



INADEQUATE LUBRICATION

EFFECT: without sufficient oil, the bearings can wear out quickly. This can cause the turbine wheel to strike the turbocharger housing, leading to visible wear marks and potential damage to both the wheel and housing.

CAUSE: the turbine wheel can suffer from inadequate lubrication and cooling due to low engine oil levels, insufficiently temperature-resistant oil, carbonization of oil supply lines, immediate high-speed operation of a cold engine, foreign substances in the oil circuit, improper oil viscosity, and restricted oil bore cross sections.

REMEDY: to ensure proper turbocharger function, the engine must be warmed up and cooled down, supplied with sufficient and specified oil, avoid short distances, adhere to manufacturer's maintenance intervals, use high-quality oil filters, and halve service intervals when using biodiesel.



INADEQUATE LUBRICATION

EFFECT: discoloration of the shaft, indicating high friction and temperature due to inadequate lubrication, which can lead to severe damage between the shaft and bearings.

CAUSE: shaft discoloration is caused by low oil levels, insufficiently temperature-resistant oil, carbonization from hot engine shutdown, improper oil viscosity, and reduced bearing housing supply bore.

REMEDY: to ensure proper turbocharger function, the engine must be warmed up and cooled down, supplied with sufficient and specified oil, avoid short distances, adhere to manufacturer's maintenance intervals, use high-quality oil filters, and halve service intervals when using biodiesel.



INADEQUATE LUBRICATION

EFFECT: a broken shaft shank results from prolonged operation of the turbocharger without enough oil, causing the shaft material to burn out and break, often due to turbocharger bearing seizure. If the temperature exceeds a certain level, the bearing material will become deposited on the shaft or the bushing might even become completely fused to the shaft.

CAUSE: a broken shaft shank can be caused by low oil levels, insufficiently temperature-resistant oil, carbonization from hot engine shutdown, immediate high-speed operation of a cold engine, foreign substances in the oil circuit, improper oil viscosity, use of biodiesel (higher solvent properties), and reduced bearing housing supply bore.

REMEDY: to ensure proper turbocharger function, the engine must be warmed up and cooled down, supplied with sufficient and specified oil, adhere to manufacturer's maintenance intervals, use high-quality oil filters, and halve service intervals when using biodiesel.



CONTAMINATED OIL

EFFECT: dirty oil damages the turbocharger by causing heavy scoring of critical bearing surfaces, leading to grooves in bushings, serious piston ring wear, increased bearing play, wobbling and possible shaft breakage, grooves in bearing collars, blocked oil return lines, oil burning and wear, and clear signs of wear at bearing points.

CAUSE: causes of oil contamination include exceeding maintenance intervals, blocked oil filters, leading cylinder head gaskets or oil coolers, improper cleaning after engine repair, unreplaced charge air coolers, considerable engine wear, and combustion faults leading to oil dilution.

REMEDY: to prevent turbocharger issues, comply with maintenance intervals, install high-quality oil filters, use specified engine oils, replace the charge air cooler and air filter when replacing the turbocharger, and clean the air filter housing and charge air line by suction.



FOREIGN OBJECT INTAKE

EFFECT: damage to gas entry edges of turbine wheel from foreign substances. Damaged and bent air guide plates in VGT unit, causing significant power loss. Impeller damage from foreign substances in intake air, potentially wearing vanes completely.

CAUSE: torn valves or fractured piston rings contacting VGT unit and turbine wheel. Leakage in intake section. Contaminated or defective air filter. Ice formation through condensation in intake section during winter.

REMEDY: ensure leak tightness of the intake section. Remove all loose parts after working on the intake section. Replace air filter as per manufacturer specifications. Clean air filter housing and charge air line by suction.

Avoid operating a turbocharger with damaged blades, as it can disrupt rotor balance and potentially shorten its service life.



