

# **Workshop manual**

**DD 575**

**DF 615**

**DT 615**

**DAF Diesel**

Service Promotion

Subject to modification

## INTRODUCTION

This Repairs and Workshop Manual, which accompanies the DAF diesel engines of the 575 and 615 series, is intended for the workshops of our Service organisation. Likewise, these books are available for users who have the required special tools and skillful staff.

Our policy being one of continuous improvement and progress, it may happen that modifications to the engine have not been included in this manual.

However, new issues covering all modifications and including all supplements, will be published at regular intervals.

Should you have any questions regarding the engine or regarding the manual, please contact your DAF-Diesel dealer, who has the latest information available.

Finally, we shall be pleased to receive your remarks and comments upon this manual so as to enable us to continuously improve the quality of future issues. For this purpose you may use the enclosed service documentation information card (see section 0-05, page 1).

Please send this card, fully and clearly filled out, to your importer's address as mentioned on the enclosed list.

Many thanks!

DAF-DIESEL  
Service Promotion

February 1979.

**All information applies both to the DD575 and to the DF and DT615 engines unless otherwise stated.  
The specifications refer to brand-new parts.**

**SUBDIVISION**

GENERAL

**0**

ENGINES

**2**

COMPRESSOR

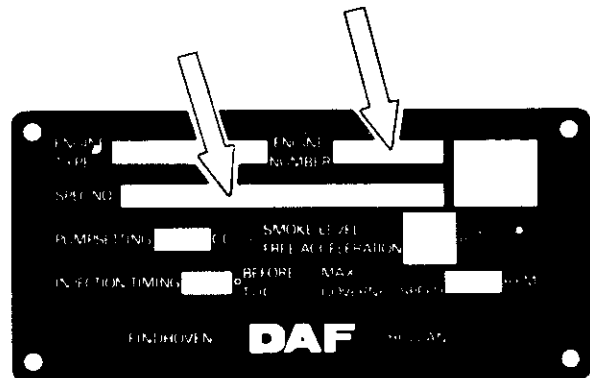
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### CONTENTS

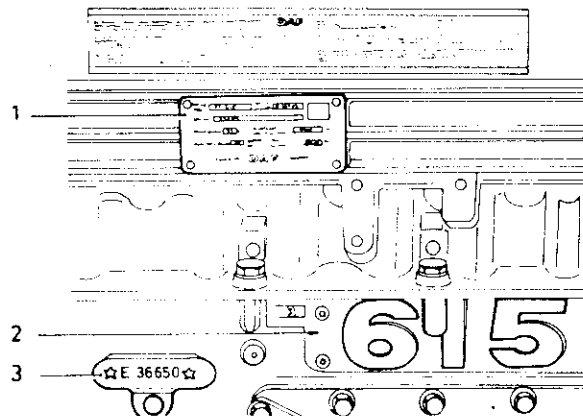
Subgroup	Subject	Page(s)
03	Ordering parts	1
05	Information card - service documentation	1 – 3

## ORDERING PARTS

When ordering parts make sure to mention not only the engine number but also and especially the specification numbers as mentioned on the identity plate on the valve cover.  
If these data are missing, it is impossible to guarantee a correct supply.



identity plate



1. identity plate
2. engine block type indication
3. location of engine number in the engine block

### CONTENTS

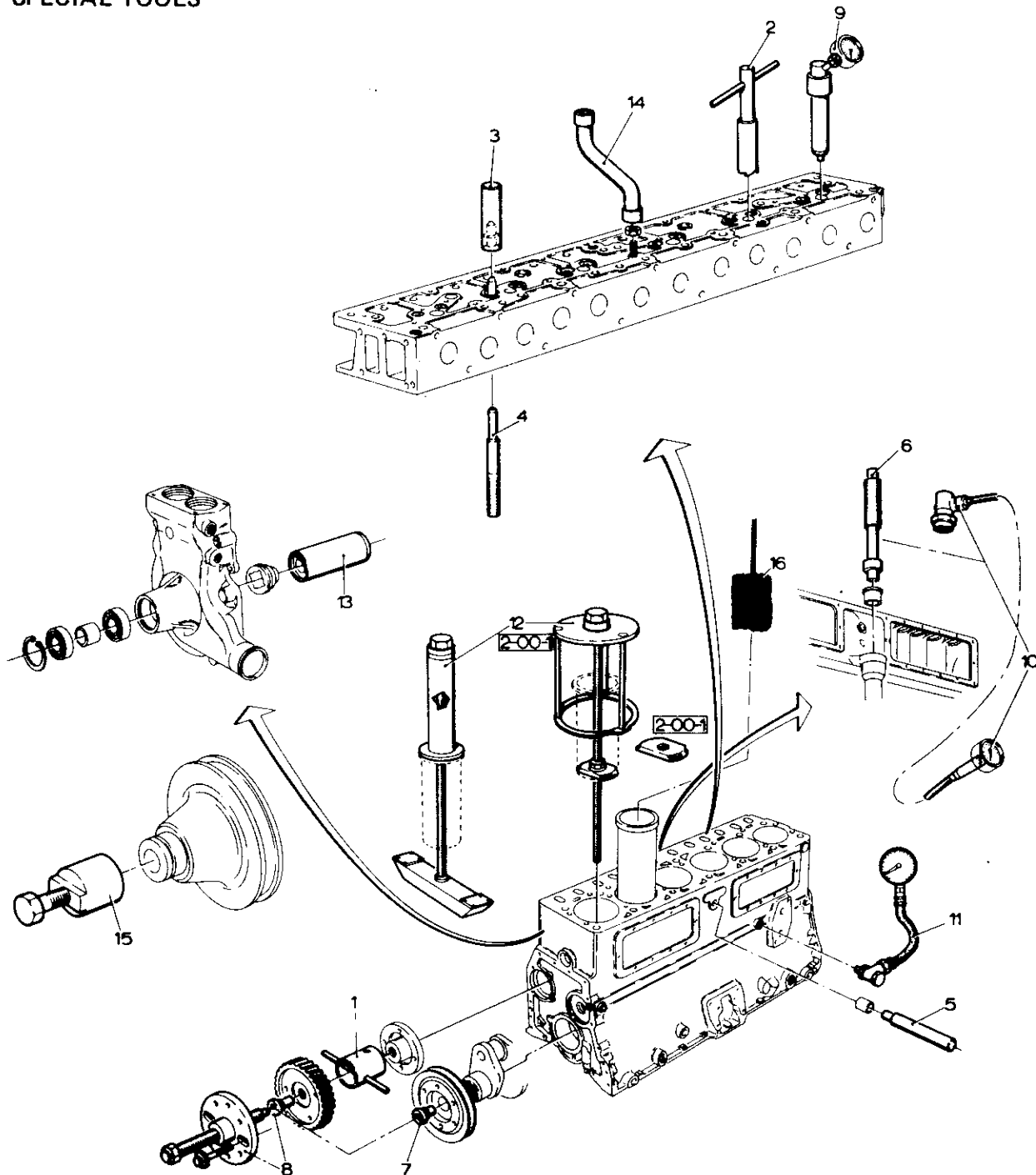
Subgroup	Subject	Page(s)
00	General:	
	Specifications	1
	Special tools	2-3
	Checks and adjustments	4
	Exhaust smoke measuring	5-7
10	Cylinder head	1-5
20	Valve gear	1-4
30	Vibration damper and pulleys	1-2
31	Engine block	1-6
32	Crankshaft, conrods and pistons	1-6
34	Flywheel and ring gear	1-3
35	Timing	1-4
36	Flywheel housing	1-2
38	Engine suspension	1-2
41	Lubrication system	1-8
51	Cooling system	1-16
61	Manifolds	1-4
63	Turbocharger	1-6

## GENERAL

### SPECIFICATIONS

Make	DAF
Type	Water-cooled diesel engine with direct injection DT615: equipped with a turbocharger
Number of cylinders	6
Bore	DD575: 100.6 mm, DF615 and DT615: 104.2 mm
Stroke	DD575, DF615 and DT615: 120.7 mm
Cubic capacity	DD575: 5.76 litres DF615 and DT615: 6.17 litres
Compression ratio	16 : 1
Valve clearance cold/warm	0.5 mm
Thread	to ISO standards
Dry weight, incl. accessories but without clutch	DD575: 530 kg, DF615: 530 kg, DT615: 570 kg
Firing order	1-5-3-6-2-4
Injection timing	28° before T.D.C. (DD575 and DT615) 26° before T.D.C. (DT615)
Injection pressure	DD575 and DT615: 165 - 173 bar DT615: 216 - 224 bar
Coolant operating temperature	75-80° C
Lubricating system	CC or CD, max. sulphated ash content 1.5%
Lubricant Viscosity, below 0° C	SAE 20
-5° to +30° C	SAE 30
above +25° C	SAE 40
Oil pressure to be measured at a coolant temperature of	75-80° C
at idling speed (new engine)	min. 1.0 bar
ditto (at wear)	min. 0.35 bar
at 2000 r.p.m.	3.5 - 4.2 bar
Capacity (incl. filter)	12 litres
ditto (incl. filter and cooler)	13 litres
ditto, double room sump	17 litres
Diesel fuel	Min. requirement British Standard no. 2869-1970 Class A2. Also refer to fuel system (fuel quality)
Starter motor	bipolar
Generator	A.C. - various versions

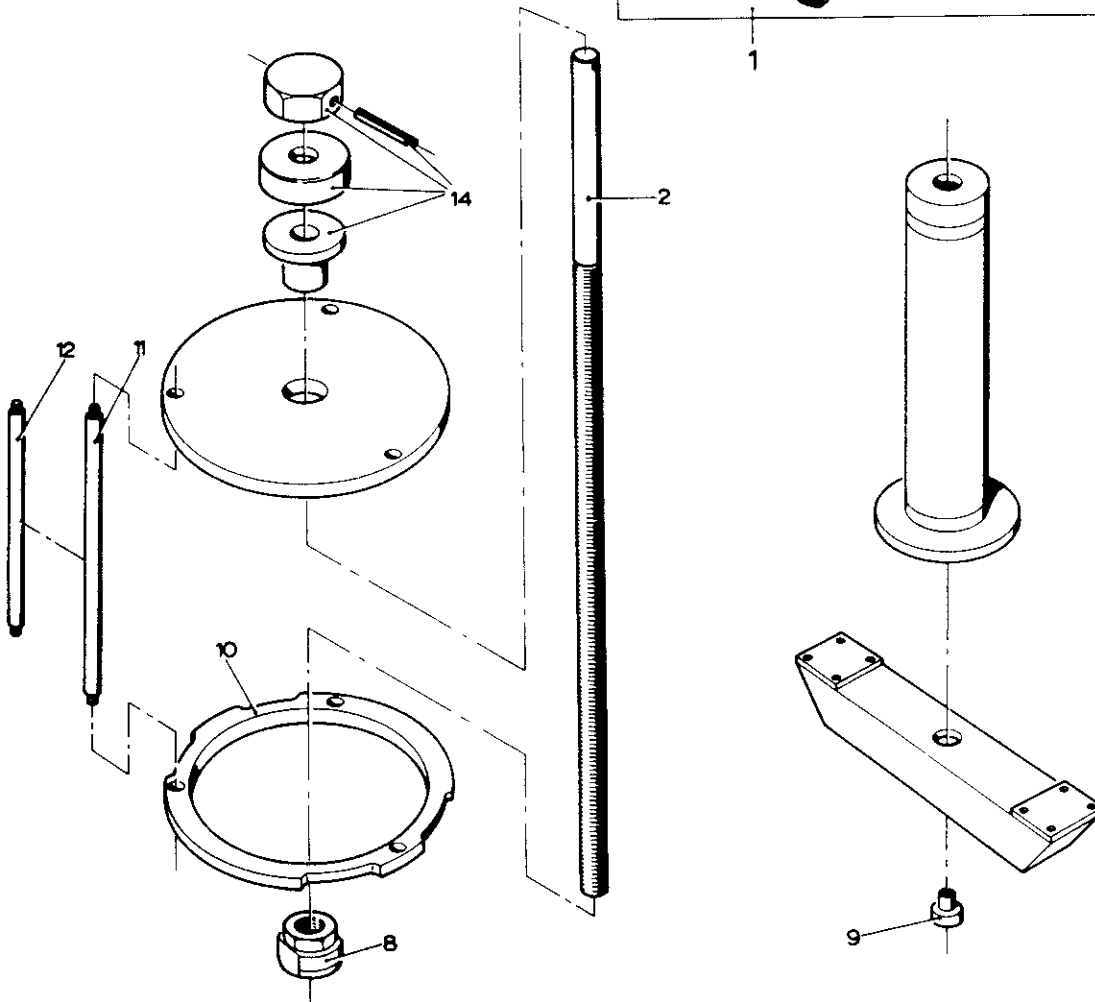
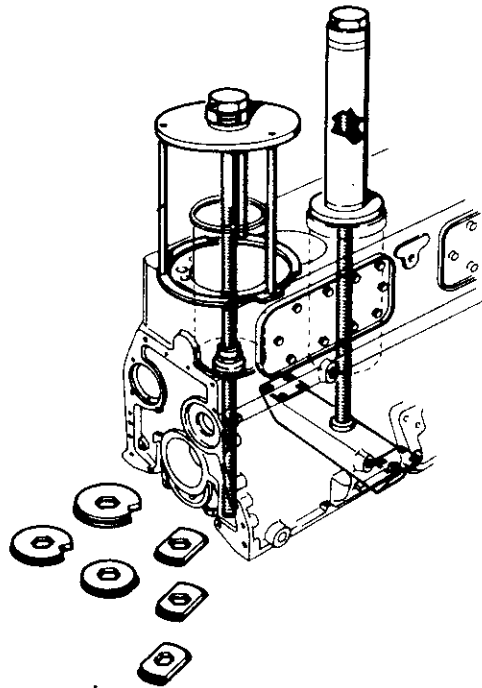
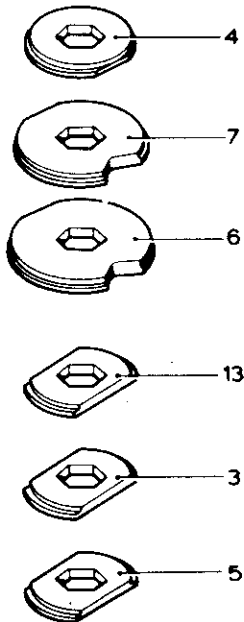
## SPECIAL TOOLS



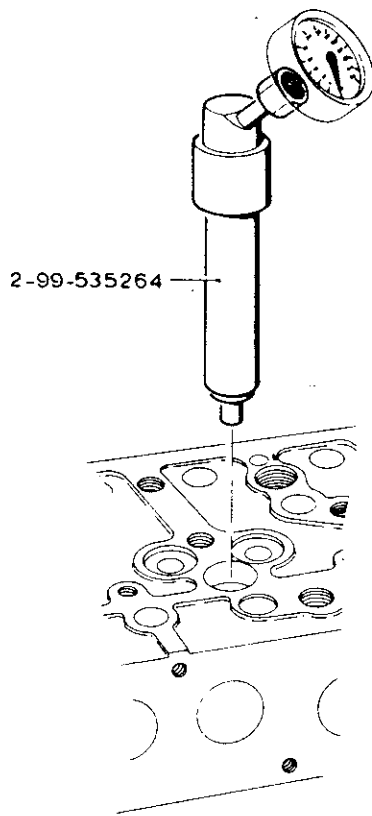
1. Bush for camshaft thrust ring centring	2-99-535047	9. Dummy injector, compression testing	2-99-535264
2. Hand cutter for cleaning injector seat in cylinder head	2-99-535058	10. Auxiliary tool for measuring engine speed	2-99-535265
3. Drift for pressing in valve guides	2-99-535073	11. Gauge, oil pressure testing complete	2-99-535551
4. Drift for pressing out valve guides	2-99-535074	12. Tool for removing and fitting cylinder liners	2-99-535625
5. not applicable		13. Drift, waterpump seal	2-99-535655
6. Drift, oil pump shaft bush	2-99-535076	14. Bent box spanner	2-99-535704
7. Spacer, camshaft puller	2-99-535077	15. Puller for removing water pump pulley	2-99-535956
8. Puller, removing crankshaft pulley and camshaft gear	2-99-535144	16. Honing tool for cylinder liner	2-99-535948



DAF order no.	575	615
1. 2-99-535625	x	x
2. 2-99-535626	x	x
3. 2-99-535627	x	—
4. 2-99-535628	—	—
5. 2-99-535629	—	x
6. 2-99-535630	—	—
7. 2-99-535631	—	—
8. 2-99-535632	x	x
9. 2-99-535633	x	x
10. 2-99-535755	x	x
11. 2-99-535756	x	x
12. 2-99-535757	—	—
13. 2-99-535916	—	—
14. 2-99-535937	x	x



## CHECKS AND ADJUSTMENTS



### COMPRESSION MEASURING

Final compression pressure:  
DD575: 25.3-26.3 bar at 300 r.p.m.  
DF615, DT615: 24.4-26.4 bar at 310 r.p.m.

Before starting measuring first ensure that the engine is well at operating temperature

- Remove injection lines
- Remove injector leak-off line
- Remove injectors (six off)
- Move the fuel handle to ZERO position
- Use for measuring special adapter: 2-99-535264
- Use Motometer, type 289 D

Make sure to receive any leaking-out fuel

## EXHAUST SMOKE MEASURING

### Introduction

Operations for exhaust smoke measuring, as described below, are based on the use of the Hartridge Mk3 measuring device. Therefore, for explanation of the construction, operating and maintenance of this measuring we may refer to the detailed documentation which accompanies the smokemeter.

To provide power supply for the smokemeter use two well-charged 12 volt batteries with a capacity of 90 Ah each or - if need be - one 12 volt battery with a capacity of 180 Ah. On no account the engine batteries should be used for this purpose.

Measurements should preferably be done at an ambient temperature between 10° C and 40° C.

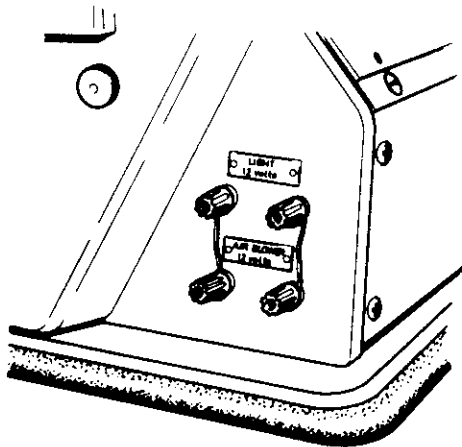


Fig. 1

### Preparatory operations

1. Place smokemeter in a horizontal position, set switch (20) to OFF-position and control (15) to ZERO CHECK. The pointer should indicate 100 H.S.U. If not, correct by means of the adjusting screw (23).
2. Connect battery cables with terminals of light source (2) and blower (1), making sure the proper polarity is observed: + cables connected with red terminals. In case only one battery is used, the four terminals should be interconnected as shown in fig. 1.
3. Check battery voltage for the light source by switching on the smokemeter (switch (20) to ON and switch (18) to V-test). The pointer should move then to the black area of the scale.

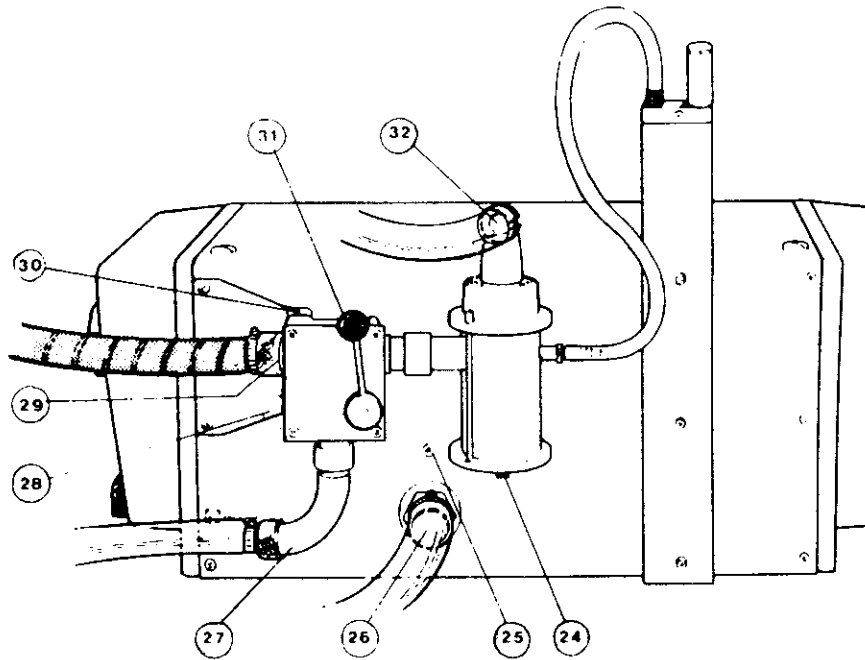
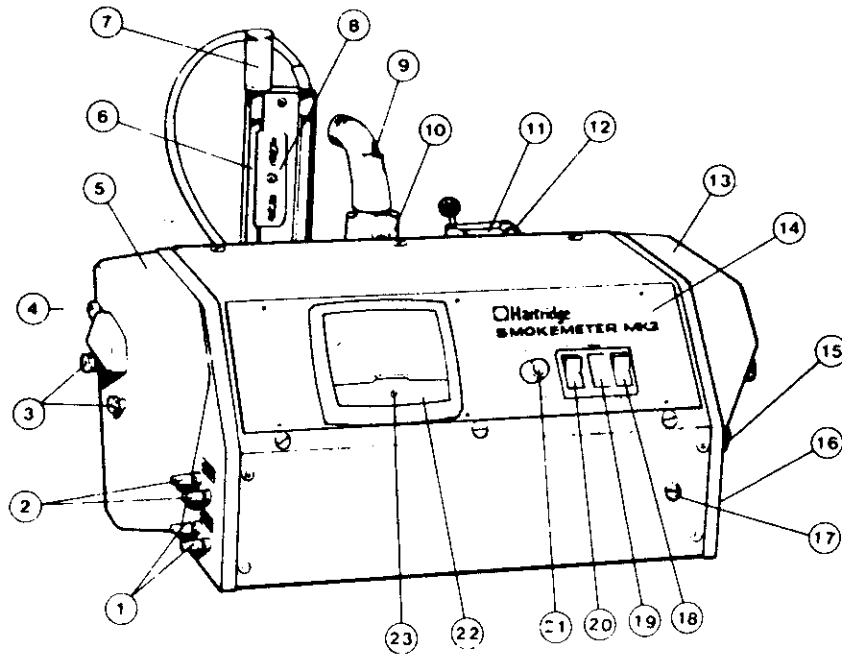
4. Check photo electric cell with accompanying filter glass. Take off the RH side cover and place the glass over the end of the smoke tube nearest to the photo electric cell. Re-install cover and turn control (15) to SMOKE-CHECK. The scale reading should not deviate more than 1 H.S.U. (Hartridge Smoke Unit) from the value indicated on the filter glass value.
5. Operate blower for some minutes to allow clean air to pass through the meter. This will remove any soot particles and will lower temperature of the photo electric cell.
6. Drain off water from the moisture separator.

### Testing conditions

1. Do not clean the glass of the micro-ammeter (22) immediately before using the meter. This might cause static electricity that would affect the meter reading.
2. If the engine has been idling for longer than 5 minutes always carry out "soot clearance" by three rapid bursts of acceleration.
3. The smokemeter must always be switched on and the air blower operating when smoke is entering, otherwise sooting up of the light source and of the photo-electric cell may occur.
4. Always leave by-pass valve (31) in the closed position (lever in a vertical position) and control (15) in ZERO CHECK position.
5. Remember to remove the probe after a test and allow the blower to run for a few moments before switching off. This will allow exhaust gases to be cleared from the smokemeter.

