

OHC 16V Turbo Diesel Engine (X 20 DTL, Y 20 DTH)

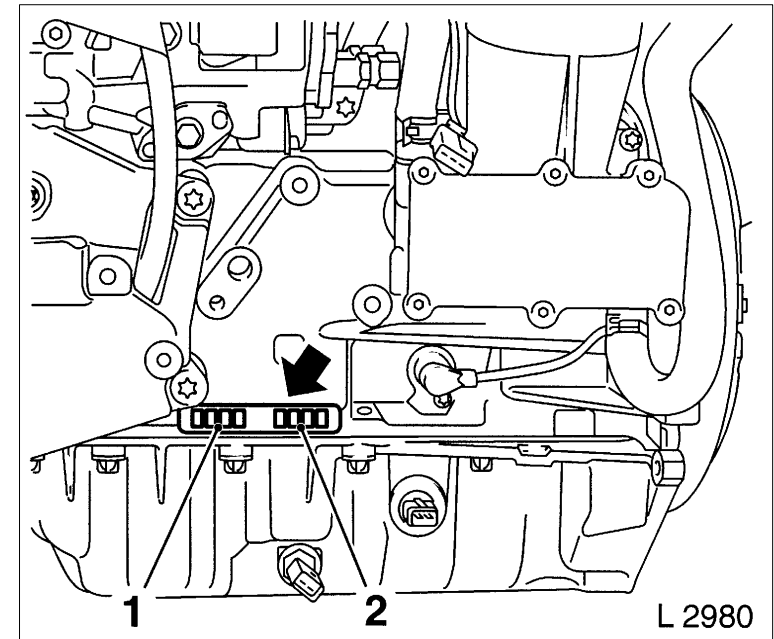
Engine Identification Code / Engine Number

The engine identification code (1) and engine number (2) are embossed on the flattened area (arrow) of the cylinder block underneath the oil filter housing.



Important!

When installing a replacement engine, the engine number must be embossed in the cylinder block before installing the engine.

