

**Op. 10 001 10****ENGINE Removal-Installation****DANGER**

Lift and handle all heavy parts using suitable lifting equipment.

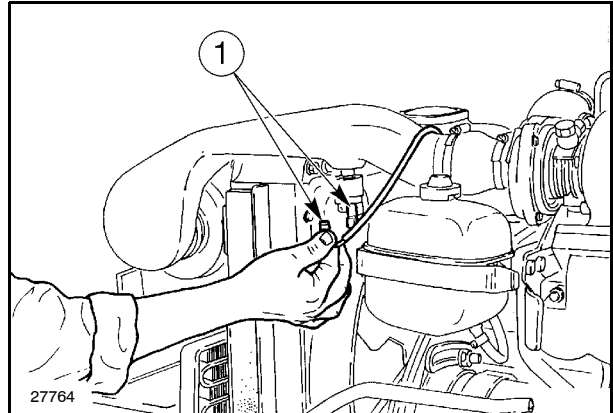
Make sure that assemblies or parts are supported by means of suitable slings and hooks. Make sure that no-one is standing in the vicinity of the load to be lifted.

**WARNING**

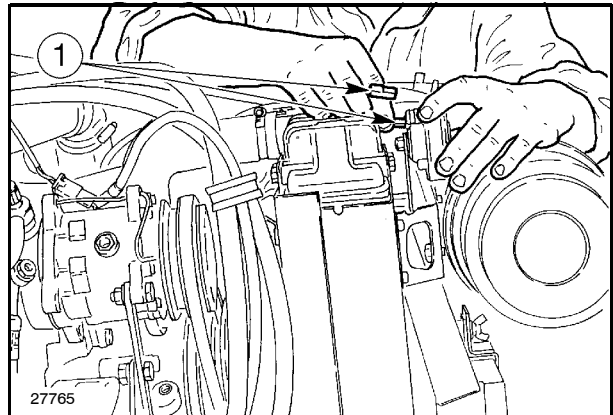
Always use appropriate tools to align fixing holes. NEVER USE YOUR FINGERS OR HANDS.

Proceed as follows.

1. Carry out Clutch operation **18 110 10**, only removal (see sect. 18).
2. Remove the clogged air filter sensor connection (1).
3. Disconnect the horn connection (1).

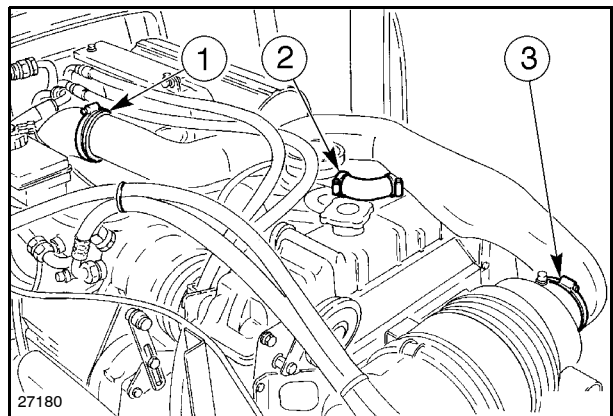


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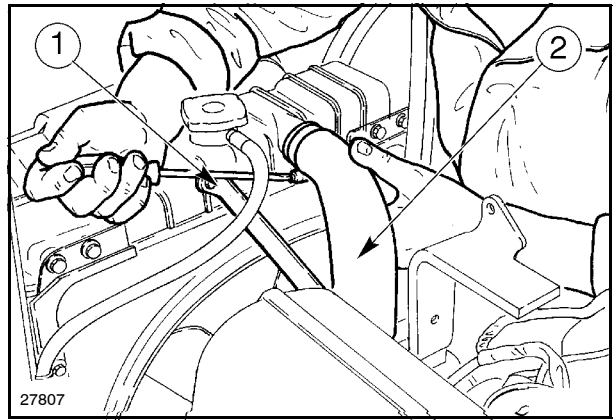
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4. Loosen the clamps (1, 2 and 3) and remove the inlet manifold.