### Connecting the smokemeter

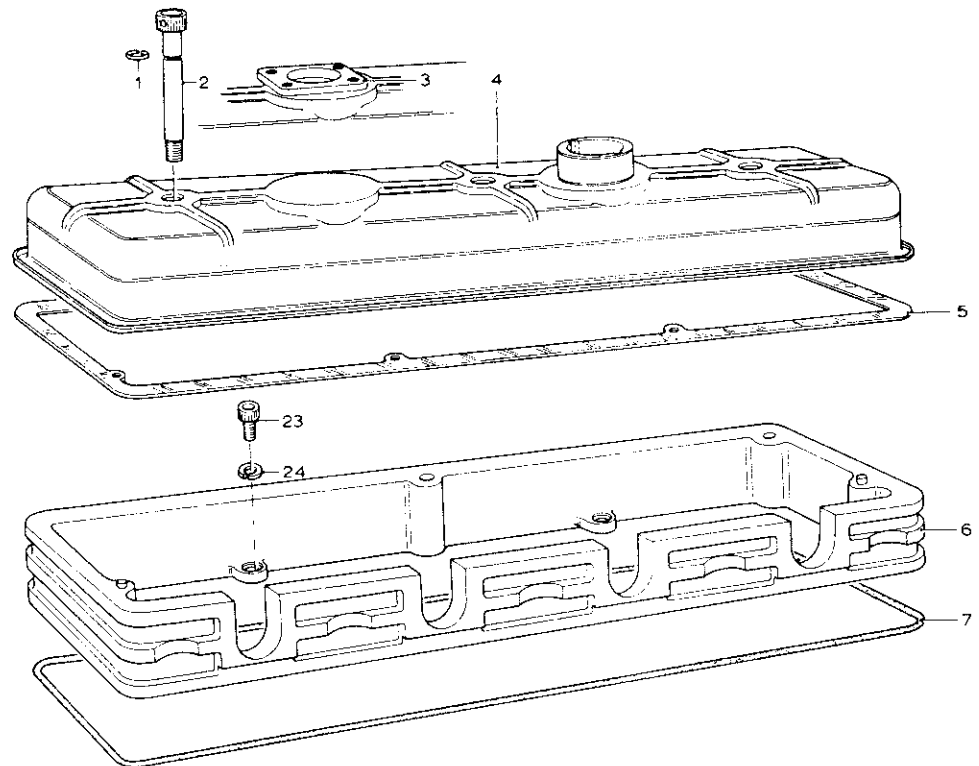
1. Connect the three plastic hoses to the smokemeter:
  - one to excess smoke outlet (32)
  - one to the smoke by-pass outlet (27)
  - one to the air and sample smoke outlet (26).Make sure that the hoses have no kinks and that the waste smoke is directed away from the clean air inlet (16).  
The excess smoke inlet (32) can be moved to any of four positions as required.
2. Connect the inlet probe to the black flexible pipe and secure with a hose clip.



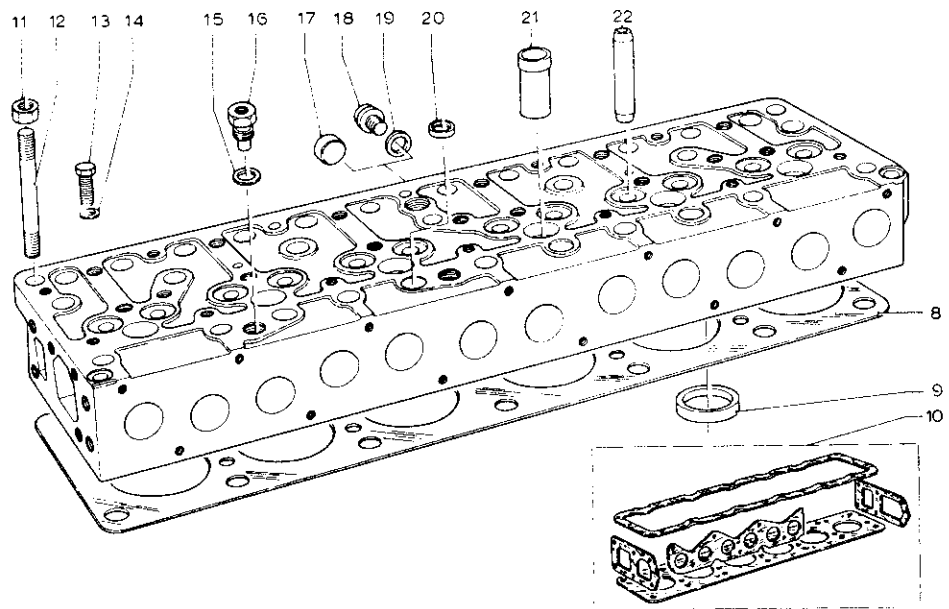
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|--|--|
| <ol style="list-style-type: none"> <li>1. Blower</li> <li>2. Light source, quartz-halogene lamp</li> <li>3. Attaching screws for cover</li> <li>4. Thermometer for measuring smoke tube temperature</li> <li>5. LH cover</li> <li>6. Pressure gauge for measuring exhaust gas pressure</li> <li>7. Filler cap</li> <li>8. Scale</li> <li>9. Pressure relief valve</li> <li>10. Water trap</li> <li>11. Smoke by-pass valve</li> <li>12. Thermometer for measuring temperature of incoming exhaust gases</li> <li>13. RH cover</li> <li>14. Instrument panel</li> <li>15. Control knob ZERO CHECK/SMOKE CHECK</li> <li>16. Inlet for clean air at ZERO CHECK</li> <li>17. Control knob, blower speed</li> </ol> | <ol style="list-style-type: none"> <li>18. V-TEST/SMOKE TEST switch</li> <li>19. Warning light</li> <li>20. ON/OFF switch, switching smoke meter on and off</li> <li>21. Zero reset knob, setting pointer to 0 at ZERO CHECK</li> <li>22. Micro-ammeter, graduation in H.S.U.</li> <li>23. Reset screw, moving pointer to 0</li> <li>24. Water drain plug</li> <li>25. Screws for attaching smoke meter housing</li> <li>26. Outlet for atmospheric air and sample smoke</li> <li>27. Outlet for exhaust in case of closed by-pass valve (31)</li> <li>28. By-pass valve open, exhaust gases pass through meter</li> <li>29. Inlet, connected with exhaust pipe of vehicle</li> <li>30. Thermometer for measuring temperature of exhaust gases</li> <li>31. By-pass valve, closed position, all exhaust gases to outlet (27)</li> <li>32. Excess exhaust gas outlet</li> </ol> |
|--|--|

3. Attach probe clamp to the probe using the appropriate adaptor, if necessary.
  4. Insert probe into exhaust pipe of vehicle and clamp the probe to the rim of the exhaust pipe. The probe should be located centrally in the pipe and can be adjusted by means of the adjusting knob.
  5. Connect the other end of the flexible pipe to the connection (29) on the smokemeter. Avoid kinks and sharp bends.  
**Note:**  
Install smokemeter at a higher point than the vehicle exhaust pipe, so that the flexible pipe slopes slightly upwards, to prevent any condensation from entering the smokemeter.
  6. Set scale plate (8) of pressure gauge (16) to mid-position. Carefully fill pressure gauge with water ensuring that no air bubbles are formed, until level is approx. that of zero on scale plate.  
Add a small quantity of fluorescense to the water. This will improve visibility of fluid level. Finally slide scale plate until its zero marking coincides with the water level.  
**Note:**  
Once filled it is only necessary to top up the fluid in the pressure gauge to the correct level.
- Measuring procedure**
1. Set control (15) to ZERO CHECK.
  2. Set switch (18) to S-TEST.
  3. Ensure by-pass valve (31) is closed (lever in vertical position)
  4. Switch on smokemeter with switch (20).
  5. Check that engine is at operating temperature.
  6. Check that idling speed and max. no-load speed are in accordance with engine specifications.
  7. Let engine operate at a speed of approx. 1,500 r.p.m. and wait at least 5 minutes to enable smokemeter to reach correct temperature (thermometer (30)).
  8. Use zero reset knob (21) to set pointer to zero.
  9. Check whether thermometer reading (30) is between 140° and 210° C.
  10. Carry out "soot clearance" by two or three rapid bursts of acceleration, so that any soot particles in the exhaust system are blown away.
  11. Set control to SMOKE TEST.
  12. Open by-pass valve (lever in horizontal position) and fully depress accelerator pedal until maximum speed **under load** has been reached. Check whether temperature and pressure are within the prescribed limits, i.e. 70° - 140° C. - thermometer (12) and 40-65 mm head of water-pressure gauge (6).  
Close by-pass valve (31).
  13. Open by-pass valve, fully depress accelerator pedal until maximum speed under load has been reached. Next:
  14. Close by-pass valve and simultaneously release accelerator pedal until engine is at idling speed.
  15. Repeat operations under 13 and 14 three times and each time take highest micro-ammeter reading. This is the smoke value in so-called Hartridge Smoke Units (H.S.U.).

## CYLINDER HEAD



1. Spring washer
2. Bolt
3. Breather connection
4. Cylinder head cover
5. Gasket
6. Valve cover
7. Sealing ring
8. Head gasket
9. Valve seat
10. Set of gaskets
11. Nut
12. Stud
13. Bolt
14. Spring washer
15. Sealing ring
16. Connecting nipple
17. Plug
18. Plug
19. Sealing ring
20. Expansion plug
21. Injector holder sleeve
22. Valve guide
23. Bolt
24. Spring washer



## SPECIFICATIONS

### Cylinder head

Height	86.31 – 86.41 mm
Min. height	86.11 mm
Dia. of initial bore for valve guides	14.288 – 14.300 mm

### Valve guides

Overall length	70.9 – 71.3 mm
Outside dia.	14.331 – 14.339 mm
Inside dia. before pressing-in	8.725 – 8.737 mm
Inside dia. after pressing-in	8.705 – 8.717 mm
Interference fit	0.03 – 0.05 mm
Projection above cylinder head	22.4 – 23.4 mm

### Valves seats

	Intake	Exhaust
Angle of valve seat	$30^{\circ} \pm 15'$	$30^{\circ} \pm 15'$
Seat width (new)	1.2 – 1.5 mm	1.5 – 1.8 mm
Height	4.394 – 4.572 mm	8.52 – 8.62 mm
Inside dia.	37.536 – 37.686 mm	34.21 – 34.37 mm
Outside dia.	48.374 – 48.386 mm	45.289 – 45.301 mm

### Machined recess in cylinder head

	Intake	Exhaust
Depth	5.70 – 5.80 mm	10.05 – 10.25 mm
Dia.	48.234 – 48.260 mm	45.187 – 45.213 mm

### Tightening torques

Bolts and nuts for the attachment of

Cylinder head, studs

82 Nm ( 8.3 mkg)

Cylinder head, nuts DF615

245 – 259 Nm (25 – 26.4 mkg)

Cylinder head, nuts DT(D)615

285 – 294 Nm (29 – 30 mkg)

Cylinder head, bolts

42 – 52 Nm ( 4.2 – 5.2 mkg)

Lifting bracket, front

50 – 61 Nm ( 5 – 6.1 mkg)

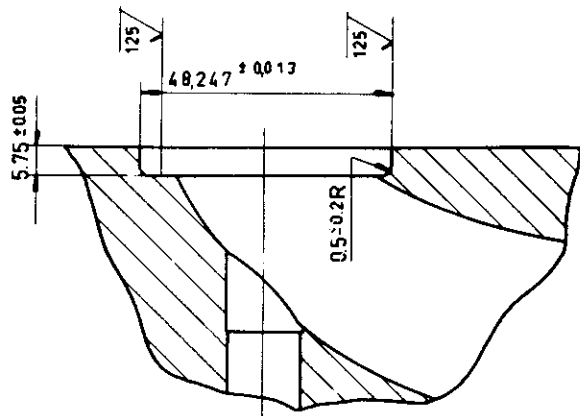
Lifting bracket, rear

25 – 27 Nm ( 2.5 – 2.7 mkg)

## INSTRUCTIONS FOR REPAIR

### Valve seat

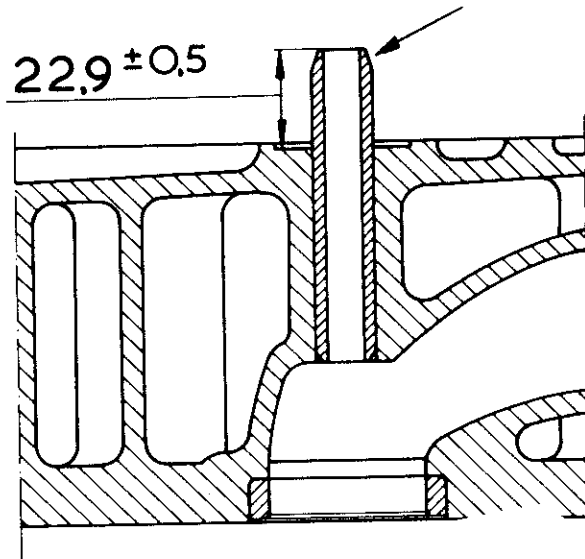
Pressed-in seats are used for the exhaust valves, whereas the valve seats are directly cut into the cylinder head. For reconditioning purposes separate seat inserts are available for the intake valves as well.



The recess to be made in the cylinder head for the inlet valve seat. When checking concentricity of this recess with the valve guide bore, dial gauge reading must not exceed 0.02 mm. The valve seats are shrunk in.

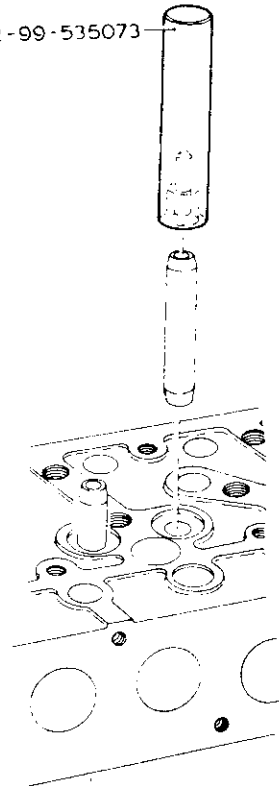
#### Valve guides

The valve guides should be pressed into the cylinder head so that their most strongly bevelled sides project above the cylinder head. The part of the valve guide protruding above the cylinder head should have a length of 22.4 – 23.4 mm.



For pressing a valve guide in and out DAF supply special tools, part numbers 2-99-535073 and 2-99-535074 resp.

2-99-535073



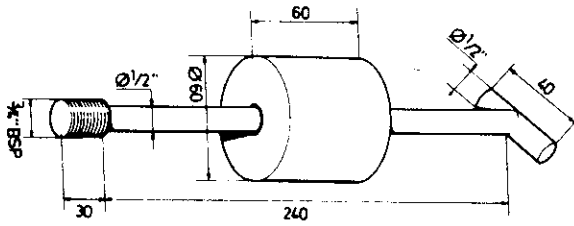
#### Studs

Use Loctite 270 (or an equivalent) for installing the studs attaching the rocker shaft brackets.

2-99-535074



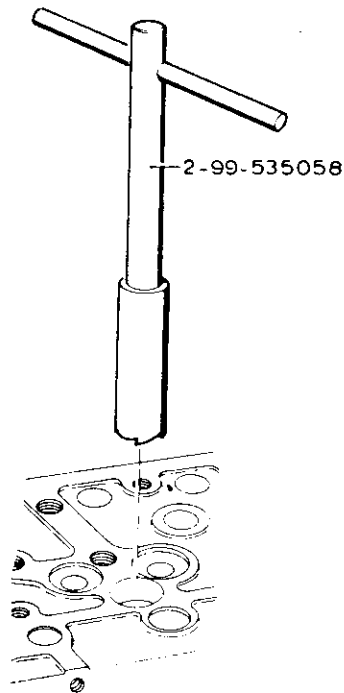




#### Injector holder sleeve

For removing an injector holder sleeve use an inside puller or a home-made auxiliary tool (see drawing). Tap 3/4" BSP thread in injector holder sleeve and screw in auxiliary tool. Next, pull or knock tool together with the injector holder sleeve out of the cylinder head.

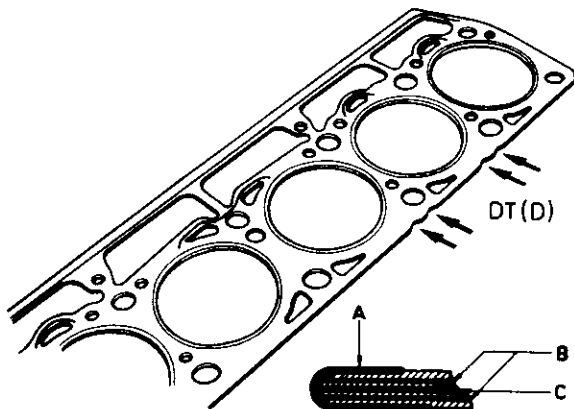
**Note:** Plug off bore in cylinder head to prevent metal particles from dropping into the combustion chamber.



#### Injector seat

Clean the injector seat in the cylinder head with a scraper, part number 2-99-535058, after treating scraper head with grease.

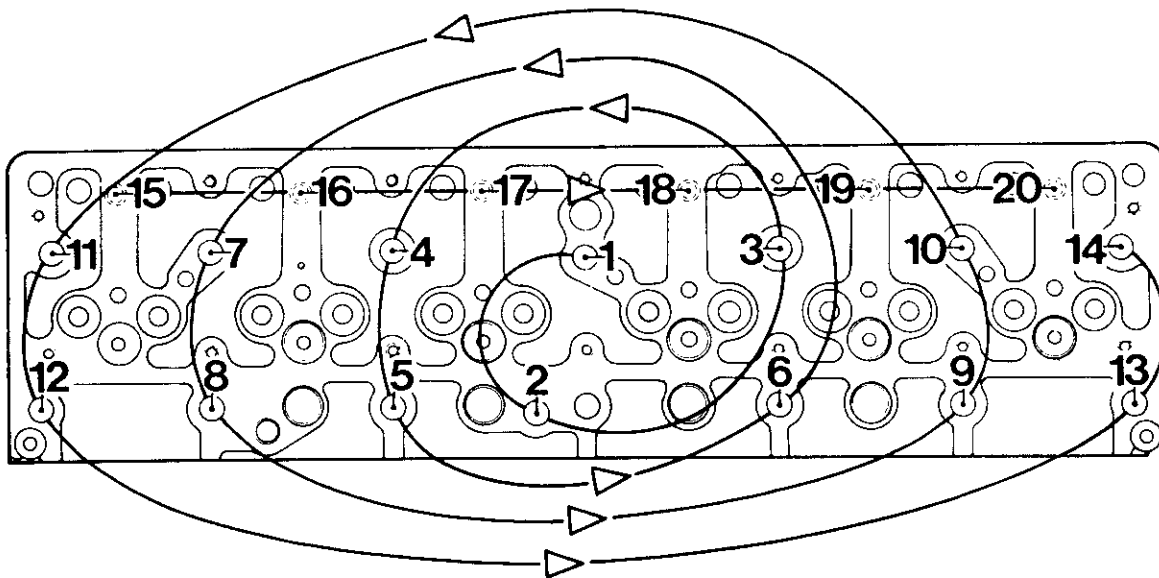
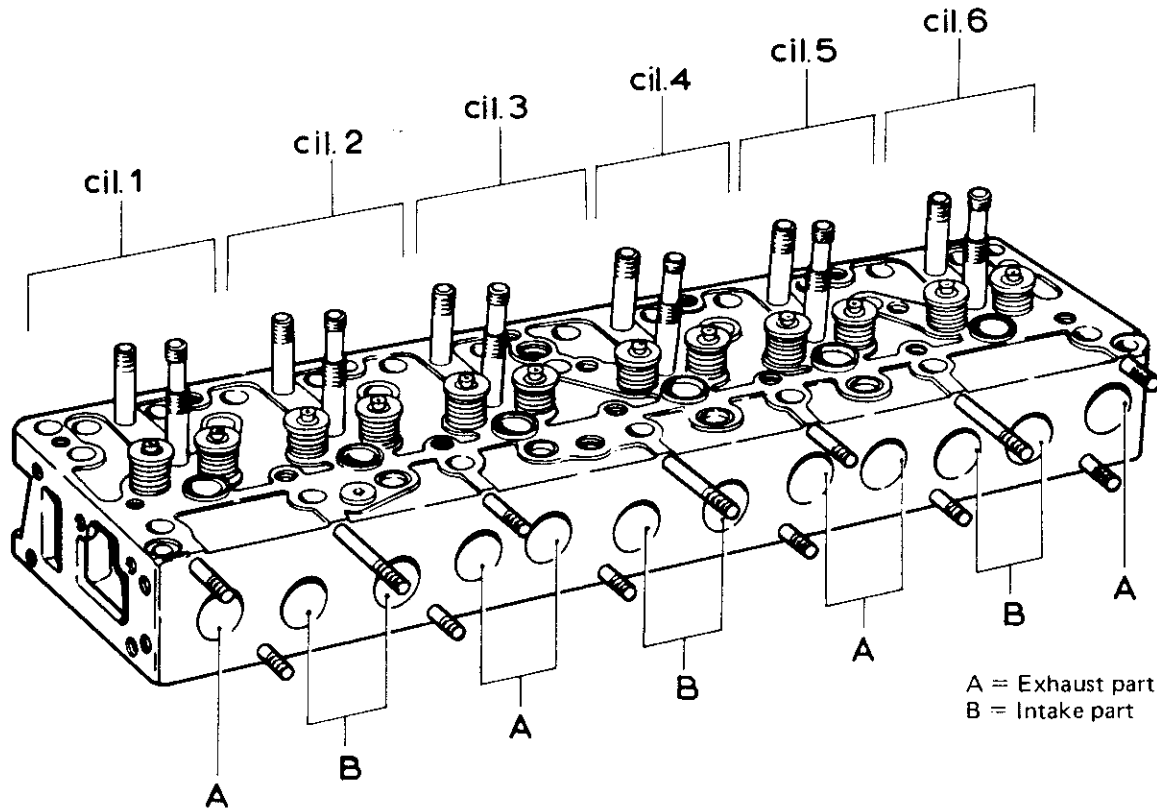
**Note:** Plug off bore in cylinder head to prevent particles from dropping into the combustion chamber.



#### Head gasket

For the DT615 engine a reinforced head gasket is used. Apart from the part number, this gasket can also be recognized by the four nicks in the edge. The head gasket should be fitted dry after cylinder head and engine block have been trued if necessary. The narrow folded edge should always be on the cylinder head side (the corresponding side of the head gasket is marked "head side").

