

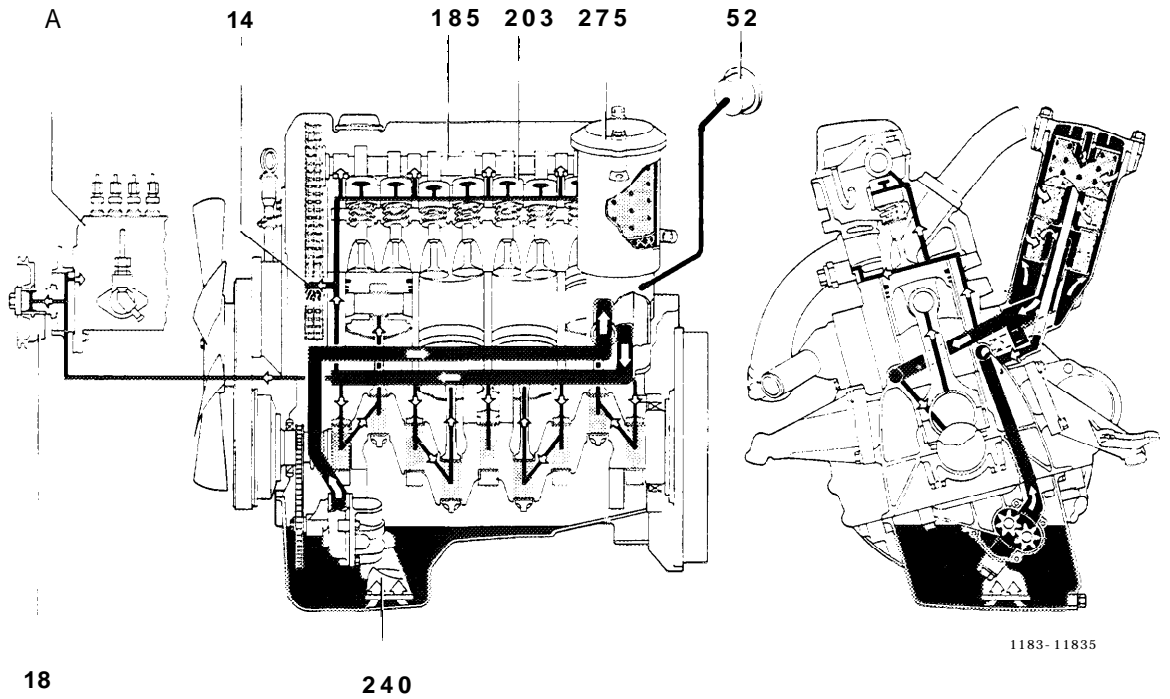


# 18 Engine lubrication

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	Job No.
<b>Oil circuit, oil consumption</b>	
Oil circuit, oil pressure, pressure relief and bypass valve, oil filter . . . . .	18-005
<b>Oil filter</b>	
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Oil circuit



Oil circuit diagram

- |                            |                  |                  |
|----------------------------|------------------|------------------|
| 14 Oil spray nozzle        | 203 Valve tappet | A Injection pump |
| 18 Injection (spray) timer | 240 Oil pump     |                  |
| 52 Oil pressure gauge      | 275 Oil filter   |                  |
| 185 Camshaft               |                  |                  |

**Oil pressure**

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At operating pressure, the oil pressure at **idle** may drop to 0.3 bar gauge pressure.

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

Opening pressures of valves	bar gauge pressure
Bypass valve filter element (differential pressure)	2
Return flow non-return valve	0.2
Oil pressure relief valve in oil pump	4.7-5.3

**Oil pressure relief valve**

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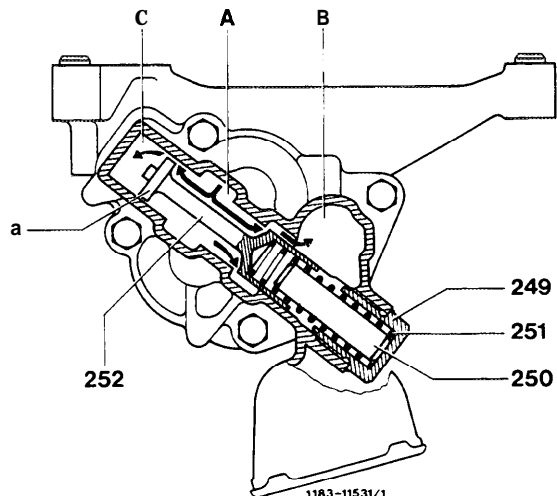
The oil pressure relief valve is integrated in oil pump.

