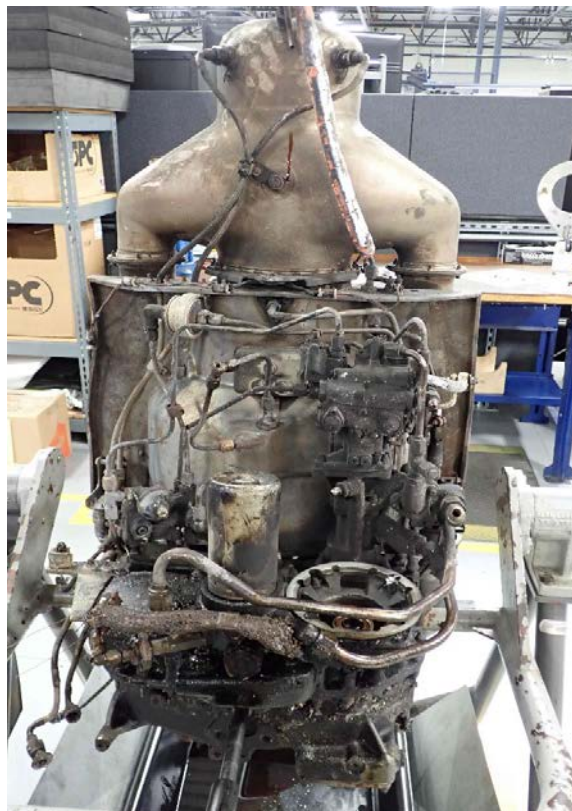


Photo 1 – Engine in Stand



Photo 2 - Gearbox Upper Chip Detector



Photo 3 - Gearbox Lower Chip Detector



Photo 4 – Fuel Filter



Photo 5 – Fuel Nozzle