- A. Strip steel
- B. Steel wire fabric
- C. Steel sheet

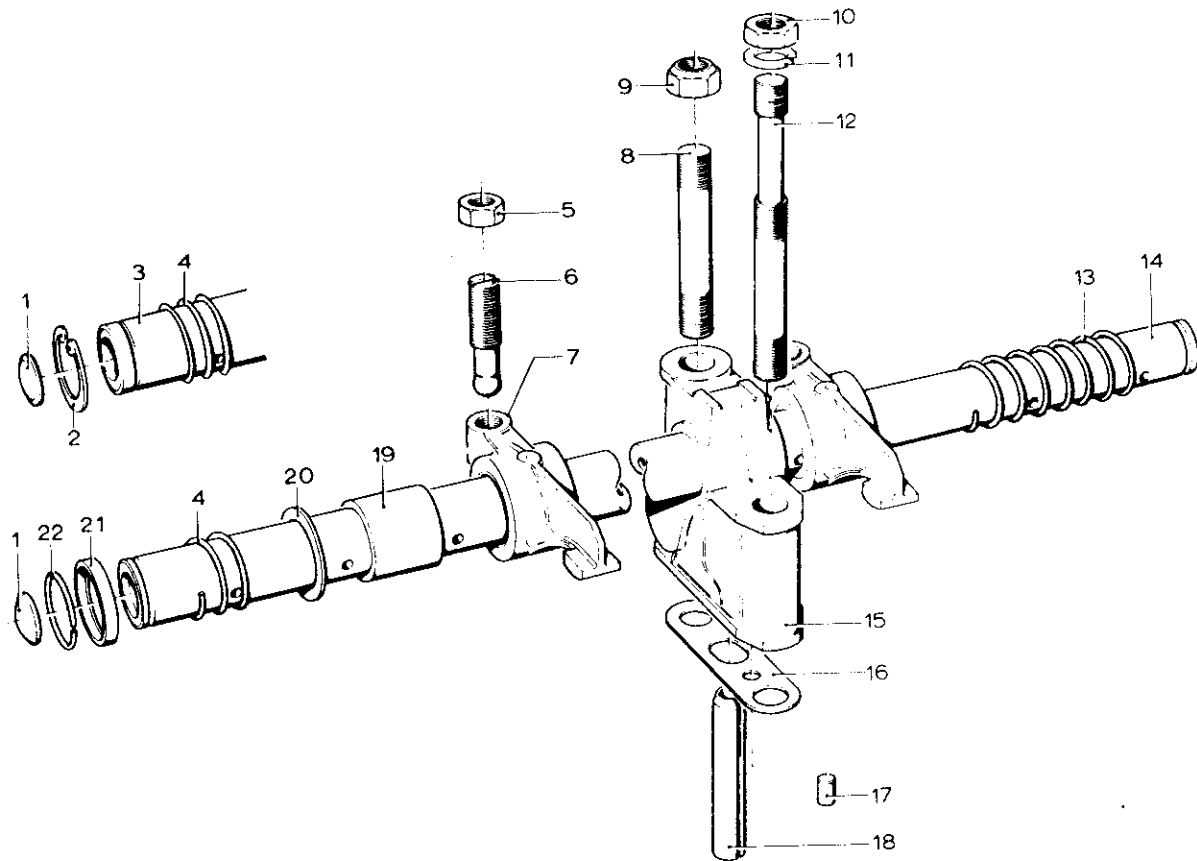


1. Fit head gasket dry, hence without oil or anything else, after thoroughly cleaning block and head.
2. Apply a little oil to stud thread and to bearing surface under nut.
3. Evenly tighten nuts in three steps and in the prescribed sequence.

DD, DF: 147 - 196 - 259 Nm (15 - 20 - 26 mkg)  
 DT: 147 - 216 - 294 Nm (15 - 22 - 30 mkg)

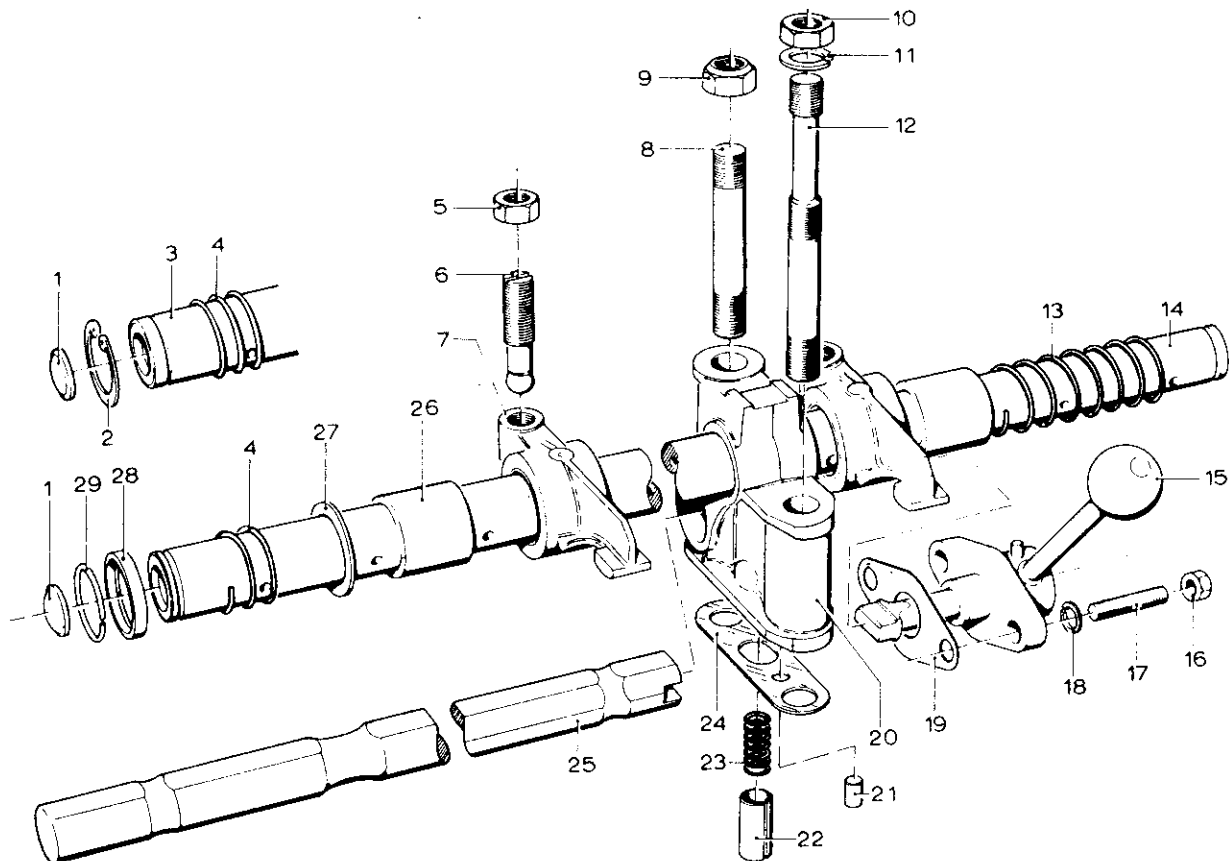
4. Tighten six cylinder bolts: 40-50 Nm (4-5 mkg)
5. Run engine until operating temperature has been reached.
6. Switch engine off and - when still warm - repeat operation under 3.
7. After 500 km (25 operating hours) retighten nuts with warm engine, after first slackening nuts somewhat (max. 1/8 turn).

## VALVE GEAR



1. Plug
2. Circlip
3. Rocker shaft
4. Spring
5. Nut
6. Adjusting screw
7. Rocker
8. Stud
9. Lock nut
10. Nut
11. Spring washer
12. Stud
13. Spring
14. Rocker shaft
15. Bracket
16. Gasket
17. Dowel pin
18. Spring pin
19. Bushing
20. Ring
21. Thrust ring
22. Snap ring

## VALVE GEAR WITH DECOMPRESSION SHAFT



This system is used when the engine has to be started by hand

- |                    |                   |                         |
|--------------------|-------------------|-------------------------|
| 1. Plug            | 11. Spring washer | 20. Bracket             |
| 2. Circlip         | 12. Stud          | 21. Dowel pin           |
| 3. Rocker shaft    | 13. Spring        | 22. Plunger             |
| 4. Spring          | 14. Rocker shaft  | 23. Spring              |
| 5. Nut             | 15. Lever         | 24. Gasket              |
| 6. Adjusting screw | 16. Nut           | 25. Decompression shaft |
| 7. Rocker          | 17. Stud          | 26. Bushing             |
| 8. Stud            | 18. Spring washer | 27. Ring                |
| 9. Nut             | 19. Gasket        | 28. Thrust ring         |
| 10. Nut            |                   | 29. Snap ring           |

## SPECIFICATIONS

### Valve timing

Intake valve opens  
Intake valve closes  
Exhaust valve opens  
Exhaust valve closes

### Valves

Valve head dia.  
Face angle  
Stem dia.  
Stem clearance in guide  
Valve clearance  
Valve lift

### with a valve clearance of 1 mm

3° after T.D.C.  
34° after B.D.C.  
33° before B.D.C.  
2° before T.D.C.

### Intake

41.9 – 42.1 mm  
29°30' ± 15'  
8.649 – 8.661 mm  
0.044 – 0.068 mm  
0.5 mm  
9.65 mm

### with a valve clearance of 0.5 mm

10° before T.D.C.  
49° after B.D.C.  
46° before B.D.C.  
13° after T.D.C.

### Exhaust

39.27 – 39.47 mm  
29°30' ± 15'  
8.624 – 8.636 mm  
0.069 – 0.093 mm  
0.5 mm  
9.65 mm

### Valve springs

Compressed to  
Spring load

Length at max. compression  
Spring load

### Inner spring

40.7 mm  
102 – 112 N  
(10.4 – 11.4 kg)  
30.9 mm  
184 – 204 N  
(18.8 – 20.8 kg)

### Outer spring

43.2 mm  
210 – 229 N  
(21.4 – 23.4 kg)  
33.5 mm  
386 – 425 N  
(39.4 – 43.4 kg)

### Valve tappets

Outside dia.  
Clearance in engine block

33.274 – 33.287 mm  
0.043 – 0.081 mm (max. 0.15 mm)

### Push rods

Overall length  
Max. permissible out of straight

373.7 – 374.3 mm  
0.25 mm

### Rocker shaft

Outside dia.  
Inside dia. of rocker bush (reamed)  
Diametrical clearance of shaft in bush

22.193 – 22.206 mm  
22.213 – 22.234 mm  
0.007 – 0.041 mm (max. 0.09 mm)

### Tightening torque

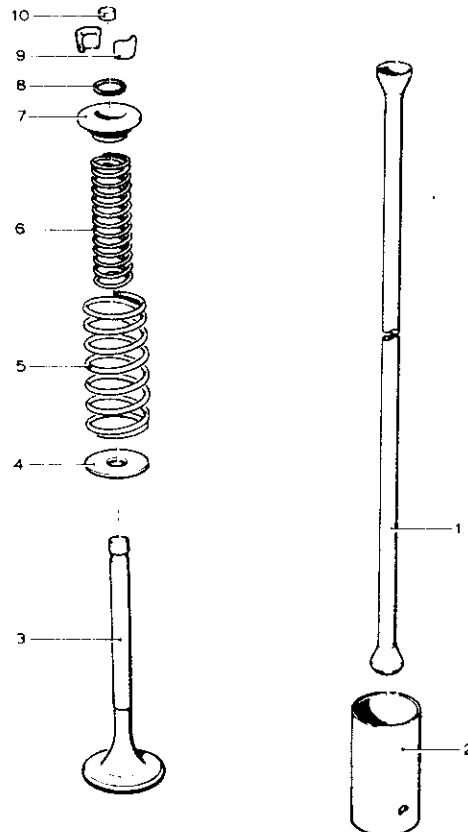
Nuts and bolts for attachment of:  
Rocker shaft seat, nut  
Injector toggle  
Valve casing

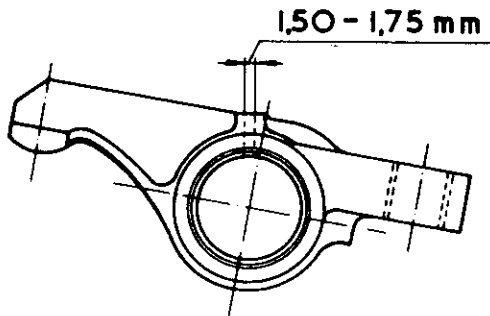
60 – 65 Nm (6.1 – 6.6 mkg)  
max. 50 Nm (5 mkg)  
39 – 41 Nm (3.9 – 4.1 mkg)

## INSTRUCTIONS FOR REPAIR

### Intake/Exhaust valve

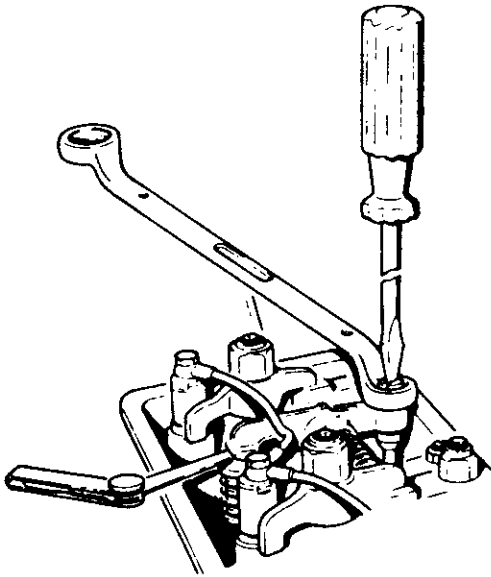
1. Push rod
2. Tappet
3. Valve
4. Shim
5. Valve spring
6. Valve spring
7. Retainer
8. O-ring
9. Cones
10. Cap





#### Rocker bush

The position of the bush seam with respect to the rocker may be chosen at random. Remember to drill the oil hole after pressing in the bush.

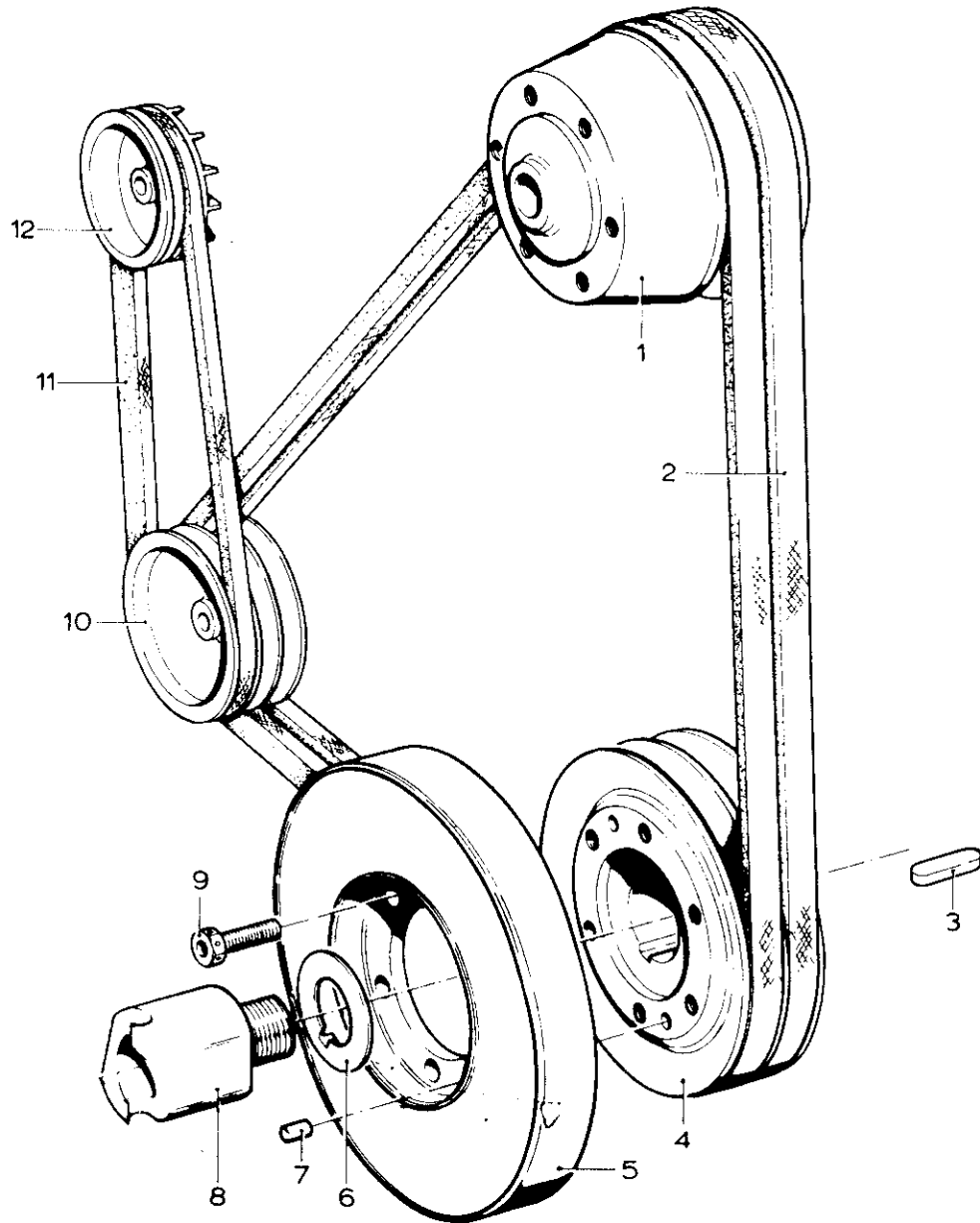


#### Valve clearance

Adjust valve clearance with the engine switched off and, preferably, cold. Check valve clearance not only at periodical servicings, but also after one or more injectors have been replaced.

### VIBRATION DAMPER AND PULLEYS

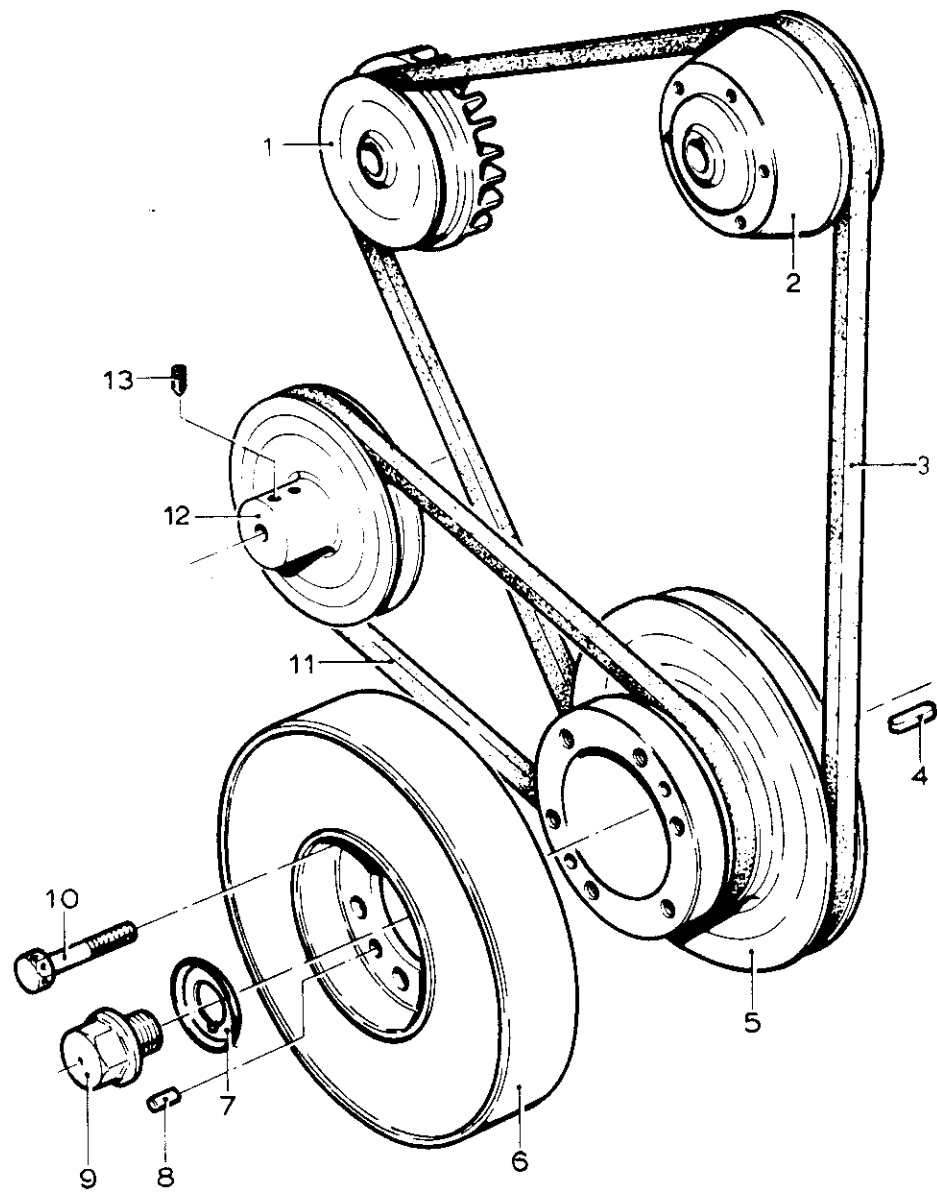
- 1. Pulley
- 2. Vee-belt
- 3. Key
- 4. Pulley
- 5. Vibration damper
- 6. Lock plate
- 7. Dowel pin
- 8. Cranking bolt
- 9. Bolt
- 10. Pulley
- 11. Vee-belt
- 12. Pulley



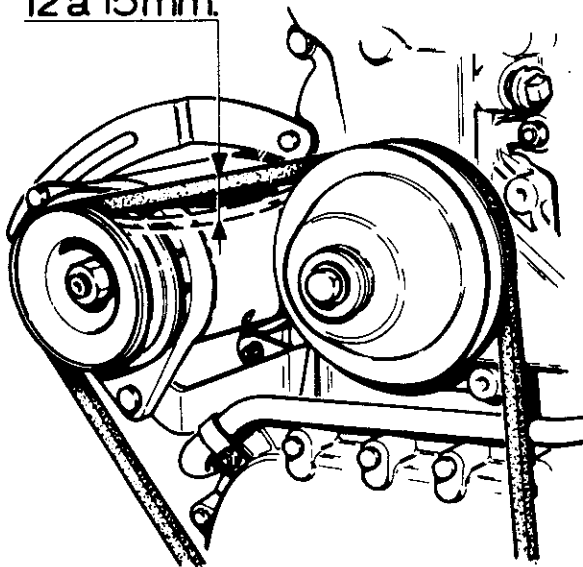
#### SPECIFICATIONS

Tightening torque of cranking bolt	373 – 412 Nm (38 – 42 mkg)
Tightening torque of vibration damper	58 – 61 Nm (5.8 – 6.1 mkg)

1. Pulley
2. Pulley
3. Vee-belt
4. Key
5. Pulley
6. Vibration damper
7. Lock plate
8. Dowel pin
9. Cranking bolt
10. Bolt
11. Vee-belt
12. Pulley
13. Screw



12 à 15mm.



