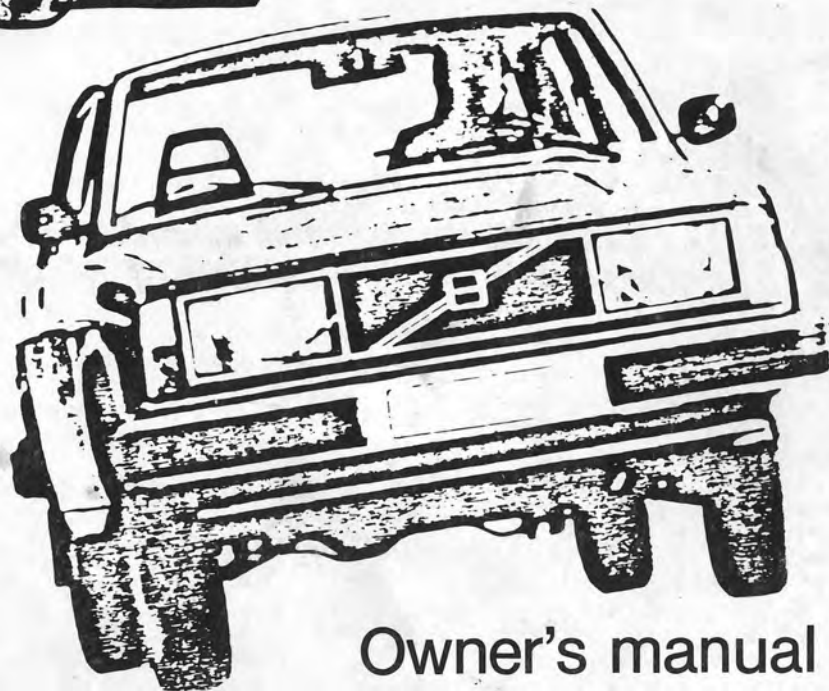


VOLVO

R
SPORT

TURBO by VOLVO R-sport



Issue **2**

Owner's manual

This owner's manual deals with items essential to know when the car has been turbo-equipped.

For handling and maintenance in general, please refer to the ordinary car manual.

Please note that petrol of at least 97 octane must be used for cars with B19AT/B21AT/B23AT engines.

INSTRUMENT

Boost pressure gauge

The boost pressure gauge is divided into three sections.

Black section: The engine acts as a normal aspirated engine. This section is the most economical to drive in.

Yellow section: The turbo is engaged.

Red section: The excess pressure in the intake manifold is too high. Drive the car carefully to a Volvo dealer for inspection.



Warning light

For increased security the pressure gauge is connected to the warning light for the parking brake.

If the excess pressure in the intake manifold becomes too high, this light is lit.

HOW TO START AND DRIVE

Cold engine:

1. Apply the parking brake (handbrake).
2. Gear lever in neutral.
3. Depress the clutch pedal.
4. **Temperature below +10°C (50°F):**
Pull out the choke fully, do not touch the accelerator pedal.
5. **Temperature above +10°C (50°F):**
Pull out the choke 3/4, do not touch the accelerator pedal.
6. Turn the ignition key to the starting position. If the engine does not start immediately slowly depress the accelerator pedal to the floor and keep it there until the engine starts. Release the key when the engine has started.
7. Push in the choke until best idling is obtained. Push it in more and more as the engine becomes warmer. The choke should be pushed fully in when the engine is thoroughly warm.

Never race an engine immediately after starting from cold!

Hot engine:

1. Apply the parking brake (handbrake).
2. Gear lever in neutral.
3. Depress the clutch pedal.
4. Depress accelerator pedal half-way.
5. Turn the ignition key to the starting position. At high temperatures there may be fuel vapors in the intake manifold and the engine can be difficult to start. Depress the accelerator pedal to the floor and keep it there until the engine starts. Release the key when the engine has started.

WARNING

Especially Important for cars with turbo engines:

Do not race the engine immediately after starting. The oil has a low viscosity when cold and does not reach directly all the parts to be lubricated.

