

# First Aid for Turbo Problems

Error messages such as 'boost pressure control above or below the set value' and/or lack of power are not always caused by the turbocharger. Oil leaks can also be too quickly attributed to the turbo.

As the intake and exhaust air systems depend on each other for proper operation, a detailed analysis must be performed. The intake air mass must be able to leave the exhaust system unhindered as exhaust gas.

Since around 2010, turbochargers have incorporated sensors in their design to ensure accurate performance. On the compressor's intake side, an intake manifold pressure sensor is used, and after the compressor outlet, a boost pressure sensor provides additional monitoring.

The exhaust gas recirculation system is located before the turbine inlet, and the exhaust gas back pressure or differential pressure sensor

follows after the turbine outlet. Nevertheless, it is not possible to make a clear diagnosis via the OBD. The data is often stored in different measurement value blocks and is therefore not completely visible or, in older vehicles (Euro 4), not yet monitored.

As such, all values must be compared in order to make a meaningful diagnosis. However, even these values can be inaccurate as all sensors are located in the intake or exhaust gas flow and are therefore exposed to contamination such as soot, fuel, oil mist and moisture.

The exhaust gas temperature is important for determining the cause. Values at the upper limit indicate restricted exhaust gas flow. The exhaust gases accumulate in the manifold and turbine housing, causing the temperature to rise. As a result, the engine control unit automatically activates engine protection and increases the injection quantity in order to lower the combustion temperature. However, the air mass remains constant, so unfortunately only a boost pressure control limit error is output by the control unit.



## Important tests using Testing Unit for Turbocharger 196202

### Crankcase – internal engine pressure measurement

#### Why is this important?

Turbochargers are lubricated by oil pressure. Within two minutes, the entire volume of engine oil is pressed through the bearings. The return line of the turbocharger flows directly into the crankcase. If the pressure here is too high, the oil flows out of the turbo more slowly and accumulates in the turbo's bearing housing. As a result of the rotation of the turbine shaft, the oil is forced under the piston rings into the intake and/or exhaust tract. Until now, turbo petrol and diesel engines have not differed fundamentally in terms of pressure conditions. While petrol engines can have a slight vacuum even when idling, diesel engines have a slight overpressure.

#### 1. Before using the hose balance, the oil filler cap must be tested.

Start the engine, unscrew the oil filler cap and leave it on the filler neck. If the cap bounces up and down, there is slight overpressure. If the cap is sucked in slightly, there is slight negative pressure in the crankcase and care must be taken when using the hose balance to ensure that the water from the hose balance is not sucked in.

If there is high negative pressure and it is difficult to open the oil filler cap, the hose balance must not be used under any circumstances! There is a risk that the liquid will be sucked out of the hose gauge immediately and into the oil circuit.



**Note:** Since around 2017, some direct injection petrol engines have been designed to operate at a negative pressure of 100 mbar in order to extract blow-by gases as an example the Volkswagen TFSI engines with codes CJZA, CJZB, CJZC. The hose balance must not be used in this case.

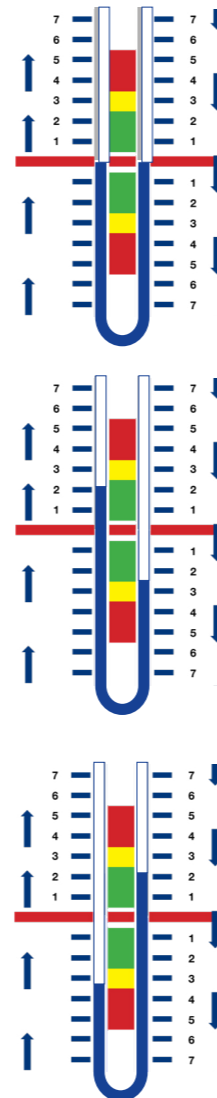
#### 2. The engine must be at operating temperature.

**3. Always carry out the test with two people** so that the open end of the hose balance can be closed or the connection to the crankcase disconnected to prevent water from being sucked in.

Fill the supplied hose gauge with 1/5 clearly visible liquid (e.g. windscreen washer fluid). Attach the hose gauge template to the front of the vehicle, remove the dipstick and insert the hose from the engine into the dipstick shaft using a plug. Align the liquid in the template with the zero line. Alternatively, the hose can be connected via the oil filler neck using the adapter supplied.

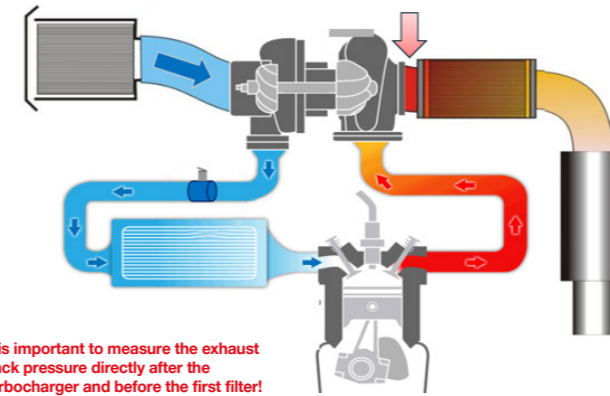
Start the engine; slight overpressure may occur at idle speed. The offset can be read in centimetres on the template. 1 cm corresponds to approx. 1 mbar. If the water column shifts by more than 5 cm, the pressure conditions in the crankcase are not correct. Possible causes here are a defective/blocked engine ventilation system or coked piston rings.