### INSTRUCTIONS FOR REPAIR

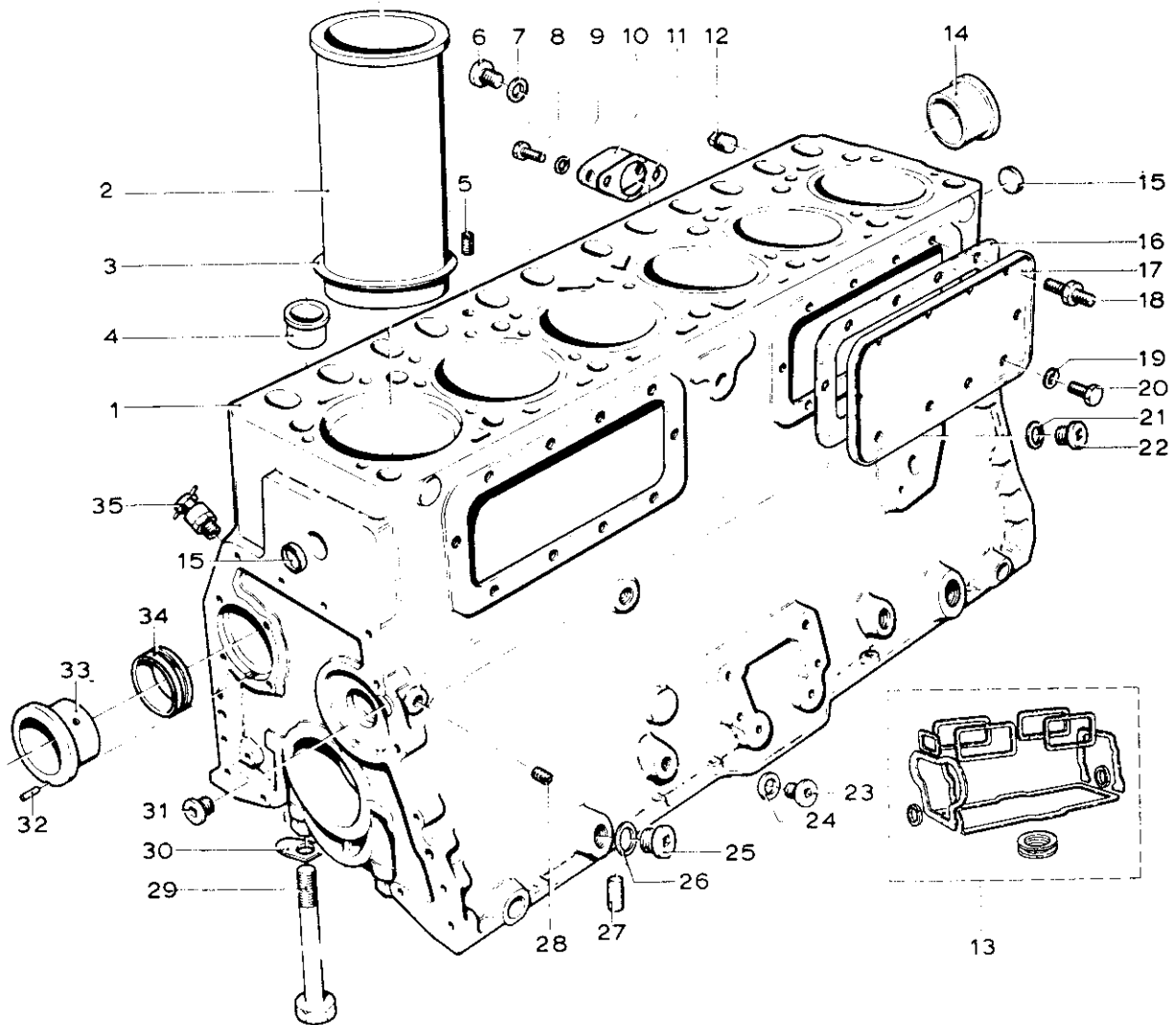
When renewing a Vee-belt proceed with care and avoid to stretch or distort the new belt. By releasing the generator it is quite simple to mount and to tension the Vee-belt or belts.

In the case of outboard waterpumps a different system is used, for which see group 2-51, page 16. In case two or more Vee-belts are running over the same pulley, all Vee-belts must be replaced simultaneously. After renewing a Vee-belt check the tension already after 2 operating hours or after 60 km and again after 20 operating hours or 600 km.

Thereafter check the tension at regular intervals.



## ENGINE BLOCK



- |                    |                    |                  |                  |
|--------------------|--------------------|------------------|------------------|
| 1. Engine block    | 10. Cover          | 19. Sealing ring | 28. Plug         |
| 2. Cylinder liners | 11. Gasket         | 20. Screw        | 29. Bolt         |
| 3. Spacer          | 12. Plug           | 21. Sealing ring | 30. Lock plate   |
| 4. Bushing         | 13. Set of gaskets | 22. Plug         | 31. Plug         |
| 5. Plug            | 14. Bearing bush   | 23. Plug         | 32. Dowel pin    |
| 6. Plug            | 15. Plug           | 24. Sealing ring | 33. Bearing bush |
| 7. Ring            | 16. Gasket         | 25. Plug         | 34. Bearing bush |
| 8. Screw           | 17. Cover          | 26. Sealing ring | 35. Cock         |
| 9. Ring            | 18. Screw          | 27. Dowel pin    |                  |

## SPECIFICATIONS

### Engine block

Overall height	454.640 – 454.720 mm (min. 454.440 mm)
Depth of recess for cylinder liner collar	12.655 – 12.700 mm
Initial bore for cylinder liners, standard size	105.665 – 105.687 mm
Initial bore for cylinder liners, oversize	105.915 – 105.937 mm
Initial bore for main bearing shells	82.88 – 82.906 mm
Initial bore for camshaft bearing bushes 1 & 4	59.680 – 59.710 mm
Initial bore for camshaft bearing 2 & 3 (in block)	53.330 – 53.360 mm
Initial bore for tappets	33.330 – 33.355 mm

### Cylinder liners

Outside diameter of cylinder liner, standard size	105.67 – 105.69 mm
Outside diameter of cylinder liner, oversize	105.92 – 105.94 mm
Inside diameter of cylinder liner	100.62 – 100.64 mm
Inside diameter of cylinder liner after pressing-in	100.60 – 100.63 mm
Projection of cylinder liner above top face of engine block	

## SPECIFICATIONS

### Engine block

Overall height	454.640 – 454.720 mm (min. 454.440 mm)
Depth of recess for cylinder liner collar	8.000 – 8.045 mm
Initial bore for cylinder liners, standard size	108.989 – 109.011 mm
Initial bore for cylinder liners, oversize	109.24 – 109.26 mm
Initial bore for main bearing shells	82.88 – 82.906 mm
Initial bore for camshaft bearing bushes 1 & 4	59.680 – 59.710 mm
Initial bore for camshaft bearing 2 & 3 (in block)	53.330 – 53.360 mm
Initial bore for tappets	33.330 – 33.355 mm

### Cylinder liners

Outside diameter of cylinder liner, standard size	108.999 – 109.009 mm
Outside diameter of cylinder liner, oversize	109.25 – 109.27 mm
Inside diameter of cylinder liner	104.18 – 104.20 mm
Inside diameter of cylinder liner after pressing in	104.16 – 104.19 mm
Projection of cylinder liner above top face of engine block	+ 0.035 – + 0.100 mm

## DD575

Overall height	454.640 – 454.720 mm (min. 454.440 mm)
Depth of recess for cylinder liner collar	12.655 – 12.700 mm
Initial bore for cylinder liners, standard size	105.665 – 105.687 mm
Initial bore for cylinder liners, oversize	105.915 – 105.937 mm
Initial bore for main bearing shells	82.88 – 82.906 mm
Initial bore for camshaft bearing bushes 1 & 4	59.680 – 59.710 mm
Initial bore for camshaft bearing 2 & 3 (in block)	53.330 – 53.360 mm
Initial bore for tappets	33.330 – 33.355 mm

Outside diameter of cylinder liner, standard size	105.67 – 105.69 mm
Outside diameter of cylinder liner, oversize	105.92 – 105.94 mm
Inside diameter of cylinder liner	100.62 – 100.64 mm
Inside diameter of cylinder liner after pressing-in	100.60 – 100.63 mm
Projection of cylinder liner above top face of engine block	

## DF615 and DT615

Overall height	454.640 – 454.720 mm (min. 454.440 mm)
Depth of recess for cylinder liner collar	8.000 – 8.045 mm
Initial bore for cylinder liners, standard size	108.989 – 109.011 mm
Initial bore for cylinder liners, oversize	109.24 – 109.26 mm
Initial bore for main bearing shells	82.88 – 82.906 mm
Initial bore for camshaft bearing bushes 1 & 4	59.680 – 59.710 mm
Initial bore for camshaft bearing 2 & 3 (in block)	53.330 – 53.360 mm
Initial bore for tappets	33.330 – 33.355 mm

Outside diameter of cylinder liner, standard size	108.999 – 109.009 mm
Outside diameter of cylinder liner, oversize	109.25 – 109.27 mm
Inside diameter of cylinder liner	104.18 – 104.20 mm
Inside diameter of cylinder liner after pressing in	104.16 – 104.19 mm
Projection of cylinder liner above top face of engine block	+ 0.035 – + 0.100 mm

### INSTRUCTIONS FOR REPAIR

#### Cylinder liner wear

If oversize cylinder liners have been fitted the mark S1 must be stamped into the engine block above the engine number.

#### Cylinder liner replacement

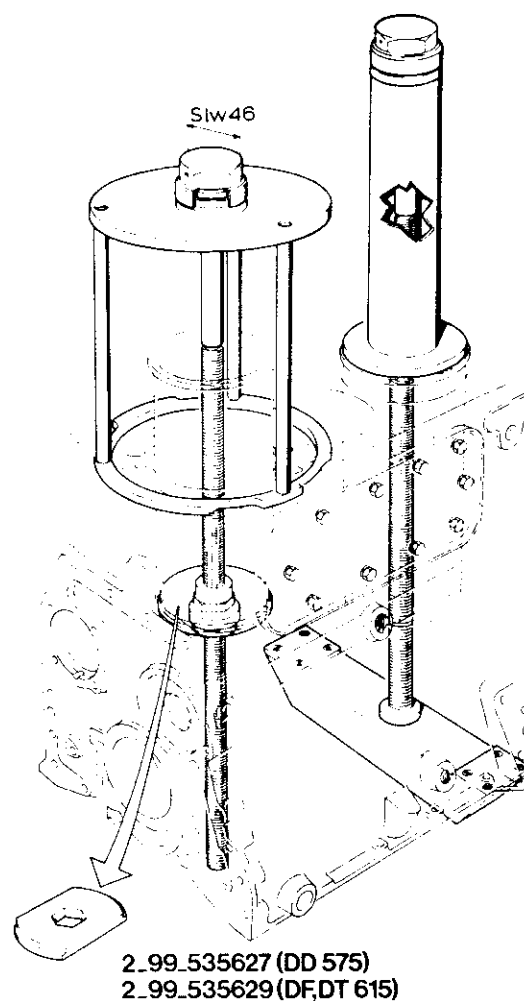
Pressing in and extracting cylinder liners is preferably carried out by using the DAF tool. No. 2-99-535625.

Lubricate the lining, when pressing in, on the outer side with a small quantity of an appropriate lubricant, e.g. Shell grease Nr. S2927A, white lead or, in an emergency, light lubricating oil. Difficulties in pressing in are practically always due to excessive lubrication or due to the presence of remnants of old lubricant.

**Note:** 2-99-535625 is the part number for the complete set of tools.

DAF tool 2-99-535625 can also be used in combination with standard hydraulic devices, available in the local trade with a working pressure of 30 tonnes (for instance Owatonna Tool Company).

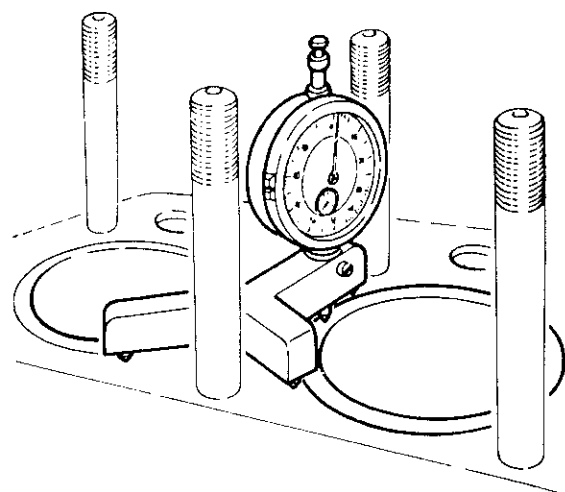
To facilitate, in the case of abnormal cylinder liner wear, tracing the possible cause a wear pattern of the liner in question should be available. For this purpose use the form as shown on page 5.



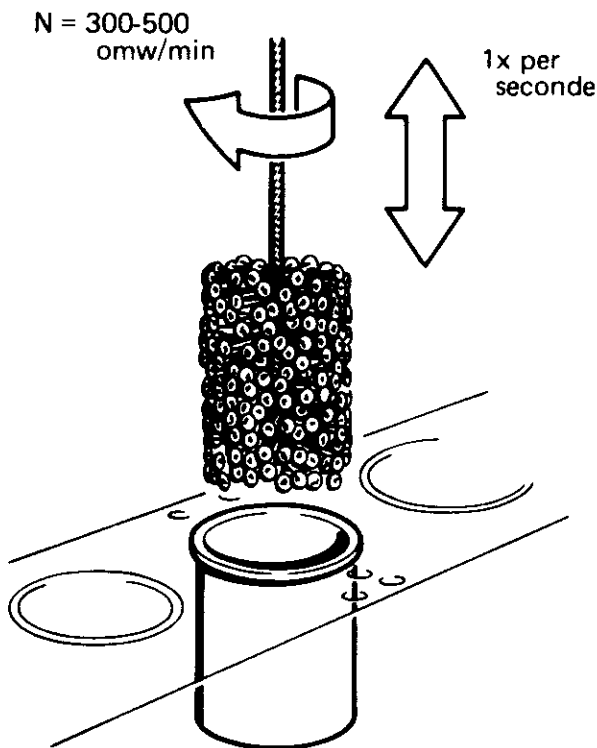
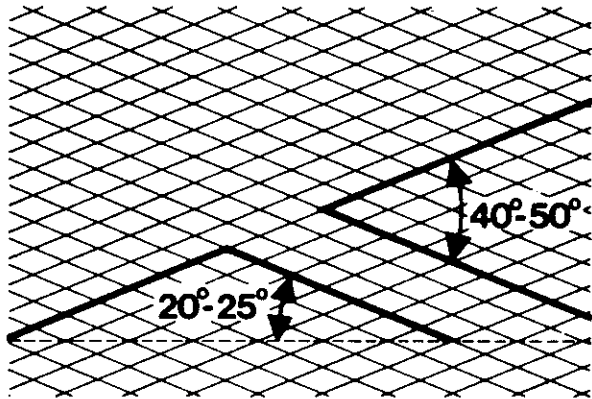
After the block has been faced, the recess for the cylinder liner collar should be rectified to its initial value. Grinding off the cylinder liner collar is inadmissible.

For measuring the projection of the cylinder liner above the cylinder block use a dial gauge. If required, rectify by means of shims.

For overhauling purposes bearing bushes for the nos. 2 and 3 camshaft bearings are available too. The corresponding engine block bores should be bored to 59.680 – 59.710 mm. After fitting, ream the bearing bushes to 53.33 – 53.36 mm.



## HONING OF CYLINDER LINERS



The quality of the cylinder liner surface is of great importance to a Diesel engine. Honing is the last machining process effected on the liner surface and is used to obtain the following:

1. a correct surface roughness: (0.4 – 0.8 Ra) to enable the piston rings to run in on the liner surface, thus bringing about a good sealing and heat emission between piston and liner surface.
2. a surface which will hold the lubricant, to ensure that under any circumstance the oil film between piston rings and liner surface is maintained.
3. a cross hatch. Such a cross hatch is of utmost importance, too steep or too flat grooves might cause an excessive oil consumption or inadequate lubrication of the liner surface with all its consequences.

When renewing the piston rings the liner surface should be honed. Of course it should be checked first whether the liner dimensions fall inside the prescribed tolerances. If not, the liners will have to be renewed too.

Preferably DAF honing tools should be used. These are available under the part number 2-99-535948.

Proceed as follows:

1. Cover the crankshaft, for instance with plastic foil.
2. Operate the honing brush at the prescribed number of revolutions: 300 – 500 per minute.
3. Move the brush up and down through the entire cylinder at a speed of once per second, and this for about 15 seconds.  
This will give the liner its proper roughness.
4. Use a honing oil of a well-known brand. Most oil companies carry such a special oil in their programmes. Do not mix oil with paraffin neither use other mixtures.
5. After the process carefully clean the liner. This **MUST** be done by washing the liner with a hot soap solution. Dry the liner with paper towels and continue until the paper remains dry and clean.
6. Apply a light coating of oil to the liners.

**It is on no account permitted to clean the liners after honing with petrol, diesel fuel or paraffin.**

Investigations have shown that on liner surfaces thus cleaned too much grinding and honing dust will be left behind in the honing grooves, which will afterwards damage both the liner and the piston rings.

## Workshop manual

### CYLINDER LINER WEAR MEASURING

Measurement taken by : .....

Additional copies of this form are available through the DAF organization.

Specification No : .....

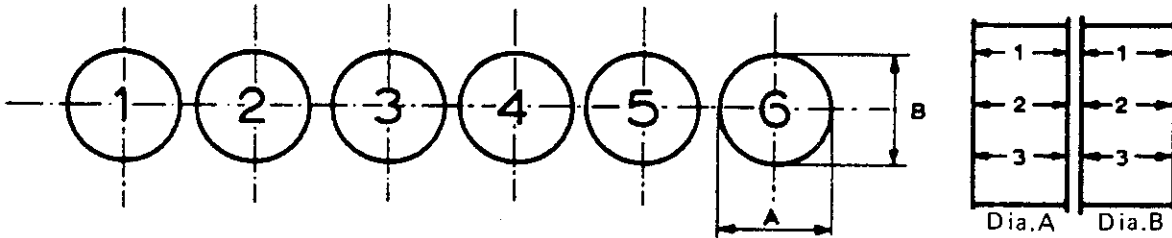
Date when put into service : .....

Engine type : .....

Number of kilometres or number of operating hours with relative cylinder liners: .....

Engine No : .....

### MEASURING INSTRUCTIONS



Point of measurement 1: abt. 10 mm under the cyl.liner top edge  
 Point of measurement 3: abt. 30 mm from the cyl.liner bottom edge

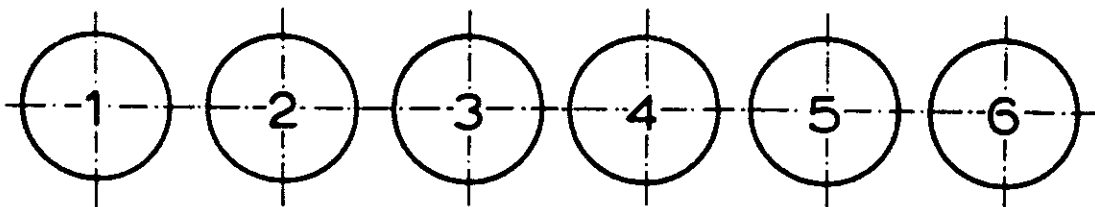
### MEASURING RESULTS

Cylinder	1	2	3	4	5	6
Dia. A 1						
Dia. A 2						
Dia. A 3						
Dia. B 1						
Dia. B 2						
Dia. B 3						
Piston dia. at piston bottom edge at right angles to gudgeon pin						
Piston clearance						

X = gap Y = Piston ring clearance in groove

	1	2	3	4	5	6
Top compr. ring						
Compr. ring						
Compr. ring						
Oil scraper ring						
Oil scraper ring						

Distance between cylinder liner collar and engine block top



..... mm\* ..... mm\* ..... mm\* ..... mm\* ..... mm\* ..... mm\*  
 \*+ if collar projects above block - if collar is lower than top of engine block

## STANDARD MEASUREMENTS (in mm)

	DD575	DF615 DT615
Bore in engine block for cylinder liners		
standard	105.665 - 105.687	108.989 - 109.011
oversize	105.915 - 105.937	109.24 - 109.26
Inside dia of cylinder liner	100.600 - 100.630	104.160 - 104.190
Dia of piston skirt at right angles to the gudgeon pin	199.457 - 100.482	100.005 - 104.025
Piston clearance	0.118 - 0.173	0.135 - 0.185
Projection of cylinder liner collar above the engine block	+0.035 - +0.100	+0.035 - +0.100
Width of groove for top compression ring	2.470 - 2.490	2.590 - 2.610
Width of groove for compression ring	2.470 - 2.90	2.570 - 2.590
Width of groove for scraper ring	6.390 - 6.410	6.040 - 6.060
Width of top compression ring	2.362 - 2.375	2.478 - 2.490
Width of compression ring	2.350 - 2.375	2.464 - 2.489
Width of scraper ring	6.312 - 6.325	5.978 - 5.990
Clearance of top compression ring in groove	0.095 - 0.128	0.100 - 0.132
Clearance of compression ring in groove	0.095 - 0.140	0.081 - 0.126
Clearance of scraper ring in groove	0.065 - 0.098	0.050 - 0.082

## STANDARDS FOR DISCARDING

**Cylinder liner** needs replacement in case of

- irregular contact reflection
- scoring
- difference between measurements at point 1 and 3 exceeding 0.07 mm

If the cylinder liner bore in the engine block exceeds the maximum measurement with 0.05 mm or more, the block should be bored out and cylinder liners with oversize outside diameters should be fitted.

**Piston** needs replacement in the case of

- irregular contact reflection
- scoring damaged groove edges
- a piston dia. (measured at the lower piston edge, at right angles to the gudgeon pin) which is 0.03 mm smaller than the nominal piston dia.

**Piston rings** should always be renewed.

## INSTRUCTIONS FOR REPAIR

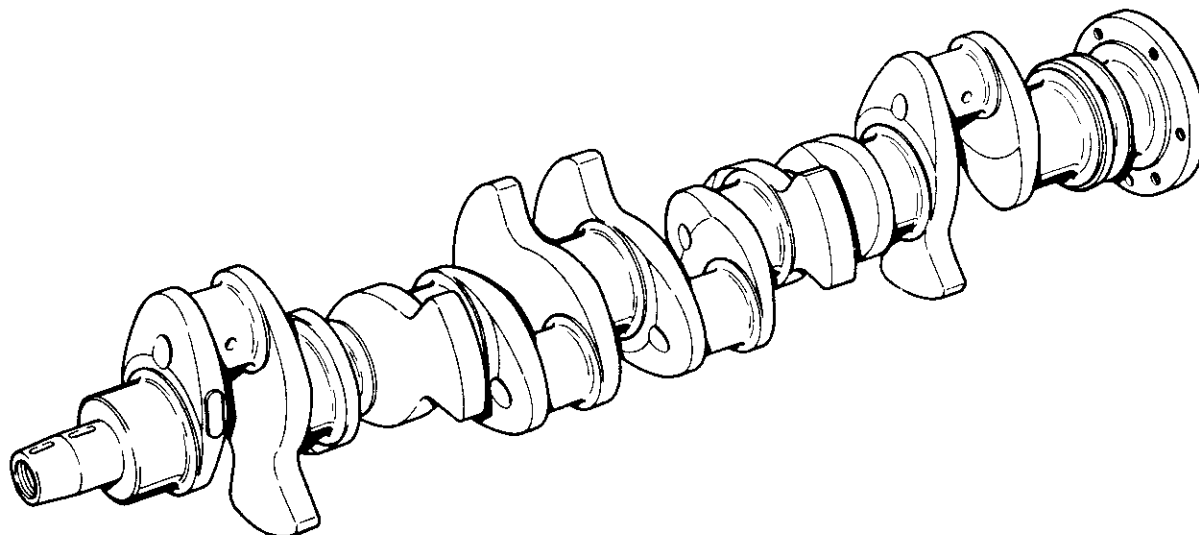
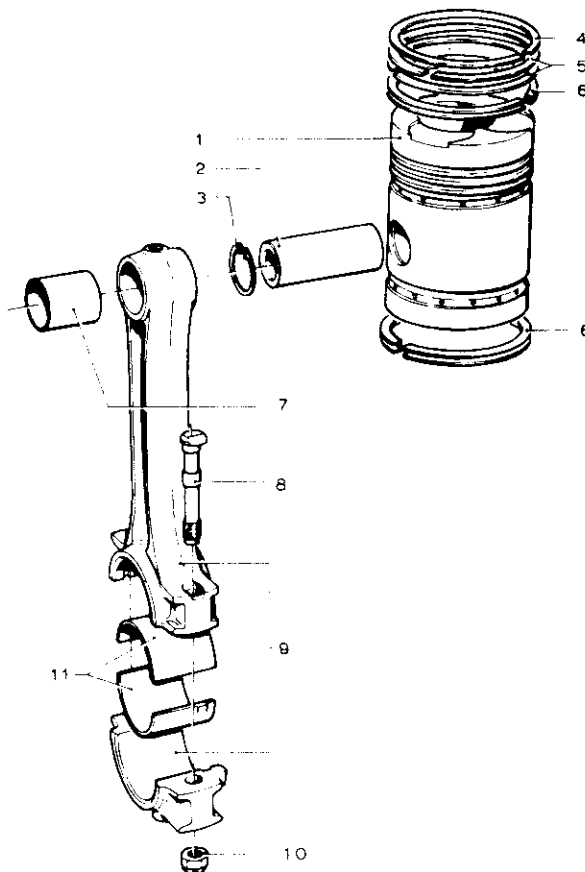
- **Cylinder liners:** when re-used, these should be honed first.
- **Main bearings and conrod bearings:** if the indium coating is still intact, bearing shells need not be renewed.

