

VOLVO

for life



Course Code: 0819

2004 Model Year Product, Featuring the R-Range

TECHNICAL UPDATE 1



IMPORTANT SAFETY NOTICE

WARNING: Before performing service, diagnosis or troubleshooting procedures on a vehicle equipped with safety devices containing pyro-technical igniters, i.e., airbags, seatbelt tensioners, side impact curtains, etc., **you must be aware of certain precautions, and follow special procedures to help ensure your safety.** Refer to applicable SAFETY SYSTEM service information for these procedures and precautions.

NOTE: The information contained in this manual is intended for technical training purposes **ONLY.** Always refer to appropriate Volvo service information & wiring diagram manuals when performing fault tracing or service procedures.

Following proper service and repair procedures is essential for the safe, reliable operation of motor vehicles, as well as for the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques.

Numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as the skill of individual doing the work cannot possibly be anticipated or provided for. Accordingly, anyone who departs from instructions provided in this manual must first establish that they compromise neither their own personal safety nor the vehicle integrity by their choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that can help you to complete a particular procedure. CAUTIONS are given to help prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow whenever you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Turn the ignition switch OFF unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission it should be in NEUTRAL unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger from carbon monoxide.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the cooling fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind your head.
- Keep hands and other objects clear of the radiator fan blades. Electric cooling fans can start to operate at any time even with the ignition turned OFF.

Date:

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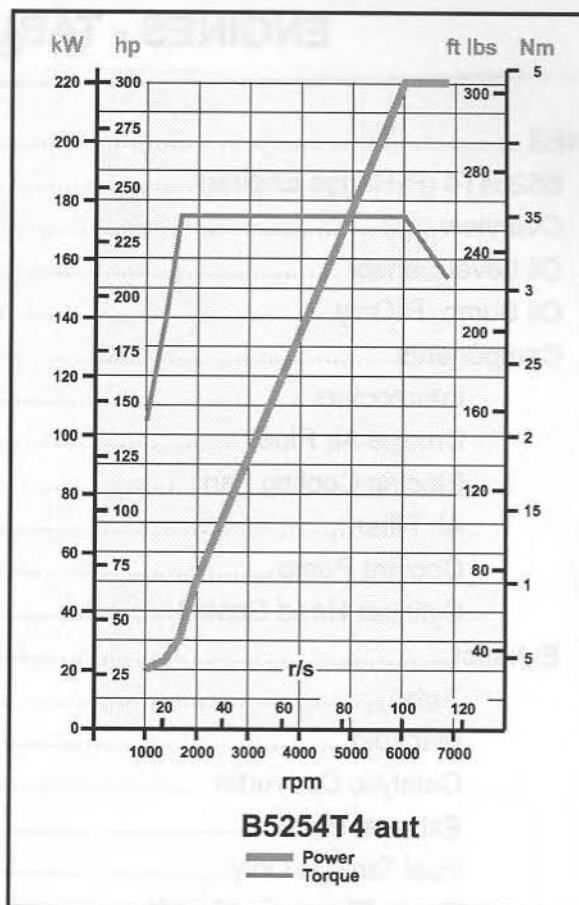
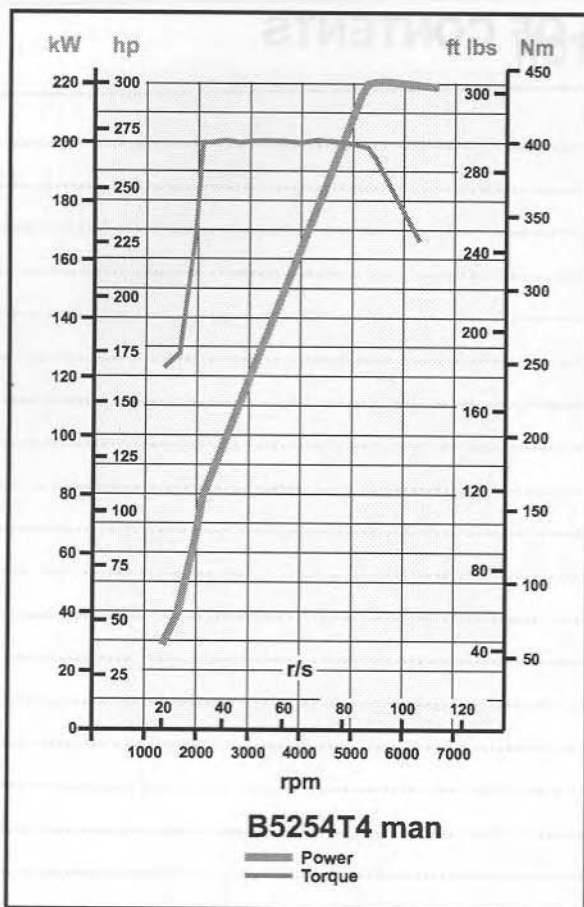
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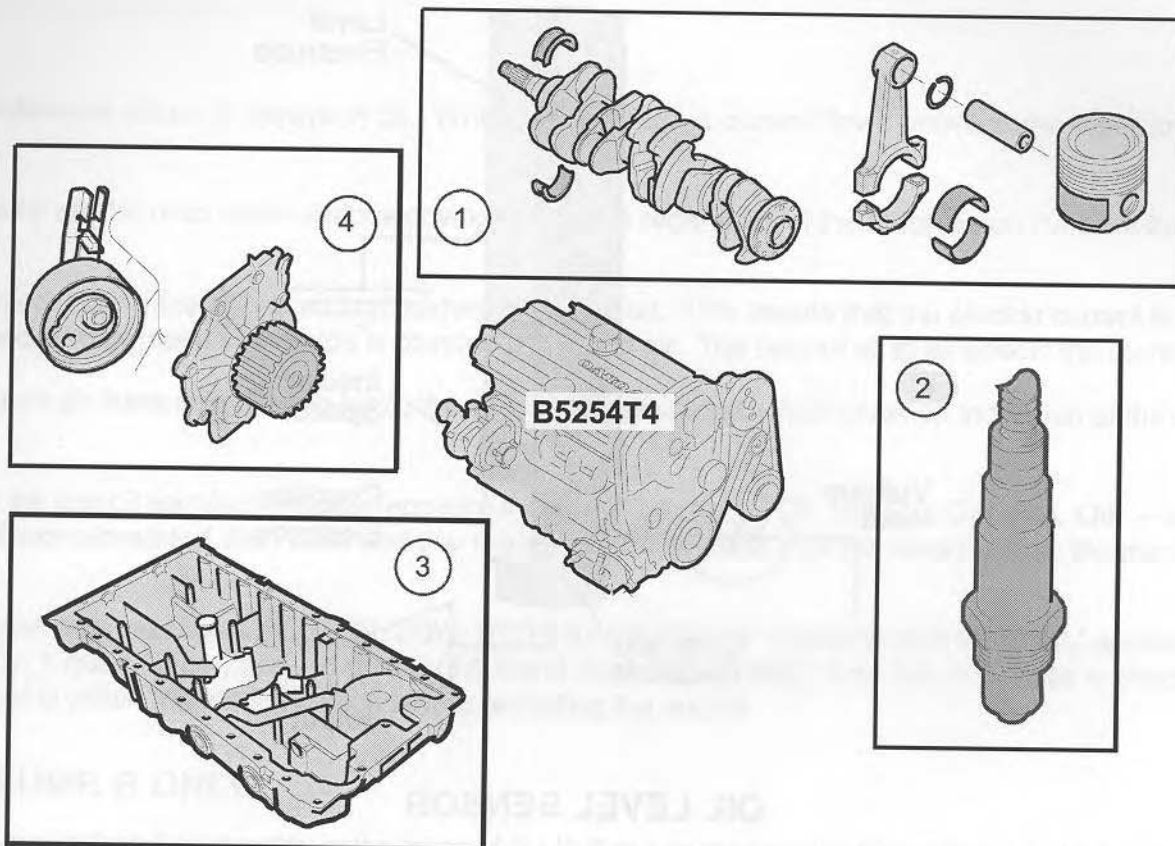


