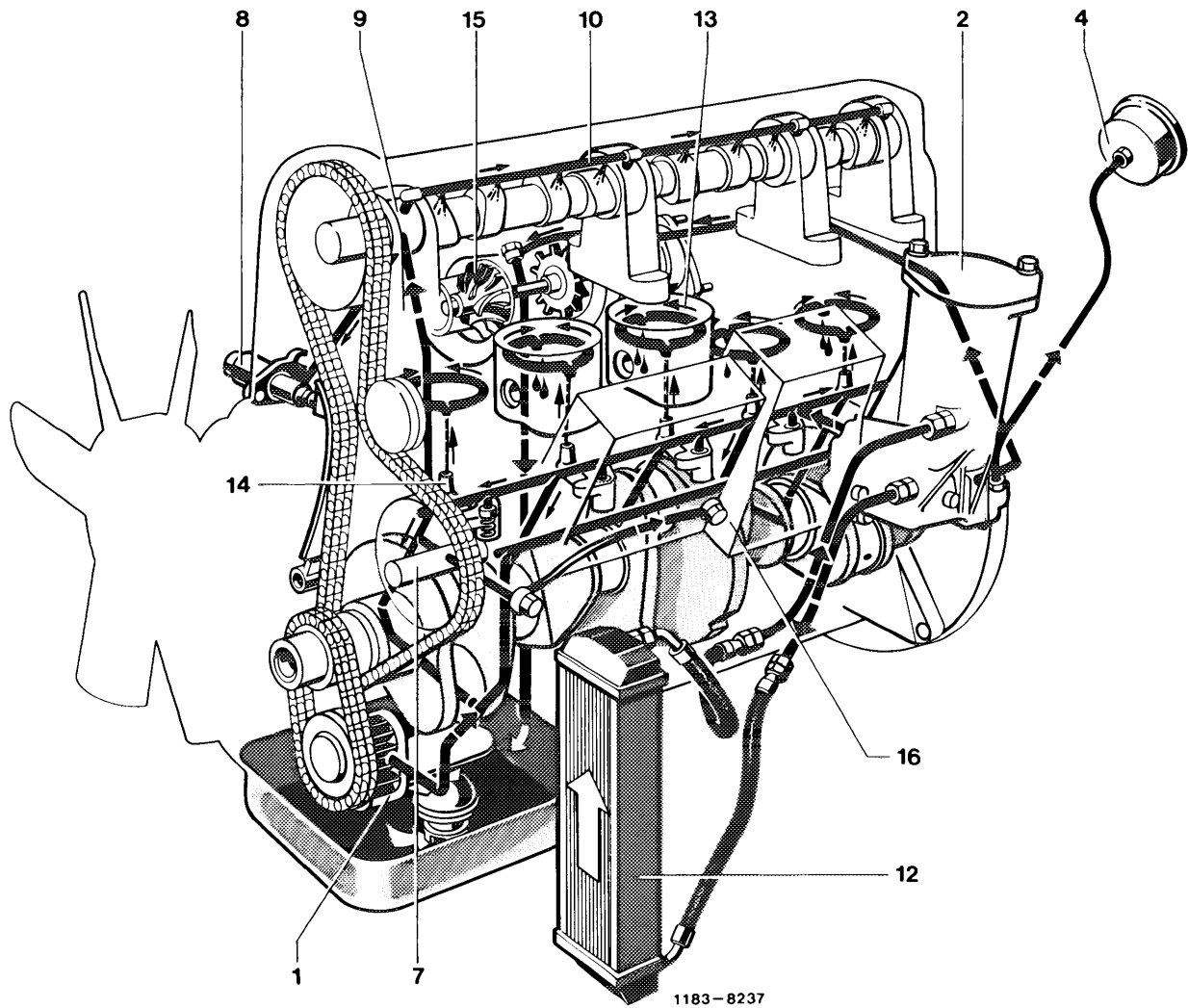


Oil circuit



- | | | |
|--|------------------------|-----------------------------|
| 1 Oil pump with integrated pressure relief valve | 8 Chain tensioner | 13 Piston |
| 2 Oil filter | 9 1st camshaft bearing | 14 Oil spray nozzle |
| 4 Oil pressure gage (readout) | 10 Oil pipe | 15 Exhaust gas turbocharger |
| 7 Intermediate sprocket shaft | 12 Air-oil cooler | 16 Injection pump |

Attention!

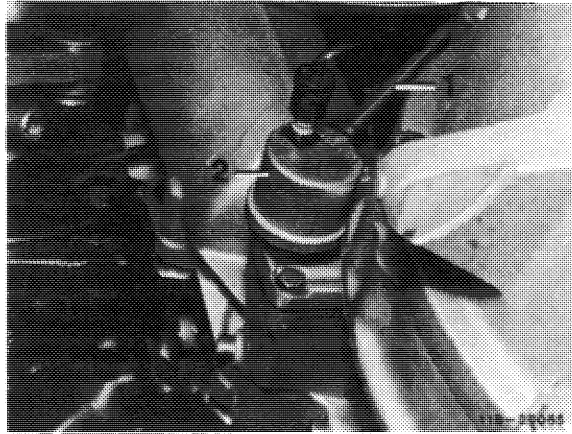
The oil circuit is controlled by a thermostat in oil filter (for operation, refer to section covering oil filter).

Oil pressure

At operating pressure, the oil pressure at idle should not drop to 0.3 bar gage pressure.

During acceleration, the oil pressure should rise again immediately and should attain at least 3 bar gage pressure at 3000/min.

In model 126, the oil pressure is no longer transmitted to oil pressure gage (readout) in instrument cluster by way of a capillary tube as up to now, but the oil pressure gage is electrically activated by an oil pressure transmitter (2), which is screwed into oil filter.



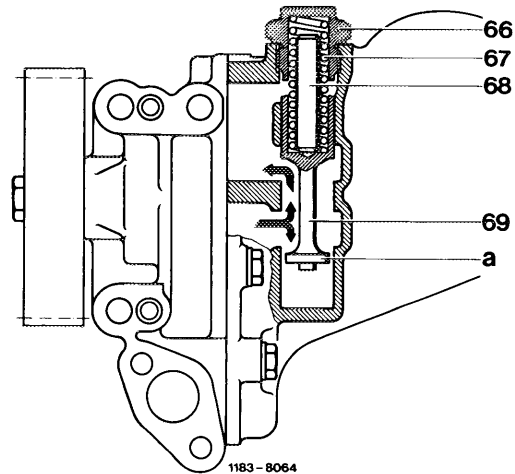
Pressure relief valves

| Opening pressure of pressure relief valves | bar gage pressure |
|--|-------------------|
| Bypass valve in oil filter | 3.5 |
| Pressure relief valve in oil pump | 7 |

Pressure relief valve in oil pump

The damped oil pressure relief valve (7 bar gage pressure) is integrated in oil pump.