In the case of operation at a speedometer reading over 100,000 km or 3400 operating hours

- always renew exhaust valves
- check inlet valve guides for wear

### CRANKSHAFT, CONRODS AND PISTONS

1. Piston
2. Gudgeon pin
3. Circlip
4. Top compression ring
5. Compression ring
6. Oil scraper ring
7. Bearing bush
8. Bolt
9. Conrod (connecting rod)
10. Nut
11. Bearing halves



## SPECIFICATIONS

### Crankshaft

Max. permissible dial gauge reading between two adjacent main bearing journals	0.08 mm
max. permissible reading on central main bearing journal; crankshaft supported at front and rear main bearing journal	0.15 mm
Min. permissible dia. at rear oil seal	78.50 mm

### Main bearing journals

Dia.	78.724 – 78.764 mm
Undersize limits	5 x 0.254 mm (max. 1.27 mm)
Width No. 1 journal	46.87 – 47.13 mm
Width No. 2, 3, 5 and 6 journals	35.433 – 35.687 mm
Width No. 4 journal	49.53 – 49.58 mm
Width No. 7 journal	49.46 – 49.66 mm
Fillet radius	3.55 – 4.05 mm
Max. permissible out of round (wear limit)	0.07 mm total permissible dial gauge reading

### Big end bearing journals

Dia.	60.944 – 60.984 mm
Undersize limits	5 x 0.254 mm (max. 1.27 mm)
Width	43.182 – 43.258 mm
Fillet radius	3.55 – 4.05 mm
Max. permissible out of round (wear limit)	0.07 mm total permissible dial gauge reading

### Crankshaft end play

End play	0.06 – 0.25 mm (max. 0.35 mm)
Size of thrust washers	2.31 – 2.36 mm
Oversize thrust washers	0.13 mm
When using oversize thrust washers regrind No. 4 journal to (the fillet radius must be adhered to!)	49.784 – 49.809 mm

### Main bearing journals

Inside dia. (when fitted)	78.803 – 78.843 mm
Bearing clearance	0.049 – 0.122 mm (max. 0.25 mm)
Undersizes	5 x 0.254 mm

### Big end bearings

Inside dia. (when fitted)	61.013 – 61.037 mm
Bearing clearance	0.028 – 0.096 mm (max. 0.25 mm)
Undersizes	5 x 0.254 mm

### Tightening torques

Bolts and nuts for the attachment of:

Big end bearing cap	196 – 203 Nm	(20.0 – 20.7 mkg)
Small end bearing cap	102 – 115 Nm	(10.4 – 11.7 mkg)
Flywheel	88 – 94 Nm	( 9 – 9.6 mkg)
Cranking bolt	373 – 412 Nm	(38 – 42 mkg)
Vibration damper	58 – 61 Nm	( 5.8 – 6.1 mkg)

### Connecting rods

	DD	DF	DT
Initial bore dia. (big end)	64.592 – 64.604 mm	64.592 – 64.604 mm	
Initial bore dia. (small end)	36.824 – 36.849 mm	42.000 – 42.025 mm	
Distance between centre lines of big and small end	223.50 – 223.54 mm	223.50 – 223.54 mm	
Outside dia. of bush	36.904 – 36.929 mm	42.06 – 42.10 mm	
Push fit of bush in connecting rod	0.055 – 0.105 mm	0.035 – 0.100 mm	
Ream inside dia. of bush in small end to	33.046 – 33.054 mm	38.017 – 38.025 mm	
Gudgeon pin clearance in small end bush	0 – 0.010 mm	0.017 – 0.030 mm	(max. 0.04 mm)



#### Pistons

Combustion chamber  
 Material  
 Gudgeon pin bore  
 Skirt edge dia.  
 Piston clearance  
 Width of grooves for No. 1 compression ring  
 Width of grooves for No. 2 & 3 compression rings  
 Width of grooves for oil scraper rings  
 Distance between top of piston in T.D.C.  
 position and top face of engine block

#### DD

**Toroidal  
 Aluminium alloy**  
 33.020 – 33.025 mm  
 100.457 – 100.482 mm  
 0.118 – 0.173 mm  
 2.47 – 2.49 mm  
 2.47 – 2.49 mm  
 6.39 – 6.41 mm

#### DT

**Toroidal  
 Aluminium alloy**  
 37.997 – 38.003 mm  
 104.035 – 104.055 mm  
 0.105 – 0.155 mm  
 2.59 – 2.61 mm  
 2.51 – 2.59 mm  
 6.04 – 6.06 mm

Max. 0.2 mm above or below  
 top of engine block

#### Gudgeon pin

Dia.  
 Clearance in small end bush

33.015 – 33.020 mm  
 0 – 0.010 mm

37.995 – 38.000 mm  
 0.017 – 0.030 mm  
 (max. 0.04 mm)

Retained by  
 Fit

Internal circlip  
 Push fit in piston, if required heated to 20 – 50 °C

#### Pistons rings

Top compression ring  
 Width of top compression ring  
 Width of No. 2 & 3 compression rings  
 Width of oil scraper rings  
 Gap of top compression ring  
 Gap of No. 2 & 3 compression rings  
 Gap of oil scraper ring  
 Clearance of top compression ring in groove  
 Clearance of No. 2 & 3 compression rings in groove  
 Clearance of oil scraper rings in groove

chromed  
 2.362 – 2.375 mm  
 2.350 – 2.375 mm  
 6.312 – 6.325 mm  
 0.35 – 0.60 mm  
 0.25 – 0.50 mm  
 0.25 – 0.45 mm  
 0.095 – 0.128 mm  
 0.095 – 0.140 mm  
 0.065 – 0.098 mm

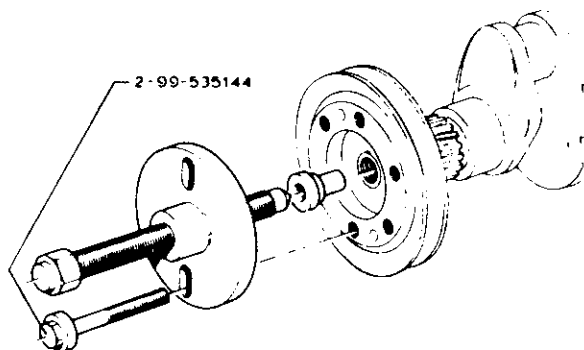
chromed  
 2.476 – 2.489 mm  
 2.464 – 2.489 mm  
 5.978 – 5.990 mm  
 0.35 – 0.60 mm  
 0.25 – 0.50 mm  
 0.25 – 0.45 mm  
 0.101 – 0.134 mm  
 0.081 – 0.126 mm  
 0.05 – 0.082 mm

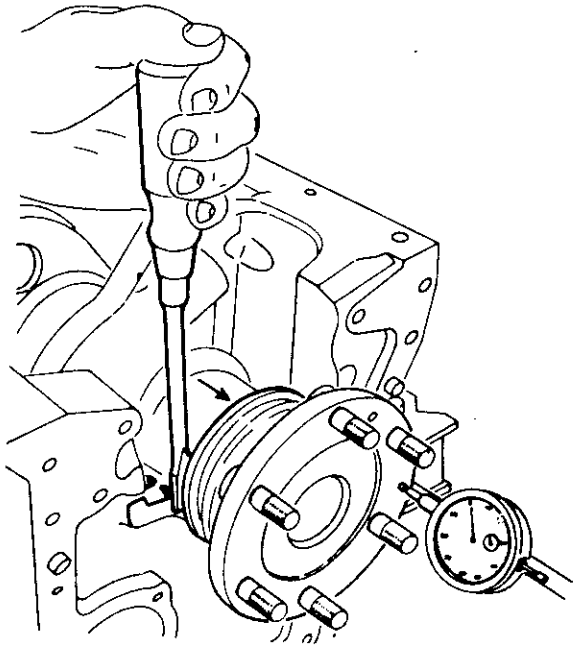
During the fitting of the piston rings the gap must not extend beyond 32 mm.

### INSTRUCTIONS FOR REPAIR

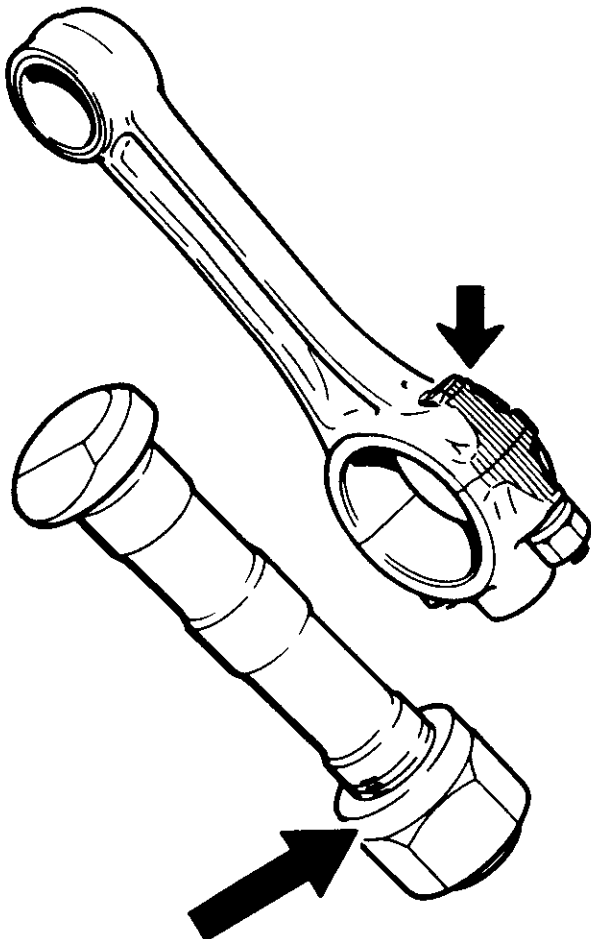
#### Crankshaft pulley

For removing the crankshaft pulley use the special  
 puller, part no. 2-99-535144.





Measuring crankshaft end play is carried out with a dial indicator. If required, rectify by means of over-size thrust rings.



After screwing the bolts into the conrod, the bolt heads should be ground off until they are flush with the narrow lateral face of the conrod. Failure to comply with this instruction may cause the bolt head to strike against other engine parts in case of dimensions coming out at the unfavourable end of the tolerance range.

#### Connecting rod attachment

Previous version:

- castled nut and split pin
- bolt with split pin hole.

Modified version:

- bolt without split pin hole
- no spring washer or lock plate.

It is permitted to use on one engine both versions, i.e. conrods with old bolts and castled nuts and conrods with new bolts and ordinary nuts, provided that per conrod the bolt and the nut are either of the old or of the new type.

**The tightening torque remains unchanged.**

**Attention:** note the correct position of the nut on the bolt.

### CRANKSHAFT GRINDING

With the statutory introduction of the SI-system on 1-1-1978, the inch measures, amongst others, must make way for metric measures.

Up to 31-12-1977 the indication on the crankshaft will be given in inches. Besides, e.g. the undersize 0.010" is indicated as 010; the letters H, D and N stand for: H = main bearing, D = connecting rod bearing and N = nitrided crankshaft.

Thus, the indication H 010/D 020/N on a crankshaft means a 0.010" undersize main bearing, a 0.020" undersize connecting rod bearing and a nitrided crankshaft.

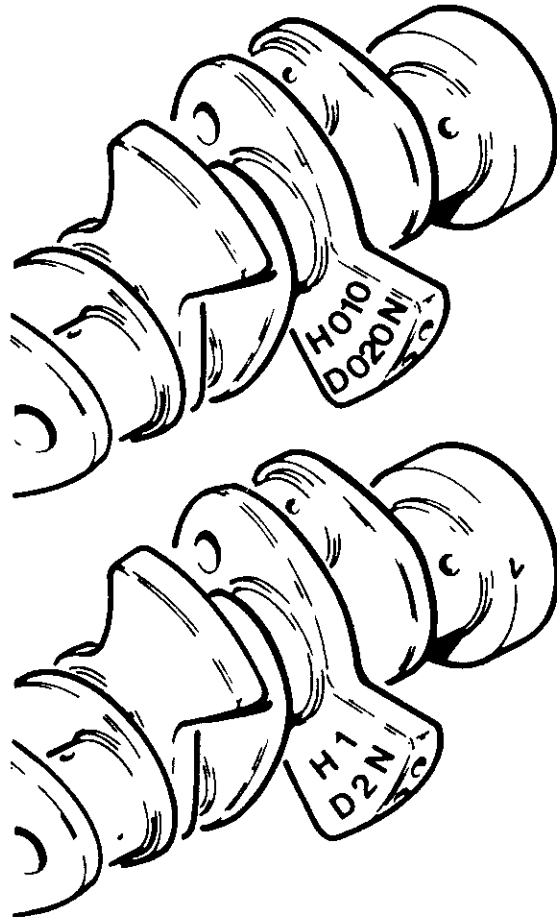
The letter indications H, D and N do not change and hold the same meaning.

The inch indications, however, will become obsolete as from 1-1-1978.

The letters H and D will be followed by the figure 1, 2, 3, 4 or 5. These figures indicate the number of times the crankshaft has been ground and thus, indirectly, the undersize.

An indication on the crankshaft can be e.g. H1, D2, N; meaning a 0.250 mm undersize main bearing, a 0.500 mm undersize connecting rod bearing and a nitrided crankshaft.

A crankshaft may be ground once to the next undersize (i.e. max. 0.250 mm) without needing renitriding. In any other case the crankshaft must again be nitrided. After the crankshaft has been ground the oil holes must be rounded off again. (r = 0.5 mm).



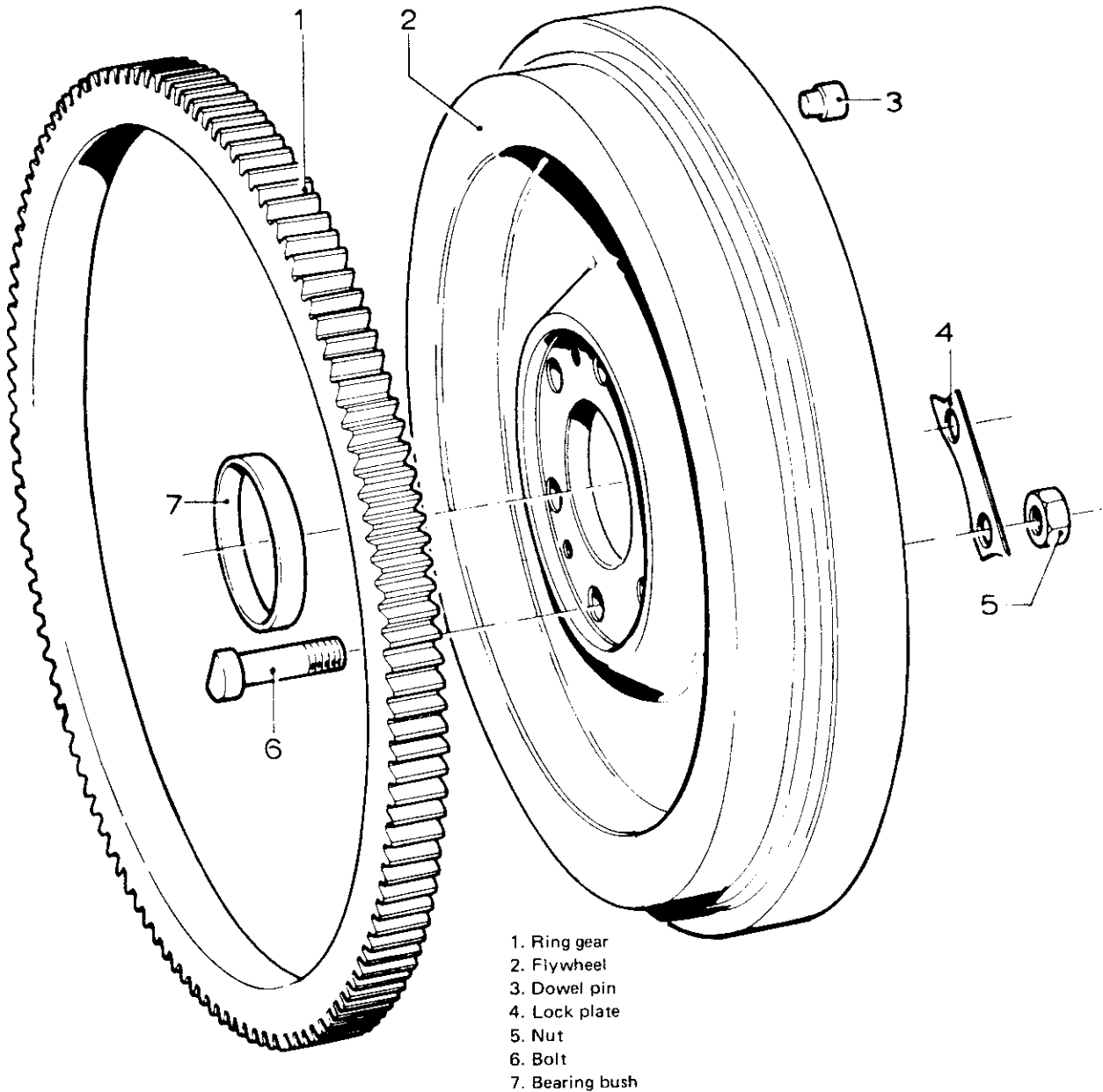
#### Crankshaft dimensions

Code number	Undersize	Main bearing journals	Conrod bearing journals
0	standard	78.724 – 78.764 mm	60.944 – 60.984 mm
1	1st undersize	78.470 – 78.510 mm	60.690 – 60.730 mm
2	2nd undersize	78.216 – 78.256 mm	60.436 – 60.476 mm
3	3rd undersize	77.962 – 78.002 mm	60.182 – 60.222 mm
4	4th undersize	77.708 – 77.748 mm	59.928 – 59.968 mm
5	5th undersize	77.454 – 77.494 mm	59.674 – 59.714 mm



### FLYWHEEL AND RING GEAR

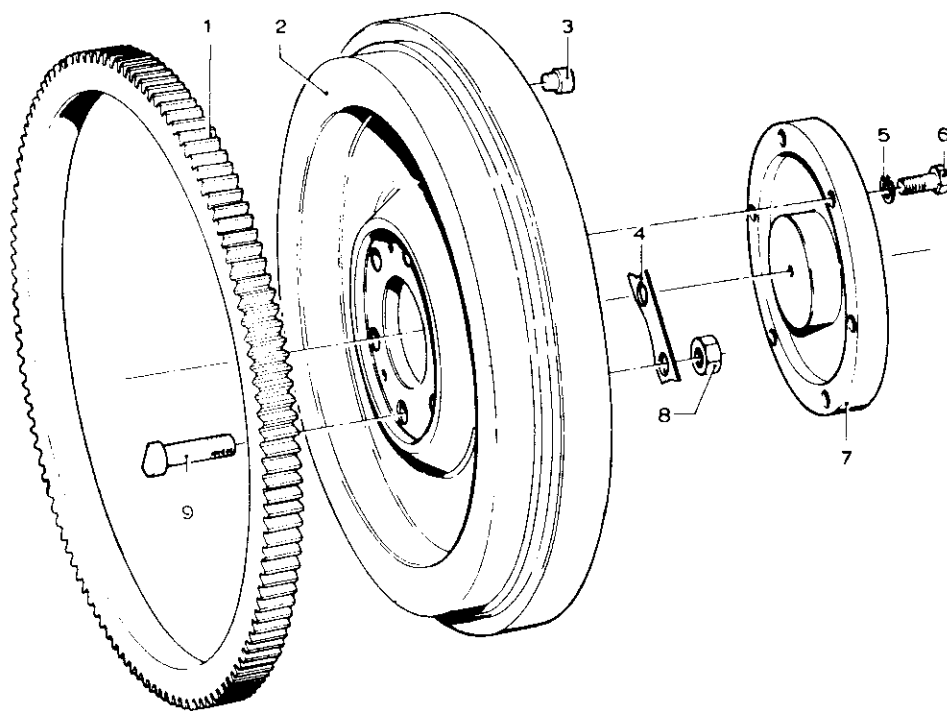
(Flywheel housing: see 2-36)



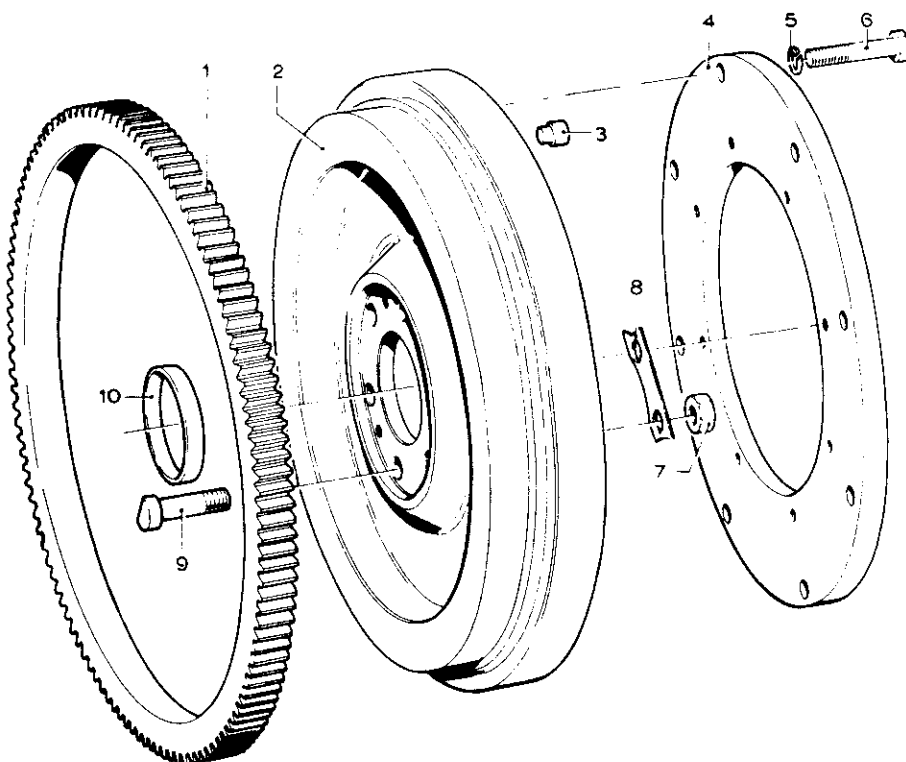
#### SPECIFICATIONS

Axial run-out  
(measured at 140 mm from centre)  
Number of teeth of ring gear  
Tightening torque of flywheel nuts

0.15 mm  
126 teeth  
89-94 Nm (9-9.6 mkg)



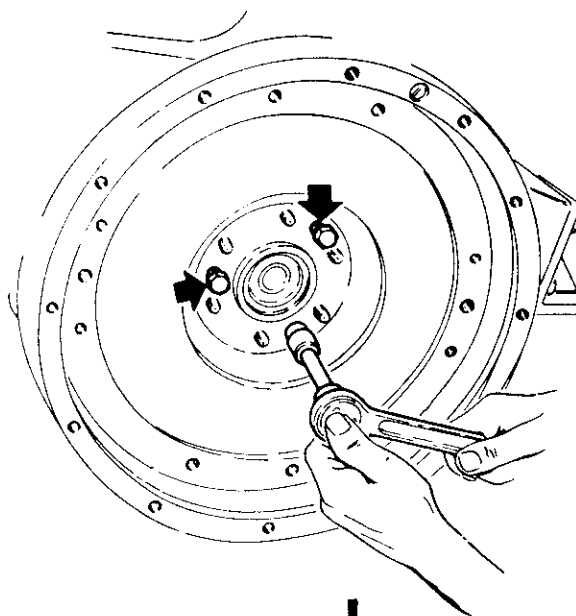
1. Ring gear
2. Flywheel
3. Dowel pin
4. Lock plate
5. Spring washer
6. Screw
7. Bearing bush
8. Nut
9. Bolt



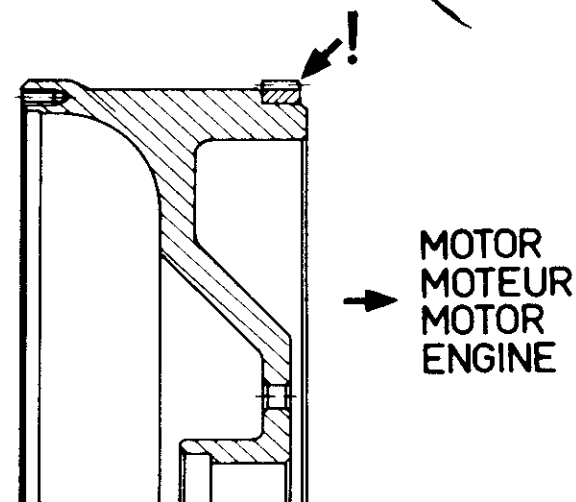
1. Ring gear
2. Flywheel
3. Dowel pin
4. Intermediate ring
5. Spring washer
6. Screw
7. Nut
8. Lock plate
9. Bolt
10. Bearing bush

## INSTRUCTIONS FOR REPAIR

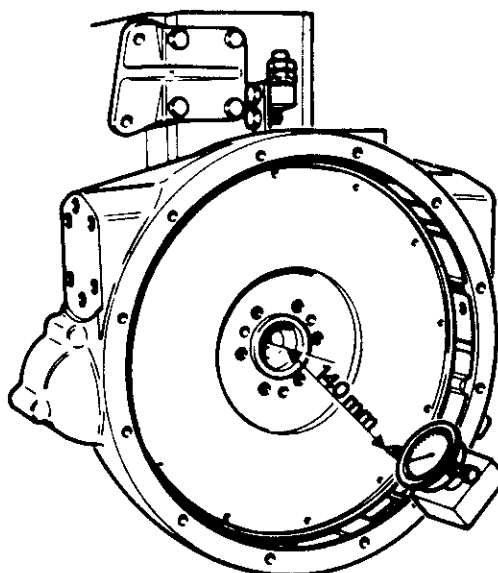
Press the flywheel off the crankshaft by means of three M10 pressure bolts.