ENGINES

B5254T4 (R-Range Engine)

GENERAL

- Based on B5254T2.
- Introduced for S60R and V70R only.
- Bosch engine management system ME 7.01 with wide-range starting concept.
- Meets emission requirements for LEV.
- Manual gearbox:
 - Maximum torque 400 N•m (295 ft•lbs) at 2100 rpm.
 - Maximum output 220 kW (300 hp) at 5400 rpm.
- Automatic transmission:
 - Maximum torque 350 N•m (258 ft•lbs) at 1800 rpm.
 - Maximum output 220 kW (300 hp) at 6000 rpm.
- Top speed electronically limited:
 - Manual gearbox (M66): acceleration 0-100 km/h (0-60 mph) in 6 seconds.
 - Automatic transmission (AW 55-51 AWD): acceleration 0-100 km/h (0-60 mph) in 7 seconds.
- Final drive ratio 3.77:1.



OVERVIEW

Forged Crankshaft, Main bearing

- Stroke length 93.2 mm (3.7 in.). Crankshaft journals: \varnothing 50.00 mm (2.0 in.). Main bearing journals: \varnothing 65.00 mm (2.6 in.).
- Both the upper and lower main bearings are aluminum.

Connecting Rods, Big-end Bearings

- Stronger connecting rods, forged with 'cracked' caps.
- Both the upper and lower bearings are lead-bronze alloy.

