

•*Before* blaming the turbo.....

It is a fact that most turbo "failures" are caused by problems outside of the turbocharger! If the turbocharger *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 the damage:

Four Major Causes

1. Oil Contamination



Fine Particle Contamination
may not be noticed in oil visually, but causes polishing of the bearing surface and tell tale 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 as shown left. The bearing bore may also be scored, usually to a lesser extent. The shaft and centre housing are usually damaged slightly less, being harder materials. The light scoring shown right 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 oilway or inlet flange). Characterised by extreme discolouring of shaft journals (as shown).

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 oil.

Total Lack of Lubrication

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

Four Major Causes, continued.....

3. Exceptional Operating Conditions



Overspeeding/Overboosting

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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 & overboosting.



Concave Back Face



Overspeeding

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



.....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 a final rapid failure.

4. Foreign Object Damage



Hard Foreign Object - Compressor
This damage was caused by a foreign object entering the compressor. The object may bounce around in the compressor inlet causing the type of damage seen above.



Salt or sand causes severe erosion and corrosion, eventually leading to blade failures.



Soft Foreign Object

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



Hard Foreign Object - Turbine

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