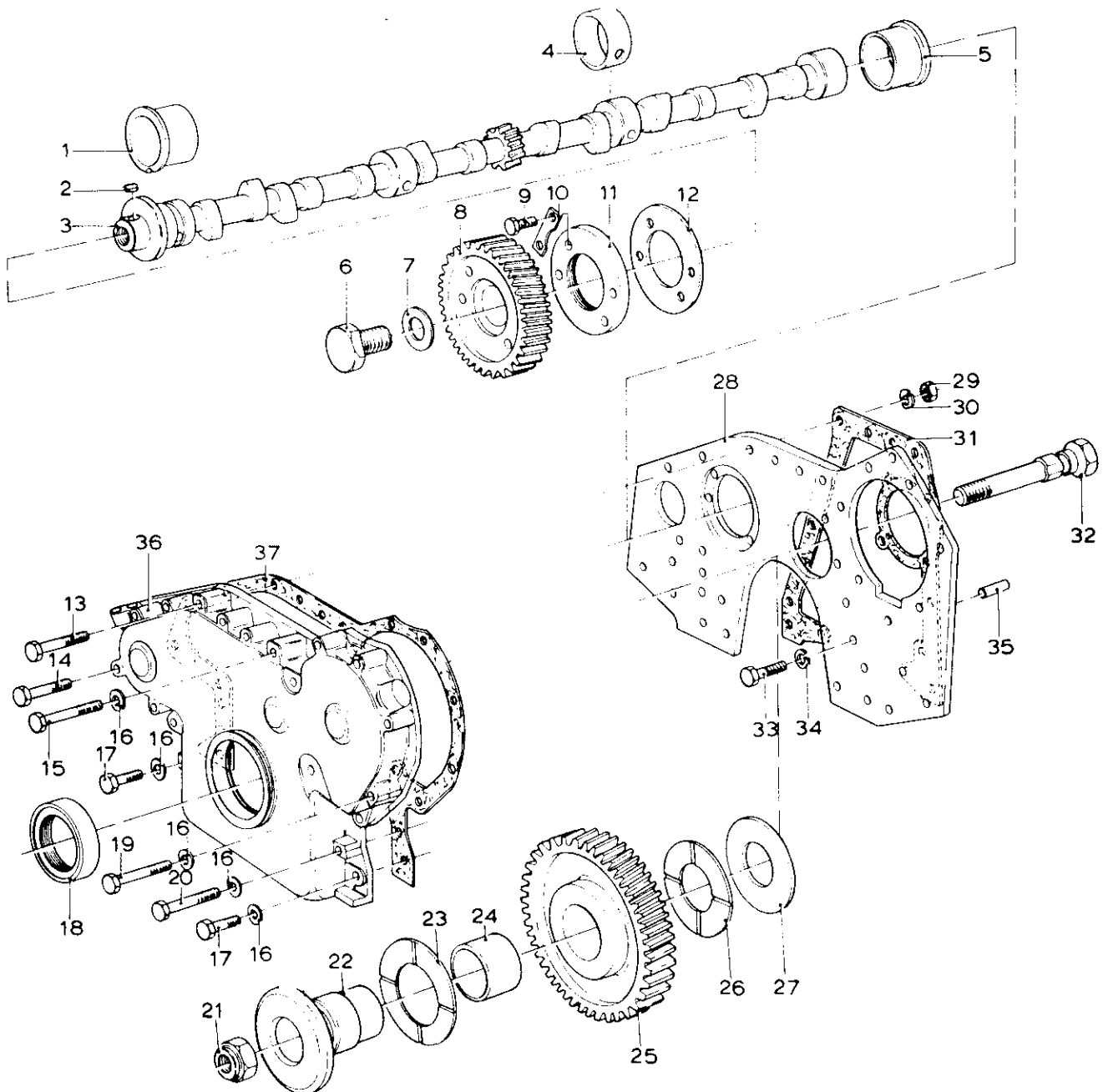
Fit ring gear by heating to approx. 230 °C. Install ring gear with the chamfering of the teeth facing the engine.



When the flywheel has been removed, check lateral run-out as follows: Install dial indicator base on fitting edge of flywheel housing and the measuring spindle on the flywheel front face at 140 mm from the crankshaft centre. Max. permissible clock reading 0.15 mm.



## TIMING



- |                   |                      |                            |
|-------------------|----------------------|----------------------------|
| 1. Bearing, front | 14. Bolt             | 27. Spacer                 |
| 2. Key            | 15. Bolt             | 28. Front supporting plate |
| 3. Camshaft       | 16. Spring washer    | 29. Nut                    |
| 4. Bearing        | 17. Bolt             | 30. Spring washer          |
| 5. Bearing, rear  | 18. Oil seal         | 31. Gasket                 |
| 6. Bolt           | 19. Bolt             | 32. Bolt                   |
| 7. Lock washer    | 20. Bolt             | 33. Bolt                   |
| 8. Camshaft gear  | 21. Self-locking nut | 34. Spring washer          |
| 9. Screw          | 22. Idler gear hub   | 35. Dowel pin              |
| 10. Lock plate    | 23. Thrust washer    | 36. Oil distribution cover |
| 11. Thrust washer | 24. Bearing bush     | 37. Gasket                 |
| 12. Shim          | 25. Idler gear       |                            |
| 13. Bolt          | 26. Thrust washer    |                            |



## SPECIFICATIONS

### Camshaft

Bearing journal dia.	53.217 - 53.230 mm
Initial dimension from nose to back of cam	44.8 - 44.9 mm
Renew camshaft when this dimension is	44.55 mm
Camshaft end play	0.10 - 0.25 mm (max. 0.3 mm)

### Camshaft bearings

Outside dia. bearings 1 & 4 (bushes)	59.721 - 59.740 mm
Inside dia., bearings 1 & 4 (bushes)	53.330 - 53.349 mm
Dia., bearings 2 & 3 (in block)	53.33 - 53.36 mm
Interference fit, bearings 1 & 4 (in block)	0.01 - 0.06 mm
Inside dia., bushes 1 & 4 (after fitting)	53.27 - 53.45 mm
Diametrical clearance, bearings 1 & 4	0.04 - 0.123 mm (max. 0.25 mm)
Diametrical clearance, bearings 2 & 3	0.10 - 0.143 mm (max. 0.25 mm)

### Timing gears

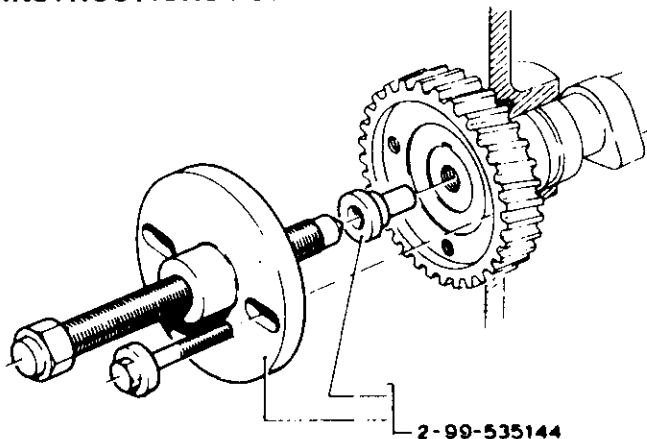
Crankshaft gear, interference fit	0.019 - 0.043 mm
Camshaft gear, interference fit	0.001 - 0.028 mm
Bush clearance in idler gear	0.035 - 0.075 mm
Idler gear spindle clearance in bush	0.03 - 0.08 mm
Idler gear end play	0.065 - 0.25 mm (max. 0.30 mm)
Idler gear to camshaft gear backlash	0.035 - 0.129 mm
Crankshaft gear to idler gear backlash	0.045 - 0.139 mm
Idler gear to fuel pump drive gear backlash	0.095 - 0.189 mm
Crankshaft gear	23 teeth
Idler gear	49 teeth
Camshaft gear	46 teeth
Accessory drive gear (fuel pump)	46 teeth

### Tightening torques:

Bolts and nuts for attachment of	
Front supporting plate	25 - 27 Nm ( 2.5 - 2.7 mkg)
Camshaft thrust washer	25 - 27 Nm ( 2.5 - 2.7 mkg)
Camshaft gear	340 Nm (34.6 mkg)
Castelled nut of idler gear	108 - 115 Nm (11.0 - 11.7 mkg)
Self-locking nut of idler gear	84 - 93 Nm ( 8.5 - 9.5 mkg)
Fuel pump drive gear	61 - 68 Nm ( 6.2 - 6.9 mkg)
Timing cover	25 - 27 Nm ( 2.5 - 2.7 mkg)

## INSTRUCTIONS FOR REPAIR

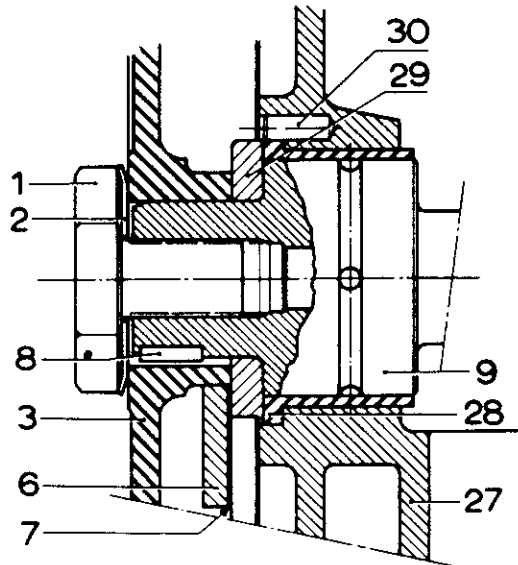
For withdrawing camshaft gear, use special puller, part number 2-99-535144.



### Section through camshaft front end

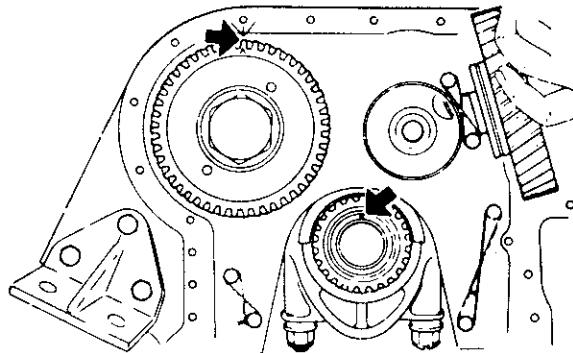
1. Screw
2. Lock washer
3. Camshaft gear
6. Thrust washer
7. Shim
8. Key
9. Camshaft
27. Engine block
28. Bearing bush
29. Thrust washer
30. Lock pin

For camshaft end play adjustment, use shim(s) 7.



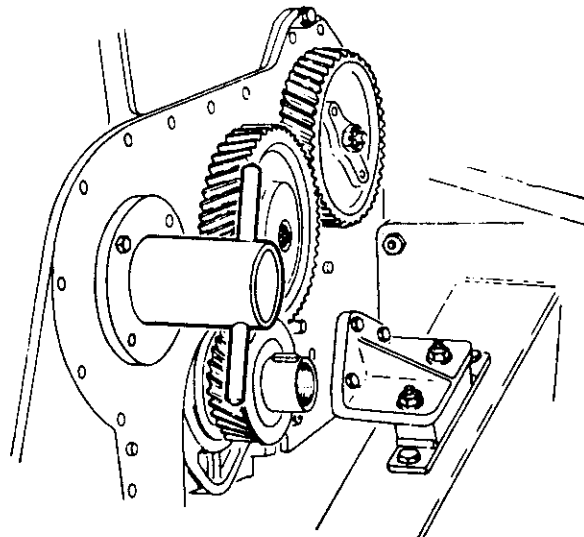
### Fitting timing gears

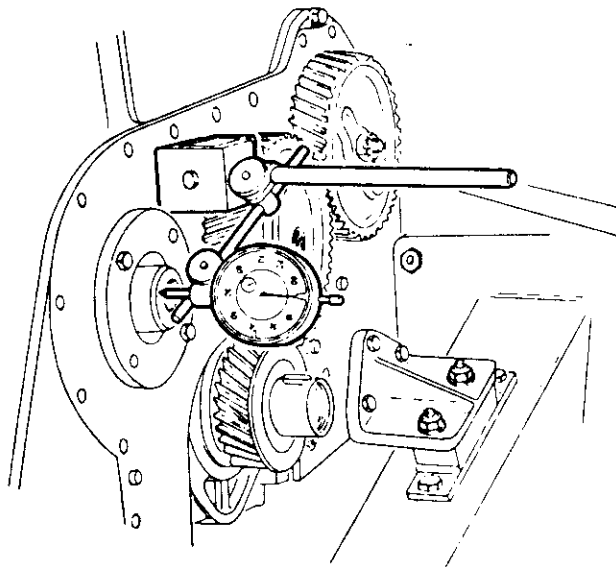
- No. 1 piston in T.D.C. (crankshaft gear key in vertical position).
- Arrows on camshaft gear and timing gear cover in line.



### Centring the camshaft thrust washer

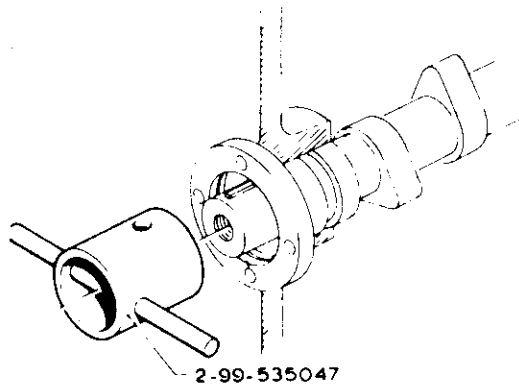
- Install thrust washer (6), but do not tighten bolts (4).
- Centre camshaft by means of centring bush, part no. 2-99-535047.
- Check whether camshaft turns without heavy spots.
- Tighten bolts but do not yet lock.



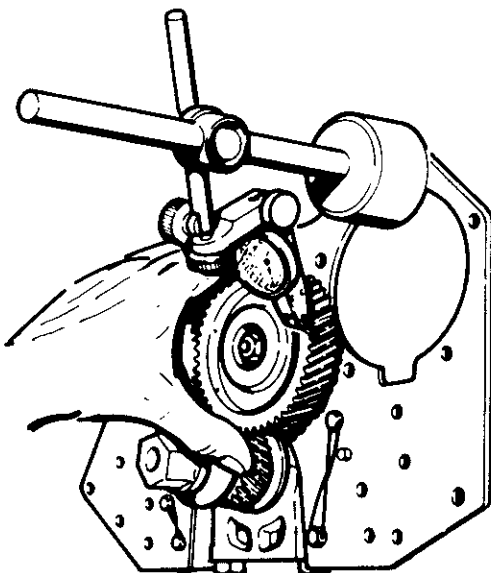


**Setting camshaft end play**

- Measure end play with the aid of a dial gauge.
- If necessary correct by means of one or more shims (7) and next centre the thrust washer (6) again.
- Tighten and lock the bolts (4).

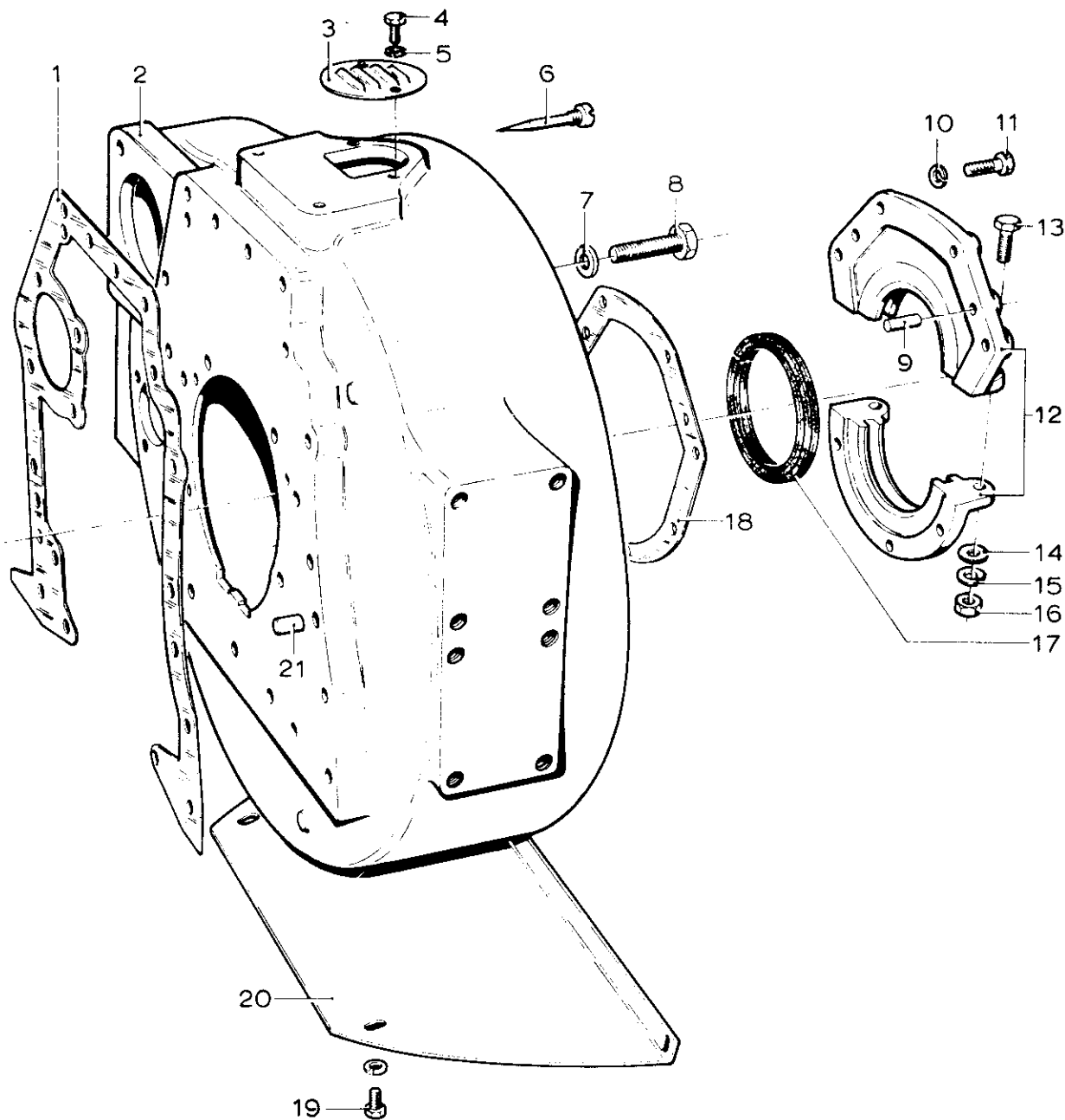


Special tool for centring the camshaft. Part no. 2-99-535047.



Measuring backlash of a timing gear, viz. the idler gear.

## FLYWHEEL HOUSING



### Flywheel housing and crankshaft oil seal.

- |                     |                    |                      |
|---------------------|--------------------|----------------------|
| 1. Gasket           | 8. Screw           | 15. Spring washer    |
| 2. Flywheel housing | 9. Dowel pin       | 16. Nut              |
| 3. Cover            | 10. Spring washer  | 17. Oil seal         |
| 4. Screw            | 11. Screw          | 18. Gasket           |
| 5. Spring washer    | 12. Oil seal cover | 19. Screw            |
| 6. Pointer          | 13. Bolt           | 20. Protection plate |
| 7. Washer           | 14. Washer         |                      |

## SPECIFICATIONS

Max. out of round in relation to crankshaft

0.2 mm

Bolts and nuts for the attachment of:

Flywheel housing

25 - 27 Nm (2.5 - 2.7 mkg)

Inspection cover

25 - 27 Nm (2.5 - 2.7 mkg)

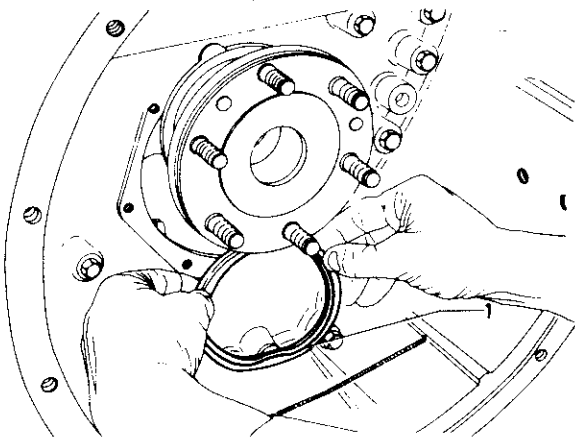
Crankshaft oil seal holder

25 - 27 Nm (2.5 - 2.7 mkg)

Crankshaft oil seal holder halves

12 - 13 Nm (1.2 - 1.3 mkg)

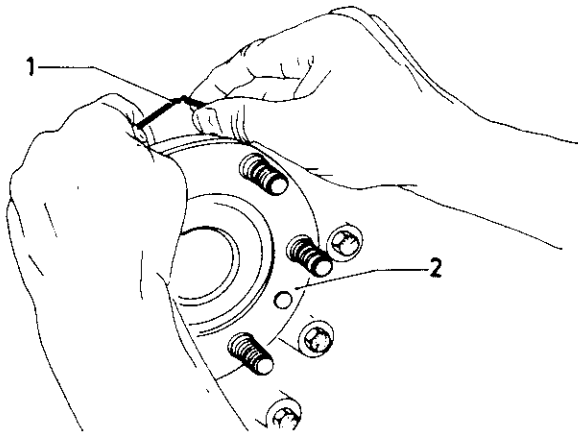
## INSTRUCTIONS FOR REPAIR



### Oil seal on flywheel side

Open out the oil seal sufficiently to be fitted around the crankshaft, the open side facing the engine block. Turn the oil seal so that the gap is on top.