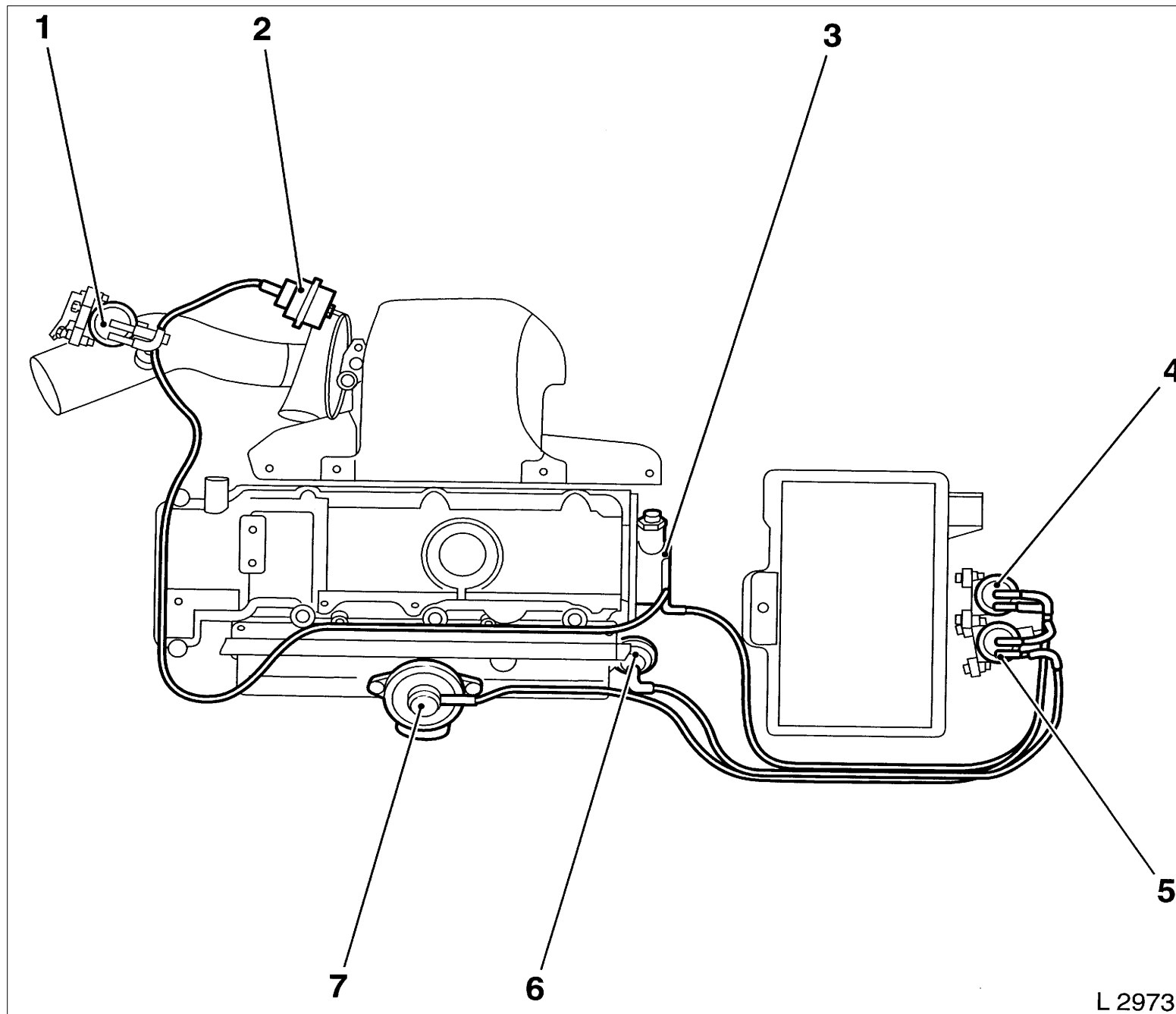


Vacuum Distribution, Engine Compartment

Note:

The vacuum pump vacuum connections to the solenoid valves are marked with a "yellow" ring and the label "VAC".

- 1 Charge pressure control solenoid valve
- 2 Charge pressure regulator vacuum unit
- 3 Vacuum pump
- 4 Exhaust gas recirculation solenoid valve
- 5 Switchover valves solenoid valve
- 6 Switchover valves vacuum unit
- 7 Exhaust gas recirculation valve



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Checking and Adjustment Operations

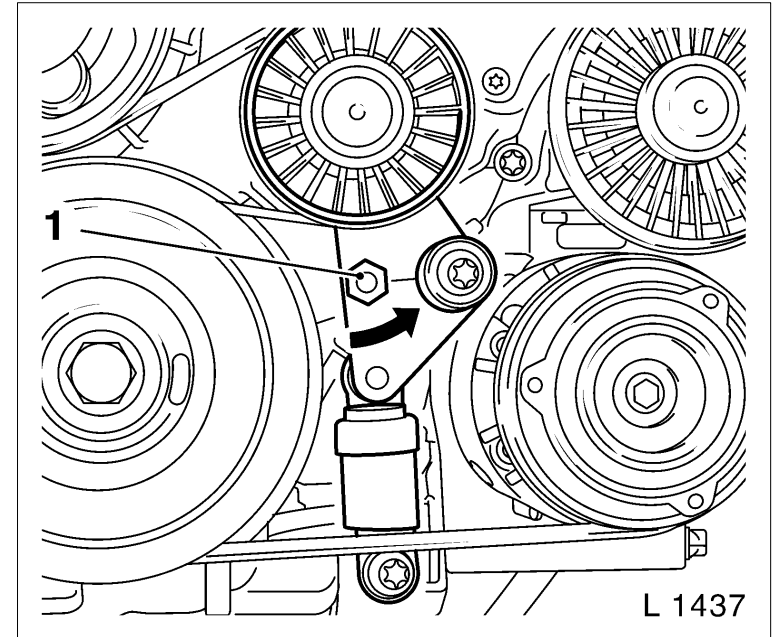
Ribbed V-belt Tensioner, Check



Inspect

The check consists of a function check of the automatic ribbed V-belt tensioner and an inspection of the ribbed V-belt and the associated components.

Tension ribbed V-belt tensioner in direction of arrow via hex lug (1) (counter-clockwise) and allow to slide back slowly – the ribbed V-belt tensioner must return to its original position.