- 66 Closing plug
- 67 Compression spring
- 68 Pin
- 69 Piston
- a Washer



A damping device (washer "a") has been installed to make sure that the pulsating oil pressure generated by the oil pump is not transferred to piston (69) of pressure relief valve with subsequent de-activating noise.

Starting at an oil pressure of 7 bar gage pressure the piston (69) is displaced against the pressure of compression spring (67) and clears the de-activation cross section.

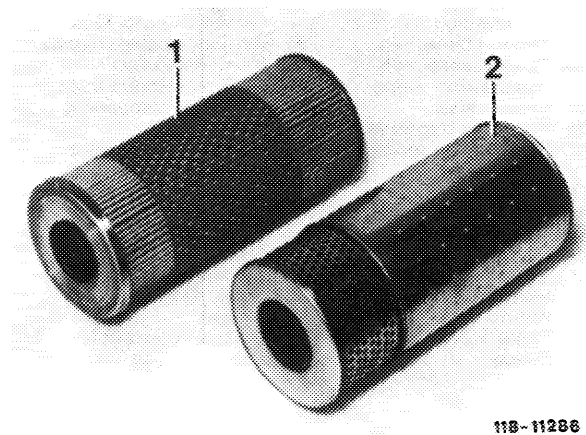
Simultaneously some of the oil (arrow) flows into the area behind washer (a) by way of two control cross sections in washer (a). The oil flowing through the control cross sections opposes the piston movements initiated by the pulsating oil pressure and will thereby dampen the piston.

Oil filter

Main and bypass filter elements are contained in a cartridge.

During first inspection (1000–1500 km or 800–1000 miles) the initial operation oil filter element (1) should be replaced by the combination filter element (2).

- 1 Initial operation filter element
- 2 Combination filter element

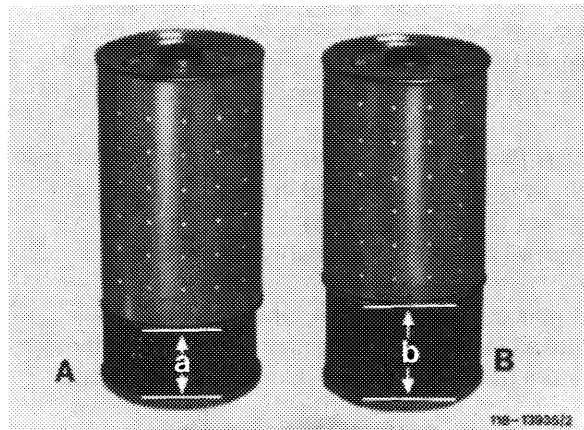


The combination filter element should then be replaced during oil change every 7500 km or 5000 miles.

Attention!

On this engine, install only the combination filter element (B), part No. 617 184 01 25 with the larger main flow filter component (dimension "b" = 55 mm).

- A Combination filter element
Dimension A = 40 mm
- B Combination filter element
Dimension B = 55 mm

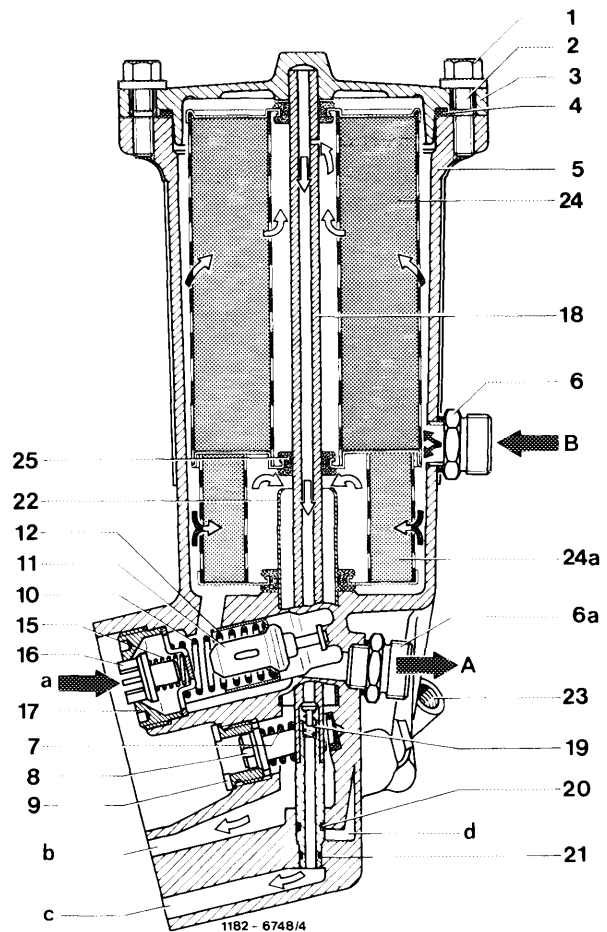


Operation

The oil filter comprises the following main components:

- a) Oil filter housing with bypass, return flow locking valve and thermostat.
- b) Cap with return flow pipe, check valve and sealing ring.
- c) Combination filter element.

- | | |
|---|---|
| 1 Nut | 21 O-ring |
| 2 Stud | 22 Riser |
| 3 Cap | 23 Connection for oil pressure gage (model 116 and 123) |
| 4 Sealing ring | 24 Oil filter element bypass filter component |
| 5 Oil filter housing | 24a Oil filter element main flow filter component |
| 6 Thread connection | 25 Rubber seal |
| 6a Thread connection | A Uncleaned oil toward air-oil cooler |
| 7 Compression spring | B Uncleaned oil from air-oil cooler |
| 8 Bypass valve | a From oil pump |
| 9 Valve seat bypass valve | b To bearing points |
| 10 Compression spring | c Finely filtered oil for oil pan |
| 11 Thermostat | d Oil return flow bore toward oil pan |
| 12 Control valve | |
| 15 Compression spring | |
| 16 Return flow locking valve | |
| 17 Valve seat return flow locking valve | |
| 18 Return flow pipe | |
| 19 Check valve | |
| 20 O-ring | |

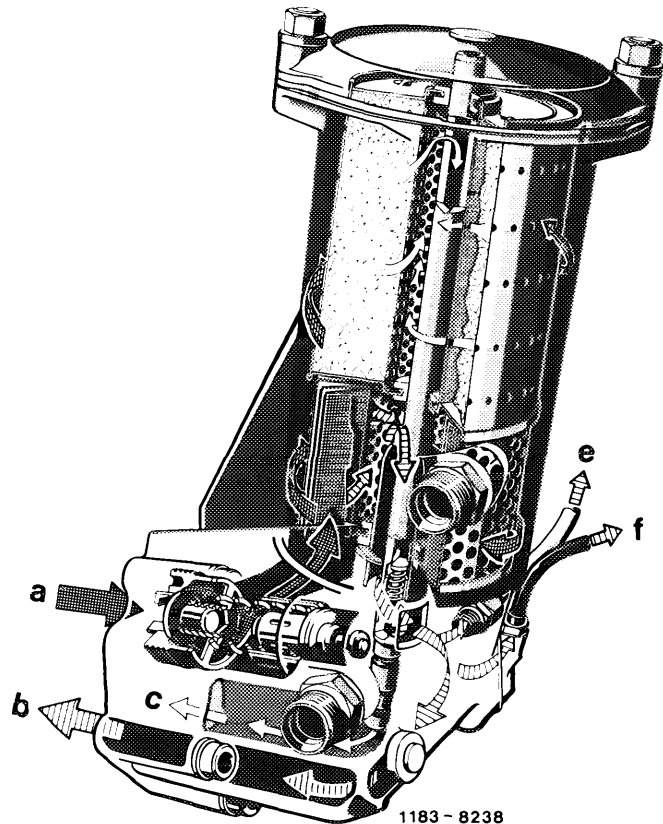


Coming from oil pump via feed duct (a), the oil enters the oil filter housing at return flow locking valve (16) and flows directly to combination filter element up to an oil temperature of approx. 110 °C.

