

DAMAGE ANALYSIS

LUBRICATION-RELATED

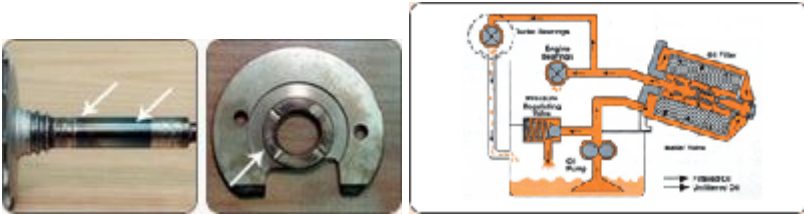


1. Dirt In Oil

Foreign materials in oil, metal shavings, abrasives from inadequate filtration and dilution can score the bearings and destroy the oil film that supports the shaft. Dirty oil damages the turbocharger with heavy scoring of critical bearing surfaces.

Causes:

- Blocked, damaged or poor quality oil filter.
- Dirt introduced during servicing.
- Engine wear or manufacturing debris.
- Malfunctioning of oil filter bypass valve.
- Poor quality oil carbonising.



2. Insufficient Lubrication

Turbocharger rotor operates at high speed on very thin film of oil. Loss of this oil film for a repetitive short duration of 4-5 sec can lead to metal-to-metal contact, wheel-to-housing rub and turbocharger failure.

Indications:

- Heat discoloration on shaft.
- Polishing and scoring on critical surfaces such as journal/thrust bearing.

Causes:

- Kinked/ restricted/ broken oil feed pipes.
- Low/ no oil levels.
- Oil pump failures.
- Blocked oil filters.
- Long period of non use.
- Oil contamination.
- Coked bearing housing.
- Failure to crank the engine after oil filter change.

FOREIGN OBJECT DAMAGE



Foreign object damage is caused by foreign materials entering the turbine/compressor housing and impacting the turbine or compressor wheel.

This leads to a lost of efficiency and unbalance rotation, ultimately resulting in turbo failure.

Causes:

- Foreign objects such as screws, nuts, and bolts entering the compressor housing as a result of negligence.
- Debris from damaged air filters.
- Debris from exhaust manifold, cracked turbine housing, engine valve and piston impacting the turbine wheel.

EXTREME TEMPERATURE



Extreme turbo temperatures are caused by excessive exhaust temperatures and can damage turbo during operation or shutdown.

Indications:

- Erosion of the turbine wheel.
- Cracked turbine inlet flange/wall.
- Blockage at oil drain cavity of bearing housing.
- Deformation of turbine housing.

Causes:

- Excessive exhaust temperature due to injection pump modifications to over deliver fuel.
- Excessive oil temperature.
- Non-approved turbine housing specifications, causing excessive rotation speed.
- Carbonising due to poor oil quality.
- Repeated hot shutdown.