

Turbocharger diagnostic matrix

Maintenance and care

Turbochargers are designed to last for the service life of the engine. Monitoring is restricted to a few periodic checks that should be performed during every engine service. One condition for achieving longevity, however, is exact compliance with the engine manufacturer's servicing specifications – such as oil change intervals, oil-filter system maintenance, oil-pressure checks, cleaning of all filter systems, and regular, professional filter changes.

Power losses and faults – the causes are frequently not inside of the turbocharger

It is crucial to analyze and detect why the turbocharger has failed. Please use the diagnostic table below to find your cause.

- This matrix is intended to help pinpoint the causes of damage or failure.
- Such causes must be eliminated before the turbocharger is replaced.
- If the true causes of damage or failure are not found and corrected, they will probably recur with a new turbocharger.
- Please do not disassemble any part of the turbocharger.

Possible Causes

Possible Causes	Problem	Compressor/turbine wheel defective	Low power/boost pressure too low	Boost pressure too high	Black smoke	Blue Smoke	Turbocharger is noisy	High oil consumption	Oil leakage at compressor	Oil leakage at turbine
Dirty air filter system			•		•	•		•	•	
Air-intake and pressure line distorted or leaking			•		•		•			
Excessive flow resistance in exhaust system/ leakage upstream of turbine			•		•	•	•	•		
Oil feed and drain lines clogged, leaking or distorted						•		•	•	•
Crankcase ventilation clogged or distorted						•		•	•	•
Coke or sludge in turbocharger bearing housing						•		•	•	•
Fuel system/injection system defective or improperly adjusted			•	•	•					
Valve guide, piston rings, engine, or cylinder liners worn/increased blow-by			•		•	•		•	•	•
Dirty compressor or charge air cooler			•		•	•	•	•	•	
Boost pressure control swing valve/poppet valve does not close			•		•					
Boost pressure control swing valve/poppet valve does not open				•						
Control line to swing valve/poppet valve defective			•	•						
Piston ring seals defective						•		•	•	•
Turbocharger bearing damage		•	•		•	•	•	•	•	•
Foreign-body damage to compressor or turbine		•	•		•		•			
Exhaust gas leakage between turbine outlet and exhaust pipe							•			
Engine air collector cracked/missing, loose gaskets			•		•		•			
Turbine housing/swing valve damaged		•	•		•		•			
Insufficient oil supply to turbocharger		•	•		•		•			



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How turbocharger damage is caused

Defects on the exhaust-gas turbocharger mostly have one of the following causes:

- **Inadequate lubrication**
If there is insufficient lubrication, the bearings will fail and the compressor and turbine wheels grind against their housings.
- **Contaminated oil**
Contaminated oil leads to score marks on shaft journals and bearings. Oil bore holes and seals become clogged and cause insufficient oil supply.
- **Intrusion of foreign bodies**
Foreign bodies that, for example, enter through a defective air filter, damage the turbine or compressor wheels. The resulting unbalance damages the turbocharger bearing.

What must be followed when handling turbochargers

The turbocharger is a technically complex unit with precisely matched components. When handling the turbocharger it is important to:

- **Train repair shop personnel**
Turbochargers reach speeds of up to 300,000 rpm. Their individual components are made to minimum tolerances. Maintenance and replacement should therefore be carried out by suitably qualified personnel. What is important here is also the use of special tools and machines, for example for balancing.
- **Do not modify the turbocharger**
Turbocharger design is optimized for a specific engine type at the manufacturing plant. For this reason, no adjustments or modifications should be made to them. For example, if they may cause the engine to overheat, resulting in damage to the pistons, cylinder head, or engine mounts.

- **Use the correct engine oil**
Important when changing the oil: Only use engine oil recommended by the manufacturer. Any deviation in viscosity may cause incorrect lubrication and damage the turbocharger.

Advice that competent car repair shops can give their customers

Here are a few tips for the customers of car repair shops which can help keep turbochargers running at top performance.

- **If the turbocharger is producing any unusual noises, oil leaks, or vibrations**
Stop the engine immediately and have the engine checked by a technician.
- **The turbocharger needs time to lubricate**
After starting the engine, it takes about 30 seconds until the oil flows completely through the oil circuit. Only then may you rev the engine at high speed.
- **Do not shut the engine off immediately**
If the engine was running at high speeds, do not shut it off immediately. The reason is that the turbocharger will continue to run without sufficient lubrication. An important tip for car repair shop customers: Before shutting down the engine, let it run at idle for about 20 seconds.



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