Pistons

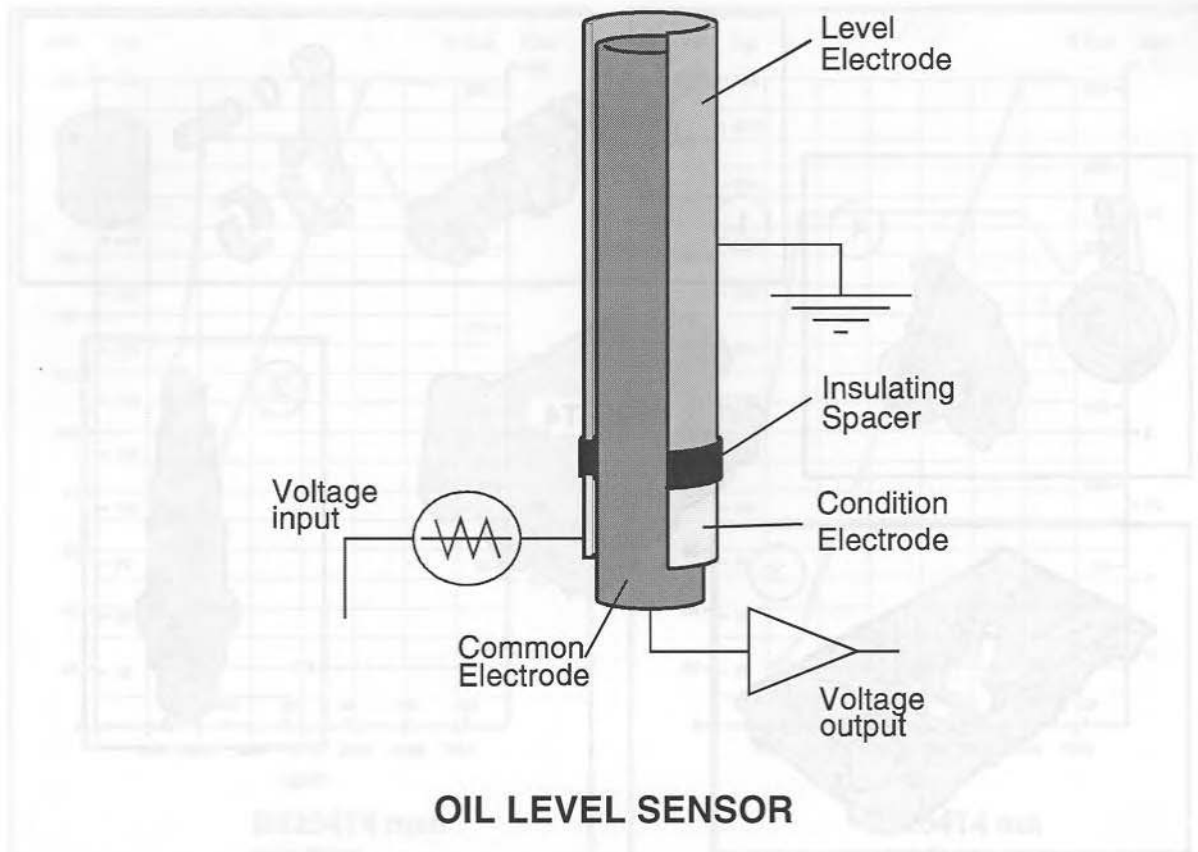
- Graphite-coated.
- The groove of the upper compression ring has a harder surface layer to reduce wear.

Cylinder Head, Camshafts

- More efficient cooling due to larger coolant passages around the exhaust ports and the spark plug recess.
- Multi Layer Sealing (MLS) gasket for the cylinder head.
- Cylinder head with Continuous Variable Valve Timing (CVVT) for both intake and exhaust camshaft.

Spark Plugs

- The spark plugs used in the R engine **cannot** be used for other engines because of the length of the thread, 26.5 mm compared to 19.0 mm for other engines.
- To reduce carbon deposits when cold starting, the ceramic has been thinned to a point at the bottom. This is known as 'Quick Heat.'
- The service interval remains unchanged.



The R engines are fitted with an active engine oil level warning system that tells the driver when the oil level is too low.

This sensor consists of three concentric electrodes:

- The one in the center is a steel tube, used for oil quality and oil level measurement.
- The outer one consists of three sections: an oil quality electrode, a housing and an oil level electrode.

The sensor receives a 5V feed from the ECM, the power consumption varies from approximately a maximum 6mA to around 3mA.

The sensor communicates with the ECM and sends a PWM (Pulse Width Modulated) signal to the ECM, which compares this signal with preprogrammed parameters. The information is updated approximately every 1.5 seconds.

There are two electrical circuits in the sensor:

- A reference circuit.
- A target circuit.

The reference circuit is always in oil. When powered up, a current flows between the inner and outer rings.

The level can be read under various driving conditions regardless of the G-forces on the oil in the sump.

The upper outer pipe is located in a mixture of oil and air. This means that the electric current is affected by how much of the pipe is covered by oil and air. The ratio of oil to air affects the current.