The oil is drawn from lowest spot in oil pan via strainer to suction chamber (B). From here, the oil flows through gearwheels to pressure chamber (A) into main oil duct toward filter.

Pressure and suction chamber are connected to each other by means of pressure relief valve.

Starting from an oil gauge pressure of 4.7-5.3 bar the piston (252) is displaced against force of compression spring (251) and clears the de-activation (shutoff) hole (arrows) to suction chamber (B).

Simultaneously, oil flows across two flats on collar (a) into damping chamber (C). This oil opposes the piston movements set up by the pulsating oil pressure and will thereby dampen the piston.



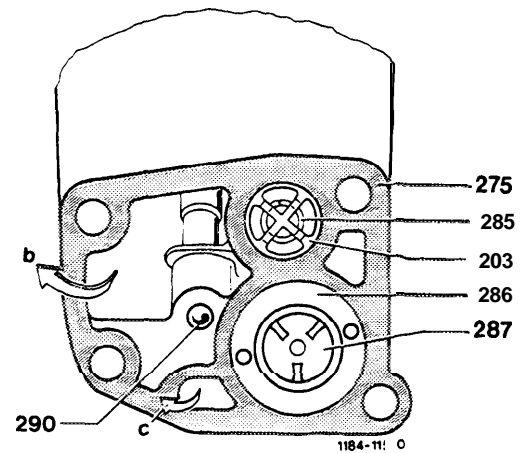
- 249 Closing plug
- 250 Guide bolt
- 251 Compression spring
- 252 Oil pressure relief valve
- A Pressure chamber
- B Suction chamber
- C Damping chamber
- a Collar

## Bypass valve in oil filter

The bypass valve (285) opens when the differential pressure between contaminated and clean side of filter exceeds 2 bar.

This will happen when the filter element is heavily contaminated. The oil will then flow in uncleaned condition to engine.

- 275 Oil filter housing
- 283 Spring retainer
- 285 Valve cone bypass valve
- 286 Valve seat return flow no-return valve
- 287 Valve cone return flow no-return valve
- 290 Ball 8 mm dia.
- b To bearing points
- c Finely filtered oil toward oil pan



## Oil filter

The main flow and the bypass flow filter element are combined in a cartridge.

During inspection (1000-1 500 km) the initial operation oil filter element (A) must be replaced by combination oil filter element (B).

The combination oil filter element should then be cleaned every 10 000 km.

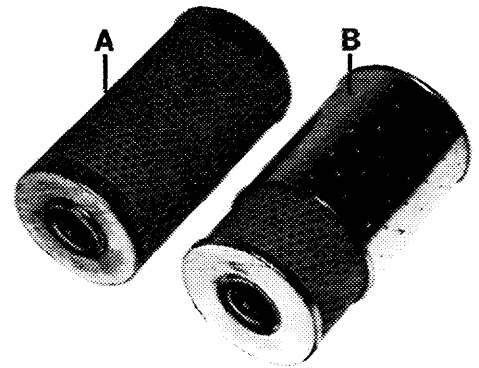
### Attention!

Do not mix up the oil filter element and the O-ring of oil filter cap of engine 601 with those of engines 615,616 and 617.

The oil filter cap is fastened by means of two nuts.

The return flow pipe (276) is pressed into cap and has a check valve (277).

Unscrew cap (273) when changing oil filter elements and pull up a bit. As a result, the return pipe (276) fastened to cap clears a bore which connects ducts (b) and (c) with each other. The oil in oil filter will flow through duct (c) into oil pan.



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## Operation

The oil filter comprises the following main components:

- a) Oil filter housing with bypass and return flow no-return valve.
- b) Cap with return flow pipe, check valve and O-rings.
- c) Combination oil filter element.