After flowing through combination filter element the oil, which has been cleaned in main flow filter component (24a), flows via riser (22) and duct (b) to main oil duct and on to bearing points.

On the other hand, the oil, which has been finely filtered in bypass filter component (24) flows through return flow pipe (18) and duct (c) toward oil pan.

To make sure that main flow and bypass flow remain separated from each other, the combination filter element is provided with a rubber seal (25).



- | | |
|--------------------------------------|---|
| a From oil pump | e To exhaust gas turbocharger |
| b To bearing points | f To oil pressure gage (models 116 and 123) |
| c Finely filtered oil toward oil pan | |

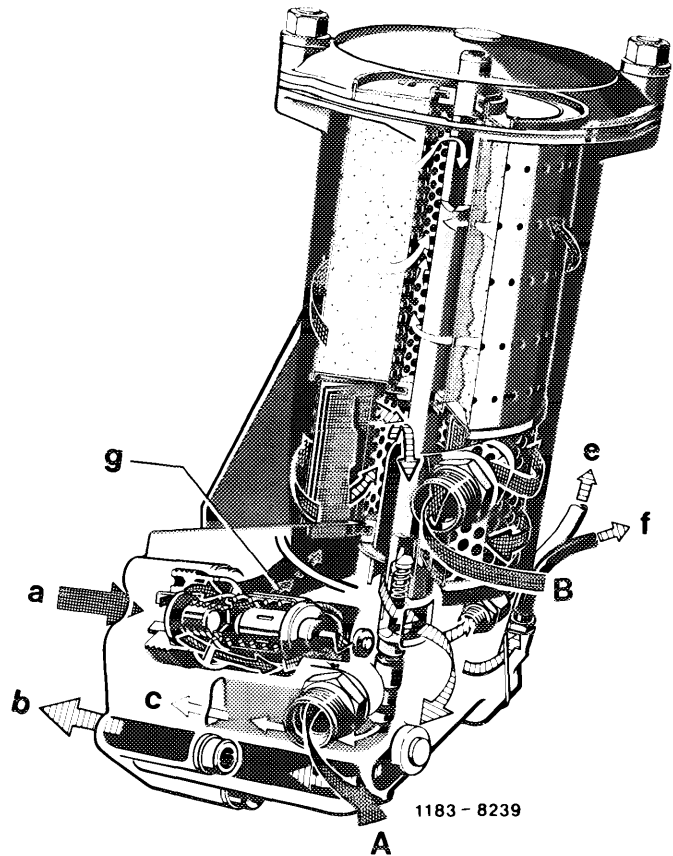
Starting at an oil temperature of approx. 110 °C the thermostat (11) starts to displace control valve (12), which arrives at its end position at approx. 125 °C. In end position, the direct flow toward combination filter element is locked except for a given quantity of oil (g). This quantity of oil is enough to guarantee lubrication of engine at low outside temperatures, when continuous flow in oil cooler is widely obstructed by viscous oil.

The larger oil quantity flows to air-oil cooler and is cooled there, it will then flow back to oil filter housing and flows through oil filter element from outside in inward direction.

The cleaned oil flows through riser (22) or return flow pipe (18) to bearing points or to oil pan.

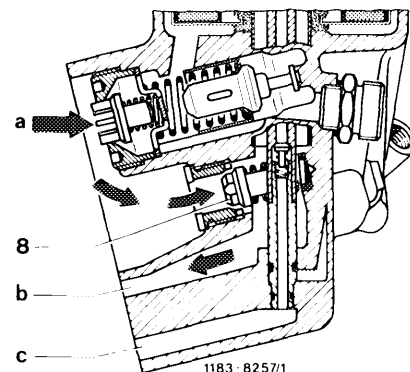
Attention!

On engine 617.950 (model 116) a 95 °C thermostat has been installed in oil filter up to engine end No. 019718. Here, thermostat control starts at approx. 95 °C and ends at approx. 110 °C.



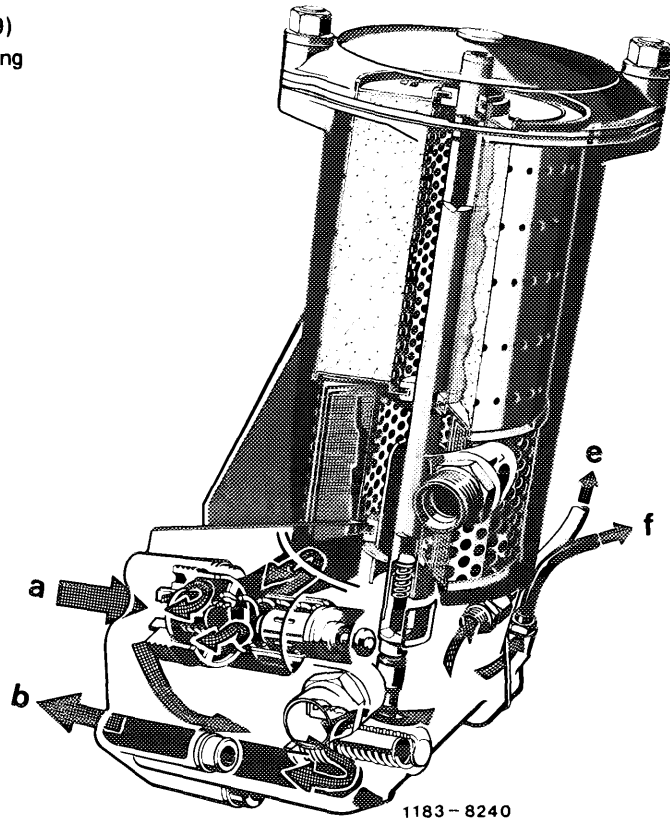
- A Uncleaned oil toward air-oil cooler
- B Uncleaned oil from air-oil cooler
- a From oil pump
- b To bearing points
- c Finely filtered oil toward oil pan
- e To exhaust gas turbocharger
- f To oil pressure gage (models 116 and 123)
- g Oil quantity directly to combination filter element

If the oil filter element is badly contaminated and the differential pressure between the contaminated side and the clean side of the filter exceeds 3.5 bar, bypass valve (8) will open. The oil will then flow uncleaned toward engine and exhaust gas turbocharger.