The more air there is in relation to oil, the higher the resistance, which gives an indication of the oil level.

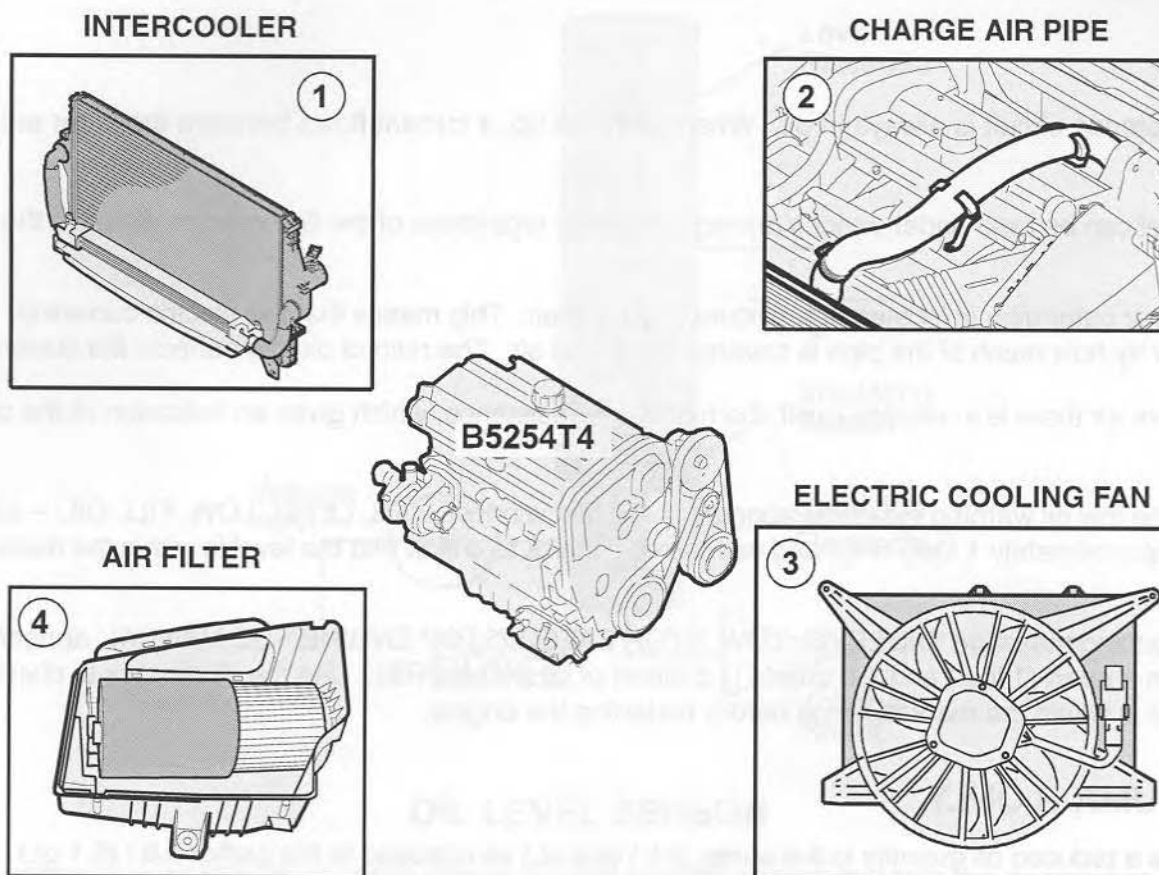
When the low oil warning message appears in the text window – 'OIL LEVEL LOW. FILL OIL' – add 1 quart (approximately 1 liter) of oil and use the oil dipstick to check that the level is within the marked range.

If the warning message 'OIL LEVEL LOW. STOP SAFELY/STOP ENGINE/SEE MANUAL' appears, add between 1 quart (1 liter) and 1.5 quarts (1.5 liters) of oil (**NO MORE**). Use the oil dipstick to check that the level is within the marked range before restarting the engine.

OIL SUMP, R ONLY

There is a reduced oil quantity in the sump, 5.5 l (5.8 qt.) as opposed to the earlier 5.8 l (6.1 qt.) (B5254T2) because the oil level sensor takes up the volume.

The lower baffle plate has been removed due to an altered splash bulkhead which provides better targeted flow of the oil and works as an anti-splash device around the oil pickup.



COMPONENTS

INTERCOOLERS (1)

- The high charge pressure means a considerably higher air temperature after the turbo than the air temperature on other turbo engines. To help reduce the temperature of the compressed air, the R engines have two intercoolers.
- The main intercooler is located behind the A/C condenser. The second intercooler is located beneath the bumper, just behind the enlarged air intake in the spoiler.

CHARGE AIR PIPE (2)

- The charge air pipe over the engine consists of hydroformed aluminum, and is mounted on the turbo unit with a V-clamp.
 - The reason for this charge air pipe is the prevailing high temperatures at high altitudes and at high ambient temperatures.