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5. Unscrew the band clamps and detach the upper (2) and lower radiator hoses, detach the radiator bracket (1).

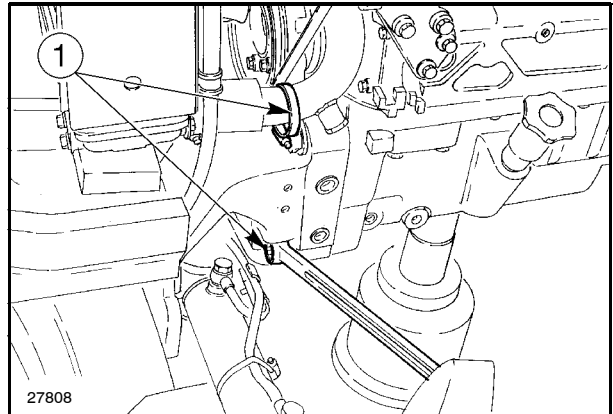


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6. Position two fixed stands under the front axle support and under the engine. Attach the chains so that the engine is balanced during hoisting and position two wood blocks between the support and the front axle, to prevent oscillation.
7. Loosen the front axle support retaining bolts (1).
8. Remove the engine from the axle-support unit.
9. To re-install the engine, proceed as follows.


**WARNING**


Always use appropriate tools to align fixing holes.  
NEVER USE YOUR FINGERS OR HANDS.





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- Apply the torque settings listed on page 20.
- Re-install the front axle-support unit on the engine.
- Connect and secure the upper and lower radiator hoses and the connecting bracket.
- Fit and secure the inlet manifold.
- Connect the horn and clogged air filter connections.
- Carry out Clutch operation **18 110 10**, only removal (see sect. 18).

**Op. 10 001 30 COMPRESSION TEST**

In case of poor engine performance, in addition to checking the fuel injection system (injection nozzles and injection pump), also test the compression on each cylinder.

 **DANGER** 

Do not use matches, lighters, blow torches or any form of naked flame as a source of light when inspecting the engine due to the presence of inflammable fluids and vapour.

**Compression ratio**

The compression ratio is a measure of the quantity of air drawn into the cylinder, and provides an indication of the efficiency of the sealing elements in the cylinder (piston rings and valves).

Uniform compression in all the cylinders ensures that they all perform an equal amount of work, provided that each cylinder is injected with the same quantity of fuel at the right time.

Low compression not only reduces engine performance, it also causes incomplete fuel combustion due to the lack of available combustion air.

The engine therefore gives poor performance with excessive fuel consumption and, consequently, exhaust smoke and restriction of the exhaust passages.

As the compression ratio **also varies with the temperature of the engine** (cold engines produce lower compression values than hot engines), the compression should only be tested when the engine is at normal operating temperature.

Compression should be tested using the compression test kit **291309**, as follows:

- 1) Run the engine until it reaches normal operating temperature.
- 2) Switch off the engine.
- 3) Disconnect the lead from the engine stop electromagnet on the injection pump in order to close the valve and block the flow of fuel to the injectors.
- 4) Remove the injector from the cylinder to be tested.
- 5) Turn the engine over a few times with the starter motor in order to expel any carbon residue.

6) Fit the dummy injector made from "Tools" on page 21, in place of the injector removed previously, interposing the copper sealing washer.

7) Connect the compression test instrument **291309** and take readings while turning the engine over with the starter motor.

On engines in perfect working order, with the sump oil at approx. 40 °C (104 °F) at sea level (760 mm - 29.92 in. - of mercury) and at an engine speed of 200 to rpm, the compression should be 25.5 to 27.5 bar (369.9 to 398.9 psi).

8) Test the compression on the other cylinders, repeating steps 4-5-6-7, bearing in mind that:

The minimum permissible compression on a used engine is 21.6 bar (313.3 psi).

The maximum permissible compression difference between cylinders is 3 bar (43.5 psi).

Every 100 meters (109.36 yards) above sea level corresponds to a reduction in compression by approx. 1%.

**CONSIDERATIONS:****Uniform compression**

Although high compression is important, it is more important for smooth engine running that compression is uniform in all cylinders.