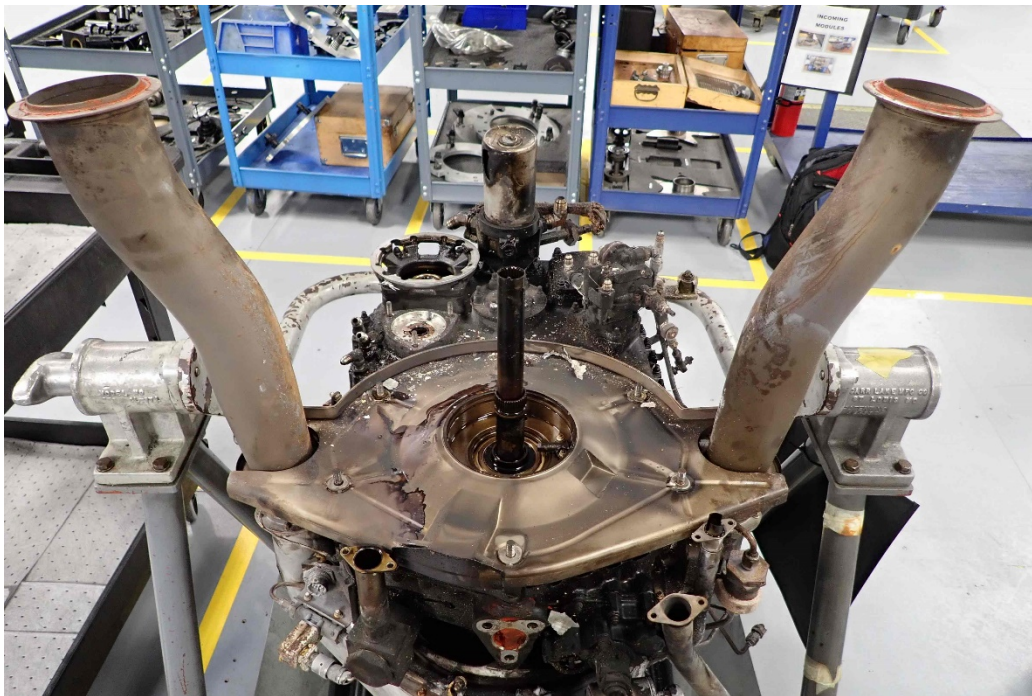


Photo 6 – Engine Spilt at Exhaust Collector Support



Photo 7 – Combustion Liner

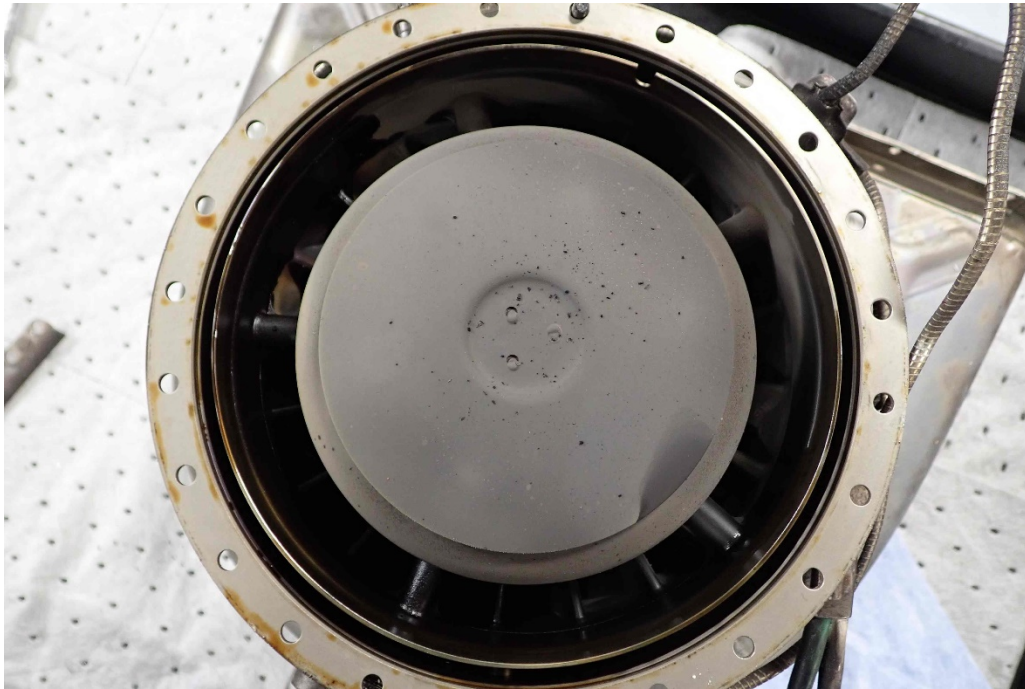


Photo 8 – Number One Nozzle Shield

