

General Factor Affecting Turbocharger Service life

An analysis of turbochargers removed from service indicates that approximately 40% of the troubles are due to foreign material going through either the turbine or the compressor. An additional 40% are due to lubrication failures. The remaining 20% are of a miscellaneous nature.

Some of the foreign material damage is the result of pieces of burned or broken valves and combustion cups passing through the exhaust system into the turbine. Other turbine damage is due to casting fins that may break out of the manifolds and ports. Occasionally improperly installed gaskets will permit pieces of the gasket to overhang a port and break off into the exhaust system. Damage due to nuts and washers that are dropped into the exhaust system is also altogether too frequent. Occasionally engines suffer from scuffed and broken pistons. Pieces of these pistons will damage turbine wheels.

Compressor wheel breakage also occurs due to foreign material although not as frequently as turbine wheel damage. Sometimes pieces of the air cleaner will break loose and go through the compressor. There have also been instances where hose connections fail and pieces of rubber or wire reinforcing from the hose gets into the compressor wheel.

Again, carelessness in allowing nuts, bolts, and washers to get into the intake system sometimes causes compressor wheel failures.

Lubrication failures may be any one of a number of types. Undersized or plugged oil lines are quite common. It is essential to have an adequate supply of oil at full engine pressure for the turbocharger bearings. The turbocharger runs at very high speeds and will very quickly overheat with even a momentary failure of oil supply. The oil supplied to the turbocharger should first pass through a good filter of adequate size so that there is always full oil pressure at the turbocharger bearings. With an adequate supply of clean oil, turbocharger bearings will run for thousands of hours with no measurable wear.

Failures may occur due to extreme exhaust temperatures encountered in excessive altitude operation. Any engine that is operating close to its limit on exhaust temperature at sea level will have excessive exhaust temperatures when operated at altitudes above 5000 feet. Altitude operation will cause the turbocharger speed to increase and may cause failures due to over-speeding as well as high temperatures unless the engine's fuel system is derated according to the manufacture's recommendations. Inlet restrictions due to plugged air cleaners, collapsing hose connections, or undersized air pipes have the effect

of reducing the air supply to the engine and result in excessive exhaust temperatures. Both inlet restriction and the excessive altitude operation can cause turbine housing cracking or even turbine wheel failures due to excess temperature.

With any turbocharger, it is possible to accumulate enough dirt in the compressor housing and diffuser to reduce the air flow capacity and the efficiency of the compressor if the air cleaning system is not properly maintained. Reduced airflow will cause the engine to run hotter and may result in burned valves and pistons, which in turn will cause turbocharger failures.

Leaking gaskets or connections on either the intake or exhaust system of the engine will cause a reduction in the air supply to the engine and will result in high exhaust temperatures.

Sometimes air connections and exhaust connections are made in such a manner that thermal expansion of the exhaust manifold and other parts connected to the turbocharger will produce very high loads on the turbocharger. These high loads result in housing distortions that cause the compressor and turbine wheels to rub.

Excessively heavy piping that is supported only by the turbocharger may also cause housing distortion.

Turbocharger mountings that are not sufficiently rigid to prevent excessive vibrations in the turbocharger can also cause distortions and failures.

In conclusion it can be stated that the very few turbocharger failures would occur if no foreign material were permitted to enter either the turbine or the compressor, if precautions were taken to prevent excessive exhaust temperatures, and if the turbocharger were always supplied with an adequate amount of clean oil.