Compression, Check



Remove, Disconnect

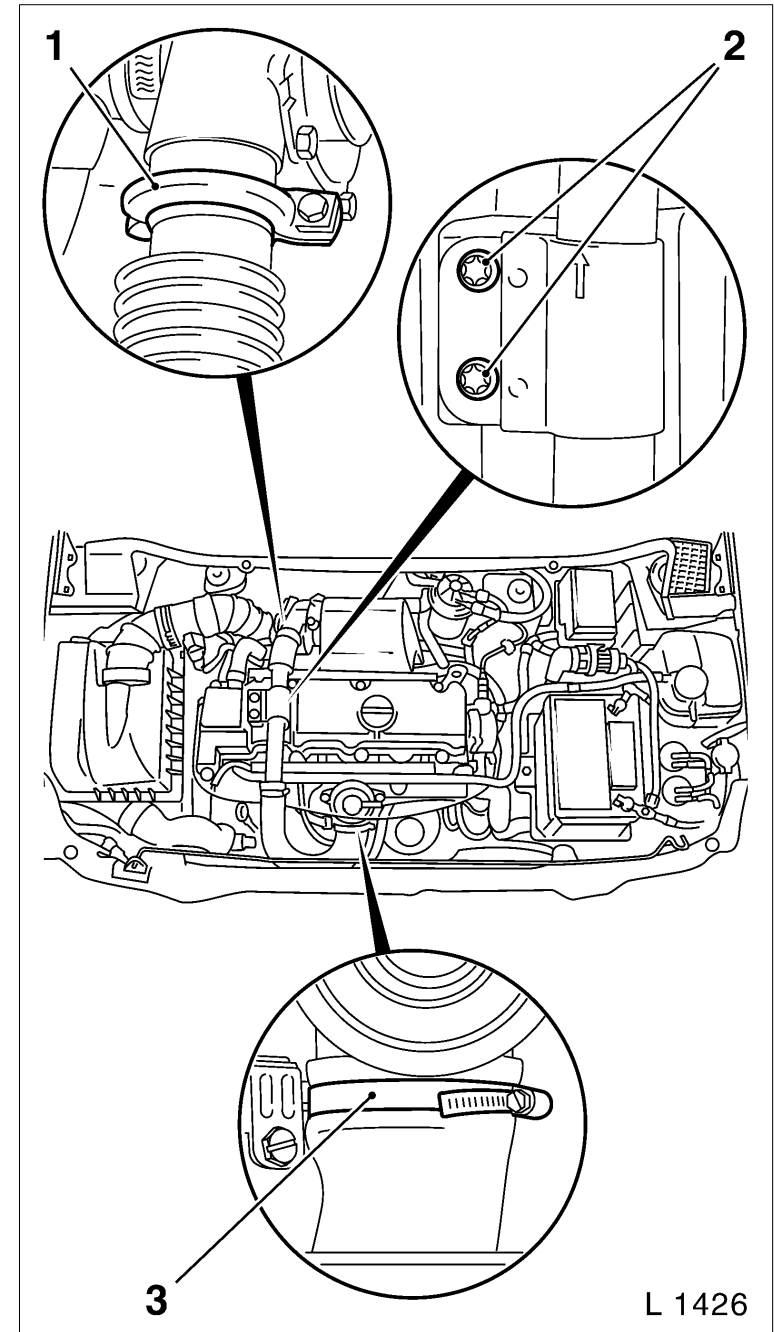
For X 20 DTL engine:

Remove engine cover.

Release hose clamp (3) from charge air hose.

Remove clamp (1) from charge air pipe.

Remove fastening bolts (2) and remove charge air pipe with charge air hose – note seal ring.





Remove, Disconnect

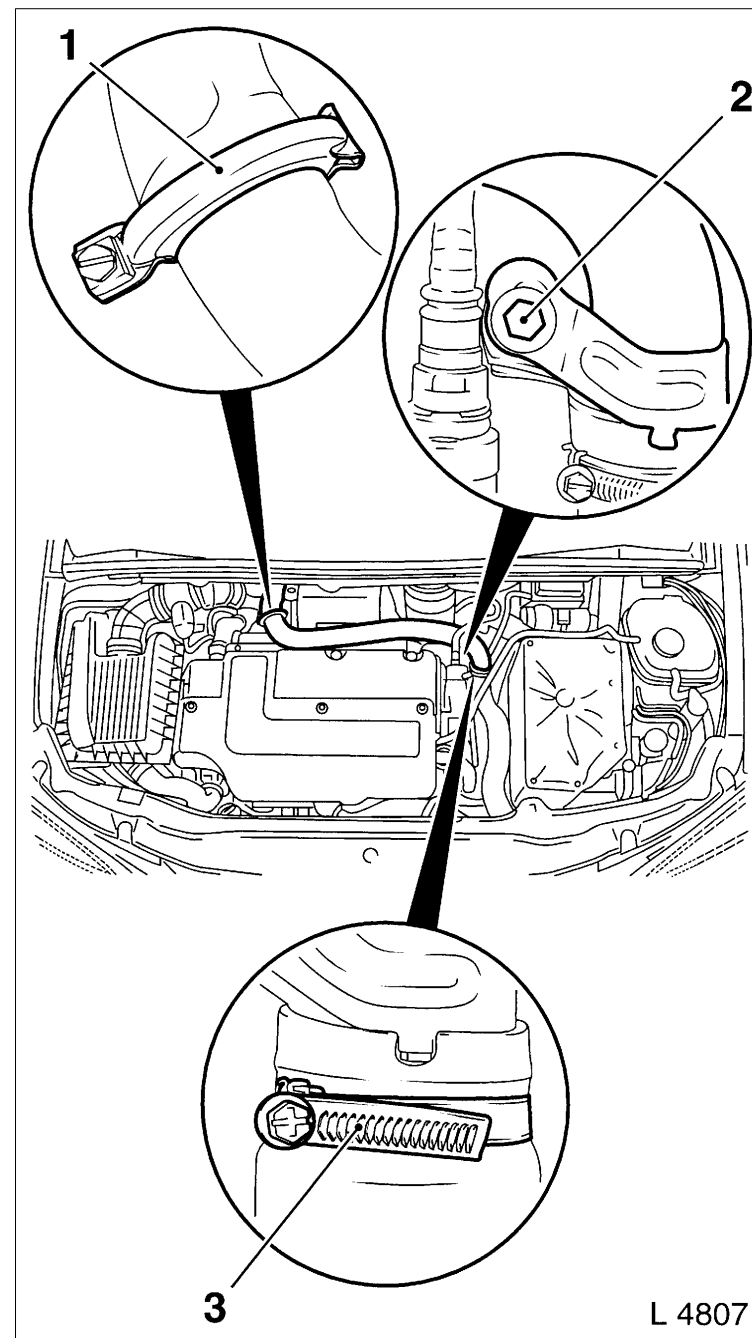
For Y 20 DTH engine:

Release hose clamp (3) from charge air hose.