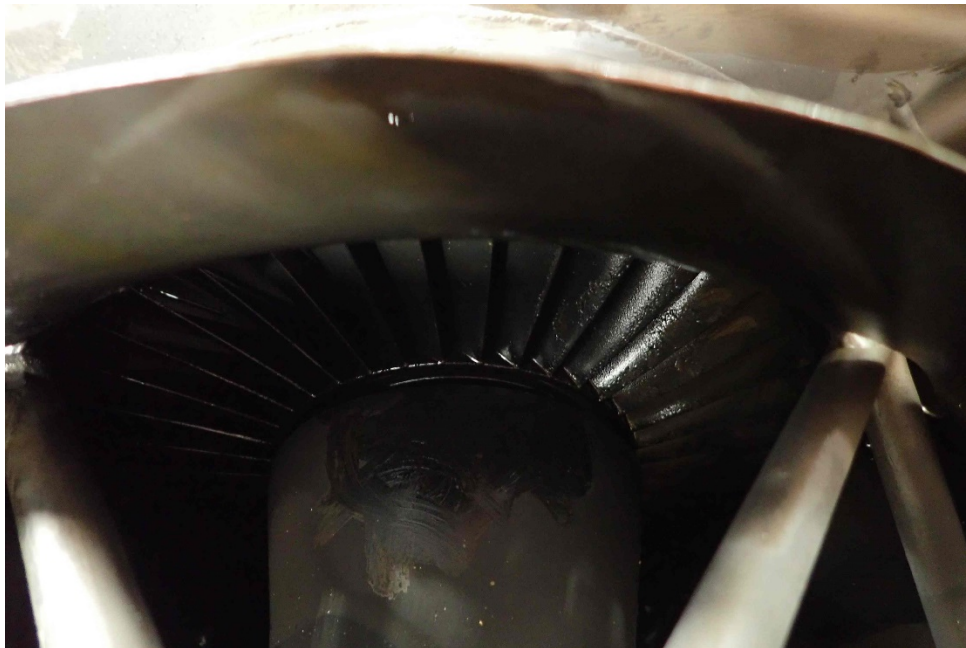


Photo 9 – Fourth Stage Turbine Wheel

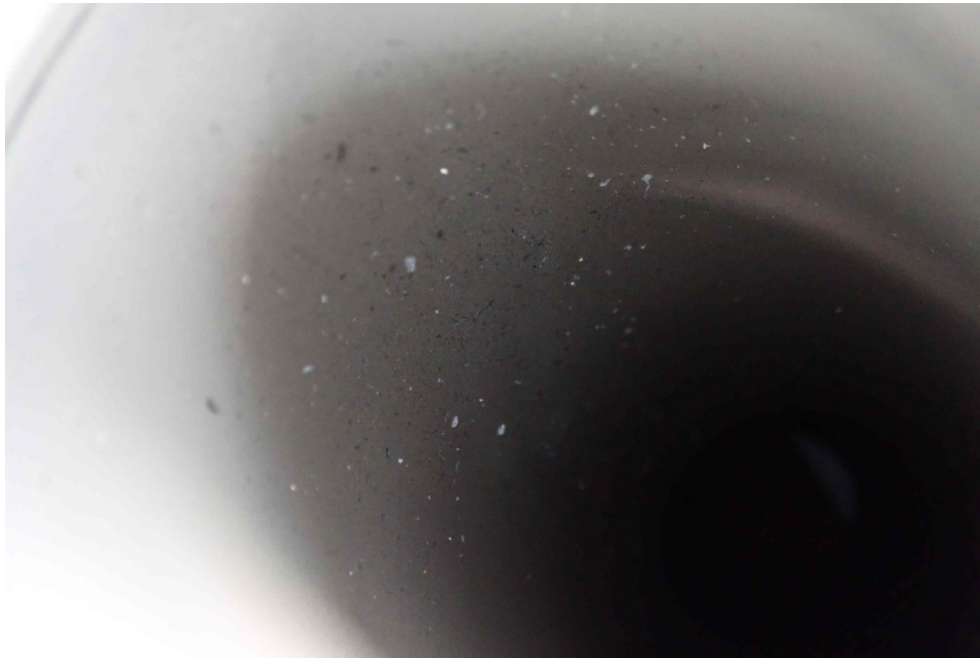


Photo 10 – Inner Surface of a Compressor Discharge Tube

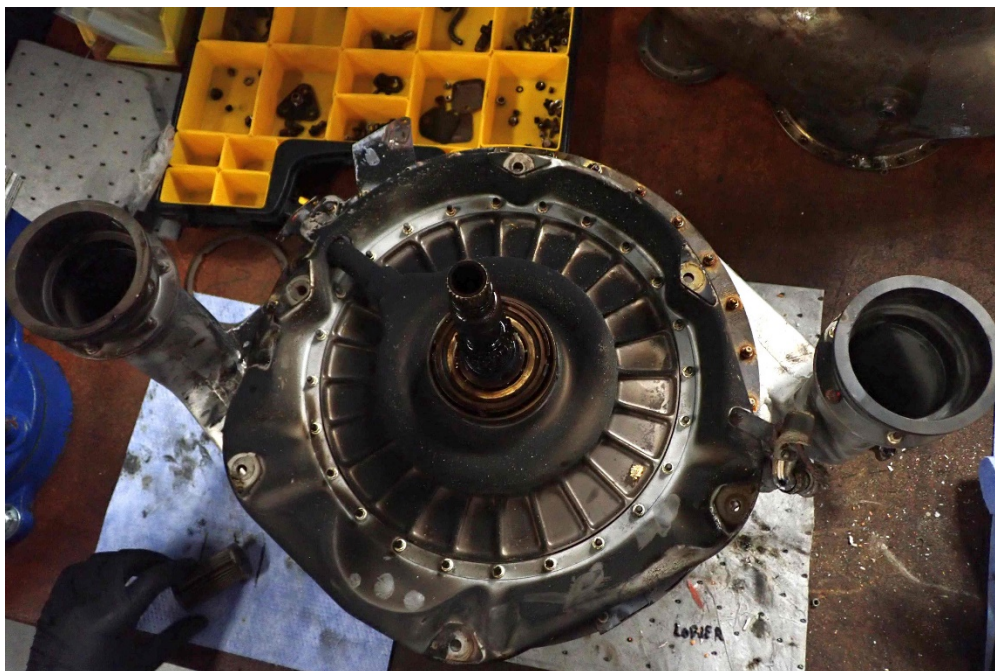