Before switching off: Always let the engine speed drop to **idle** before switching off. After a hard drive let the engine idle for a few minutes before switching off. If the turbo is tating at high speeds and the engine is switched off there is a great risk of heat damage or shearing due to lack of lubrication.



MAINTENANCE

Positive crankcase ventilation

The crankcase is ventilated to prevent crankcase vapours from entering into the air. The vapours are led through the intake manifold into the cylinders, taking part in the combustion.

Engine oil

Turbo-equipped B19A/B21A/B23A-engines require more frequent changes of engine oil and oil filter. An extra change should be made between the ordinary service intervals, that is at 5.000 km or 7.500 (depending on the car's ordinary service intervals).

Engine oil of the same quality as for standard engines shall be used.

Volume including filter: 3,85 litres.

Please note the more frequent change intervals for oil and oil filter.

Carburettor

The dashpot oil level shall be approx. 6 mm from the edge.

Oil quality: Engine oil as recommended for the engine.

Oil volume: 4,5 cm³

Check level: Every 1.000 km

Please note that engine oil shall be used in the carburettor.

WHEELS AND TYRES

Due to increased performance and speed (> 180 km/h) HR-tyres should be fitted to the car.

SPARK PLUGS

Spark plugs type W5DC are included in the kit. When using the car mainly in metropolitan areas spark plugs W6DC are recommended. (Volvo part no. 273596).

Please note that spark plugs must be changed at 7.500 to (max) 10.000 km (depending on the car's ordinary service intervals).

SPECIFICATIONS

Engine

Four-cylinder, fluid-cooled, petrol engine. Cylinder block of special cast iron. Cylinder liners drilled directly in the block. Cylinder head of aluminium with separate inlet and exhaust ports. Single, overhead camshaft. Lubrication via a gear pump driven from the crankshaft. Oil filter of the full-flow type. Fuel system with carburettor and pressure compensated fuel pump. The cooling system is of the sealed, overpressure type.

Type designation**B19AT****B21AT****B23AT (Overseas)**

Fan, type	Fixed	Viscous	Fixed	Viscous	Viscous
Output, DIN	99 kW at 92 r/s (135 hk at 5500 r/m)	100 kW at 92 r/s (136 hk at 5500 r/m)	103 kW at 92 r/s (140 hk at 5500 r/m)	105 kW at 92 r/s (143 hk at 5500 r/m)	105 kW at 83 r/s (143 hk at 5000 r/m)
Max. torque, DIN	202 Nm at 67 r/s (20,6 kpm at 4000 r/m)	203 Nm at 67 r/s (20,7 kpm at 4000 r/m)	216 Nm at 58 r/s (22,0 kpm at 3500 r/m)	218 Nm at 58 r/s (22,2 kpm at 3500 r/m)	231 Nm at 50 r/s (23,5 kpm at 3000 r/m)
Boost pressure ¹⁾	50±2 kPa		50± 2 kPa		50±2 kPa
Number of cylinders	4		4		4
Bore	88,9 mm		92 mm		96 mm
Stroke	80 mm		80 mm		80 mm
Displacement	1.99 litres		2.13 litres		2.32 litres
Compression ratio	8.5:1		8.5:1 alt. 8.4:1 ²⁾		8.1:1 ³⁾
Valve system	Overhead valves		Overhead valves		Overhead valves
Valve clearance					
warm engine, inlet, exhaust					
when adjusting	0.40—0.45 mm (0.016—0.018")		0.40—0.45 mm (0.016—0.018")		0.40—0.45 mm (0.016—0.018 ")
when checking	0.35—0.50 mm (0.014—0.020")		0.35—0.50 mm (0.014—0.020")		0.35—0.50 mm (0.014—0.020")

¹⁾ Measured in the air box, before the carburettor, at 3000—3500 r/m full throttle drive against the brakes in 3rd or top gear).

²⁾ Compression ratio 8.5:1. Standard for Overseas, Norway, Europe up to and including 1978, for Sweden up to and including 1980.
Compression ratio 8.4:1. Standard compression 9.3:1 **plus** two cylinder head gaskets.