Remove clamp (1) from charge air pipe.

Remove fastening bolt (2) and remove charge air pipe – note seal ring.

Remove glow plugs – see operation "Glow Plugs, Remove and Install".





Remove, Disconnect

Release wiring harness plug (1) in direction of arrow and detach from fuel injection pump control unit.

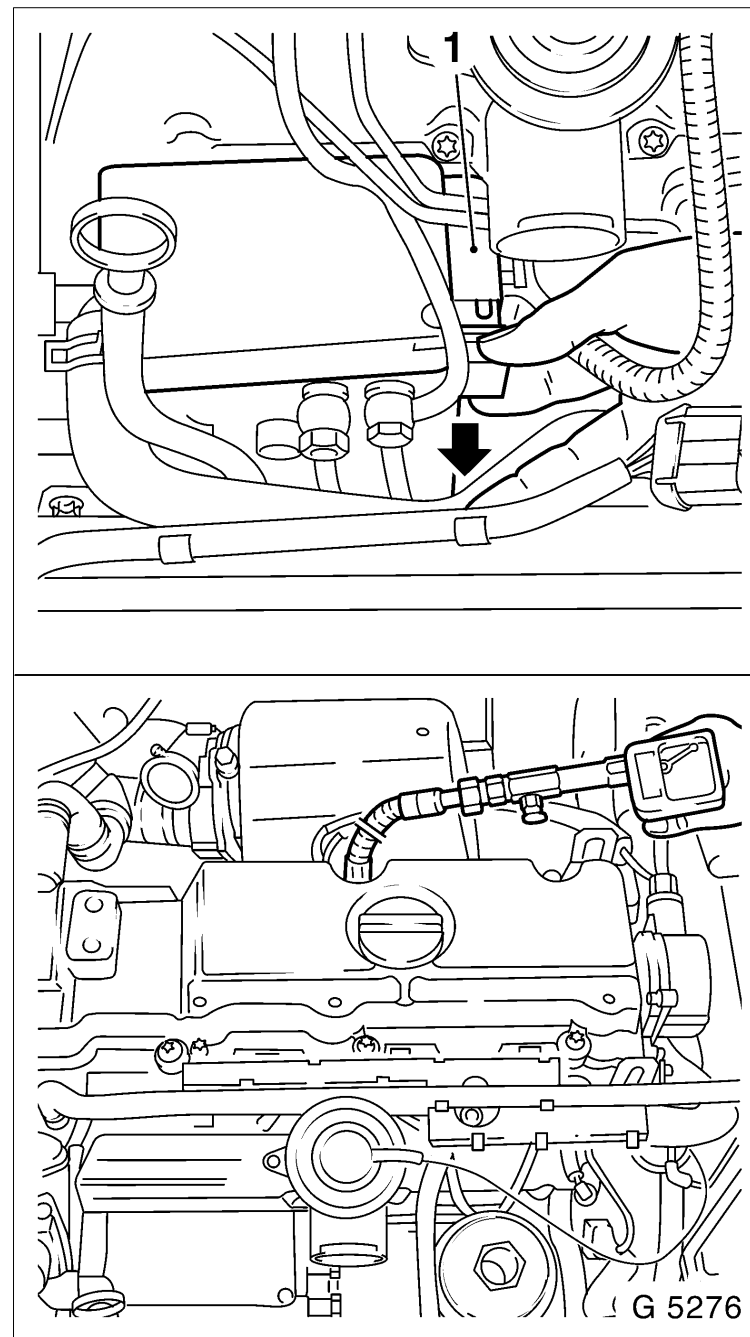
Use a compression recorder with a measurement range from 10 up to 40 bar in conjunction with Adapter KM-533-B and Connector KM-928. Screw Connector KM-928 into glow plug bore.



Inspect

Actuate starter for approx. 4 seconds – minimum engine speed 150 rpm.

The pressure difference between the individual cylinders should not exceed 100 kPa (1 bar).





Install, Connect

Connect wiring harness plug to fuel injection pump control unit and lock.

Install glow plugs – see operation "Glow Plugs, Remove and Install".

For Y 20 DTH engine: Install charge air pipe – see "Illustration Air Duct, Y 20 DTH".

For X 20 DTL engine: Install charge air pipe with charge air hose – see "Illustration Air Duct, X 20 DTL" and attach engine cover to cylinder head cover.