When the engine speed is increased, the pressure ratio should reverse. The water column is sucked towards the dipstick. The pressure conditions are incorrect if this exceeds 5 mm. Possible causes here include a lack of intake air mass due to a clogged air filter/air mass meter screens.



## Check the exhaust back pressure after the turbo with a pressure gauge

The basis for the measurement is that the arrangement of the catalytic converter and DPF is taken into account. If both filters are structurally separate, measuring at the front of the DPF is of no use as the contamination from soot, oil, fuel residues and moisture has already been absorbed in the catalytic converter – the first filter after the turbo – and may already be causing exhaust back pressure.



It is important to measure the exhaust back pressure directly after the turbocharger and before the first filter!

For combination filters, the measurement is taken using the pressure gauge supplied and the transparent hose via a T-piece on the differential pressure sensor or the exhaust back pressure sensor – use the connection line before the filter. It is important to check the lines for continuity (blow them clear) as they may also be blocked.

Take the pressure gauge into the vehicle interior (attach it to the dashboard) and measure the exhaust back pressure while driving under all load conditions. The exhaust back pressure must remain below 0.3 bar (except during regeneration).



In the case of separate oxidation catalytic converters, retrofitted catalytic converters or petrol engines, there is no load monitoring via the OBD. Instead, a measuring hole must be drilled.

Drill a 4 mm hole in the weld seam (due to the greater material thickness) in front of the catalytic converter in an easily accessible location and fit it with an M5 thread. A piece of brake line with an M5 thread cut into it is suitable as a measuring sensor.

After the test drive, the hole can be closed again with a M5 x 16 screw with a copper ring seal.

Another focus of the exhaust back pressure investigation is the silencers. Water can collect in the rear silencer and, just like loose baffles in the resonance chambers, restrict the flow of exhaust gases. To make matters worse, in winter this water can repeatedly freeze and thaw, causing sporadic faults that are difficult to trace. In such cases, it is recommended to dismantle the exhaust system from the rear to the front, test driving the vehicle in between to rule out sources of error.

## Checking the vacuum control of the control box on the turbocharger

**Frequent error message: Boost pressure control below minimum, sporadic error**

Possible causes include leaky connecting hoses or pipes or a worn vacuum pump. Vacuum-controlled turbochargers require the highest

vacuum when idling in order to close the VTG vanes or the exhaust flap. Due to the low engine speed, the vacuum generated is still low. If the vacuum pump is worn, this may not be sufficient. This is particularly the case when braking at the same time.

To test this, tap the vacuum pressure at the control box using the small hose and T-piece supplied. Connect the transparent hose and pressure gauge, take the pressure gauge into the vehicle interior and start the engine. The vacuum pressure on the pressure gauge should level off at -0.6 bar. Press the brake pedal several times in quick succession. If the vacuum drops, the cause may be the vacuum pump. In the case of control boxes with position sensors, a warning light will be displayed on the dashboard.

## Turbo is leaking oil – immediately after installation During initial start-up after turbo replacement

the vehicle emits black smoke, oil leaks into the intake area (intercooler) and/or from the turbine outlet or other flange connections of the turbo.

### Please remain calm!

Do not remove the turbo immediately!

The turbocharger housing has been factory-balanced to 5 mg at up to 190,000 rpm. To do this, the turbo is connected to the oil supply. If a leak occurs during this process, the turbo is not sold.

Check the amount of oil returning to the oil pan by filling the engine oil to the maximum level, removing the oil return line from the engine block and holding it in a suitable measuring container.

Let the engine idle for 1 minute. Depending on the size of the turbo, between 0.5 and 0.7 litres of oil will return – up to 2 litres in commercial vehicle applications.

### Caution!

Always carry out this test with two colleagues and strictly adhere to the time specified to avoid damage. If the return quantity is too low, disassemble the return line from the turbo, check for passage and the correct installation position of the seal and ensure that the transport lock (plug) has been removed. Also check the cross-section of the oil return bore in the oil pan. If everything is correct, check the crankcase pressure using a hose gauge.

For directly flanged turbochargers (mounted without lines), if possible, carry out a crankcase test first, then remove the charger and carry out a blast test. Screw a bevelled fuel hose into the oil supply and blow air forcefully into it with your mouth (note the resistance). If the exhaust air is audible and noticeable coming out of the oil return, the turbo is fault-free.

- Check that the seal is correctly positioned.
- Check the return line to the engine block for continuity.

Rely on tested, OE-matching quality replacement parts from febi. The entire range of Turbocharger replacement parts can be found at: [partsfinder.bilsteingroup.com](http://partsfinder.bilsteingroup.com).

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