- 8 Bypass valve
- a From oil pump
- b To bearing points

Return flow locking valve (16) and check valve (19) in return flow pipe (18) prevent the oil from flowing out of oil filter back into oil pan with the engine stopped for an extended period.

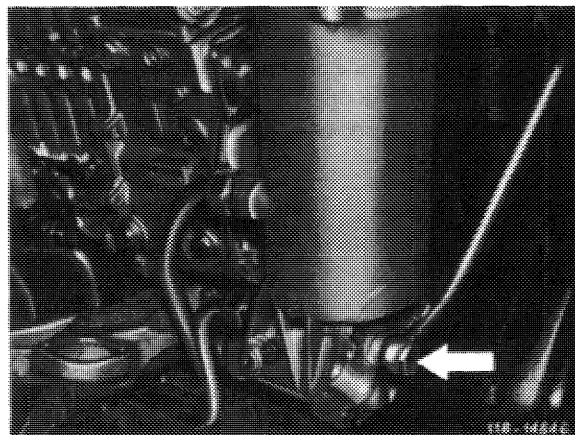


- a From oil pump
- b To bearing points
- e To exhaust gas turbocharger
- f To oil pressure gage (models 116 and 123)

When renewing oil filter element, unscrew cover (3) and pull up a bit.

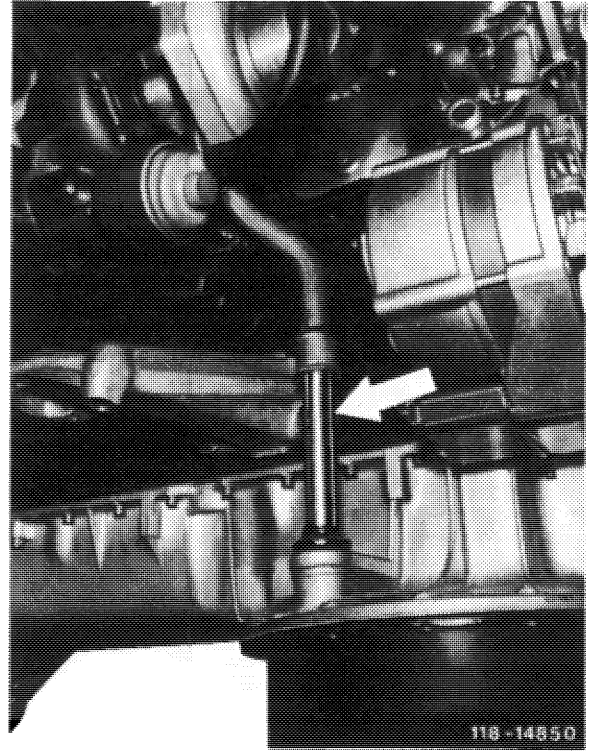
The return flow pipe (18) attached to cap will then expose a bore which connects ducts (a) and (b) to each other. The oil in oil filter will flow through duct (c) into oil pan.

The exhaust gas turbocharger is provided with the oil required for lubrication and cooling by way of a line (arrow) on rear oil filter cover.



Models 116 and 123
(engines 617.950/952)

The oil return flow from exhaust gas turbocharger to oil pan proceeds at outside of engine (arrow).



118-14650

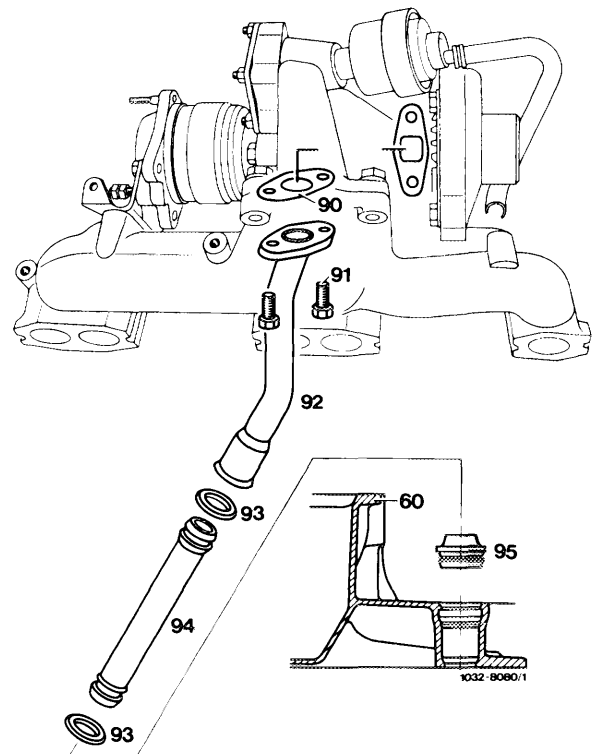
Note

The return flow line consists of two line sections.

The upper line section (92) is screwed to exhaust gas turbocharger.

This line section holds the lower line section (94) which is sealed by means of an O-ring (93), which in turn is sealed by an O-ring (93) in contoured sealing ring (95) and is inserted with the latter in oil pan upper half (60).

- 60 Oil pan upper half
- 90 Gasket
- 91 Hex. screws (2 each)
- 92 Upper line section
- 93 O-ring
- 94 Lower line section
- 95 Contoured sealing ring



Removal

- 1 Unscrew upper line section (92) from exhaust gas turbocharger.
- 2 Push upper line section down, pull outwards and remove.
- 3 Push lower line section (94) slightly down and force contoured sealing ring (95) out of oil pan.

4 Pull out lower line section (94) in upward direction together with contoured sealing ring (95).

5 Check contoured sealing ring (95) and O-ring (93) for damage and porosity and replace, if required.

Installation

6 Insert contoured sealing ring (95) into oil pan (60).

7 Slip lower line section (94) into contoured sealing ring (95).

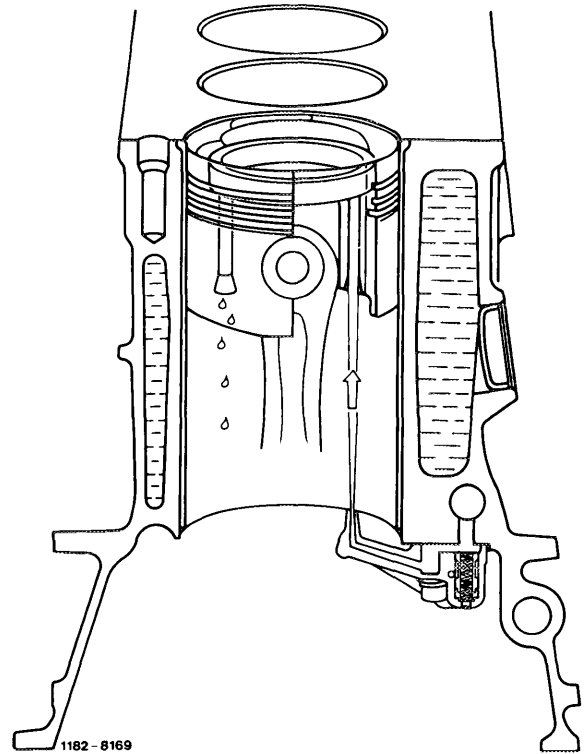
8 Insert upper line section (92) with a new gasket (90) and screw to exhaust gas turbocharger.