Design is also an important factor.

ELECTRIC COOLING FAN (3)

The electric cooling fan has undergone certain changes compared with the XC90 (B6294T):

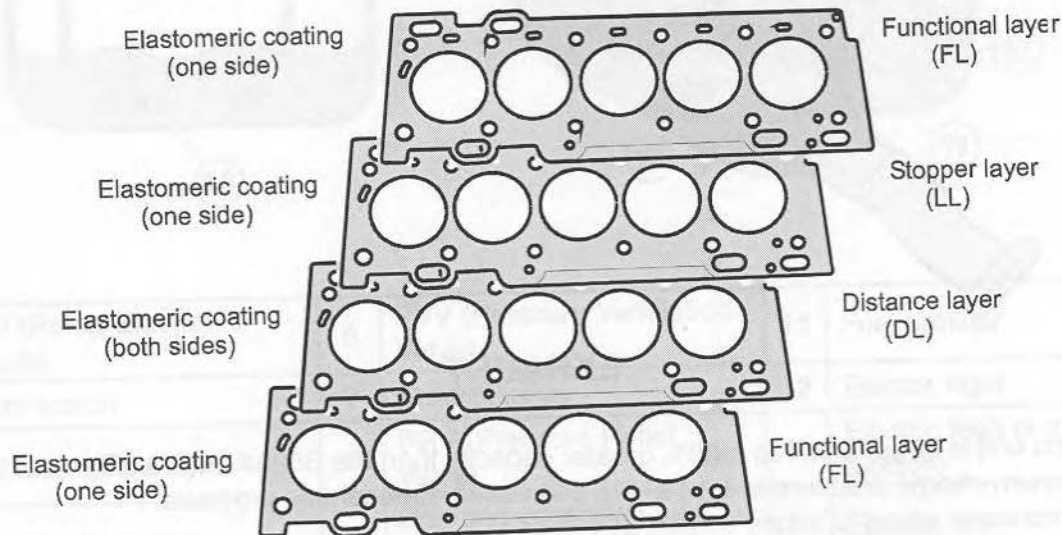
- Controlled in seven specific stages, formerly six.
- The electric cooling fan now has thirteen fan blades instead of seven.
- The electric cooling fan will also be introduced on the B5254T2, B5234T3, B6294T and B6294S2.

AIR FILTER (4)

- Air filter volume is reduced from 12.5 liters to 8.5 liters (762.8 cu. in. to 518.7 cu. in.).
- The air filter is cylindrical and half the filter is clad in a foam filter to restrict noise when accelerating.
- The air intake is perforated with holes on the underside to dampen intake noise that occurs at high engine revolutions.
- A spring-loaded compensation valve is located at the bottom of the air filter and opens if the pressure drops below 7 kPa.
- Service interval is unchanged.

COOLANT PUMP

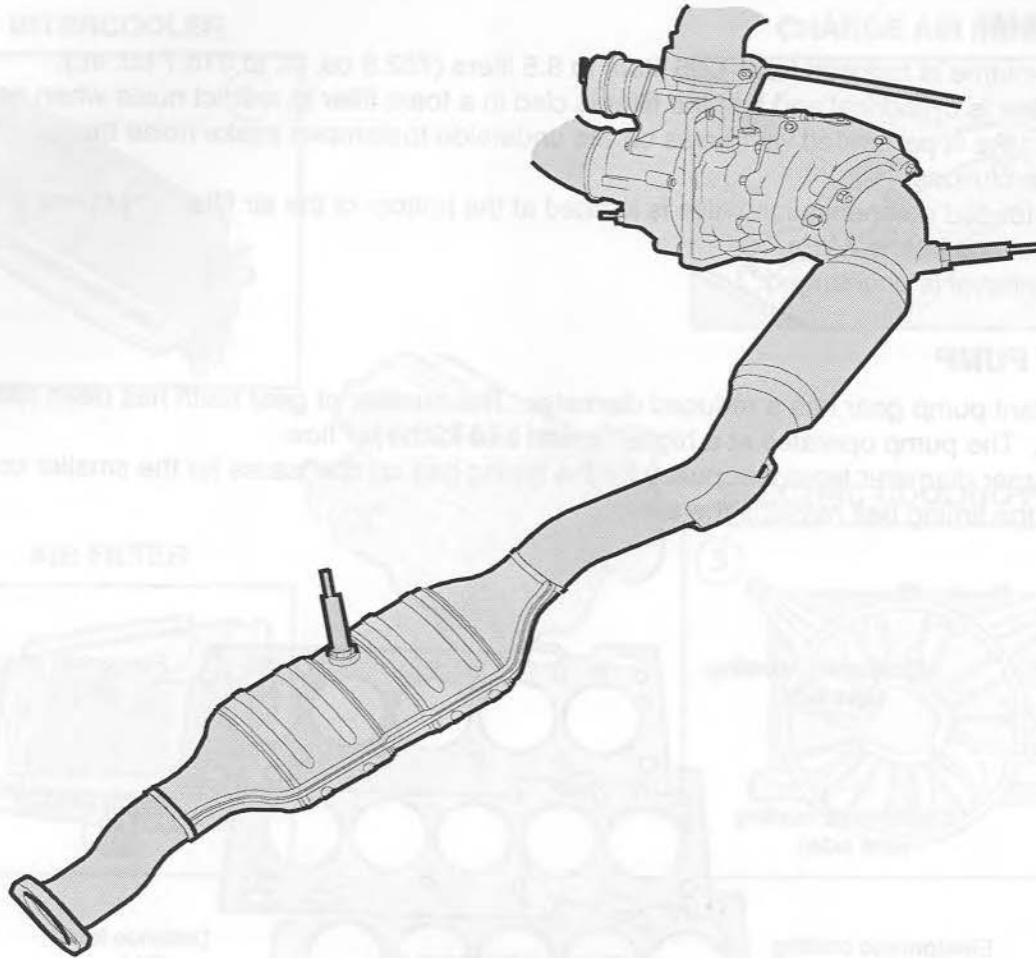
- The coolant pump gear has a reduced diameter. The number of gear teeth has been reduced from 21 to 19. The pump operates at a higher speed and for better flow.
- A new larger diameter tensioner pulley for the timing belt compensates for the smaller coolant pump gear, so the timing belt remains the same.