Pressure Loss, Check



Remove, Disconnect

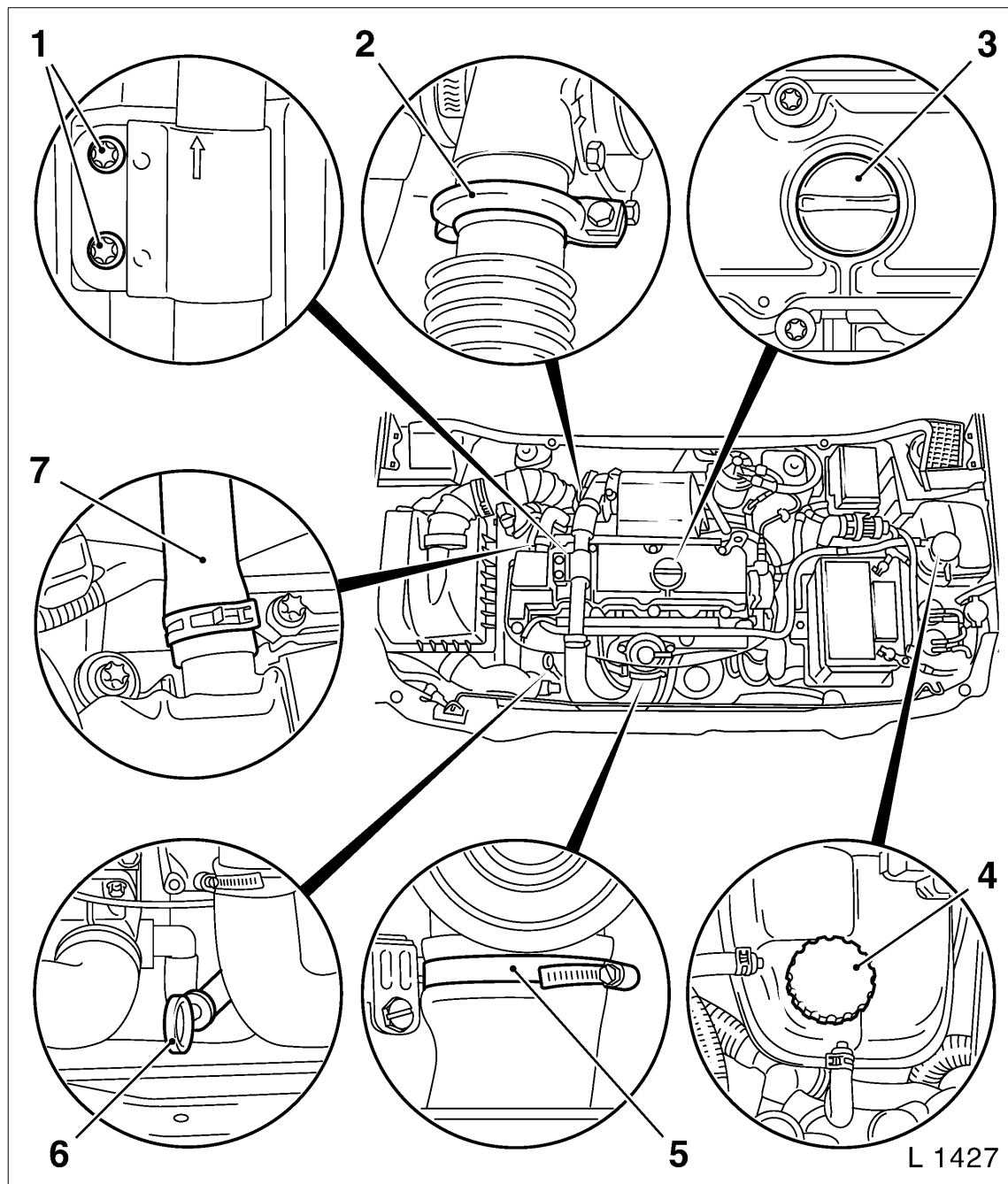
Remove glow plugs – see operation "Glow Plugs, Remove and Install".

Remove vacuum pump – see operation "Vacuum Pump, Remove and Install".

Detach engine vent hose (7) from cylinder head cover.

For X 20 DTL engine: Release hose clamp (5) from charge air hose. Remove clamp (2) from charge air pipe. Remove fastening bolts (1) and remove charge air pipe with charge air hose – note seal ring.

Detach closure cap from oil filler aperture (3) and coolant compensation tank (4). Withdraw oil dipstick (6) from guide tube.



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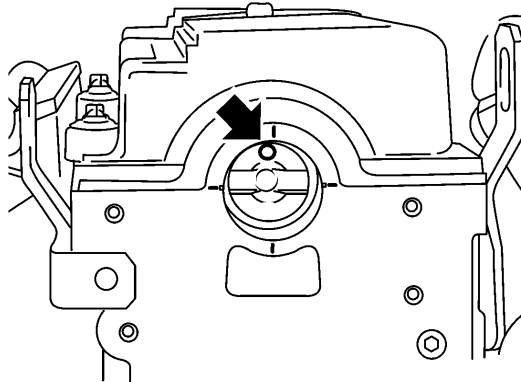
Adjust

At fastening bolt of the torsional vibration damper, turn the crankshaft in engine rotational direction to TDC of the cylinder being checked.