EXCESSIVE EXHAUST HEAT DAMAGE

EFFECT: cracks in the turbocharger housing. Coking of oil lines: A carbonized supply line leads to insufficient oil supply, while a coked return line prevents oil from flowing out, resulting in forced oil leakage from the turbocharger.

CAUSE: Altered temperature levels due to tuning. Engine combustion faults.

REMEDY: Shutting off the engine while it is still hot. Install the turbocharger only in specified vehicles. Maintain the turbocharger in its original condition without any technical modifications. Allow the engine to cool down at moderate speeds after high-stress conditions, such as full-load driving.



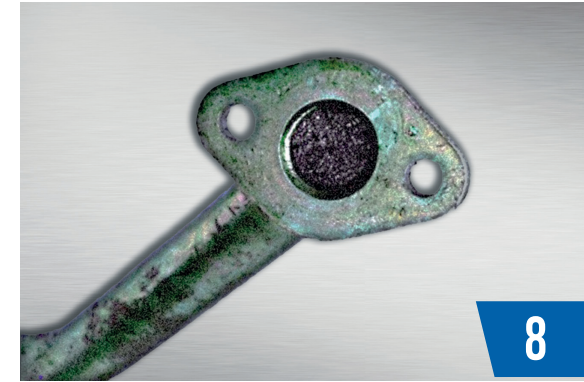
OVERSPEEDING

EFFECT: minor deformation: Small dents appear on the impeller's rear, caused by plastic deformation of the material (typically aluminum) due to high centrifugal forces at excessive speeds.

CAUSE: Severe damage: Further speed increases can lead to impeller contact with the housing or complete impeller disintegration.

REMEDY: tuning-related overspeed: Exceeding the turbocharger's maximum permissible speed due to engine modifications. VGT system malfunction: Air guide plates becoming stuck in the low-speed position due to carbonization, leading to overspeed when engine speed increases. Control system issues: Defective or leaking pneumatic or electric control systems.

REMEDY: maintain original original configuration. Install in specified vehicles only. Cool engine at moderate speeds after high-stress operation. Use manufacturer-specified engine oils. Follow recommended maintenance intervals.



OIL LEAKAGE FROM TURBOCHARGER

EFFECT: oil forced out of the turbine/compressor side. Blue smoke from the exhaust. Oil in the intake section and charge air cooler. Engine power loss. Uncontrolled overspeed ("rising") due to oil in the charge air cooler. Coked guide vanes in VTG turbocharger.

CAUSE: clogged/kinked oil return line due to coking, missing heat shields, poor routing, heat soak, inadequate oil quality, or liquid sealants. Excessive engine oil preventing proper return flow, causing oil foaming. High crankcase pressure from excessive blow-by or blocked ventilation hindering oil drainage.

REMEDY: Clear oil return line obstructions and address coking, heat shielding, routing, heat soak, oil quality, and sealant usage. Maintain correct oil levels to prevent foaming and ensure proper return flow. Regulate crankcase pressure by addressing blow-by and ventilation blockages.

OIL LEAKAGE FROM TURBOCHARGER

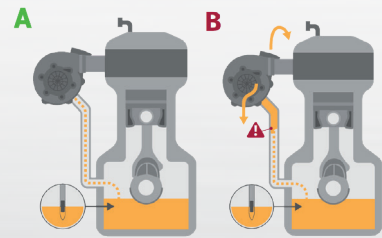


DIAGRAM A Normal Oil Flow: Depicts the proper flow of oil returning to the oil pan without any obstructions or issues.

DIAGRAM B Clogged/Kinked Oil Return Line: Shows how the oil return line is obstructed, preventing oil from flowing out of the turbocharger. Causes include coking, missing heat shields, poor routing, heat soak, inadequate oil quality, or liquid sealants.

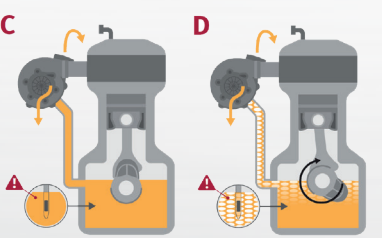


DIAGRAM C Excessive Engine Oil: Illustrates the scenario where too much engine oil prevents proper return flow, causing the oil to foam and creating a barrier for the returning oil from the turbocharger.