Photo 11 – Impeller Shroud and Spur Adapter



Photo 12 – Number 2 Bearing and Spur Adapter



Photo 13 – Pressure Oil Filter

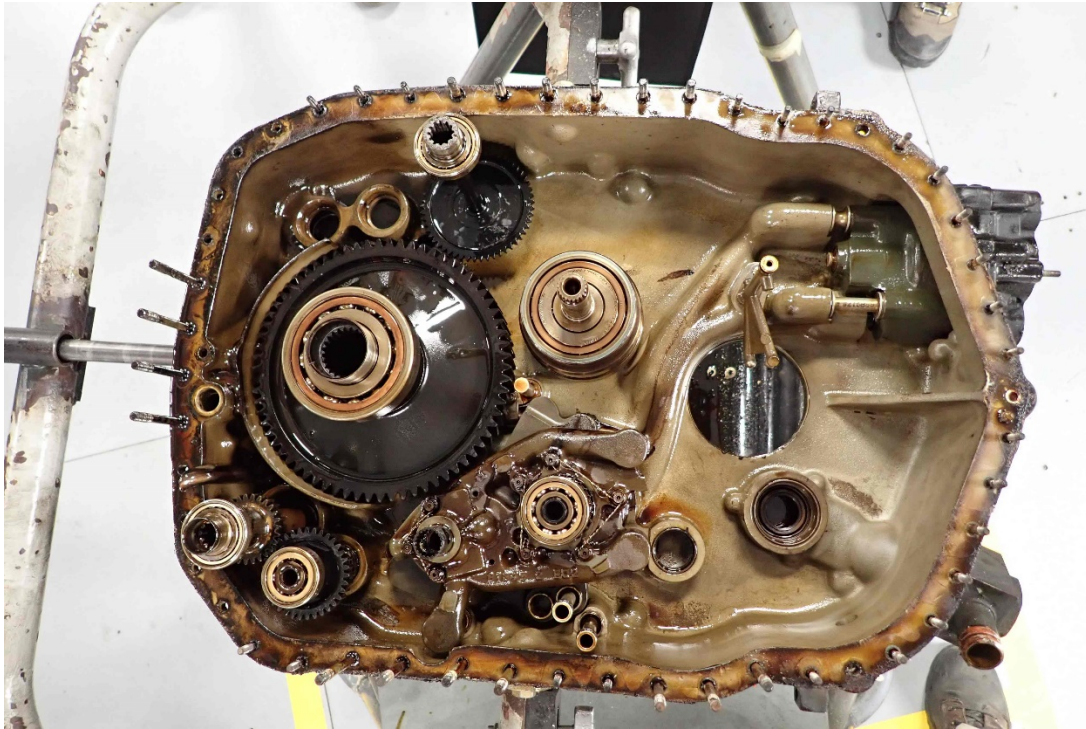


Photo 14 – Opened Gearbox Half