³⁾ Compression ratio 8.1:1. Standard compression 9.0:1 **plus** two cylinder head gaskets.

COOLING SYSTEM

Type	Positive pressure (sealed system)
Thermostat, begins to open at	92°C (198° F)
Thermostat, fully open at	102°C (216° F)
Fan belts (two), designation	HC-38-925
Capacity (incl. heating system)	9,5 litres (2.1 UK/2.5 US gal)

FUEL SYSTEM

Carburettor	Zenith 175 CDSE
Petrol, octane rating	97 (RON) ¹⁾
Idle speed	900 ± 50 r/m ²⁾
CO idle value (warm engine)	2.0% + 1.0% - 0.5%

¹⁾ For certain markets with slightly lower octane rating, or variations in fuel quality, ignition setting must be retarded to prevent knocking. (3° to 7° retard is recommended)

²⁾ **1975—1977 model:** Adjust idle with screw on carburettor.
1978— model: Adjust idle with screw in inlet manifold behind carburettor. Do not adjust screw on carburettor.

IGNITION SYSTEM

Firing order	1—3—4—2
Ignition setting (vacuum governor disconnected)	10° BTDC at 12—13 r/s ¹⁾ (700—800 r/m) Volvo No. 273591-8 (Bosch W5DC) Volvo No. 273596-6 (Bosch W6DC) 0.7—0.8 mm (0.028—0.032")
Spark plugs	20—30 Nm (2—3 kpm) (14.5—22 lbf ft)
Alternative spark plugs for metropolitan driving	
spark plug gap	
tightening torque	
Distributor	
direction of rotation	Clockwise
ignition points gap	0.4—0.5 mm (0.016—0.020")

Function, adjustment and fault finding

This description covers special parts used in the Turbo Kit. For other information please refer to ordinary car manual and service literature.

TURBOCHARGER

Function:

Exhaust gas energy is utilized to drive a turbine wheel mounted on the same shaft as a compressor wheel. Inlet air is compressed before passing into the engine, enabling it to develop increased power and torque. A muted whistle from the turbo, which can revolve at up to 100.000 rpm, is quite normal. Maximum boost pressure is controlled by an integral wastegate, operated by an actuator, which allows part of the exhaust gases to bypass the turbine.

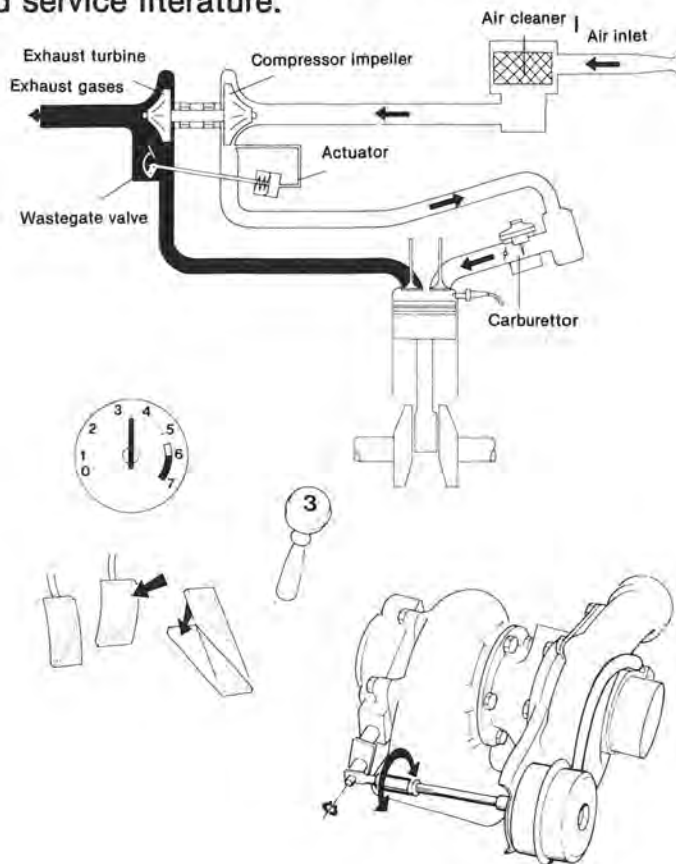
Adjustment:

Boost pressure is factory set to 50 ± 2 kPa (7,25 psi, 5 bar) and does not normally require adjustment.