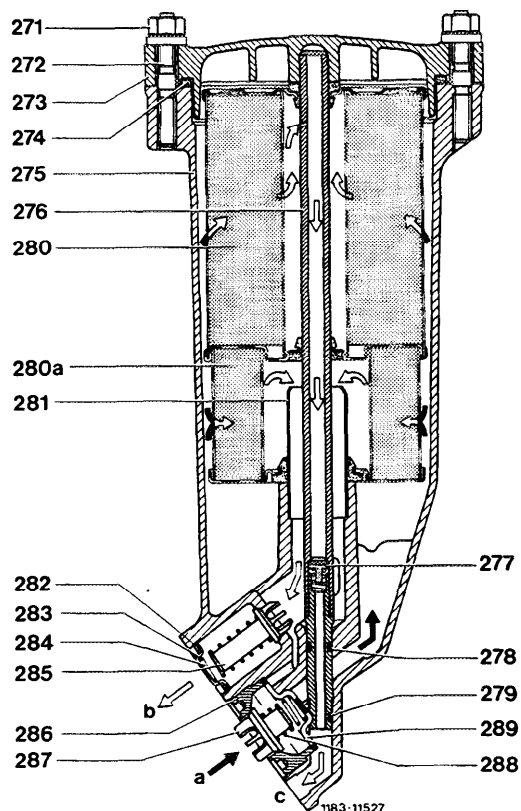
Coming from supply duct (a) the oil flows in through return flow no-return valve (286 and 287) in oil filter housing and from there directly to combination filter element.

After flowing through combination filter element the oil cleaned in main flow filter element (280a) flows through riser (281) and duct (b) to main oil duct and on to bearing points.

On the other hand, the oil finely filtered in bypass filter element (280) flows through return flow pipe (276) and duct (c) to oil pan.

To keep main flow and bypass flow separate, the combination filter element is provided with a rubber seal.

- 271 Nut M 8
- 272 Stud M 8
- 273 Cap
- 274 O-ring
- 275 Housing
- 276 Return flow pipe
- 277 Check valve
- 278 O-ring
- 279 O-ring
- 280 Oil filter element
- 280a Main flow filter section
- 281 Riser
- 282 Locking ring
- 283 Spring retainer
- 284 Spring
- 285 Valve cone bypass valve
- 286 Valve seat return flow no-return valve
- 287 Valve cone return flow no-return valve
- 288 Compression spring
- 289 Spring retainer
- a To oil filter
- b To bearing points
- c To oil pan



### **Complaints about oil filter**

**If following a filter element change an oil pressure below 0.3 bar gauge pressure shows up at idle, observe the following:**

**Forcible pushing-in of return flow pipe (276) during oil filter change may, under certain circumstances, force the sealing ring of oil filter element out of its holder into a position in front of riser (281). The oil supply proceeds then through bypass valve (285), which will lead to an oil pressure drop.**

**To prevent knocking out of sealing ring, introduce return flow pipe (276) into oil filter without using force.**

## 18-110 Removal and installation of oil filter

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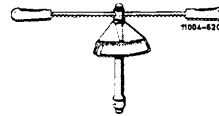
Tightening torques	Nm
Nuts for oil filter cap	20-25
Screws for oil filter to cylinder crankcase	25

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### Special tools

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Torque wrench, double arm,  
3/8" square, 8-32 Nm



001 589 51 21 00

Box-end wrench element, open,  
12 mm, 3/8" square



61758901 0300

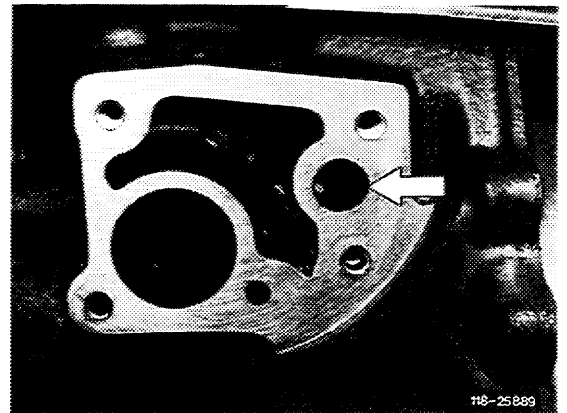
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### Note

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When removing oil filter it is quite possible that remains of gasket will stick to flange surface of cylinder crankcase.

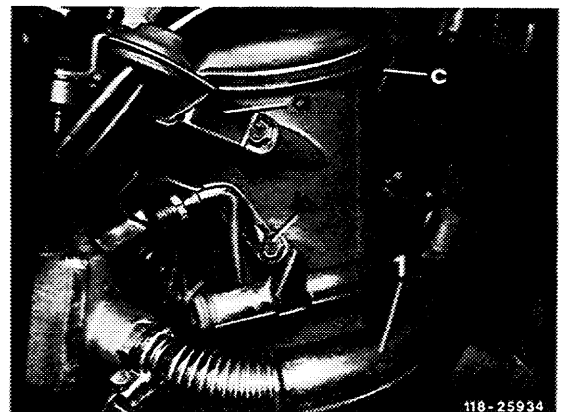
To make sure that during their removal (e. g. by scraping) no such remains of gasket will enter the clean-oil duct (arrow) of cylinder crankcase, be sure to cover or close bore beforehand.



