DELIVERING THE DIFFERENCE

THEME: TURBO AND TURBOCHARGED SYSTEM

EXHAUST BACKPRESSURE

BACKGROUND

When operating, the turbo compressor and turbine wheels are exposed to pressure impact from either the compressed air or the exhaust gases. On one side, pressure comes from the compressed air leaving the compressor outlet. On the other side, pressure comes from the exhaust system – the so-called backpressure – where the utilized exhaust flow is directed. The thrust bearing on the shaft is designed to level the impact of the side pressures during normal operation conditions. Together with the journal bearing, it ensures the shaft's proper balance and friction-free rotation.

Any inaccuracies causing the side pressures to raise abnormally will cause boost malfunction and can lead to severe failures of the turbo.

PROBLEM

By excessive side pressures, the turbo thrust bearing is exposed to heavy loads that cannot be handled and cause the bearing damages. Consequently, the shaft will be set out of free rotation, resulting in the turbine/compressor wheels touching the housings, tearing and ultimately damaging the turbo totally.

The excessive thrust pressures may have several sources in the vehicle. On the compressed air side, it is typically too high boost level generated or limited air flow by inner clogs. On the exhaust flow side, an excessive backpressure after the turbo is the main reason for the failure. Sludge, soot and carbon built up on the exhaust line and the exhaust treating devices are the main culprits here. Depending on the engine type, a jammed DPF filter or catalytic converter will increase the backpressure significantly.

RECOMMENDED SOLUTION

Before fitting a new turbo, make sure that the exhaust system is free of excessive backpressure. Despite the engine design, the backpressure measured in the exhaust right after the turbo should not exceed 0,3 bar or 4,5 psi. If the pressure is higher, its root cause within the system must be detected and eliminated. Clogged catalytic converter, clogged DPF filters and mufflers or tie pipes coming apart internally can all be sources of the excessive backpressure and must be cleaned or replaced.

COMMON FAILURES PROVOKED BY **AN EXCESSIVE EXHAUST BACKPRESSURE**

- Unbalanced air-fuel-ratio, increased emissions and increased temperature of the exhaust
- Improper boost pressures, lack of power and increased fuel consumption
- Premature, severe turbocharger failures: excessive shaft play, shaft seal leaks, mechanical damages of the turbine/compressor wheels, completely broken shaft

EXHAUST BACKPRESSURE CHECK

There are several methods of checking the pressure. The overall idea is to measure the backpressure right after the turbo and before the exhaust treatment devices, where clogs and restrictions typically occur.

Method 1 - Direct Pressure Measure

To determine the system backpressure, read pressure data from OBD connection or hook up a pressure gauge at relevant places along the exhaust line.

In gasoline engines, the oxygen sensor is a good spot for the measure. You can use a dedicated adaptor to connect the gauge through the oxygen sensor port or make your own by utilizing housing of an old sensor. A new access port can also be drilled in the front of the catalytic converter or any other device if applied in the exhaust. You can utilize a threaded piece of a brake line or a breather from a brake caliper to make the gauge connection port. By diesel applications with DPF devices, apply one of the existing pressure or temperature sensor's sockets to connect the gauge.

Once connected, start the engine and wait until it reaches the operational temperature. Then measure the backpressure in the entire range of the engine load. It should ideally go from idle to high revs, once driving.

If higher than **0,3 bar / 4,5 psi** pressure is noticed, the catalytic converter or the DPF will suffer from some clogs that must be eliminated.

Method 2 - Temperature Measure

Measuring the temperature of the exhaust line devices can also be a way of determining possible inner restrictions causing excessive backpressure. An infrared thermometer or an OBD diagnostics tool can be used to measure. Measure the temperature at the CAT/DPF inlet and outlet and compare the readings. Onboard diagnostics can perform the same reading if the vehicle applies temperature sensors by the treatment devices.

If the temperature difference between inlet and outlet is higher than **10 °C / or 50 °F**, there may be an inner flow restriction causing the backpressure to raise.

CAUTION! It may be necessary also to check the exhaust line for condense water. Excessive water depots can build up in the exhaust, creating a massive resistance for the exhaust flow, which must be eliminated.

Visible grooving on the thrust bearing - outcome of an excessive thrust pressure affecting the turbo.

Torn out compressor/turbine wheel blades – outcome of and excessive shaft play / broken thrust bearing.

Oil contamination inside is a sign of leaking oil seals. They occur as the shaft moves back and forth. In the end, the shaft may break totally too.

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