

# Turbocharger Damage Analysis

**Before** blaming the turbo.....It is a fact that most turbo failures are caused by problems outside the turbocharger! If the turbo is damaged, it is most important to find the reason **why**, before fitting another turbo. Use the following guide to help you find the cause of damage:

## 1. OIL CONTAMINATION

### FINE PARTICLE CONTAMINATION

May not be noticed in oil visually, but causes polishing of the bearing surface and telltale rounding of the outer edges. Often the compressor end bearing may be worn to a taper on the outside diameter.



### LARGE PARTICLE CONTAMINATION

Oil borne large particles may cause impact damage and deep scoring. The bearing may also be scored, usually to a lesser extent. The shaft and center housing are usually damaged slightly less, being harder materials. The light scoring was caused by large oil borne contaminants.



## 2. LACK OF LUBRICATION

### MARGINAL LUBRICATION

Where the oil supply to the turbo is reduced (for instance when gasket materials partially block an oil way or inlet flange). Characterized by extreme discoloring of the shaft journals.

### CHEMICAL CONTAMINATION

Causes heavy wear of bearing/shaft and excessive temperature. The visual indications are very much the same as for Marginal Lubrication. The most common cause is dilution of oil by fuel, reducing the lubricating properties of the oil.



### TOTAL LACK OF LUBRICATION

For similar causes, will show similar damage, but more extreme. Damage happens very rapidly!

## 3. EXCEPTIONAL OPERATING CONDITIONS

### OVERSPEEDING / OVER BOOSTING

Typical damage is high temperature at the bearing journals, on severe examples; the oil burns and "cokes" the shaft. Often the back face of the turbine wheel is slightly concave, usually accompanied by an "orange peel" effect on the back face of the compressor wheel – very clear signs of overspeeding & over boosting.



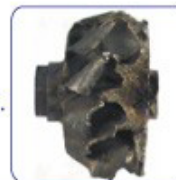
### OVERSPEEDING

Overspeeding can also cause the loss of a portion of the turbine blades. The damage may look similar to F.O.D, but is often accompanied by cracking at the exducer (outlet) blade root.



### OVERSPEEDING

In extreme cases the wheel can burst due to overspeeding. Minute stress cracks appear as the wheel is "stretched" beyond its designed limits and these gradually increase during overspeeding cycles – followed by rapid failure.



## 4. FOREIGN OBJECT DAMAGE (F.O.D)

### HARD FOREIGN OBJECT- COMPRESSOR

This damage is caused by a foreign object entering the compressor. The object may bounce around in the compressor inlet. Salt or sand causes sever erosion and corrosion eventually leading to blade failures.



### SOFT FOREIGN OBJECT

Soft foreign objects such as workshop cloths or even paper wipes can cause damage. Typically, the blades bend backwards and in extreme cases sections of the blade may break way due to metal fatigue.



### HARD FOREIGN OBJECT – TURBINE

A hard foreign object entering the turbine will damage the inducer (inlet) blades. Even small objects such as rust scale (from the exhaust manifold) can cause considerable damage to such high speed components.