### Removal

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- 1 Completely remove air cleaner (09-400).
- 2 Unscrew holder (a) for starter cable, (b) for return flow line of heating system and (c) clamp for vacuum lines.
- 3 On vehicles with EGR, remove EGR line (1).





4 Unscrew oil filter cap and pull up a bit, so that the oil flows back toward oil pan.

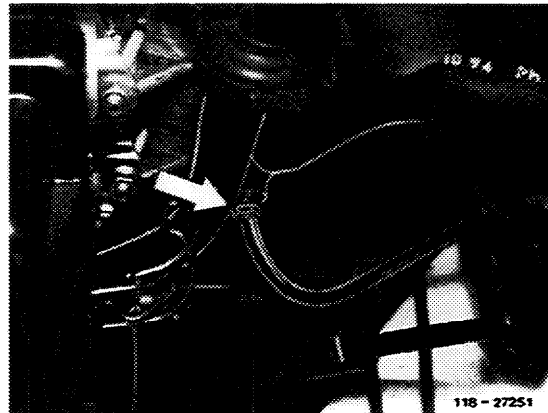


5 Unscrew line for oil pressure gauge (arrow).

6 Unscrew filter and remove.

7 Clean sealing surfaces on oil filter and cylinder crankcase.

For this purpose, close bores on cylinder crankcase.



Line for oil pressure gauge engine 601.91 1

## Installation

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8 Position oil filter with new gasket and screw down.

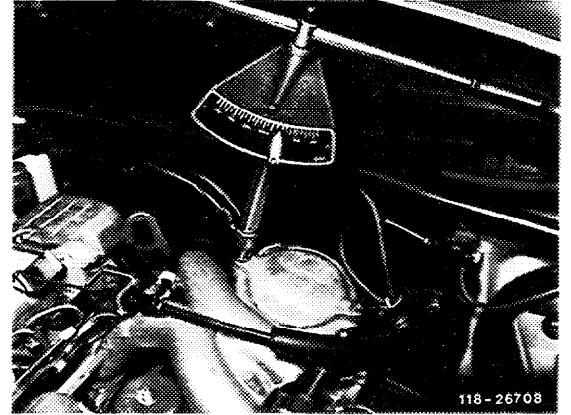
9 Connect line for oil pressure gauge to oil filter.

10 If required, insert new oil filter element.



Line for oil pressure gauge engine 601.921

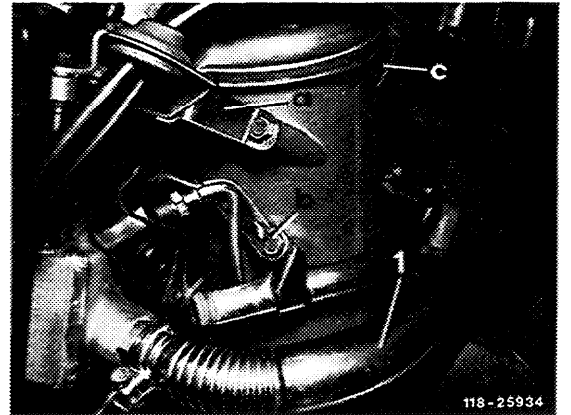
11 Mount oil filter cap and tighten nuts to 20-25 Nm.



12 On vehicles with EG R, install EGR line (1).

13 Mount holder (a) for starting line, (b) for return flow line of heating system and (c) clamp for vacuum lines.

14 Run engine at idle and check for leaks.

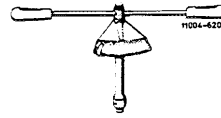


## 18-210 Removal and installation of oil pump

Tightening torques		Nm
Oil drain plug on oil pan		30
Nuts for oil filter cap		20-25
Screws for oil pan on cylinder crankcase	M 6	10
	M 8	25
Screw for drive sprocket on oil pump		25
Screws for oil pump on cylinder crankcase		25

### Special tool

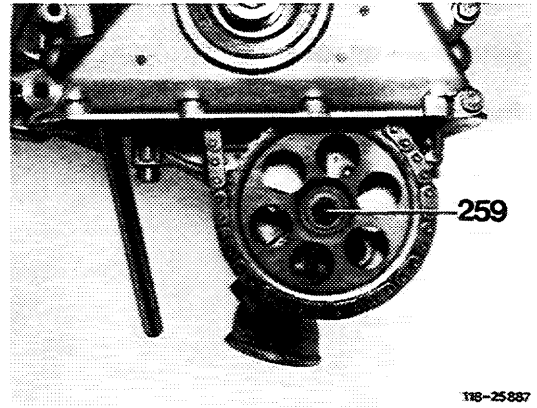
Torque wrench, double arm,  
3/8'' square, 8-32 Nm