**Low compression readings**

If extremely low pressure readings are obtained on one cylinder it is advisable to repeat the test.

Before testing this time, pour approx. one spoonful of engine oil into the cylinder through the injector bore.

Turn over the engine a few times to distribute the oil evenly over the cylinder walls, and then repeat the test.

If the second test readings are significantly higher, the problem may be worn piston rings, out-of-round or damaged pistons or liners.

If the second test readings are not higher, the problem will be the valves.

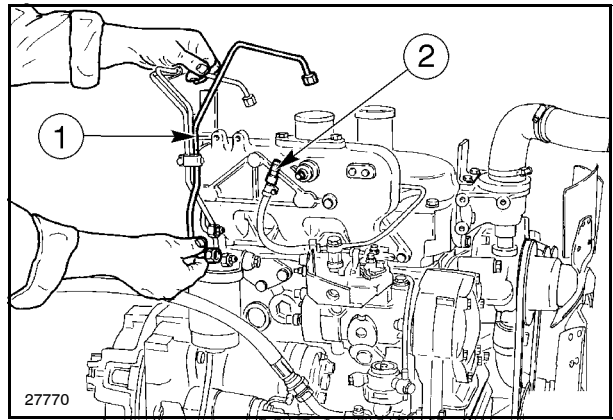
On the other hand, if the second test reading shows only a slight improvement, the problem will be due to both the valves and the rings.

**Op. 10 001 54****ENGINE Removal-Assembly****WARNING**

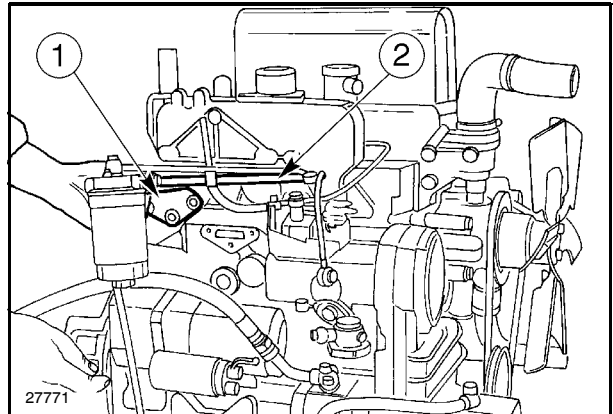
Handle all parts carefully. Do not put your hands or fingers between parts. Wear suitable safety clothing - safety goggles, gloves and shoes.

Proceed as follows.

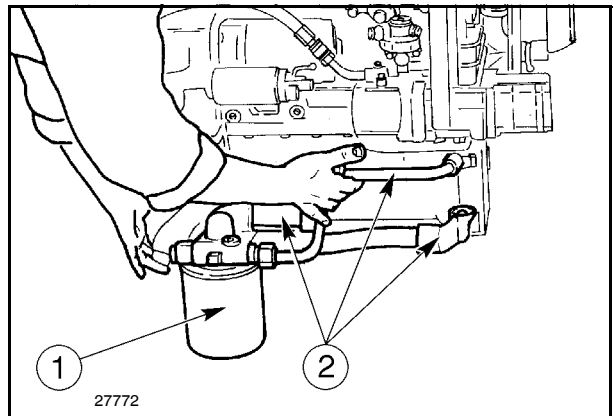
1. Unscrew: the thermostarter union (2), the inlet line retaining unions (1) from the pump and the injectors, and detach the piping (1).
2. Unscrew: the connecting lines (2) to the injection pump and the support retaining bolts (1), remove the pump and the fuel filter.
3. Unscrew: the hydraulic pumps piping retaining bolts (2), the oil filter (1) retaining bolts, complete with the support, from the engine and remove.
4. Unscrew the retaining bolts and remove the hydraulic pumps from the lift (2) and services (1), which completes the piping (3).