Measure pressure in the air box before the carburettor. **(NOT in inlet manifold).** Insert a T-piece in the pressure line between air box and fuel pump, and connect to a calibrated gauge inside the car. Drive full throttle at 3000—3500 rpm in 3rd or top gear, against the brakes, and read boost pressure.

Adjust by disconnecting actuator rod-end from wastegate lever and turning. One turn inwards raises boost pressure approx 2 kPa.

Note that the exhaust system is specially developed to suit the turbo kit. Only correct replacement parts should be used, or boost pressure will be upset.



CARBURETTOR

Function is normal, but sealed screws are used to prevent leakage under boost. A larger 2,5 mm float needle increases fuel flow capacity, and a special metering needle in combination with an externally vented damper, ensure correct mixture.

Fill damper with same oil as recommended for engine.

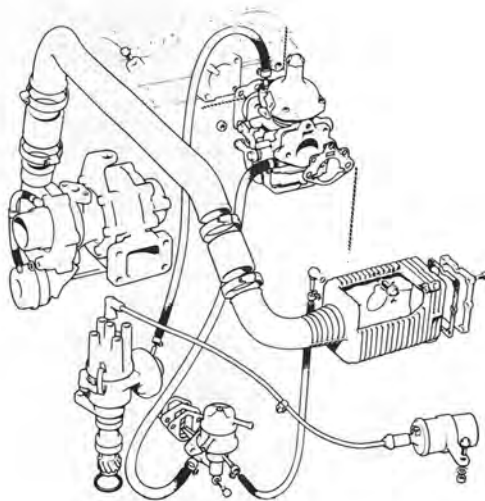
NOTE: DO NOT USE ATF OIL.

FUEL PUMP

This is of mechanical diaphragm type with increased pressure and flow capacity. To enable the pump to deliver fuel to the pressurized carburettor, compensating pressure is applied under the diaphragm via a hose from the air box.

DISTRIBUTOR

The mechanical advance curve is developed to suit the turbo kit and does not give full advance until 5000 engine rpm. The vacuum capsule is special, and gives up to 8° retard under boost pressure to prevent knocking.



FAULT FINDING

SYMPTOM	CAUSE	REMEDY
1. Poor hot starting	Can be caused by fuel vapour trapped in the inlet manifold.	Use no choke, open throttle fully, turn key until engine starts (3 to 5 sec). Hot starting can be improved by fitting insulator flange part no 1317315 between carburettor and inlet manifold. Longer studs are required, part no 953047.
2. Carburettor flooding If this occurs liquid fuel can collect in the air box in front of carburettor.	Float valve defect	Loosen air box cover and empty before restarting. To cure flooding remove and clean, or change, float valve assembly. Check/adjust float level afterwards.
3. Fuel starvation or engine dies under boost condition, but will run without boost.	Broken or leaking pressure compensation hose between air box and fuel pump. Dirt or restriction in fuel lines.	Tighten/replace the hose. Check from suction point in tank through to carburettor float chamber.
4. Engine runs, but will not pull.	Engine gets no air	If round air filter with separate thermostat housing is installed check that thermostat points towards air filter. (If thermostat housing is fitted wrong way round engine air inlet is permanently closed).
5a. Engine misfires or jerks Under light load or light acceleration.	Wrong carburettor dashpot oil. Weak mixture Dirty spark plugs. Engine valves not sealing correctly, or large carbon build-up on combustion chamber and on valves.	Empty and fill with engine oil (not ATF oil). increase idle CO. Renew plugs. For vehicles used mainly for city driving change to softer W6DC plugs (part no 273596). Carry out compression check, repair, grind valves as required.
5b. Engine misfires or jerks Under hard acceleration.	Especially after extensive light load driving, spark plug deposits can cause misfiring during the first hard acceleration.	Accelerating slowly to full load will usually burn off the deposits and cure the misfire. If not, fit new plugs.