CYLINDER HEAD GASKET

Multi Layer Sealing (MLS)

A multi-layer gasket for the cylinder head is also used in the B5254T2. There is a thin layer of rubber between each section - Elastomeric coating.



EXHAUST

TURBO

- The turbo unit is larger and has a 20% greater capacity than the B5234T3 (2.3 HT).
- Its maximum charge pressure is 1.1 bar (16 psi) above atmospheric pressure.
- The compressor wheel is larger, 61 mm (2.4 in.).
- The fresh air hose is larger, 70 mm (2.8 in.).
- The oil pipe routing is improved with flat flange connection to the turbo.

MANIFOLD

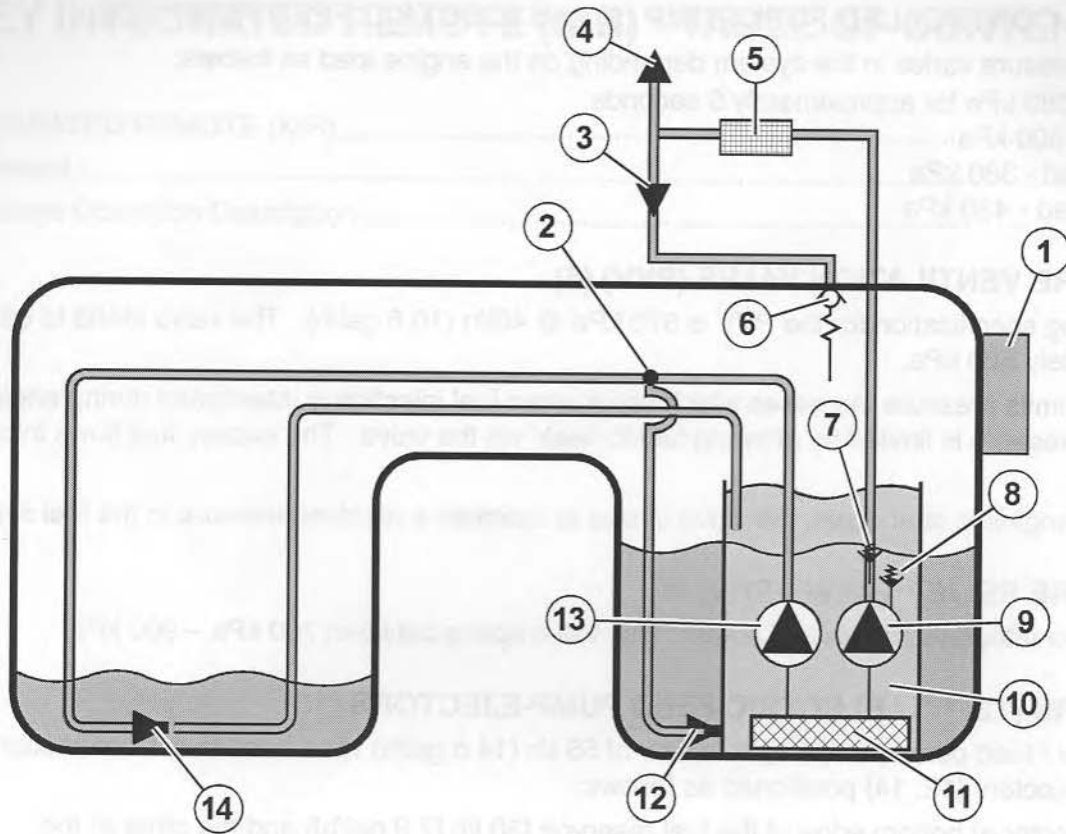
- The manifold remains unchanged. Same as XC90 B5254T2 (2.5 LT).