Note

Due to the higher thermic load, the pistons are cooled via a ring duct located in piston crowns.

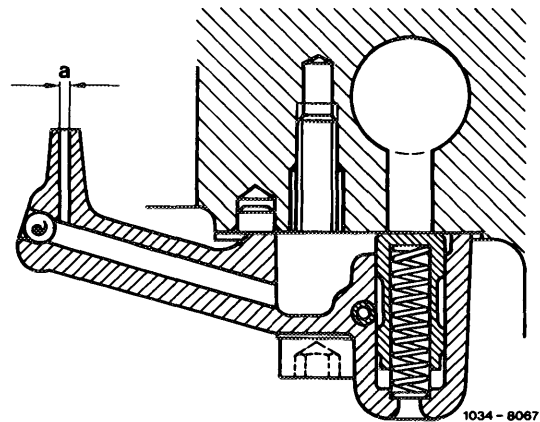
The required oil for the pistons is provided by oil spray nozzles located underneath cylinder bores at the left (driving direction).

The oil spray nozzles in turn are connected to engine oil circuit via the main oil duct in cylinder crankcase.



Starting at an engine oil pressure of 1.0–1.5 bar gage pressure, the valve located in oil spray nozzle opens.

An oil jet will come out of nozzle bore (a), aimed accurately into feed bore in piston.



a = 1.5 mm dia.

The ring duct (7 mm dia.) distributes the oil in piston crown, absorbs heat and flows back to oil pan through return flow bore.

Valve in oil spray nozzle closes at 1 bar gage pressure at the latest.

Since piston cooling is of considerable importance for life of engine, proper functioning of oil spray nozzles is extremely important.

It is also very important that in each piston position the oil jet sprays accurately into feed bore on piston.

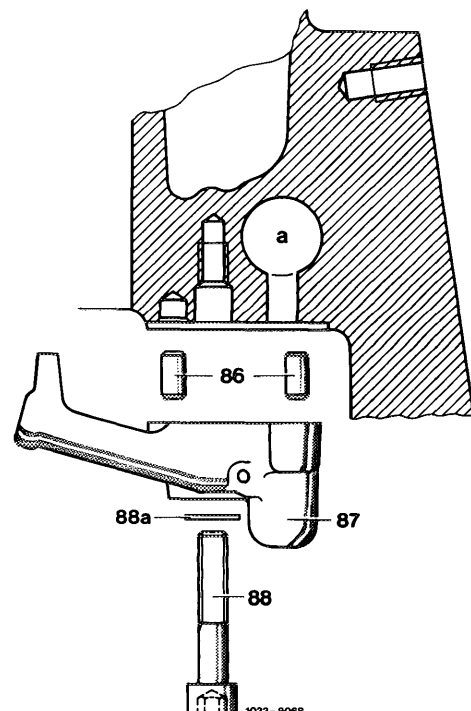
To prevent plugging of nozzle bore (a) by particles of dirt, make sure that during assembly jobs no dirt will settle at clean oil end of oil circuit.

Remove oil spray nozzles for cleaning cylinder crankcase. **Do not mix up oil spray nozzles.**

Removal

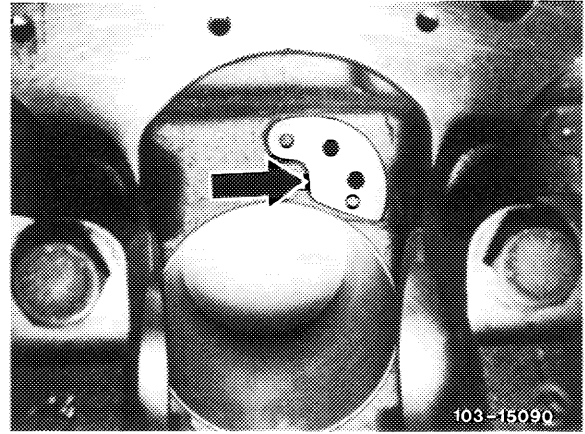
- 1 Completely remove oil pan (01–310).
- 2 Position crankshaft in such a manner that the respective oil spray nozzle is accessible.
- 3 Unscrew screw (88).
- 4 Pull out oil spray nozzle.

When pulling out oil spray nozzle, **do not cant nozzle and do not hold nozzle at nozzle neck.**



- 86 Cylindrical pin
- 87 Oil spray nozzle
- 88 Hex. socket screw
- 88a Washer
- a Main oil duct

5 Cover or close oil feed bores in cylinder crankcase.



Installation

Attention!

The installation of oil spray nozzles with heavily out-of-round nozzle bore or with burr at nozzle outlet is no longer permitted.

6 Blow out oil spray nozzle with compressed air, with direction of air flow corresponding to direction of oil flow.

Do not position compressed air hose at nozzle bore.

Also do not use hard objects for cleaning nozzle bore.

7 Remove covers on oil feed bores in cylinder crankcase.

8 Position oil spray nozzle vertically to parting surface on cylinder crankcase and press on.

9 Screw-in screw (88) and tighten to 10 Nm.

10 Install oil pan (01-310).

18–110 Removal and installation of oil filter

Tightening torques

Nm

Nuts for oil filter cover (cap)

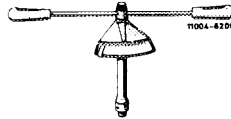
20–25

Screws for oil filter on cylinder crankcase

20–25

Special tool

Torque wrench 3/8" square head,
8–32 Nm

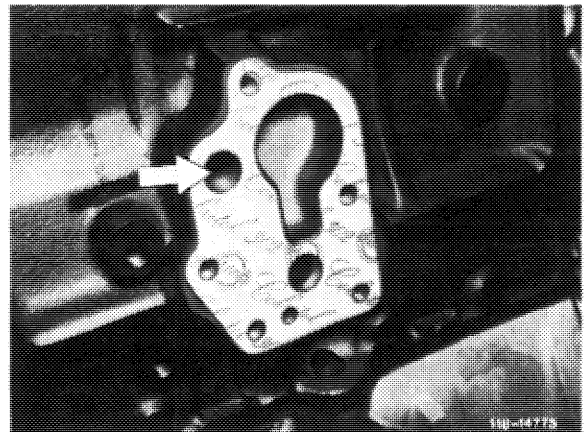


001 589 51 21 00

Note

When removing oil filter, residue from gasket may remain stuck to flange surface of cylinder crankcase.

To prevent such residue from entering the clean oil duct (arrow) of cylinder crankcase during removal (e.g. by scraping), make sure to cover or close bores first.