DIAGRAM D Oil Foaming: Demonstrates how foaming oil, caused by the crankshaft splashing too much oil, forms an additional barrier to oil returning from the turbocharger.

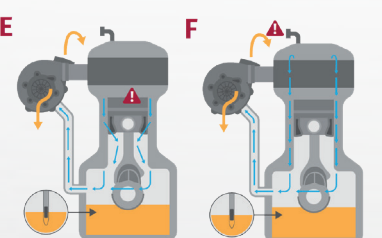


DIAGRAM E High Blow-by Pressure: Shows how excessive blow-by pressure in the crankcase is transferred to the oil return line, hindering oil drainage from the turbocharger.

DIAGRAM F Blocked Crankcase Ventilation: Depicts how a blocked crankcase ventilation system causes high pressure in the crankcase, which is then transferred to the oil return line, preventing proper oil drainage from the turbocharger.

TURBOCHARGER DAMAGE- POSSIBLE ERRORS					
PROBLEM	CAUSE	HOW TO IDENTIFY	WHY THE PROBLEM OCCURS	SOLUTION	PREVENTIVE ACTIONS
OIL LEAK	Crank ventilation not working	When lifting the dipstick – check if pressure is released	Increased pressure from the crank case is preventing oil return from the turbo	Replace PCV	Check before fitting a new turbo, that the PCV is ok
OIL LEAK	Oil return line blocked by use of liquid sealant	Unscrew the oil return line, check if oil is flowing back	Liquid sealant is blocking the flow of oil	Avoid using sealant	Clean surfaces, and use only gaskets to seal
OIL LEAK	Increased pressure in crankcase caused by engine wear	PCV working, but pressure is high	Blow by is causing too high pressure in crank case	Replace valve guides or pistons/rings as needed	Never exceed service intervals. Check for pressure in crankcase before turbo replacement
LACK OF POWER	Lack of intake air	Clogged air filter/ damaged hoses	Air filter not changed, hoses pinched of during installation	Replace filter or hoses	Fit new air filter, inspect hoses
LACK OF POWER	Lack of charge air	Leak between turbo and intake manifold	Wear on parts	Replace leaking parts	Check tightness before installation
LACK OF POWER	Exhaust leaks in manifold or joints	Exhaust leaking into engine bay	Cracks in manifold, bolts not torqued	Replace manifold, torque bolts down, and replace gaskets	Check for tightness before installation, use correct torque
LACK OF POWER	Blockage in DPF/ Catalyst	Black smoke, engine light on	Soot build up in exhaust	Clean/replace	Examine why the soot builds up – injection, EGR, airmass, etc.
LACK OF POWER	Vacuum lines not tight, or bent	Actuator is not moving, or not moving enough	Lines worn or bent	Replace vacuum line	Before replacement, check tightness of lines, if they cannot hold vacuum, replace
LACK OF POWER	Vacuum solenoid valve not working	The lines are tight, but vacuum doesn't reach the actuator	The valve is worn out	Replace the vacuum valve	Before replacement of the turbo, check, that vacuum is present at the actuator
LACK OF POWER	EGR valve stuck open	If you unplug the EGR valve at some revs, Airmass doesn't change on diagnostic teste	Due to soot, EGR valve is stuck in open position	Replace EGR valve	Check fuel system to avoid buildup of soot
LACK OF POWER	MAP or Airmass sensor not working	Check with diagnostic tester, that the expected value at idle is ok	MAP or airmass sensor are failing	Replace sensor	Check Sensors before replacing the turbo
LACK OF POWER	Intake throttle not working correctly	Check that the throttle moves freely	Throttle failing, or build up of soot	Replace or clean throttle	Check throttle before replacing the turbo
LACK OF POWER	Intake manifold contaminated	Visual inspection	Buildup of soot	Replace or clean	Check fuel system to avoid buildup of soot
BLACK SMOKE	Air filter contaminated	Visual inspection	Lack of service	Replace	If in doubt of when the filter was last replaced, replace it at turbo replacement