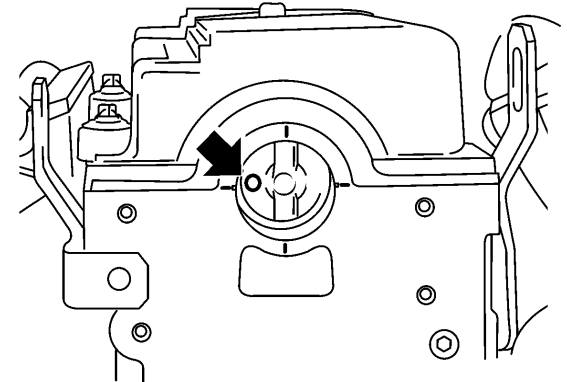
Bore (arrow) on the camshaft must align with the relevant guide mark.

- I TDC for 1st cylinder.
- II TDC for 3rd cylinder.
- III TDC for 4th cylinder.
- IV TDC for 2nd cylinder.

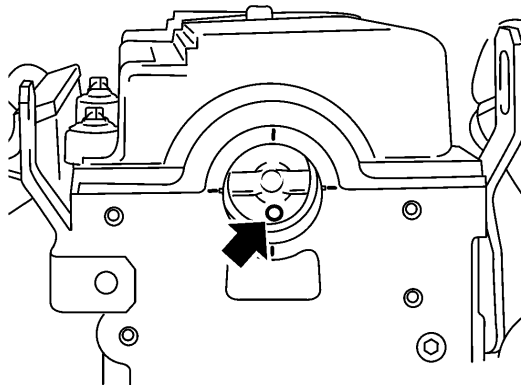
I



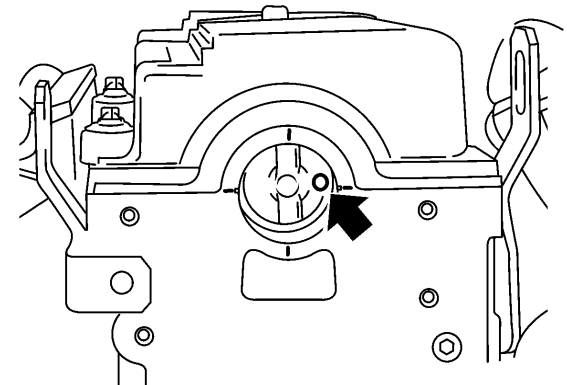
II



III



IV



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Important!

The crankshaft is not permitted to rotate during the test procedure. In order to avoid this, engage 1st gear or selector lever position "P" and apply parking brake.



Install, Connect

Connect pressure loss tester to compressed air system and calibrate (observe manufacturer's instructions).

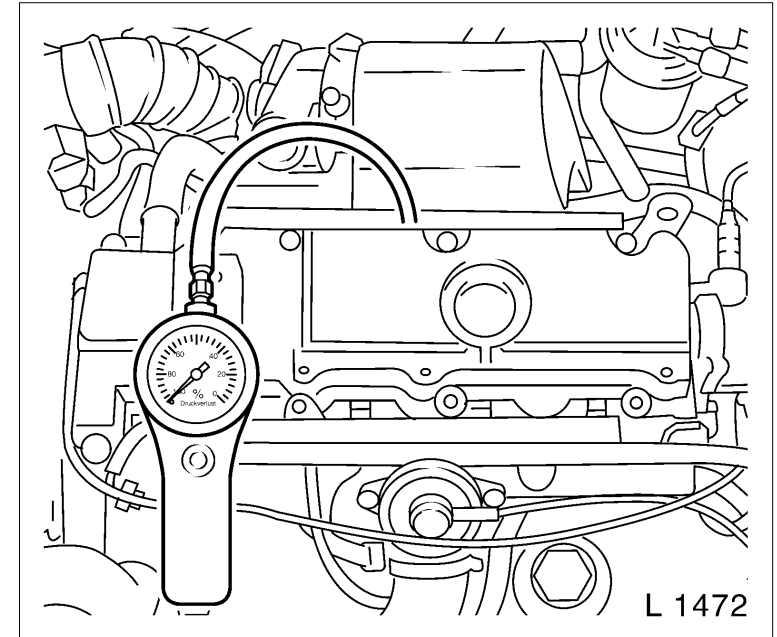
Screw pressure loss tester into sheathed glow plug bore with Adapter KM-533-1-A and Connector KM-928.



Inspect

Read off pressure loss from test equipment as percentage. Thereby note any audible escape of compressed air from the intake manifold, turbocharger, exhaust, glow plug bores and crankcase as well as any bubbling within the coolant compensation tank.

Max. permissible pressure loss difference between the individual cylinders approx. 10 %. The max. pressure loss of one cylinder should not exceed 25 %





Remove, Disconnect

Remove pressure loss tester with adapter and connector.



Install, Connect

Insert oil dipstick into oil dipstick guide tube.