CATALYTIC CONVERTER

- The UFC (Under Floor Catalyst) has twin oval ceramic monoliths.
- Two oxygen sensors are used.
- The catalytic converter is optimized to reduce back pressure.

EXHAUST PIPE

The exhaust system consists of two parallel pipes to reduce back pressure and ensure efficient gas flow. This has a positive effect on engine performance.



1	PEM (Pump Electronic Module)	6	PVV (Pressure Ventilation Valve)	11	Fuel prefilter
2	T connection	7	Control valve	12	Ejector, right
3	Fuel return pipe to tank	8	PRV (Pressure Relief Valve)	13	Electric feed pump - ejectors
4	Fuel pipe to engine	9	Demand-controlled fuel pump	14	Ejector, left
5	Main fuel filter	10	Fuel pump reservoir		

FUEL TANK, R ONLY

The pump reservoir in the saddle tank contains two pumps, a demand-controlled fuel pump and an electric pump used to force the ejector nozzles to move fuel between the tank halves.

PUMP ELECTRONIC MODULE (PEM) (1)

The PEM is the power stage which converts the ECM control signal into power for the demand-controlled fuel pump. The pump provides the engine with the correct amount of fuel to eliminate 'recycling' unused fuel back to the tank.

Up to twice every drive cycle, the ECM increases the pressure (approximately 600 kPa) in the system so the PVV opens. This is to flush the valve clean of any particles which could impair the seal.

DEMAND CONTROLLED FUEL PUMP (9) and ELECTRIC FEED PUMP (13)

The fuel pressure varies in the system depending on the engine load as follows:

- Start - 380 kPa for approximately 5 seconds
- Idling - 300 kPa
- Low load - 380 kPa
- High load - 420 kPa

PRESSURE VENTILATION VALVE (PVV) (6)

The opening specification for the PVV is 570 kPa @ 40i/h (10.6 gal/h). The valve starts to open at approximately 500 kPa.

The valve limits pressure increases which occur when fuel injection is interrupted during engine braking. The pressure is limited by allowing fuel to 'leak' via the valve. The excess fuel flows into the reservoir.

When the engine is shut down, the valve closes to maintain a residual pressure in the fuel system.

PRESSURE RELIEF VALVE (PRV) (8)

Safety valve integrated in the fuel pump. This valve opens between 700 kPa – 900 kPa.

EJECTORS (12, 14) / ELECTRIC FEED PUMP-EJECTORS (13)

The ejector / feed pump pumps up to a flow of 55 l/h (14.5 gal/h) via a hose to a T connection and then on to two ejectors (12, 14) positioned as follows:

- One ejector at bottom edge of the fuel reservoir (30 l/h [7.9 gal/h]) and the other at the corresponding tank half (25 l/h [6.6 gal/h]) together with the level sensor.

FUEL FILTERS (5, 11)