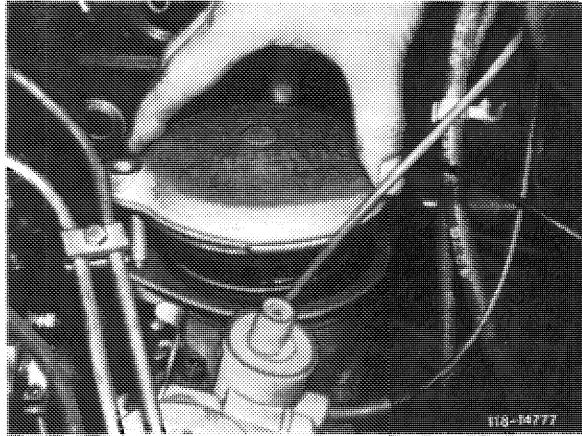


Residue from gasket dropping into clean oil duct may be flushed by the oil to the oil spray nozzles and plug the bore (1.5 mm dia.) there.

A plugged oil spray nozzle will definitely result in engine damage (seized pistons).

Removal

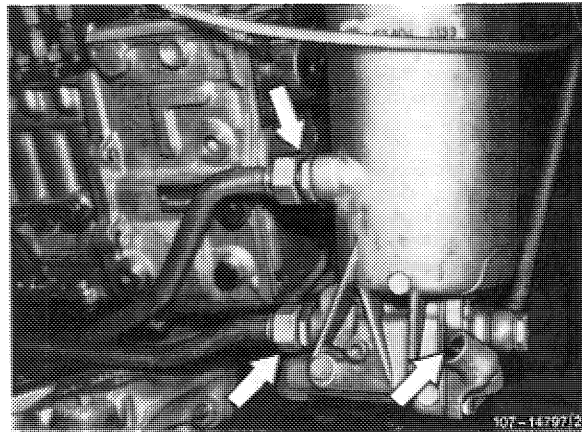
1 Unscrew oil filter cover (cap) and pull up for a short distance so that the oil flows back to oil pan.



2 Unscrew oil cooler lines (arrows).

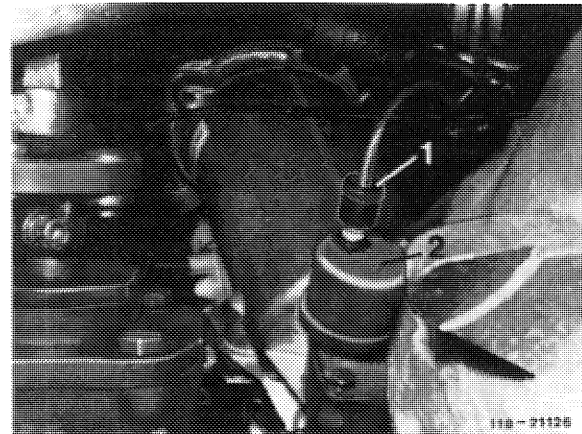
3 Unscrew line toward oil pressure gage on oil filter of models 116 and 123 (arrow).

Models 116 and 123
(engines 617.950/952)



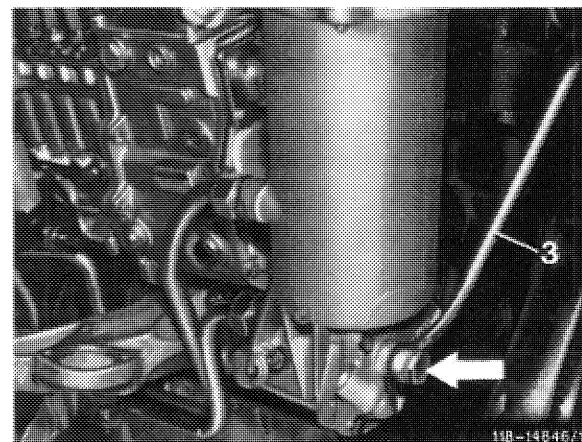
On model 126 pull off single plug connection (1) of electric line toward oil pressure gage on oil pressure transmitter (2).

Model 126 (engine 617.951)

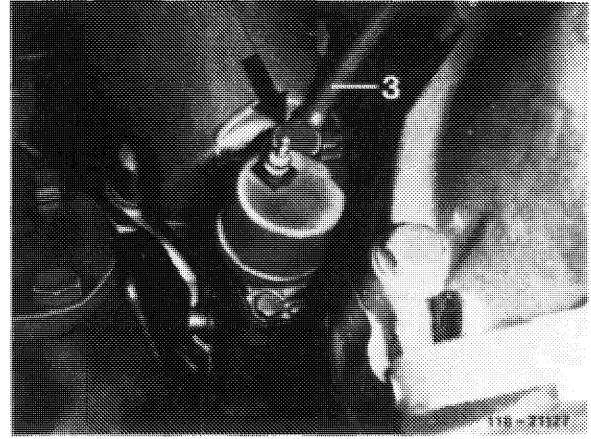


4 Unscrew oil feed line (3) toward exhaust gas turbocharger on oil filter (arrow).

Models 116 and 123
(engines 617.950/952)



Model 126 (engine 617.951)



5 Unscrew oil filter (5 hex. socket screws) and remove.

6 Thoroughly clean sealing surfaces on oil filter and cylinder crankcase.

For this purpose, close bores on cylinder crankcase.

Installation

7 Position oil filter with new gasket and screw down.

8 Screw on oil cooler lines.

9 Connect lines toward oil pressure gage on oil filter or on oil pressure transmitter.

10 Screw on oil feed line for exhaust gas turbo-charger on oil filter.

11 Mount oil filter cover (cap) and screw down.

12 Run engine at idle and check for leaks.

Special tool

Telethermometer for measuring engine oil temperature



116 589 27 21 00

Note

To obtain a favorable operating temperature of engine oil at a faster rate, a thermostat with an opening temperature of 110 °C (formerly 95 °C), part No. 117 180 00 75 has been installed in oil filter since December 1979.

The thermostat 110 °C can also be installed in engines manufactured at an earlier date as a spare part.

Start of series

| Model | Engine | Engine end No. |
|---------|---------|----------------|
| 116.120 | 617.950 | 019719 |

Checking

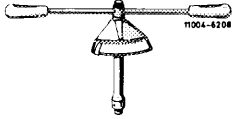

- 1 Exchange oil dipstick for flexible heat sensor.
- 2 Run engine at increased speed and watch telethermometer.
- 3 At an oil temperature of 110 ± 4 °C or 95 ± 4 °C, depending on thermostat installed, a distinctive increase of oil temperature on oil cooler should be noticeable (manually).

If not, replace thermostat (18–125).