Attach closure caps to oil filler aperture and coolant compensation tank.

For X 20 DTL engine: Attach charge air pipe with new seal ring to turbocharger – tightening torque 8 Nm / 6 lbf. ft. Attach charge air hose to upper part of intake manifold. Attach charge air pipe to cylinder head cover – tightening torque 3 Nm / 2 lbf. ft.

Attach engine vent hose to cylinder head cover.

Install vacuum pump – see operation "Vacuum Pump, Remove and Install".

Install glow plugs – see operation "Glow Plugs, Remove and Install".

Oil Temperature, Measure



Remove, Disconnect

Remove oil dipstick.



Measure

Oil temperature with MKM-596 (A). Insert probe into oil dipstick guide tube until approx. 1 cm above bottom of oil pan. Seal opening of guide tube with accompanying rubber plug.

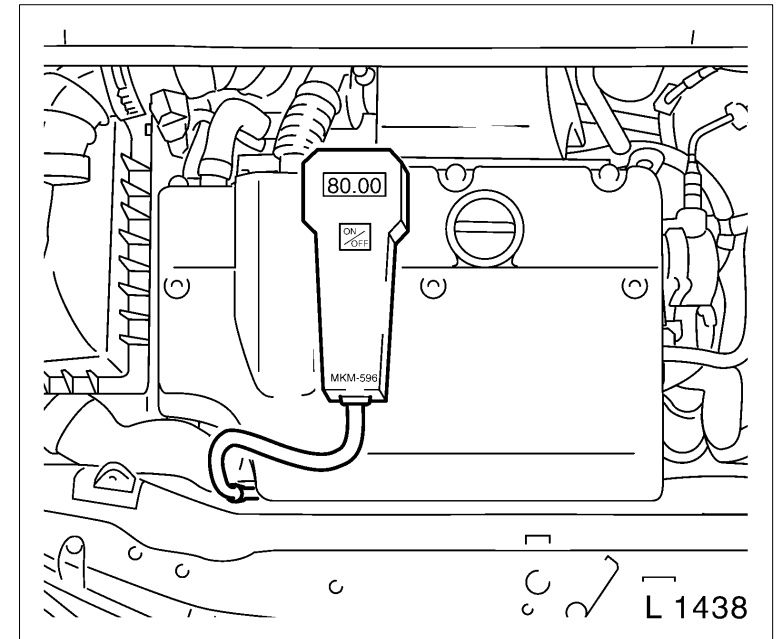
Note:

The oil temperature is dependent on the engine load. High ambient temperatures and engine loads can cause oil temperatures of up to approx. 150 °C/302 °F.



Install, Connect

Insert oil dipstick.



Oil Pressure, Check



Remove, Disconnect

Remove lower engine compartment cover. Detach wiring harness plug (1) from oil pressure switch. Remove oil pressure switch (2) from cylinder block – collect escaping engine oil.



Inspect

Check oil pressure with KM-498-B (3) and KM-135 (4). Oil pressure should be approx. 150 kPa (1.5 bar) with idle speed and oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$.



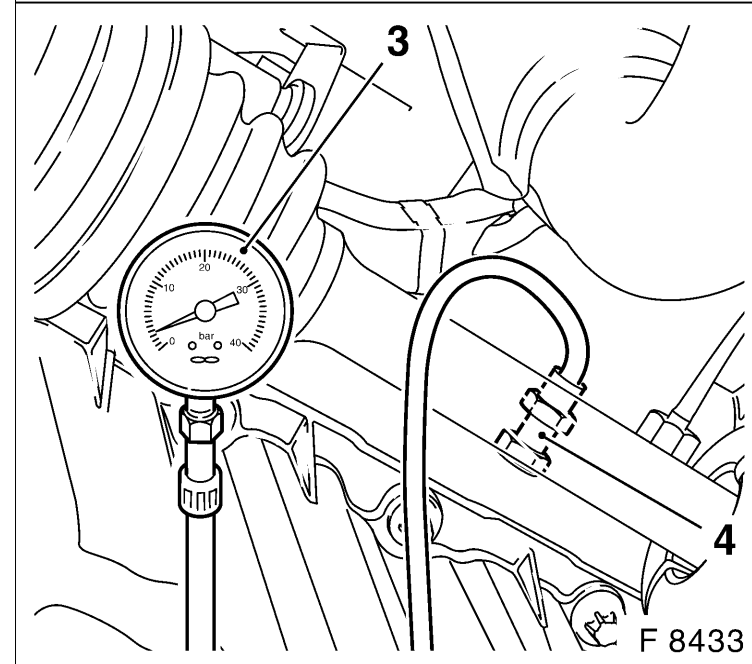
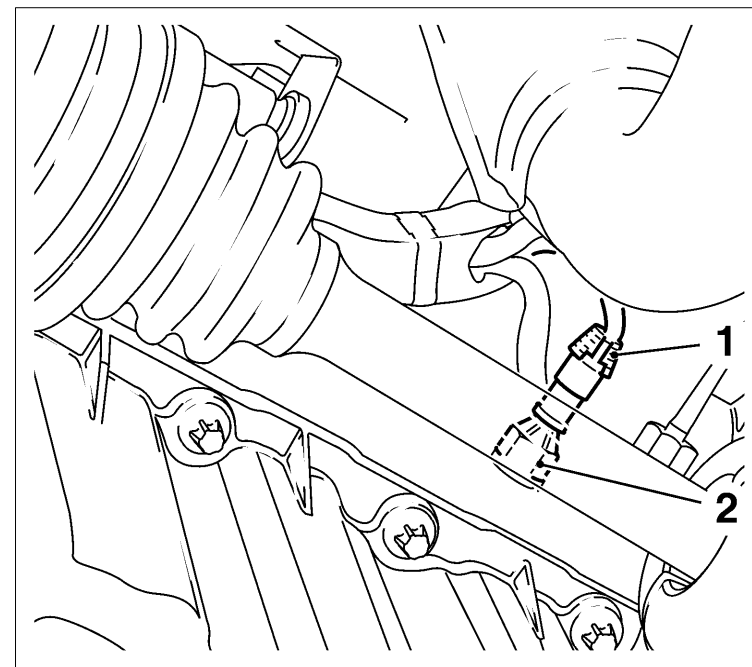
Install, Connect