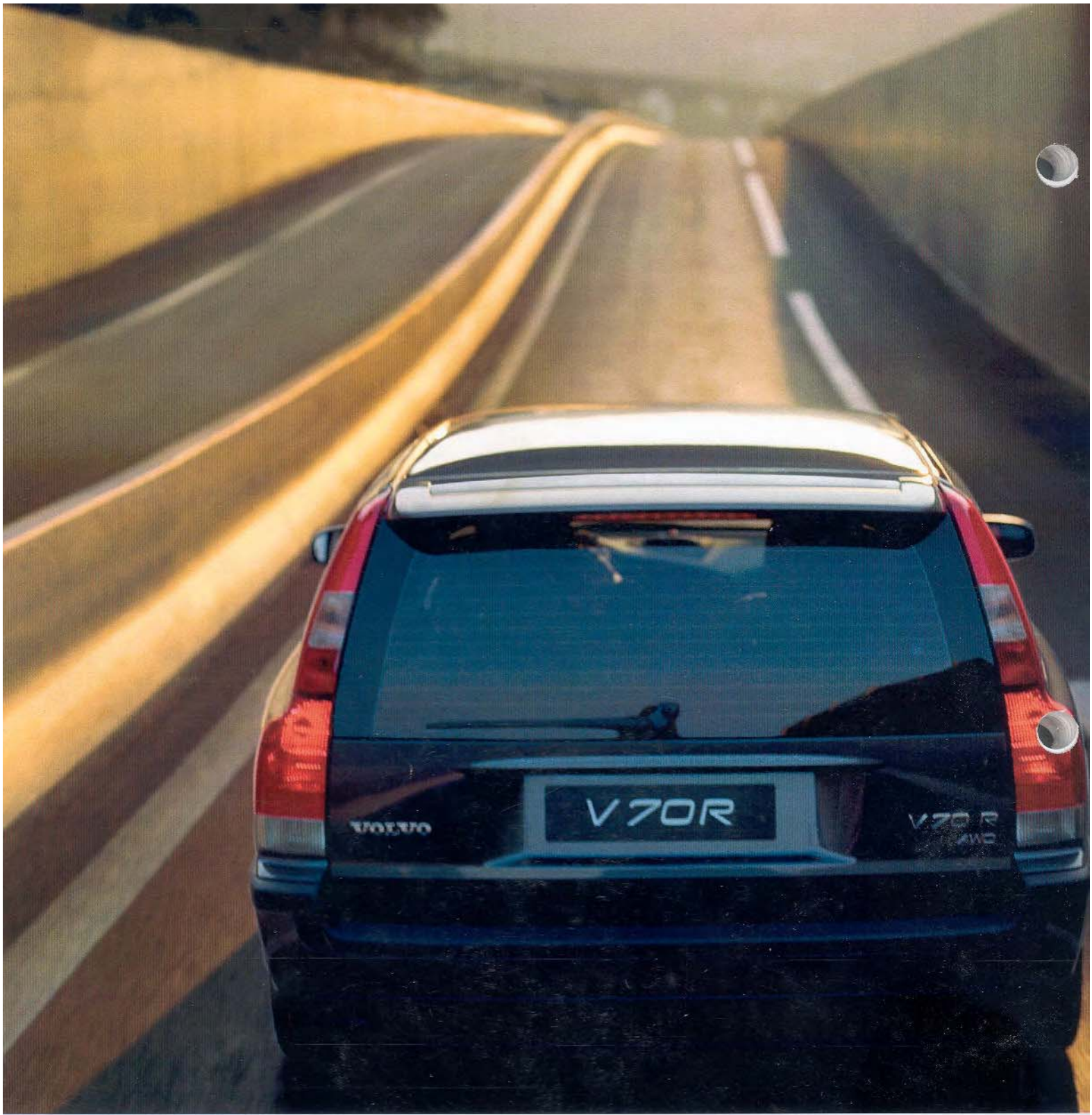
There are two fuel filters:

- The main fuel filter (5) is located on the right side in front of the fuel tank.
- The other fuel filter (prefilter) (11) is located in the pump reservoir, which cannot be replaced separately from the pump assembly.

The fuel pressure is measured by a pressure sensor in the fuel rail similar to the unit used for the M/Y 2003 Denso engine management system.

GLOSSARY

ABS	Anti-lock Braking System	KIR	Key Integrated Remote
A/C	Air Conditioning	LDC	Load Dependable Control
ACS	Active Chassis Setting	LED	Light Emitting Diode
AUX	AUXiliary	LEV	Low Emission Vehicle
AWD	All Wheel Drive	LSM	Light Switch Module
AYC	Active Yaw Control	MHz	MegaHertz
BCM	Brake Control Module	MLS	Multi Layer Sealing
BGC	Brake Grip Control	MMS	Mass Movement Sensor
BRC	Bump and Rebound Control	MOST	Media Oriented Systems Transport
CAN	Controller Area Network	PDM	Passenger Door Module
CCC	Close Coupled Catalyst	PEM	Pump Electronic Module
CCM	Climate Control Module	Prog-mode	Programming mode
CEM	Central Electronic Module	PRV	Pressure Regulation Valve
CM	Control Module	PVV	Pressure Ventilation Valve
CVVT	Continuously Variable Valve Timing	PWM	Pulse Width Modulated
DBC	Dynamic Body Control	RSC	Roll Stability Control
DCC	Dynamic Cornering Control	REM	Rear Electronic Module
DDM	Driver Door Module	SAS	Steering Angle Sensor
DEM	Differential Electronic Module	SBL	Secondary BootLoader
DIM	Driver Information Module	SC	Stability Control
DLC	Dive and Lift Control	SCM	Siren Control Module
DSTC	Dynamic Stability and Traction Control	SRS	Supplementary Restraint System
DTC	Diagnostic Trouble Code	SULEV	Super Ultra Low Emission Vehicle
DVD	Digital Versatile/Video Disc	SUM	SUspension Module
EBA	Emergency Brake Assistance	TCM	Transmission Control Module
ECM	Engine Control Module	TCV	Turbo Control Valve
FOUR-C	Continuously Controlled Chassis Concept	TRACS	TRACtion Control System
FWD	Front Wheel Drive	UEM	Upper Electronic Module
GDL	Gas Discharge Lightning	VADIS	Volvo Aftersales Diagnostics & Information System
IR	Infra Red	WHC	Wheel Hop Control
ISM	Inclination Sensor Module		



VOLVO

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Service Training and Development Department

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