SYMPTOM	CAUSE	REMEDY
<p>8. Exhaust leakage</p>	<p>From exhaust pipe system.</p> <p>From joint exhaust pipe to wastegate.</p> <p>From joint wastegate to turbine housing.</p> <p>From joint turbine housing to exhaust manifold.</p> <p>From joint exhaust manifold to engine.</p>	<p>Tighten joints or renew parts as necessary. Use only standard replacement parts.</p> <p>Check nuts are tight. Renew flange locknuts (Part no 948645) if locking grip is lost.</p> <p>Check nuts are correctly torqued 25 to 27 Nm (18 to 20 ft lb). If leakage persists turbine housing and wastegate must be dismantled and faces reground flat. Reassemble and torque nuts as above.</p> <p>Remove exhaust manifold and turbine housing and regrind faces flat. Reassemble with new gasket and torque to instruction 47 in Installation Instruction.</p> <p>Renew gasket if necessary. Check nuts are correctly torqued 27 Nm (20 ft lb). If stud breakage has occurred renew only with correct stud (Part no 953046).</p> <p>On engines from 1979 on,</p> <p>If stud breakage recurs, an exhaust manifold steady, Part no 8360062 can be mounted from bottom of manifold to engine crankcase (round boss to rear of oil filter).</p> <p>On some engines this boss must be drilled and tapped 8 mm to fit steady. (Early engines do not have this boss).</p>
<p>9. Loud engine knocking If engine knocks hard under full load CLOSE THROTTLE IMMEDIATELY to prevent serious engine damage.</p>	<p>Vacuum hose from carburettor to distributor broken/detached.</p> <p>Poor quality fuel.</p> <p>Ignition overadvanced.</p> <p>Incorrect sparkplugs — too soft or burnt.</p> <p>Boost pressure too high.</p>	<p>Replace and ensure ends are correctly clamped.</p> <p>Drain tank and refill with 97 oct fuel.</p> <p>Correct.</p> <p>Replace with correct grade.</p> <p>Check/correct.</p>

SYMPTOM	CAUSE	REMEDY
<p>10. Water leakage from engines with 2 cylinder head gaskets. (ie B21A with original compression ratio 9,3:1 or B23A Overseas with C.R. 9,0:1).</p>	<p>Cylinder head not retorqued after 500 km.</p> <p>Incorrect sealing ring fitted between water pump and cylinder head.</p>	<p>Fit 2 new gaskets and torque to instruction 34 in Installation Instructions. Drive 500 km (300 miles) let engine cool at least 30 min then retorque to instruction 104.</p> <p>Fit correct sealing ring Part no 1276668-9. Ring and cylinderhead/water pump grooves must be smeared with Dinitrol or similar anti-corrosion li-liquid before assembly, or leakage will recur.</p>
<p>11. Boost gauge sticks/does not function</p>	<p>Pressure line disconnected or blocked.</p>	<p>Early gauges were fitted with a sintered metal filter in the gauge inlet. This can become clogged with fuel from the inlet manifold. It is permissible to CAREFULLY drill out the filter using a 2,3 mm dia drill.</p> <p>If gauge still does not work, or was not fitted with a filter — renew gauge.</p> <p>On early kits outlet to gauge was at rear end of inlet manifold. Later kits use outlet on top front of manifold to minimize risk of fuel reaching boost gauge.</p> <p>Early kits can be updated using adaptor 1276164 at front of manifold and plug 952075 at rear.</p>
<p>12. Noise/rattle from boost gauge First check that cause is not loose mountings, or something else rattling under instrument panel.</p>	<p>Pressure waves from turbo</p>	<p>If noise is caused by pressure waves from turbo, fit adapter Part no 1276164 on top front of inlet manifold and connect gauge. (This adapter has a 1 mm dia hole to damp out pressure fluctuations).</p> <p>Applies only to early kits (8360000) produced up to May/June 1982. Later kits (8360100 LHD and 8360200 RHD) already have this adapter. Cars with A/C must use adapter 1276445 (Ø 2,3) here.</p>

Function, adjustment and fault finding

This description covers special parts used in the Turbo Kit. For other information please refer to ordinary car manual and service literature.