BLACK SMOKE	Air intake hose collapsed or restricted	Visual inspection	Damaged when working on other items	Remove restriction or replace hose	Visual inspection before replacement of turbo
BLACK SMOKE	Leak between compressor and intake	Inspection of hoses, intercooler, gaskets, manifold	Wear of parts, damaged parts	Replace or tighten clamps/gaskets/ hoses as needed	See/hear/feel for any leaks
BLACK SMOKE	Intake manifold contaminated	Visual inspection	Buildup of soot	Replace or clean	Check fuel system to avoid buildup of soot
BLACK SMOKE	Damage to compressor wheels	Visual inspection	Object from airside damaged the wheel	Inspect intake – find out where the object came from and fix the problem, and install new turbo	Inspect all intake parts at replacement of turbo
BLACK SMOKE	Problem in fuel injectors or pump(S)	Diagnostic tester	Parts worn	Replace needed parts	Check the fuel system before fitting a new turbo
BLACK SMOKE	Problem with MAP or Airmass sensor	Check with diagnostic tester, that the expected value at idle is ok	MAP or airmass sensor are failing	Replace sensor	Check Sensors before replacing the turbo
BLACK SMOKE	Blockage in DPF/ Catalyst	Black smoke, engine light on	Soot build up in exhaust	Clean/replace	Examine why the soot builds up – injection, EGR, airmass, etc
WHITE/BLUEISH SMOKE	Engine oil consumption too high	Check oil consumption	Wear on pistons/rings, liners valve-train, gaskets	Repair problem as needed	Check oil consumption before fitting a new turbo
WHITE/BLUEISH SMOKE	Crank ventilation not working	When lifting the dipstick – check if pressure is released	Increased pressure from the crank case is preventing oil return from the turbo, and increasing consumption	Replace PCV	Check before fitting a new turbo, that the PCV is ok
WHITE/BLUEISH SMOKE	Leak between compressor and intake	Inspection of hoses, intercooler, gaskets, Manifold	Wear of parts, damaged parts	Replace or tighten clamps/gaskets/ hoses as needed	See/hear/feel for any leaks
WHITE/BLUEISH SMOKE	Lack of intake air	Clogged air filter/ damaged hoses	Air filter not changed, hoses pinched of during installation	Replace filter or hoses	Fit new air filter, inspect hoses
WHITE/BLUEISH SMOKE	Oil return line blocked by use of liquid sealant	Unscrew the oil return line, check if oil is flowing back	Liquid sealant is blocking the flow of oil	Avoid using sealant	Clean surfaces, and use only gaskets to seal
WHITE/BLUEISH SMOKE	Residue from the old turbo	If the old turbo was leaking oil	Oil from the old turbo left in exhaust	If the amount of oil is not excessive, let it burn off	If the amount is excessive at disassembly, wipe it off as far as possible
NOISE	Whistling noise	Compressor wheel damaged by foreign object	Visual inspection	Replace turbo	Before fitting a new turbo, make sure, that air ducts, and all intake parts are in good shape
NOISE	Leaks from intake, charge side or exhaust	Check the intake hose, charge hoses, intercooler, manifold, turbo & exhaust for leaks	Wear on parts, or incorrect gaskets or torque has been used	Tighten screws or replace needed gaskets, hoses or cracked manifold or exhaust parts	Inspect intake, charge hoses and exhaust parts before fitting a new turbo
NOISE	Metallic noise – compressoror turbinewheel damaged by foreign object	Visual inspection	Parts from intake or engine has entered the turbo and damaged the wheel	Identify where the part has come from and correct the problem, and replace the turbo	Inspect intake well before installing a new turbo. If the old turbo has damaged turbine or compressor wheel, clarify why