18–125 Removal and installation of thermostat in oil filter

| Tightening torques | Nm |
|---|-------|
| Nuts for oil filter cover | 20–25 |
| Screws for oil filter on cylinder crankcase | 20–25 |
| Valve seat ring in oil filter housing | 35–45 |

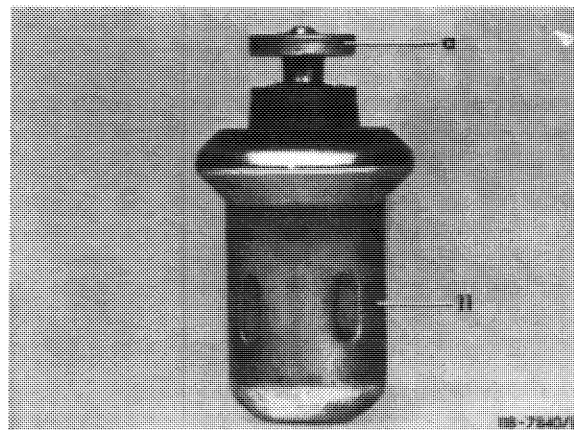
Special tools

| | | |
|--|--|------------------|
| Torque wrench 3/8" square, 8–32 Nm |  | 001 589 51 21 00 |
| Socket 1/2" square for valve seat ring |  | 617 589 00 07 00 |

Note

Remove functioning thermostat only at temperatures below 60 °C, since otherwise the thrust pin (a) will be pushed out.

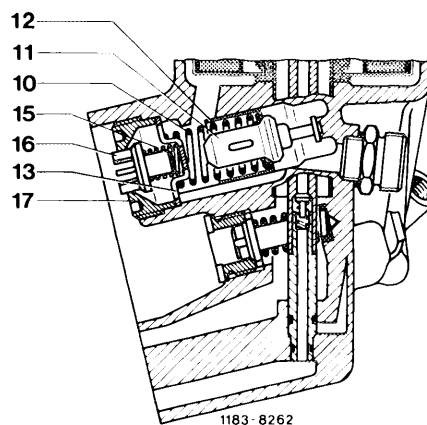
Never pull thrust pin (a) out of wax thermostat (11), since otherwise proper function cannot be guaranteed.

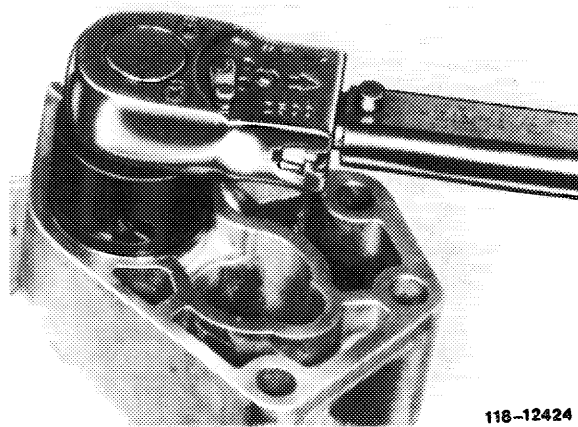


Removal

- 1 Remove oil filter (18–110).
- 2 Unscrew valve seat ring (17) by means of socket.

- | | |
|-----------------------|--|
| 10 Compression spring | 15 Compression spring |
| 11 Thermostat | 16 Return flow locking valve |
| 12 Control valve | 17 Valve seat ring return flow locking valve |
| 13 Spring retainer | |





3 Remove return flow locking valve (16) with compression spring (15), spring retainer (13), compression spring (10) and thermostat (11) with control valve (12).

Installation

5 Insert thermostat (11) with control valve (12), compression spring (10), spring retainer (13) and return flow locking valve (16) with compression spring (15).

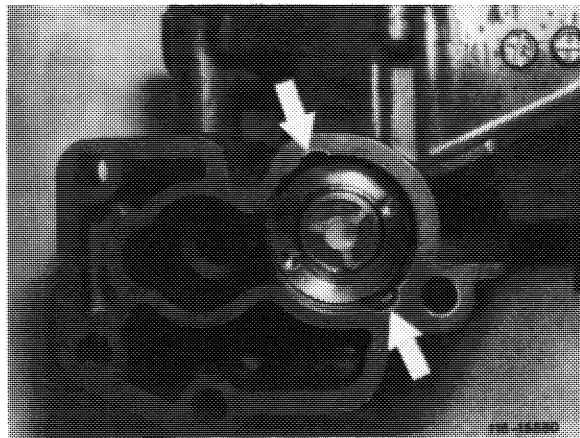
6 Tighten valve seat ring (17) by means of socket to 35–45 Nm.

7 Peen valve seat ring in both recesses on oil filter housing (arrows) by means of a cross chisel.

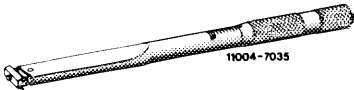



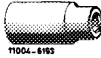

8 Install oil filter with new gasket (18–110).

9 Run engine at idle and check for leaks.

10 Correct oil level.



18–210 Removal and installation of oil pump

| Tightening torques | | Nm |
|---|--|------------------|
| Oil drain plug to oil pan | | 35–45 |
| Oil pan upper half to cylinder crankcase | M 6 | 9–11 |
| | M 8 | 20–25 |
| Oil pan lower half to upper half | | 9–11 |
| Engine carrier to engine mount front | | 70 |
| Oil pump | to crankcase | 20–25 |
| | to flange member | 9–11 |
| Sprocket on oil pump | | 30–35 |
| Special tools | | |
| Torque wrench handle 20–100 Nm |  | 001 589 35 21 00 |
| Torque wrench handle 50–200 Nm | | 001 589 44 21 00 |
| Changeover ratchet for torque wrench |  | 001 589 42 09 00 |
| Allen wrench 5 mm, 300 mm long |  | 116 589 02 07 00 |
| Knock-out mandrel 9 mm dia. |  | 110 589 02 15 00 |
| Socket 27 mm, 1/2" square for rotating engine |  | 001 589 65 09 00 |
| Knock-in tool for oil dipstick guide tube |  | 117 589 00 31 00 |
| Conventional tool | | |
| Engine hoist (Motordirigent) size 1.5 | e.g. made by Bäcker, D–5630 Remscheid Order No. 3178 | |

Note

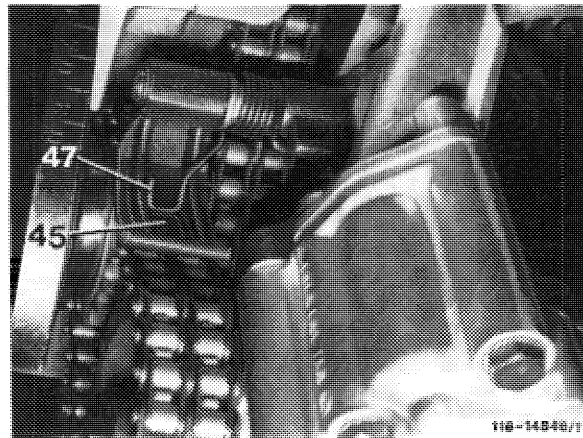
Since a connecting link might wipe against timing chain or oil pan, do not open double roller chain during repairs and connect again by means of a connecting link.

To renew double roller chain and tensioning unit, completely remove oil pan (01-310) and front cylinder housing cover (01-107).