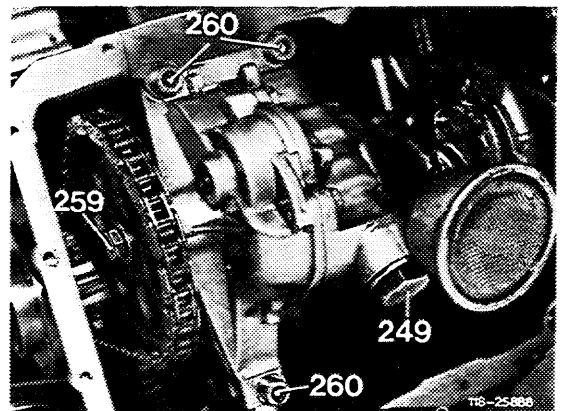
001 589 51 21 00

### Removal

- 1 Remove engine (01-030).
- 2 Remove oil pan (01-310).
- 3 Unscrew screw (259) on sprocket and remove sprocket from drive shaft.



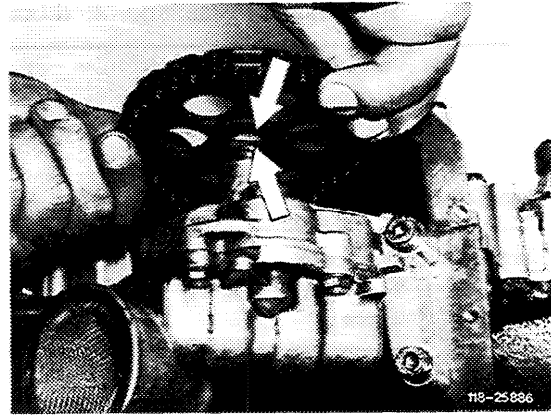
- 4 Unscrew screws (260) and remove oil pump.



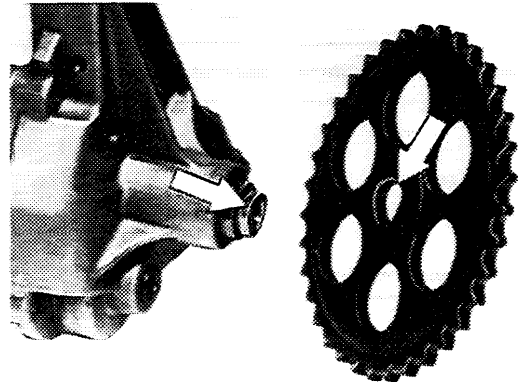
## Installation

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- 5 Install oil pump and tighten hex. socket screws to 25 Nm.
- 6 Engage sprocket in chain and set on drive shaft.



**Note:** Mount sprocket in such a manner that crown is facing oil pump and that the trochoid shape corresponds with that on oil pump shaft (arrows).



- 7 Install oil pan (01-340).
- 8 Install engine (01-030).
- 9 Run engine, check for leaks.

## 18-215 Removal and installation of oil pressure relief valve

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Tightening torques	Nm
Closing plug for oil pressure relief valve	50 ± 5

Opening pressure	bar gauge pressure
Oil pressure relief valve in oil pump	4.7-5.3

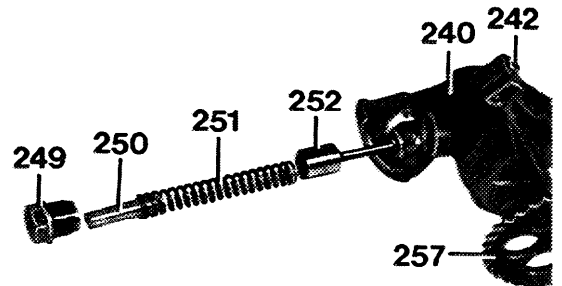
### Removal

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- 1 Remove engine (01-030).
- 2 Remove oil pan (01-310).
- 3 Unscrew closing plug (249) and remove compression spring (251) with guide pin (250) and piston (252).

**Note.** Closing plug is under pressure.

- 240 Oil pump
- 242 Dowel sleeve
- 249 Closing plug
- 250 Guide pin
- 251 Compression spring
- 252 Piston
- 257 Sprocket



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### Installation

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- 4 For installation proceed vice versa.
- 5 Run engine and check for leaks.