Attach oil pressure switch to cylinder block with new seal ring – tightening torque 30 Nm / 22 lbf. ft. Connect wiring harness plug to oil pressure switch. Install lower engine compartment cover.



Inspect

Check engine oil level and correct if necessary.



Oil Consumption, Measure

General

The oil consumption of a combustion engine is defined as the volume of oil which is consumed as a result of the combustion process. Under no circumstances must oil consumption be confused with oil loss occurring as a result of leaks at the oil pan, cylinder head, etc.

The task of the engine oil is to:

- 1 Separate surfaces that slide on one another with an oil film, i.e. prevent dry friction;
- 2 Conduct the heat produced by friction away;
- 3 Conduct combustion residue away.

These duties necessitate the consumption of a certain amount of oil, i.e. the expectations of many who claim that further development of the internal combustion engine will lead to an engine that does not require oil are absolutely nonsensical. The oil consumption is however influenced by external operating factors, driving style and manufacturing tolerances. Under normal circumstances, the consumption is so minimal that between the specified oil change intervals little or no topping up is necessary. Topping up is however absolutely necessary if the oil level sinks below the "MIN" mark on the dipstick. Likewise, ensure that the oil level does not exceed the upper "MAX" mark on the dipstick, which leads to increased oil consumption.

Engine Oil Consumption, Measure (Continued)

As oil consumption is a technical necessity, indications that an engine is not consuming oil mean that it is reasonable to conclude that the oil is being diluted by particular operating conditions. Frequent cold starts, driving when over-cold, etc., lead to the oil returning to the oil pan conducting fuel particles and condensation, and thus becoming "diluted"; this can lead to the incorrect supposition that the engine is not consuming any oil at all.

Oil diluted in this fashion lacks lubricating power and may lead to engine damage if the specified oil change intervals are not observed. The main causes for oil dilution are driving in mainly urban traffic and frequent driving at insufficient engine rpm when the engine is cold.

The oil consumption first begins to stabilise after operating for a few thousand kilometres; therefore, measurements of the oil consumption only become realistic after about 7500 km / 4000 miles. Before measuring the oil consumption, ensure that the engine is not losing oil due to leaks.

Note:

The oil dipstick can only be used for checking and not for measurement. The engine must always be switched off for at least 2 minutes before an oil level check can be performed. If, after an oil change, the maximum engine oil top-up does not correspond to the maximum level mark on the dipstick, this can be attributed to manufacturing tolerances.

All information regarding the permissible engine oil consumption and filling quantities are included in the Owner's Manual.

Engine Oil Consumption, Measure (Continued)

Measuring Method

- 1 The check is carried out with the vehicle on a horizontal surface with the engine at operating temperature (engine oil temperature min. 80 °C / 176 °F).
- 2 Drain engine oil immediately after switching off engine – draining time approx. 30 minutes (this value was determined experimentally).
- 3 The drained engine oil quantity is determined in a measuring container¹⁾ and fresh oil is added up to the maximum engine oil filling quantity, minus the volume for the unchanged engine oil filter.
- 4 Using this amount of engine oil, the customer should drive at least 1000 km/625 miles without of course topping up the engine oil (the driver should keep to his normal routes and driving styles).
- 5 The procedure described above (points 1 to 2) is then repeated with exactly the same time for draining engine oil.
- 6 The quantity of engine oil "missing" from the measuring container is the engine oil consumption with respect to the distance travelled.
- 7 The oil consumption is calculated as follows:

$$\frac{\text{filled oil quantity (l)} - \text{drained oil quantity (l)}}{\text{distance actually driven (km)}} \times 1000 = \text{oil consumption (l/1000 km)}$$

1) measuring container with at least 6 litre capacity and scale.