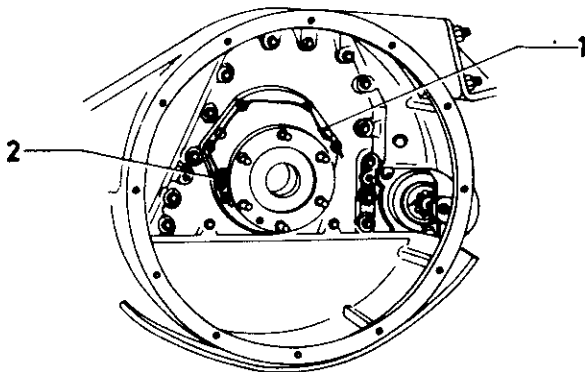
1. Oil seal



Fit the coil spring around the crankshaft and hook the ends together. Install the coil spring in the oil seal groove in such a manner that the connection is opposite the gap.

1. Coil spring

2. Crankshaft



Apply liquid sealing compound to the gasket and the grooves in the oil seal holder.

Install the gasket against the flywheel housing. Install the holder around the oil seal and fit the attachment bolts.

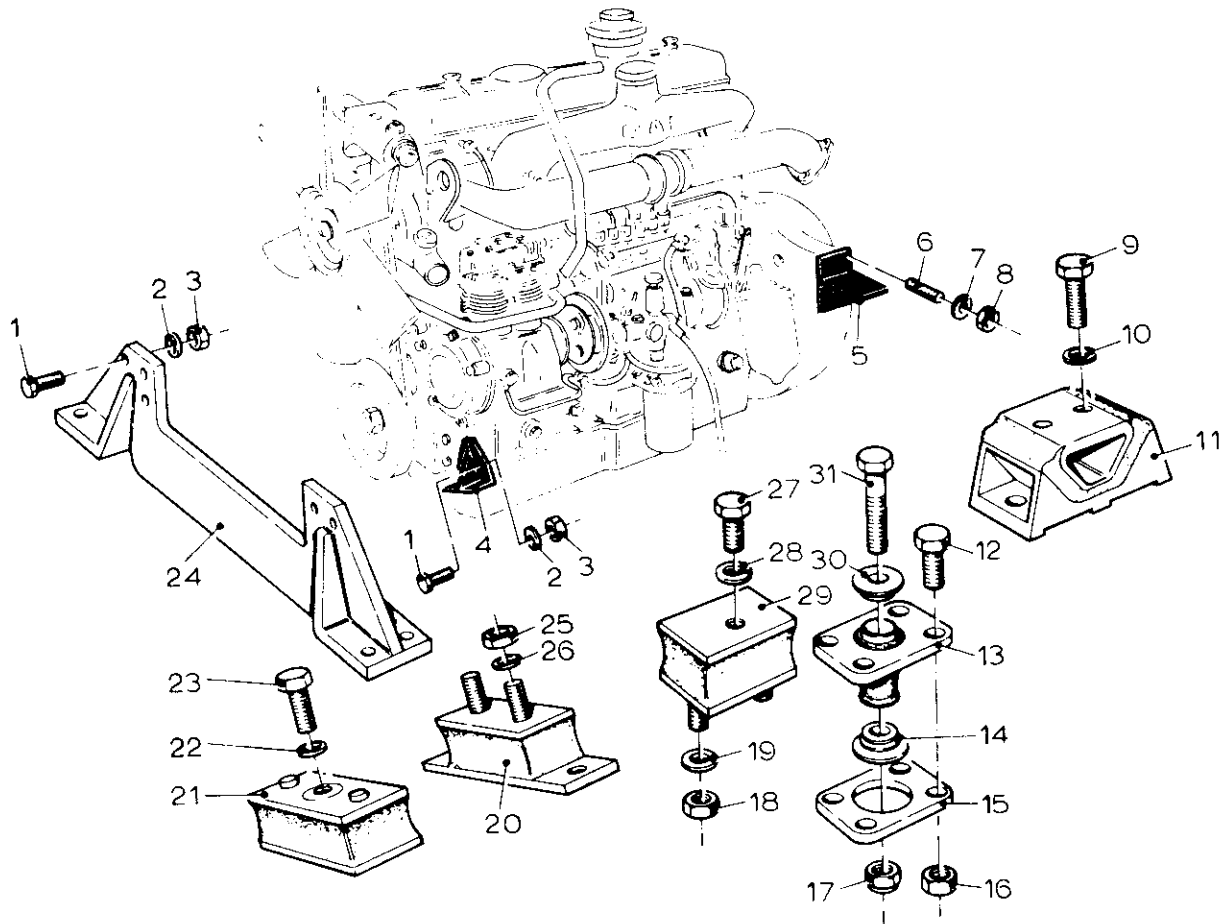
First tighten the clamping bolts and thereafter the attachment bolts.

Lock the attachment bolts with locking wire.

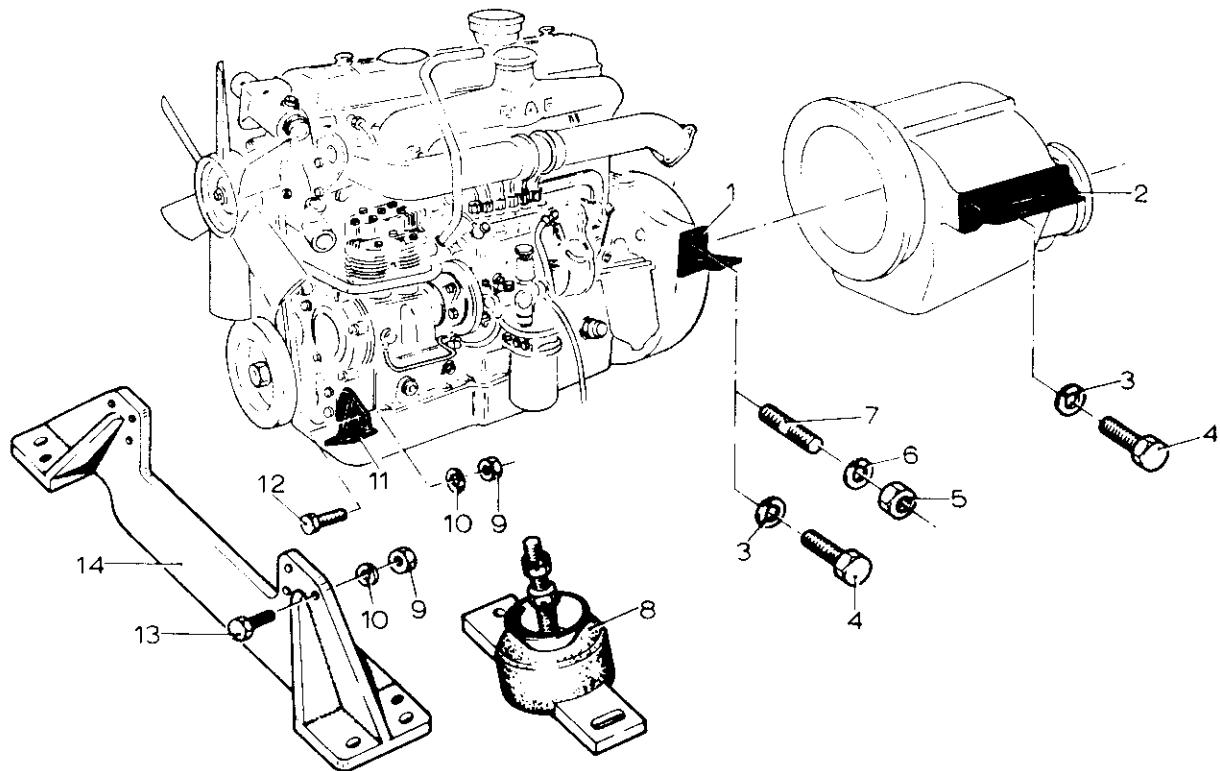
1. Locking wire

2. Clamping bolt

### ENGINE SUSPENSION



- |                           |                       |
|---------------------------|-----------------------|
| 1. Bolt                   | 17. Nut               |
| 2. Spring washer          | 18. Nut               |
| 3. Nut                    | 19. Ring              |
| 4. Engine bracket (front) | 20. Suspension rubber |
| 5. Engine bracket (rear)  | 21. Suspension rubber |
| 6. Stud                   | 22. Spring washer     |
| 7. Spring washer          | 23. Screw             |
| 8. Nut                    | 24. Supporting girder |
| 9. Screw                  | 25. Nut               |
| 10. Spring washer         | 26. Spring washer     |
| 11. Suspension rubber     | 27. Screw             |
| 12. Bolt                  | 28. Spring washer     |
| 13. Suspension rubber     | 29. Suspension rubber |
| 14. Ring                  | 30. Washer            |
| 15. Plate                 | 31. Bolt              |
| 16. Nut                   |                       |

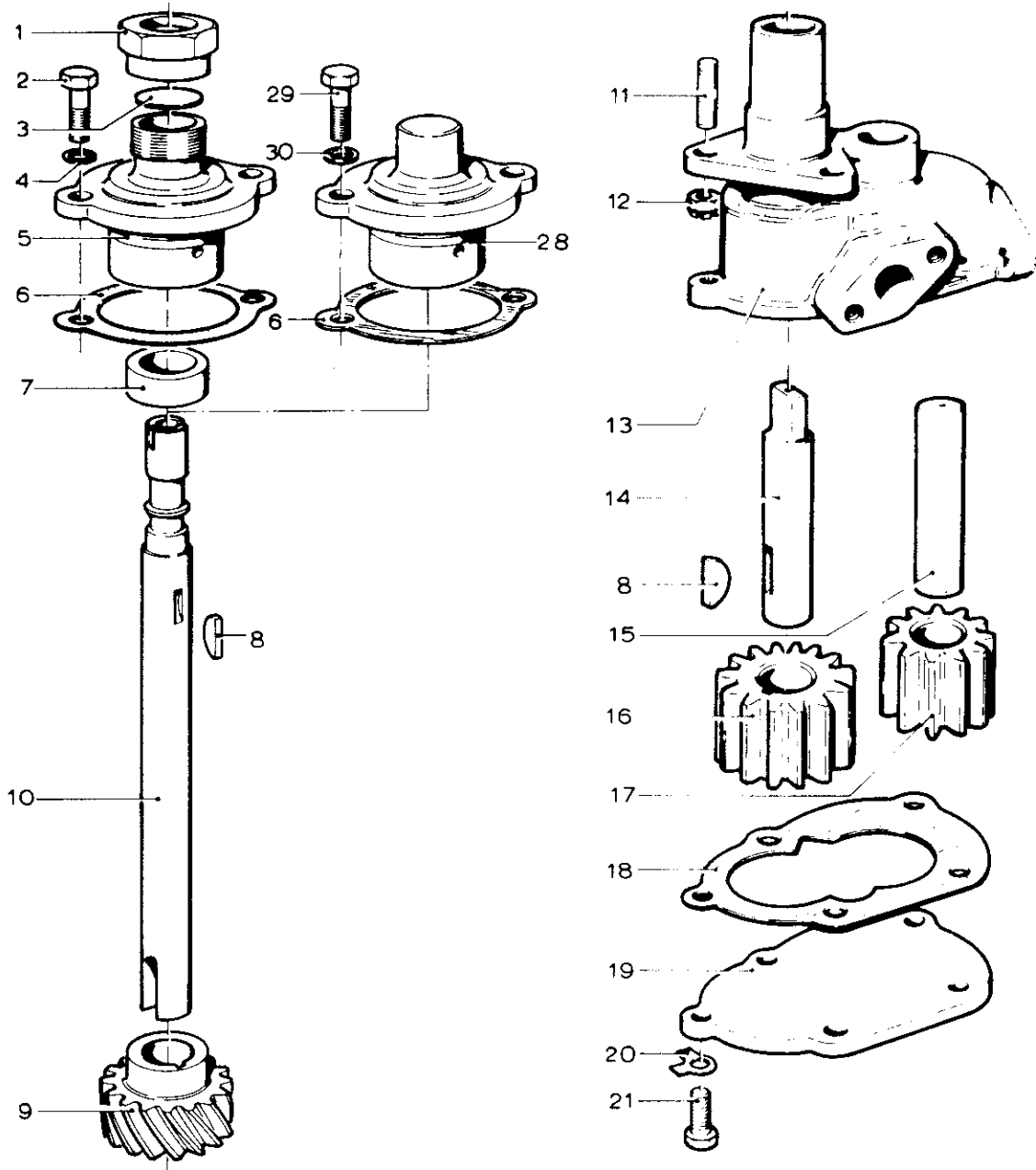


- |                          |                            |
|--------------------------|----------------------------|
| 1. Engine bracket (rear) | 8. Suspension rubber       |
| 2. Bracket               | 9. Nut                     |
| 3. Spring washer         | 10. Spring washer          |
| 4. Screw                 | 11. Engine bracket (front) |
| 5. Nut                   | 12. Bolt                   |
| 6. Spring washer         | 13. Bolt                   |
| 7. Stud                  | 14. Supporting girder      |

Bolts and screws used for the engine suspension must be of material quality 8.8.

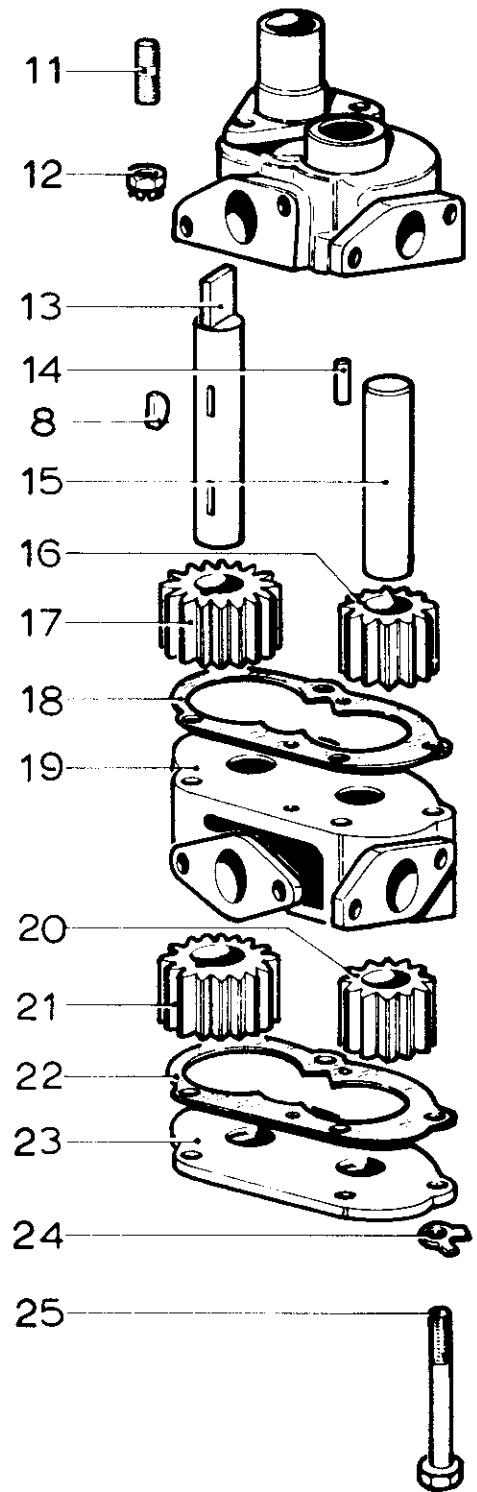
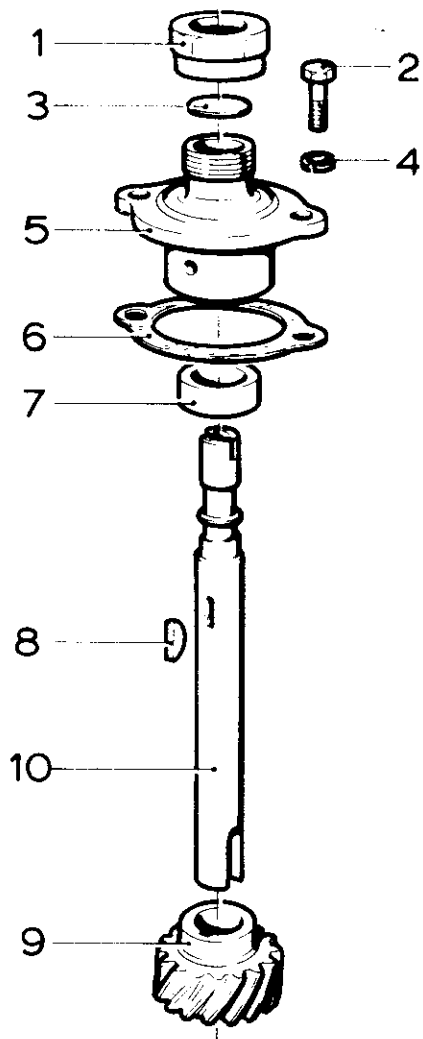
The tightening torque depends on the size of the bolt/screw, for which see the DAF pocket memo, section 0, pages 8 to 11.

### LUBRICATING SYSTEM



- |              |                   |                |
|--------------|-------------------|----------------|
| 1. Union nut | 8. Key            | 15. Spindle    |
| 2. Screw     | 9. Gear           | 16. Gear       |
| 3. End plate | 10. Spindle       | 17. Gear       |
| 4. Washer    | 11. Stud          | 18. Gasket     |
| 5. Housing   | 12. Castelled nut | 19. Cover      |
| 6. Gasket    | 13. Pump housing  | 20. Lock plate |
| 7. Bushing   | 14. Spindle       | 21. Screw      |





**Lubricating oil pump (twin version)**

- |                   |                  |
|-------------------|------------------|
| 1. Union nut      | 14. Dowel pin    |
| 2. Screw          | 15. Spindle      |
| 3. End plate      | 16. Gear         |
| 4. Washer         | 17. Gear         |
| 5. Housing        | 18. Gasket       |
| 6. Gasket         | 19. Pump housing |
| 7. Bushing        | 20. Gear         |
| 8. Key            | 21. Gear         |
| 9. Gear           | 22. Gasket       |
| 10. Spindle       | 23. Cover        |
| 11. Stud          | 24. Lock plate   |
| 12. Castelled nut | 25. Screw        |
| 13. Spindle       |                  |

### SPECIFICATIONS

#### Lubricating system

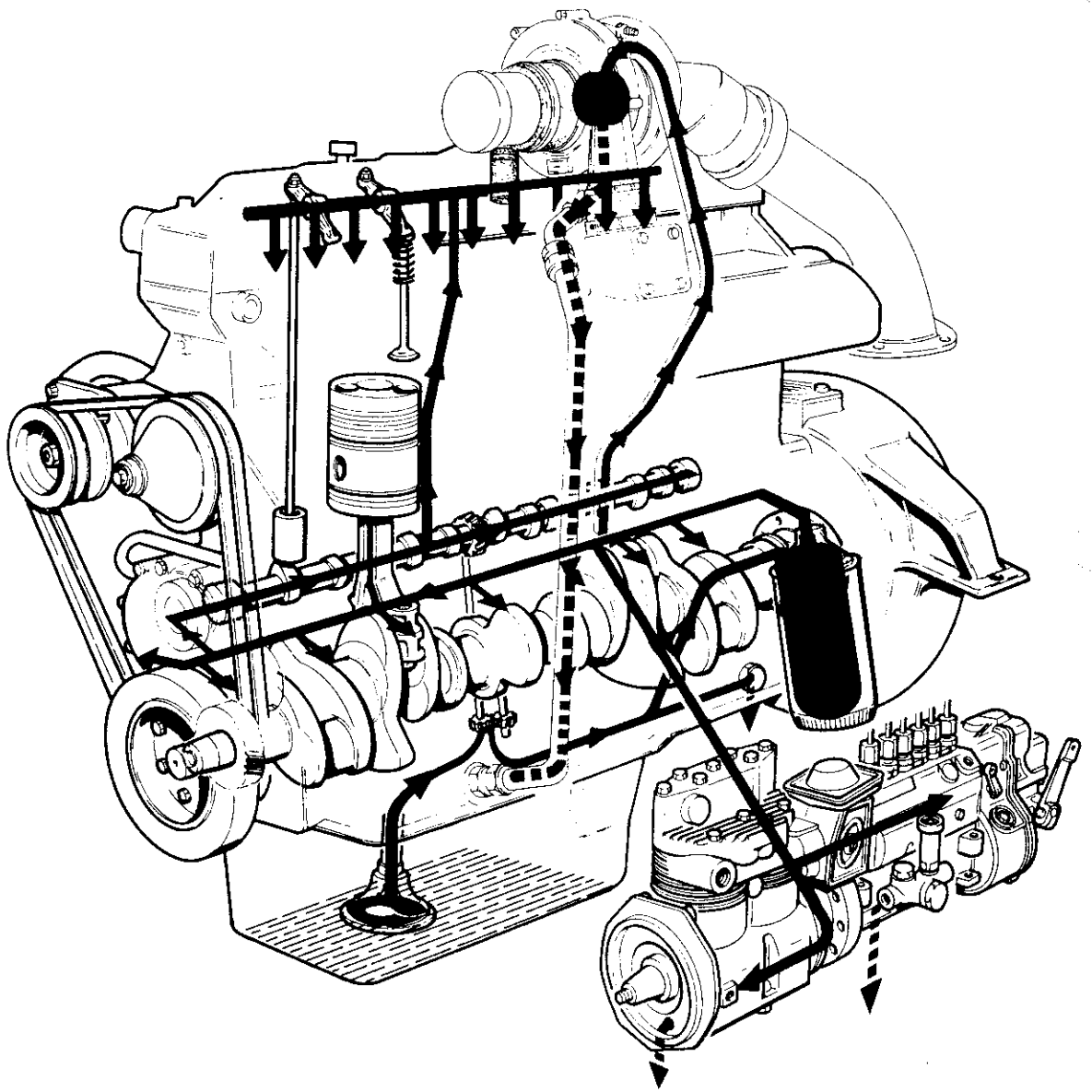
Capacity	12 litres
Oil sump contents (max. level)	10.5 litres
Oil sump contents (min. level)	8.5 litres
Lubricant:	
A.P.I. classification	CC or CD, max. sulphated ash content 1.5 %
below 0 °C	SAE20
from -5 °C to +30 °C	SAE30
above +25 °C	SAE40
Viscosity	
Oil pressure: measured at	75 - 80 °C coolant temperature
at idling speed (when new)	min. 1.0 bar (kg/cm <sup>2</sup> )
at idling speed (after running in)	min. 0.35 bar (kg/cm <sup>2</sup> )
at 2000 r.p.m. engine speed	3.5 - 4.2 bar (kg/cm <sup>2</sup> )
Lubricating oil filter	full-flow filter

#### Lubricating oil pump

Operation	Shaft driven from camshaft
Ratio	1 : 1
Diametrical clearance of driving spindle in bush	0.051 - 0.083 mm
Inside dia. of pump housing	53.677 - 53.703 mm
	44.487 - 44.513 mm
Pump housing depth	34.875 - 34.925 mm
	53.57 - 53.60 mm
Outside dia. of pump gears	44.385 - 44.410 mm
Height of pump gears	34.887 - 34.913 mm
Backlash between gears	0.37 - 0.63 mm
Driving spindle dia. (primary gear)	17.408 - 17.418 mm
Diametrical clearance of spindle in housing	0.037 - 0.067 mm
Driven spindle dia. (secondary gear)	17.345 - 17.355 mm
Interference fit of spindle in housing	0.009 - 0.031 mm
Clearance, driven spindle in driven gear	0.032 - 0.054 mm
Min. pump output at 4 bar (kg/cm <sup>2</sup> ) counter pressure, SAE 30 lubricating oil, 80 °C	35 litres/min. at 1200 r.p.m. pump speed 5.5 litres/min. at 250 r.p.m. pump speed