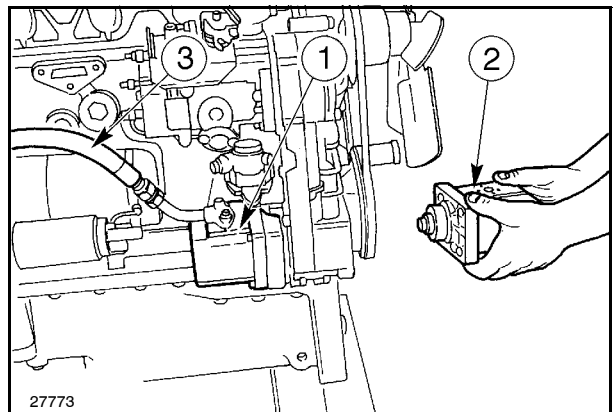
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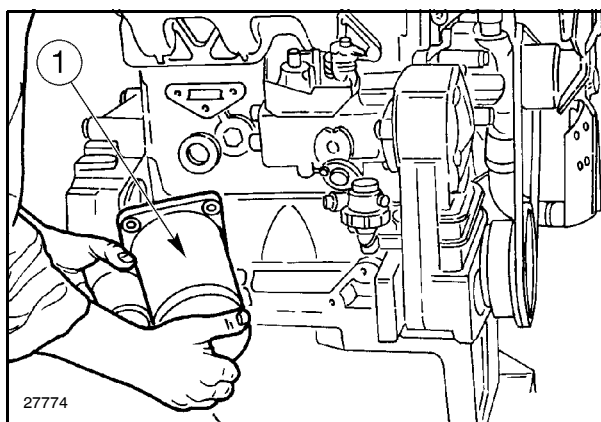


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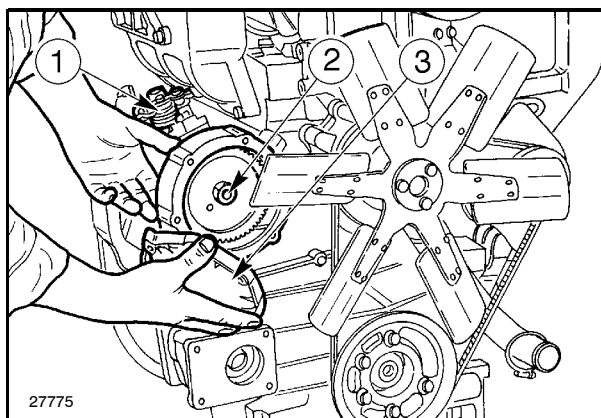
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5. Unscrew the retaining bolts and remove the starter motor (1).



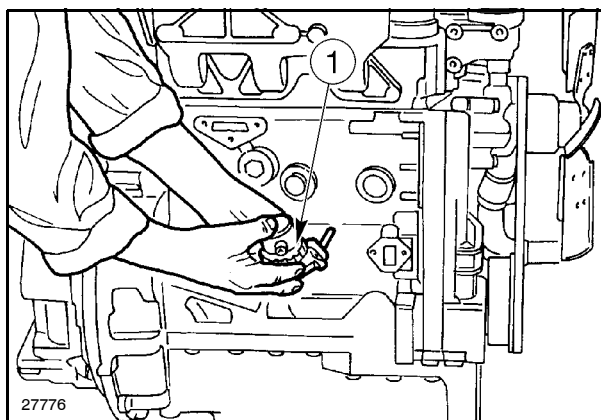
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6. Unscrew the retaining bolts and remove the cover (3), loosen the retaining nut (2) on the injection pump (1) and remove from the opposite side.



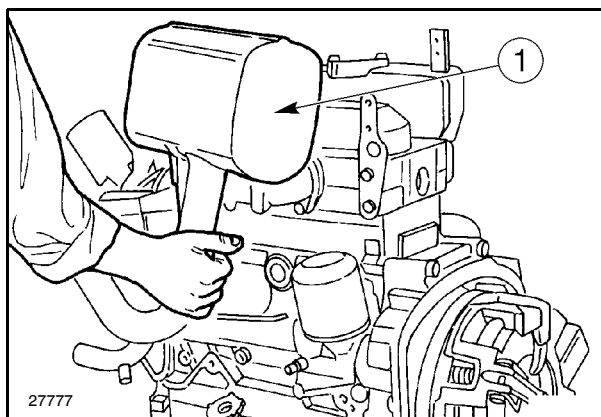
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7. Unscrew the retaining nuts and remove the fuel pump (1).