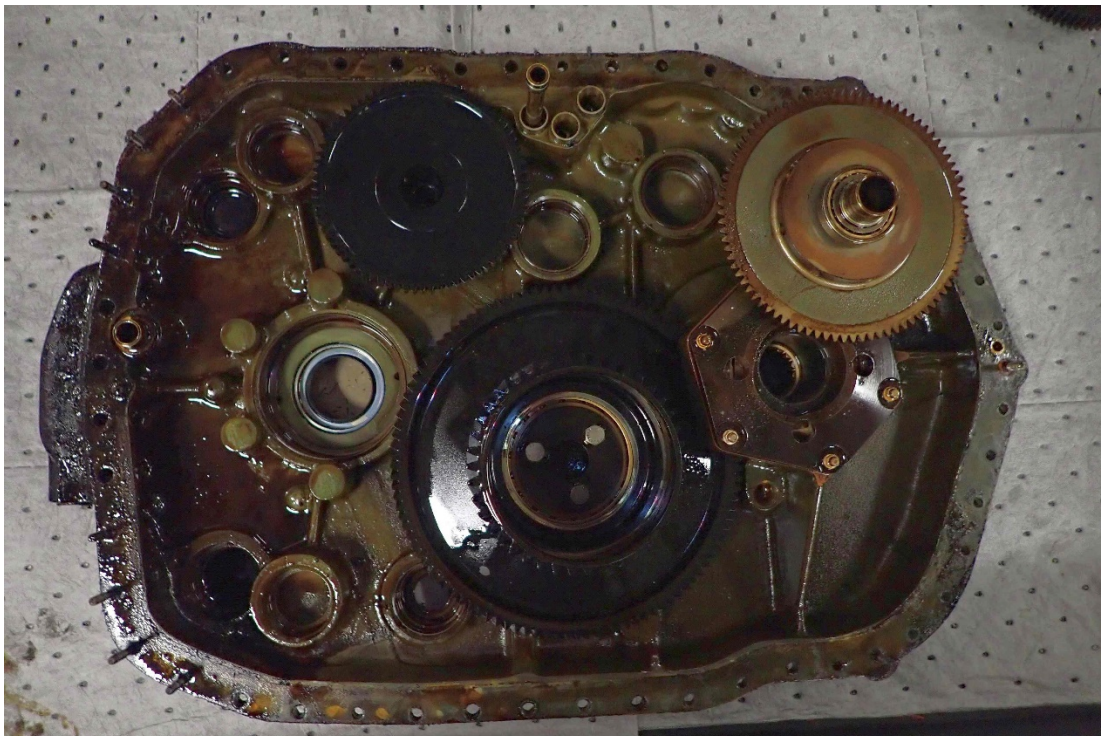


Photo 15 - Opened Gearbox Half

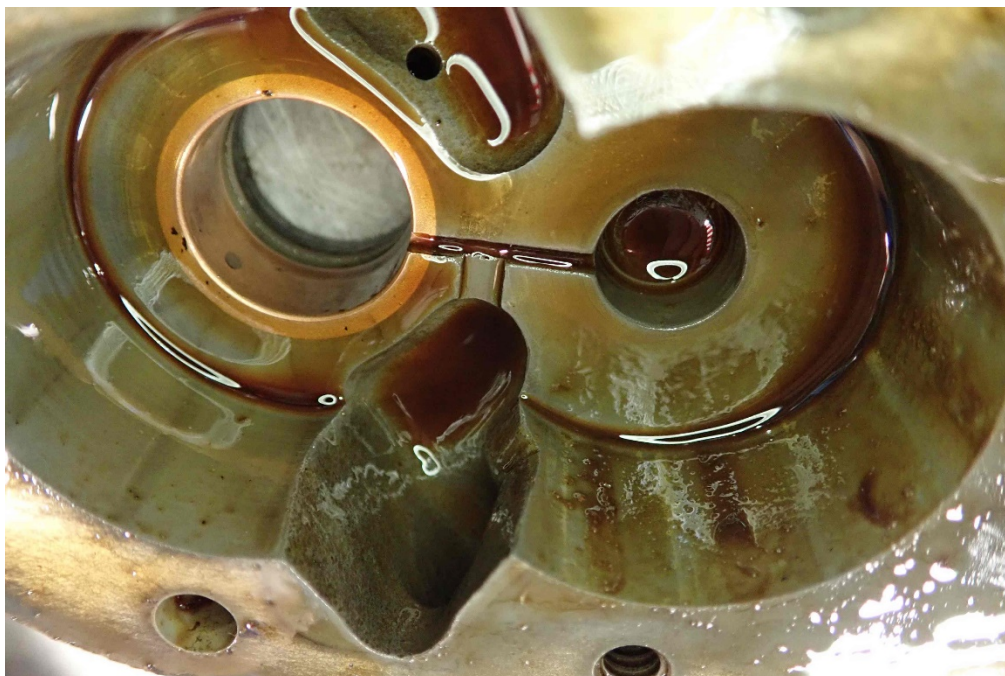


Photo 16 – Cavity of Pressure-Side Oil Pump



Photo 17 – Scavenge Oil Pump Gears