TURBOCHARGER

Function:

Exhaust gas energy is utilized to drive a turbine wheel mounted on the same shaft as a compressor wheel. Inlet air is compressed before passing into the engine, enabling it to develop increased power and torque. A muted whistle from the turbo, which can revolve at up to 100.000 rpm, is quite normal. Maximum boost pressure is controlled by an integral wastegate, operated by an actuator, which allows part of the exhaust gases to by-pass the turbine.

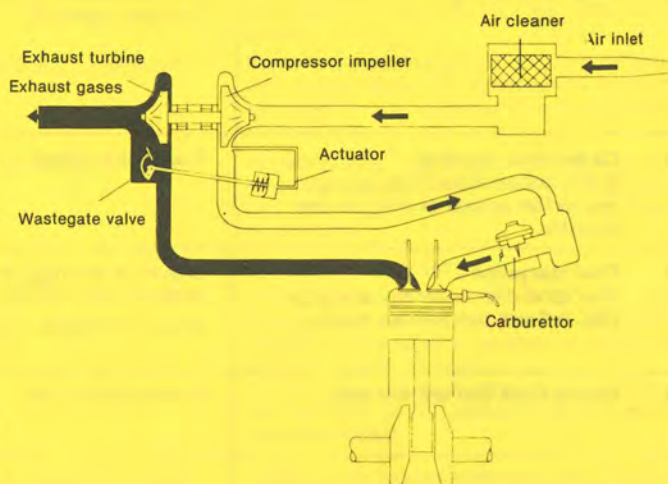
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Measure pressure in the air box before the carburettor. (NOT in inlet manifold). Insert a T-piece in the pressure line between air box and fuel pump, and connect to a calibrated gauge inside the car. Drive full throttle at 3000—3500 rpm in 3rd or top gear, against the brakes, and read boost pressure.

Adjust by disconnecting actuator rod-end from wastegate lever and turning. One turn inwards raises boost pressure approx 2 kPa.

Note that the exhaust system is specially developed to suit the turbo kit. Only correct replacement parts should be used, or boost pressure will be upset.



CARBURETTOR

Function is normal, but sealed screws are used to prevent leakage under boost. A larger 2,5 mm float needle increases fuel flow capacity, and a special metering needle in combination with an externally vented damper, ensure correct mixture.

Fill damper with same oil as recommended for engine.

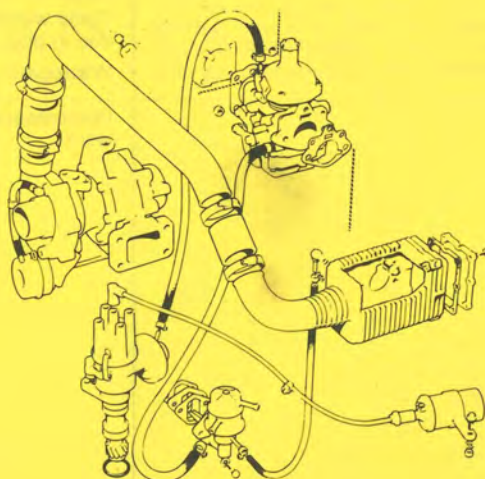
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DISTRIBUTOR

The mechanical advance curve is developed to suit the turbo kit and does not give full advance until 5000 engine rpm. The vacuum capsule is special, and gives up to 8° retard under boost pressure to prevent knocking.