Removal

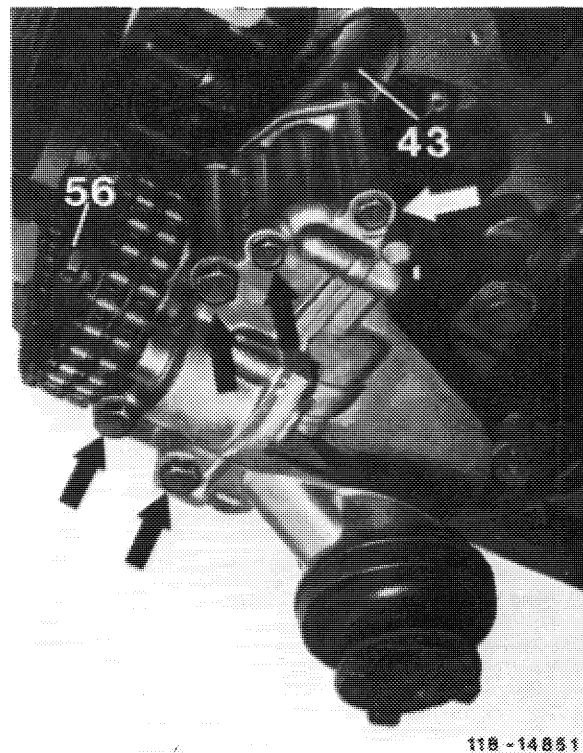
- 1 Completely remove oil pan (01-310).
- 2 Unscrew fastening screw (56) of sprocket.
- 3 Remove torsion spring (47) from clamp (45) in rearward direction.
- 4 Turn clamp in upward direction.

45 Clamp
47 Torsion spring



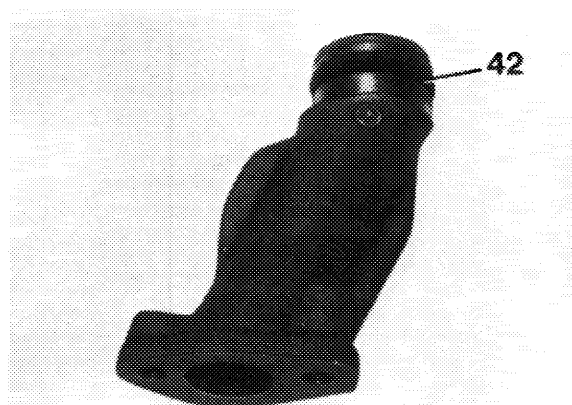
- 5 Remove sprocket by means of two screwdrivers.
- 6 Unscrew hex. screws (arrows) on oil pump and remove oil pump.
- 7 Remove sprocket.
- 8 Pull flange member (43) out of cylinder crankcase.

43 Flange member
56 Fastening screw



Installation

- 9 Renew O-ring (42) on flange member, if damaged.
- 10 Insert flange member.
- 11 Place sprocket into double roller chain.
- 12 Install oil pump and tighten fastening screws to 20–25 Nm on crankcase or 9–11 Nm on flange member.

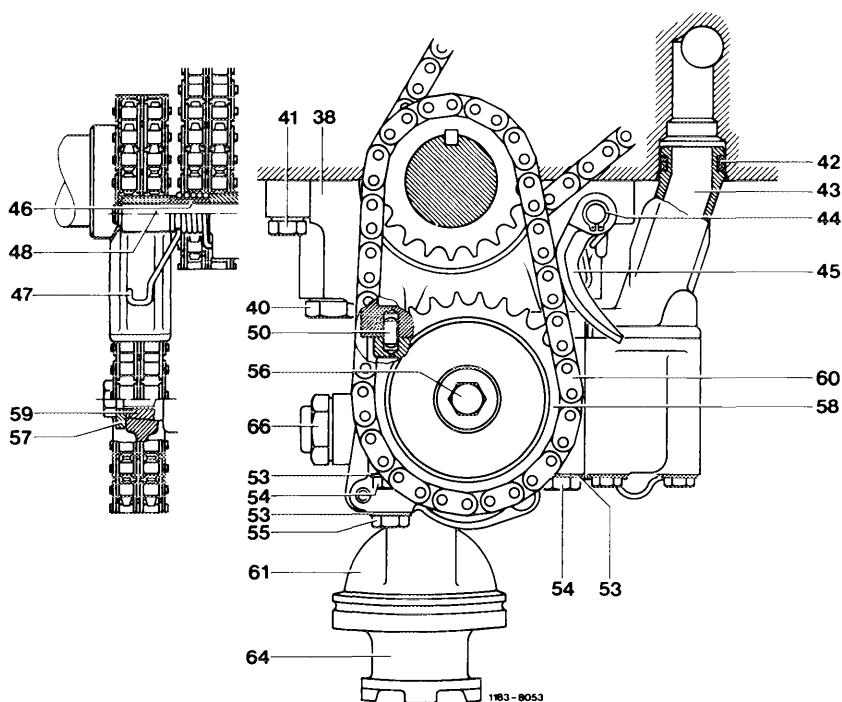


42 O-ring

118-14776

- 13 Place sprocket on drive shaft and tighten fastening screw (56) to 30–35 Nm.
- 14 Set clamp on double roller chain and place torsion spring on clamp.
- 15 Completely install oil pan (01–310).

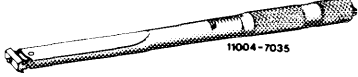

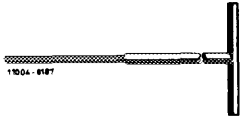
Layout of oil pump



- | | | |
|-----------------------------|-------------------|---|
| 38 Crankshaft bearing cover | 47 Torsion spring | 58 Drive sprocket |
| 40 Hex. screw | 48 Bolt | 59 Drive shaft |
| 41 Hex. screw | 50 Fitted pin | 60 Double roller chain |
| 42 O-ring | 53 Spring washer | 61 Strainer |
| 43 Flange member | 54 Hex. screw | 64 Adapter |
| 44 Locking ring | 55 Hex. screw | 66 Closing plug oil pressure relief valve |
| 45 Clamp | 56 Hex. screw | |
| 46 Bushing | 57 Washer | |

| Tightening torques | Nm |
|--|-------|
| Oil drain plug to oil pan | 35–45 |
| Oil pan lower half to upper half | 9–11 |
| Closing plug for oil pressure relief valve | 35–45 |

Special tools

| | | |
|--------------------------------------|--|------------------|
| Torque wrench handle 20–100 Nm |  | 001 589 35 21 00 |
| Changeover ratchet for torque wrench |  | 001 589 42 09 00 |
| Allen wrench 5 mm, 300 mm long |  | 116 589 02 07 00 |

Removal

- 1 Remove oil pan lower half.
- 2 Unscrew closing plug (66).

Attention!

Closing plug is under pressure of compression spring (67).

- 3 Remove compression spring (67), pin (68) and piston (69).

Installation

- 4 Install piston (69), pin (68) and compression spring (67).
- 5 Screw in closing plug (66) with new sealing ring and tighten to 35–45 Nm.
- 6 Install oil pan lower half with new gasket and tighten screws to 9–11 Nm.

66 Closing plug 68 Pin
67 Compression spring 69 Piston

