

Basic Turbocharger Installation Tips

Turbocharger installation must follow a process that minimizes problems that occur at, or soon after installation.

Our turbos are electronically (VSR Machine) balanced and QC'ed at the factory. The latest VSR Machine Technology from the UK is used in the test phase. The balance test involves the VSR machine spinning the turbine wheel with compressed air. Speeds of up to 210,000 RPM are tested to ensure balance over the working range. Whilst rotating, the VSR machine calculates tiny imbalances created by the spinning components. It then formulates a correction for any imbalance that may be detected.

The result is a turbocharger straight out of the box, that is ready to install and work as per normal operational requirements. And it is unusual for a turbocharger to fail upon immediate installation due to the above QC testing.

Main Reasons for Turbocharger Installation Failure at Start Up

Upon failure at initial start up, the turbocharger is often blamed. However, initial failure is more likely due to incorrect installation procedures. Such as foreign matter entering compressor at start up. Particles left loose from removing the old turbocharger and from air filters or pipes get sucked in at start up. Or the unit was not correctly pre-primed with oil at install, in which case the bearing may fail. Else, oil seals may leak due to incorrect pressure in the oil lines or sump.

At worst, complete outright failure can result in shaft breakage due to one or more of the above issues. Or, due to bearing failure from oil starvation, or foreign matter ingress, the nut holding the impellor on, comes loose. This only happens when the shaft comes to complete stop from high speed, as the nut is torqued-on with opposing thread to rotation.

Other Reasons for Turbocharger Installation Failure at Start Up

Other minor issues related to turbocharger installation, include gasket leaks. These leaks create incorrect pressure for the turbo to work correctly, especially for producing the correct boost. A gasket leak will often produce a high pitch whining noise that may increase in pitch with increased engine revs. A faulty Air Flow Sensor can also produce unusual issues, as can a clogged EGR valve. It is a recommendation that with new turbo installations, the AFM be replaced or at least cleaned, and the EGR valve be cleaned.

At initial start up after turbocharger installation, you should allow 5 minutes of engine idle. This allows oil to circulate and to burn off smoke that may appear, due to assembly lubrication being heated and dissipated.

A short 'run-in' period is also advised where the vehicle is run at lower revs and boost. This will allow manufacturing tolerances to adjust to the running environment.

Above are the most common faults that may occur soon after installation. They are an installation issue, not connected to a manufacturing fault.

Compressor / Turbine Housing Rotation / Alignment

In some cases during turbocharger installation there may be small differences apparent in the set up of each vehicle. To suit the individual application, it may be a requirement to rotate either the inlet (compressor) or outlet (turbine) housings. Or both in the case where the cartridge (CHRA) angle is adjusted.

This is a common procedure at time of installation across all turbocharger suppliers. It is affected by slight loosening of a few bolts, a v-band or large split-ring (this depends on the turbo unit type being adjusted). After loosening the housing (compressor or turbine) the angles can be rotated (SLOWLY to stop seal damage) to the desired position.

Re-tension of the bolts needs to be done in a diagonally opposing fashion and NOT circular sequence. This will create an even tension in the housing. Failure to create an even tension may result in core distortion at high speed / temperatures.

Moving the housings as above, may result in a change in angle of actuator rod. This will only be the case where an external rod vacuum (pneumatic) actuator is present (on many non-variable vane turbos). Usually there is a provision on housing mounts to allow for moving the actuator. Position it where the rod maintains an angle as close to perpendicular to the actuator diaphragm housing as possible. If angle is too great the actuator may fail to actuate its full range of movement.

Boost Control

Our aftermarket turbos are designed as direct factory replacement for the original OEM. Where an internal wastegate or variable vane system applies, boost pressure (wastegate opening) is set at factory. This will be set to the range of factory pressures (generally around 10+psi).

This ensures a balance between efficiency, effective boost and useful life of turbo.

However, factors such as exhaust flow and general condition and 'tuning' of the engine can also effect actual boost pressures achieved.

On most turbos there is limited adjustment available on the actuator arm to adjust boost via lengthening or shortening the arm.

For turbos with electronic stepper motors, there is usually a screw on the cartridge that can be adjusted to change the actuation length of the stepper swing arm.

For more information on Electronic Stepper Motor adjustment and calibration, click [HERE](#).

A better way to control boost in a pneumatically-actuated turbo, is via an electronic controller or a manual boost controller (such as a Dawes Valve).

They generally deliver a smoother boost curve than factory standard and prevent over-boost spikes that contribute to accelerated turbo wear or turbo failure.

General 'Best Practice' Turbocharger Installation Tips

- 1) Change engine oil & oil filter to vehicle manufacturer's specifications or better.
- 2) Check air filter and case to ensure it is clean and free from debris and replace air filter.
- 3) New oil feed line (or at minimum ultrasonically cleaned where appropriate).
- 4) Clean and flush ENTIRE oil system, including dropping out sump and cleaning oil pick up / oil scavenge pump (where fitted) cleaned and tested, oil check valves (where fitted) tested for correct cracking pressure, replaced or cleaned where necessary.
- 5) Clean the engine crankcase / sump ventilation breather system to make sure there are no blockages that could cause excessive pressure in the crank case. Including breather hoses and filters cleaned or replaced where necessary. High pressure in the engine block may cause oil leaks from the turbocharger cartridge (CHRA). High pressure oil will push around turbo seals. And find its way into the engine and/or inter cooler, or into the exhaust system causing excessive smoke and loss of engine oil.
- 6) Return of oil to sump checked and must flow freely through return line without 'pooling' in line and no back pressure from sump (a symptom of poor sump ventilation).
- 7) Oil pressure through now-cleaned oil system (via new or cleaned feed line) **MUST** be tested for correct flow of oil to turbo.
- 8) Turbo must be primed before initial start-up with oil injection into turbo oil gallery to coat thrust bearing. Then hand cranks of shaft to encourage oil distribution, and ignition-less engine cranks to build oil pressure in feed line and oil gallery prior to initial start-up. Engine should be cranked for around 10 seconds without ignition to help oil pressure build in oil feed lines and CHRA / oil gallery.
IMPORTANT: This lubrication in the few seconds at the start of the engine, is vital to the health of the turbocharger.
- 9) Inter cooler removed and cleaned, induction pipes checked and cleaned, and exhaust cleaned if previous turbo leaked oil into the exhaust system.

10) EGR Valve and DPF system should be checked and cleaned.

11) It is also recommended that the Air Flow Meter be replaced at same time as turbo or cleaned at minimum.

12) Water lines checked (in the case of water-cooled turbos), to be free from obstruction and hoses are not damaged internally.

13) Entire installation process clean and free from any debris (this includes NOT using liquid gaskets, liquid sealant or exhaust sealing paste on any flange that can be sucked into turbo. Please only use correct stainless or fibre/paper gaskets either supplied or as recommended for that turbo.

14) Start the engine and idle for around 5 to 10 minutes to allow for warm up and inspection.

Check for any oil or gas /air leaks.

Stop the engine and check sump oil level.

It should be between minimum and maximum on the dipstick.