FAULT FINDING

SYMPTOM	CAUSE	REMEDY
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3. Fuel starvation or engine dies under boost condition, but will run without boost.	Broken or leaking pressure compensation hose between air box and fuel pump. Dirt or restriction in fuel lines.	Tighten/replace the hose. Check from suction point in tank through to carburettor float chamber.
4. Engine runs, but will not pull.	Engine gets no air	If round air filter with separate thermostat housing is installed check that thermostat points towards air filter. (If thermostat housing is fitted wrong way round engine air inlet is permanently closed).
5a. Engine misfires or jerks Under light load or light acceleration.	Wrong carburettor dashpot oil. Weak mixture Dirty spark plugs. Engine valves not sealing correctly, or large carbon build-up on combustion chamber and on valves.	Empty and fill with engine oil (not ATF oil). increase idle CO. Renew plugs. For vehicles used mainly for city driving change to softer W6DC plugs (part no 273596). Carry out compression check, repair, grind valves as required.
5b. Engine misfires or jerks Under hard acceleration.	Especially after extensive light load driving, spark plug deposits can cause misfiring during the first hard acceleration.	Accelerating slowly to full load will usually burn off the deposits and cure the misfire. If not, fit new plugs.
6. Overboost condition Boost gauge needle in red sector, and handbrake warning light on. CLOSE THROTTLE IMMEDIATELY to prevent serious engine damage. Vehicle can be driven gently to a workshop for investigation.	Pressure hose from compressor to wastegate actuator broken or disconnected. Turbo wastegate valve seized or corroded in closed position. Actuator broken/leaking.	Tighten/replace hose. Remove actuator rod end and check. Operating arm should swing through an arc of approx 30°. Change wastegate complete if necessary. NOTE! Use only correct stud (Part no 1306910) for joint exhaust pipe to wastegate. Non standard studs or bolts can jam wastegate valve and cause serious problems. Remove and test. When a pressure of 46—53 kPa (6,7—7,7 psi) is applied to inlet pipe actuator rod should start to move outwards. As pressure is increased slightly actuator rod should move fully out. Renew actuator if rod does not move, or if actuator leaks.
7. Zero (or very low) boost condition	Loose or broken rubber connector on air pipe. Air box loose on carburettor. Turbo wastegate valve seized or corroded in open position. Wastegate actuator broken. Compressor/turbine bearings seized or worn.	Repair/replace. Check as in point 6 and repair/replace. Replace. Remove compressor inlet pipe and adaptor. Check compressor shaft rotates freely. Check radial play in shaft. Considerable side play (up to 0,5 mm) on shaft end is normal, but if compressor or turbine wheel rubs on housing bearings are worn. Replace turbocharger complete, or replace centre housing assembly complete with shaft and wheels (see also standard E turbo service literature for full check of shaft side play). NOTE: Racing engine immediately after starting can lead to turbine seizure due to lack of oil. Switching off engine immediately after hard driving can carbonize oil in turbo bearings, leading to seizure. After extended full throttle driving always run engine at light load or idle for a few minutes to allow turbo to cool before switching off.

SYMPTOM	CAUSE	REMEDY
8. Exhaust leakage	<p>From exhaust pipe system.</p> <p>From joint exhaust pipe to wastegate.</p> <p>From joint wastegate to turbine housing.</p> <p>From joint turbine housing to exhaust manifold.</p> <p>From joint exhaust manifold to engine.</p>	<p>Tighten joints or renew parts as necessary. Use only standard replacement parts.</p> <p>Check nuts are tight. Renew flange locknuts (Part no 948645) if locking grip is lost.</p> <p>Check nuts are correctly torqued 25 to 27 Nm (18 to 20 ft lb). If leakage persists turbine housing and wastegate must be dismantled and faces reground flat. Reassemble and torque nuts as above.</p> <p>Remove exhaust manifold and turbine housing and regrind faces flat. Reassemble with new gasket and torque to instruction 47 in Installation Instruction.</p> <p>Renew gasket if necessary. Check nuts are correctly torqued 27 Nm (20 ft lb). If stud breakage has occurred renew only with correct stud (Part no 953046).</p> <p>On engines from 1979 on,</p> <p>If stud breakage recurs, an exhaust manifold steady, Part no 8360062 can be mounted from bottom of manifold to engine crankcase (round boss to rear of oil filter).</p> <p>On some engines this boss must be drilled and tapped 8 mm to fit steady. (Early engines do not have this boss).</p>
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