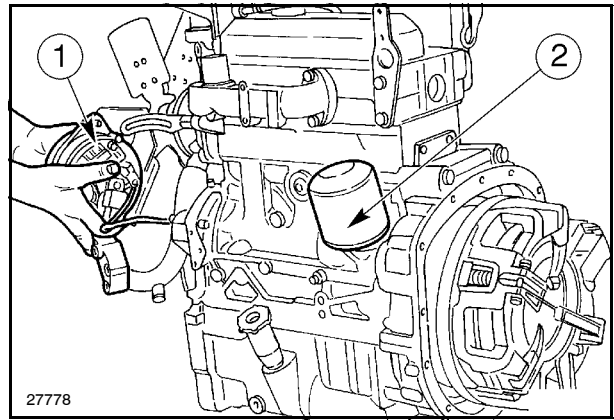
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8. Unscrew the retaining bolts and remove the exhaust silencer (1) complete with the vertical pipe. On models with horizontal exhaust pipes, remove when disassembling the engine.

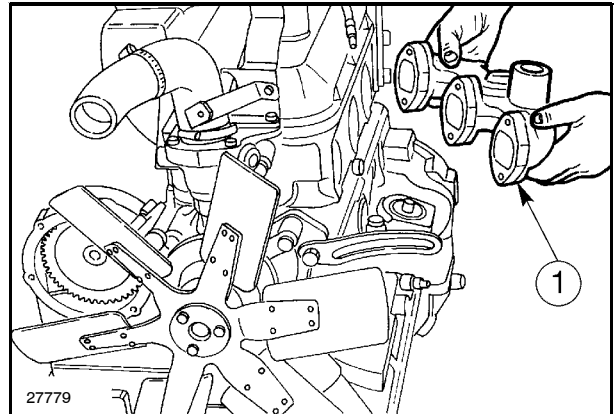


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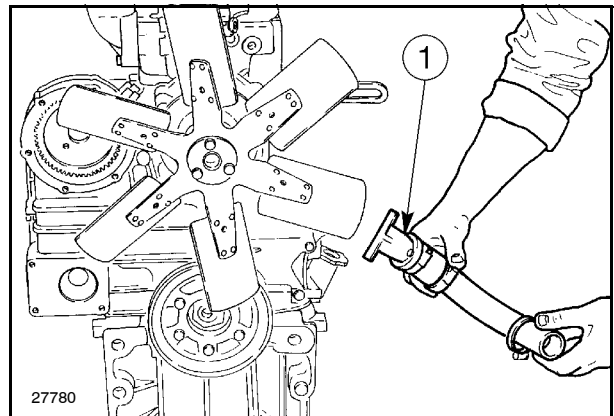
9. Unscrew the retaining bolts, remove the alternator (1) and recover the drive belt.
10. Remove the engine oil filter (2).



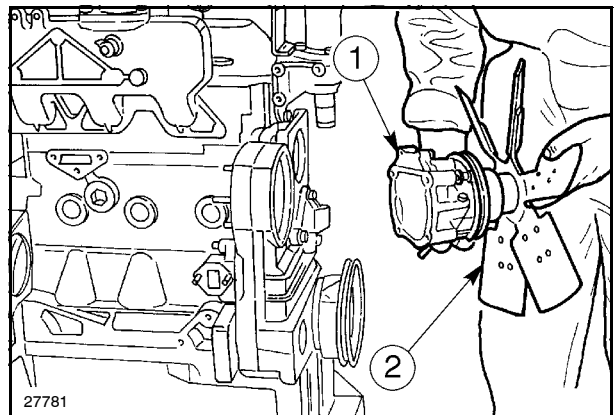
11. Unscrew the retaining bolts and remove the exhaust manifold (1).



12. Unscrew the retaining bolts and detach the coolant pump hose(1).



13. Unscrew the retaining bolts and detach the coolant pump (1) complete with fan (2).



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