#### Tightening torques

Oil pump cover	13 - 14 Nm (1.3 - 1.4 mkg)
Oil pump	27 - 30 Nm (2.7 - 3.0 mkg)
Thrust bearing gear	25 - 27 Nm (2.5 - 2.7 mkg)
Suction and pressure lines	25 - 27 Nm (2.5 - 2.7 mkg)
Clamping ring	23 - 25 Nm (2.3 - 2.5 mkg)
Oil pan	25 - 27 Nm (2.5 - 2.7 mkg)
Dipstick holder	23 - 25 Nm (2.3 - 2.5 mkg)
Lub. oil filter	39 - 41 Nm (3.9 - 4.1 mkg)
Drain plug	79 - 88 Nm (8 - 9 mkg)

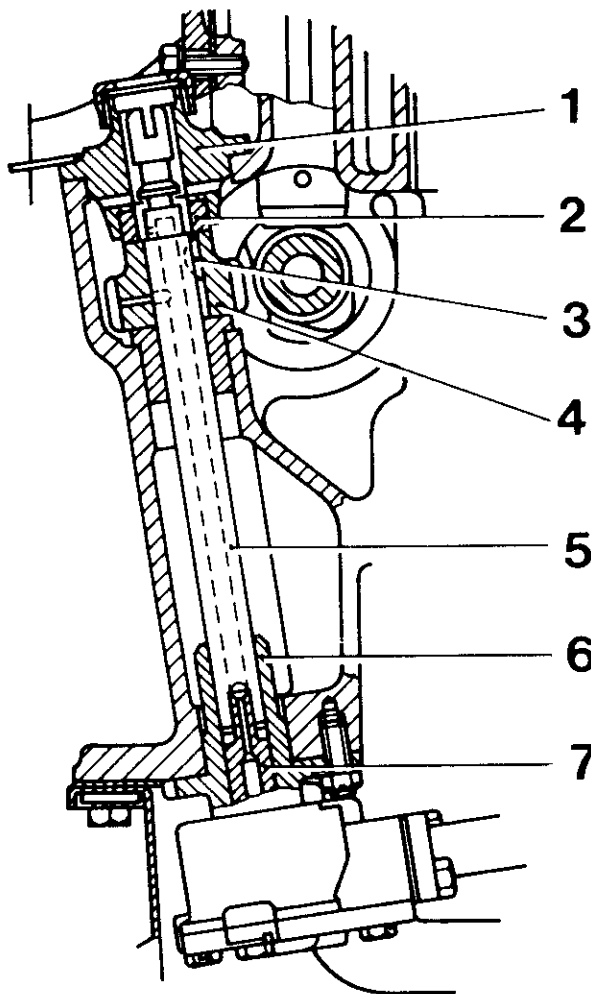


■ Lubricating oil circuit DD, DF and DT

▬ DT only

#### Oil pump drive

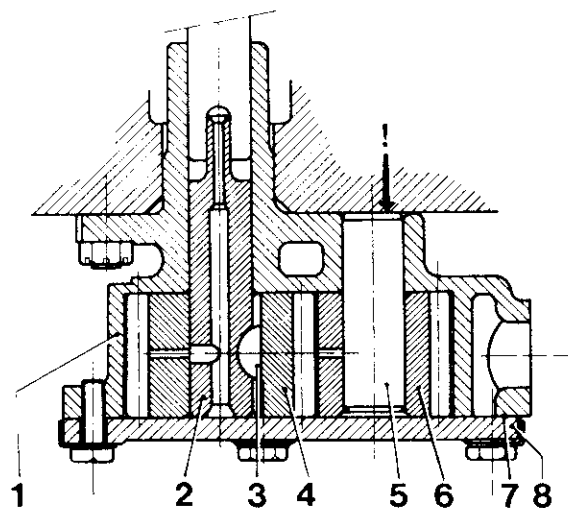
- 1. Thrust bearing
- 2. Bearing bush
- 3. Key
- 4. Drive gear
- 5. Drive spindle
- 6. Oil pump housing
- 7. Primary pump spindle

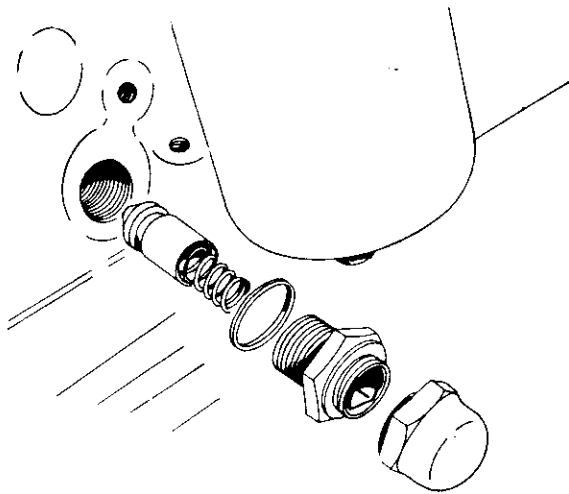


#### Section through oil pump

- 1. Oil pump housing
- 2. Primary pump shaft
- 3. Key
- 4. Primary gear
- 5. Secondary pump shaft
- 6. Secondary gear
- 7. Gasket
- 8. Cover

Press in the secondary pump shaft until it is flush with the pump housing.





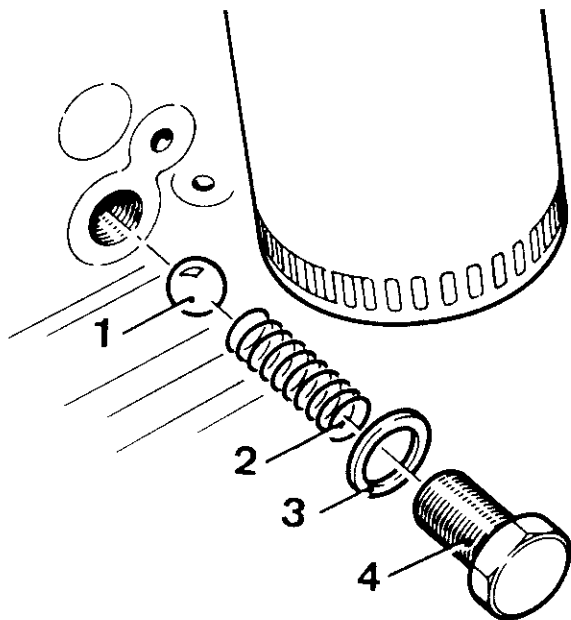
**PRESSURE RELIEF VALVE  
(old version)**

Adjusting oil pressure relief valve

– engine oil SAE 30

– oil temperature 80 °C

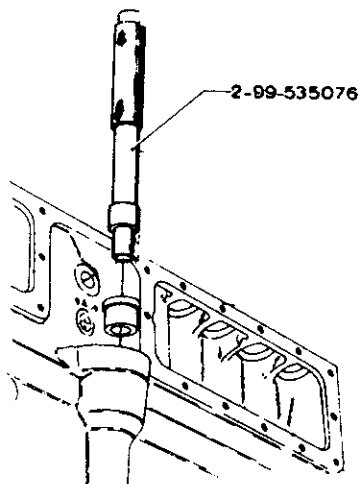
If, owing to wear, oil pressure no longer reaches the prescribed value, it is not permissible to increase this pressure by further screwing in the relief valve.



(new version)

Non-adjustable pressure relief valve.

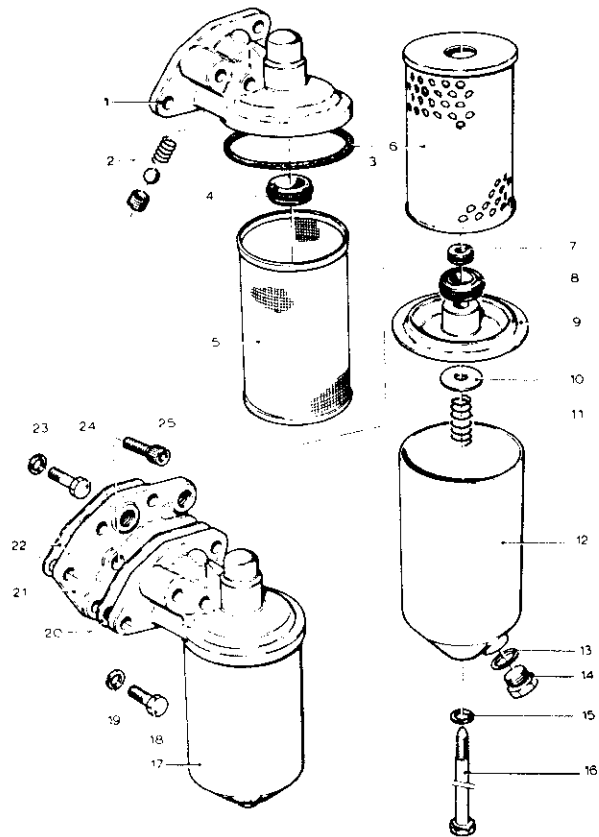
1. Ball
2. Spring
3. Ring
4. Screw



Use drift 2-99-535076 to press drive gear bush home.

- |                   |                      |
|-------------------|----------------------|
| 1. Filter head    | 14. Plug             |
| 2. By-pass valve  | 15. Sealing ring     |
| 3. Rubber ring    | 16. Central bolt     |
| 4. Sealing rubber | 17. Filter complete  |
| 5. Strainer       | 18. Screw            |
| 6. Filter element | 19. Spring washer    |
| 7. Grommet        | 20. Gasket           |
| 8. Sealing rubber | 21. Connecting piece |
| 9. Bottom cover   | 22. Gasket           |
| 10. Washer        | 23. Spring washer    |
| 11. Spring        | 24. Screw            |
| 12. Filter bowl   | 25. Allen screw      |
| 13. Sealing ring  |                      |

When renewing the filter element also clean the filter strainer and the interior of the filter bowl and check O-ring and sealing rubbers. Every 1000 operating hours (30,000 km) the O-ring must be renewed.



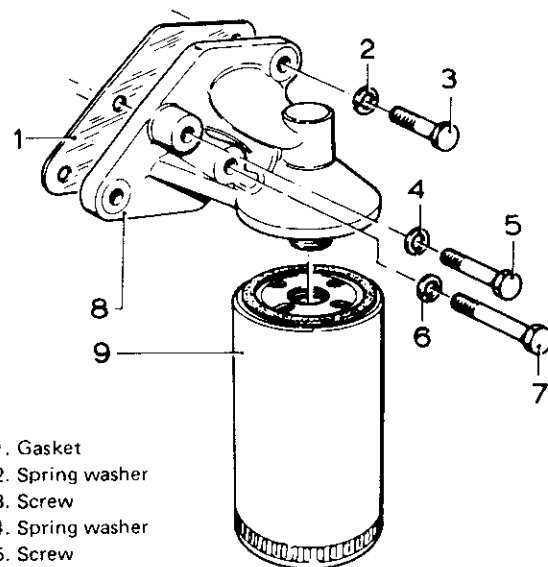
#### Disposable oil filter

On some versions of the engine the lubricating oil filter with renewable filter element has been replaced by a disposable oil filter. Such a filter is screwed into the filter head and discarded after use. Cleaning for re-use is, hence, not permitted.

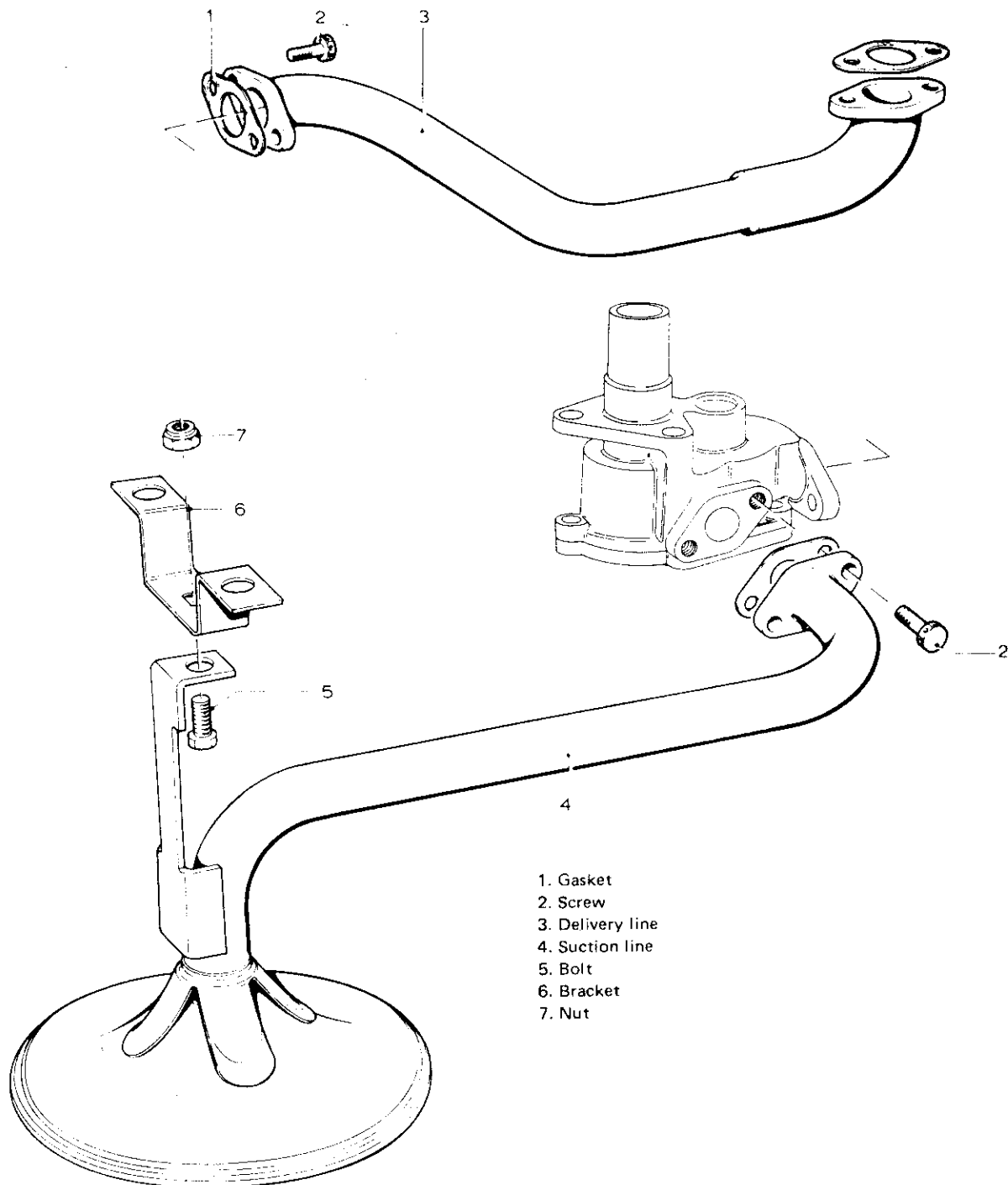
A pressure relief valve in the filter bottom will open if the filter is excessively fouled. The oil passes the filter without being filtered then.

#### Installation:

- Moisten filter seal with oil
- Screw filter into filter head by hand
- Run engine for a short moment and check for leakage.

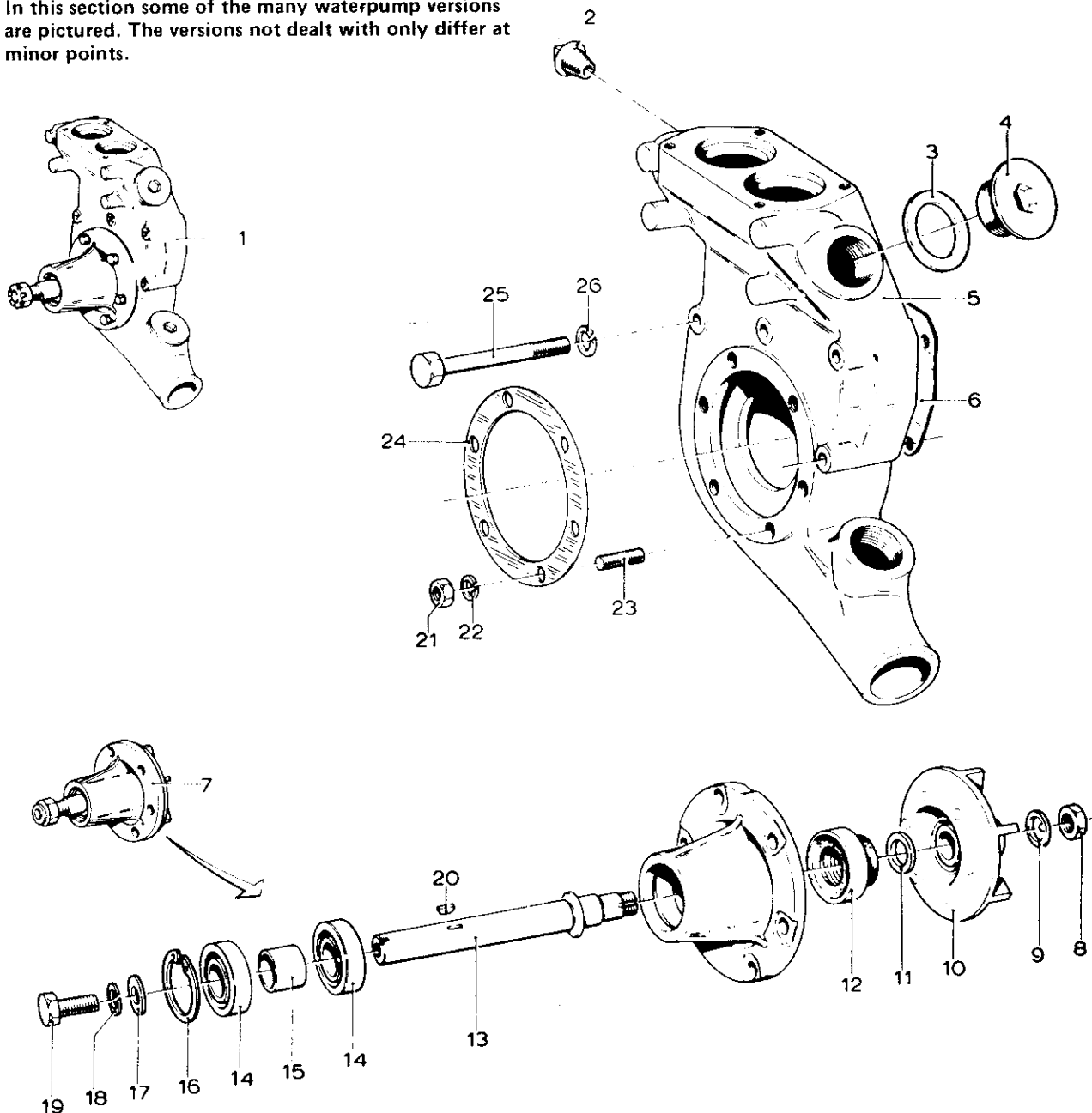


- |                   |
|-------------------|
| 1. Gasket         |
| 2. Spring washer  |
| 3. Screw          |
| 4. Spring washer  |
| 5. Screw          |
| 6. Spring washer  |
| 7. Screw          |
| 8. Filter head    |
| 9. Filter element |



### COOLING SYSTEM

In this section some of the many waterpump versions are pictured. The versions not dealt with only differ at minor points.



- |                             |                   |                               |
|-----------------------------|-------------------|-------------------------------|
| 1. Waterpump                | 10. Impeller      | 19. Screw                     |
| 2. Plug                     | 11. Wearing ring  | 20. Key                       |
| 3. Sealing ring             | 12. Water seal    | 21. Nut                       |
| 4. Plug                     | 13. Shaft         | 22. Spring washer             |
| 5. Waterpump housing        | 14. Ball bearing  | 23. Stud                      |
| 6. Gasket                   | 15. Spacer sleeve | 24. Gasket                    |
| 7. Bearing housing complete | 16. Circlip       | 25. Screw L = 70 mm L = 76 mm |
| 8. Nut                      | 17. Washer        | 26. Spring washer             |
| 9. Lock washer              | 18. Spring washer |                               |



## SPECIFICATIONS

### Cooling

Cooling system  
 Thermostat opens at  
 Thermostat min. 8 mm open at  
 Operating temperature

forced coolant circulation  
 73 - 77 °C  
 87 °C  
 75 - 80 °C

### Waterpump

Press fit, pulley to shaft  
 Press fit, impeller to shaft

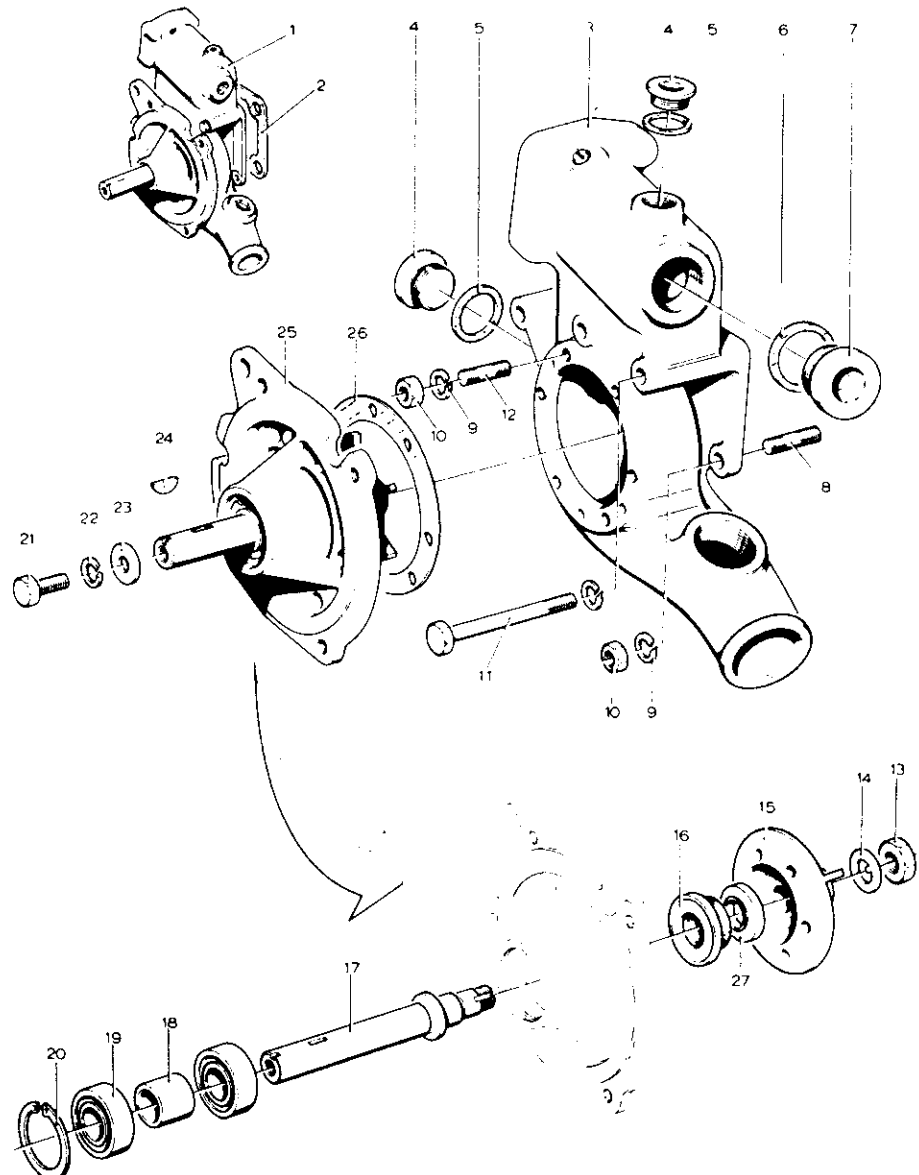
0.003 - 0.033 mm  
 0.022 - 0.050 mm

### Tightening torques

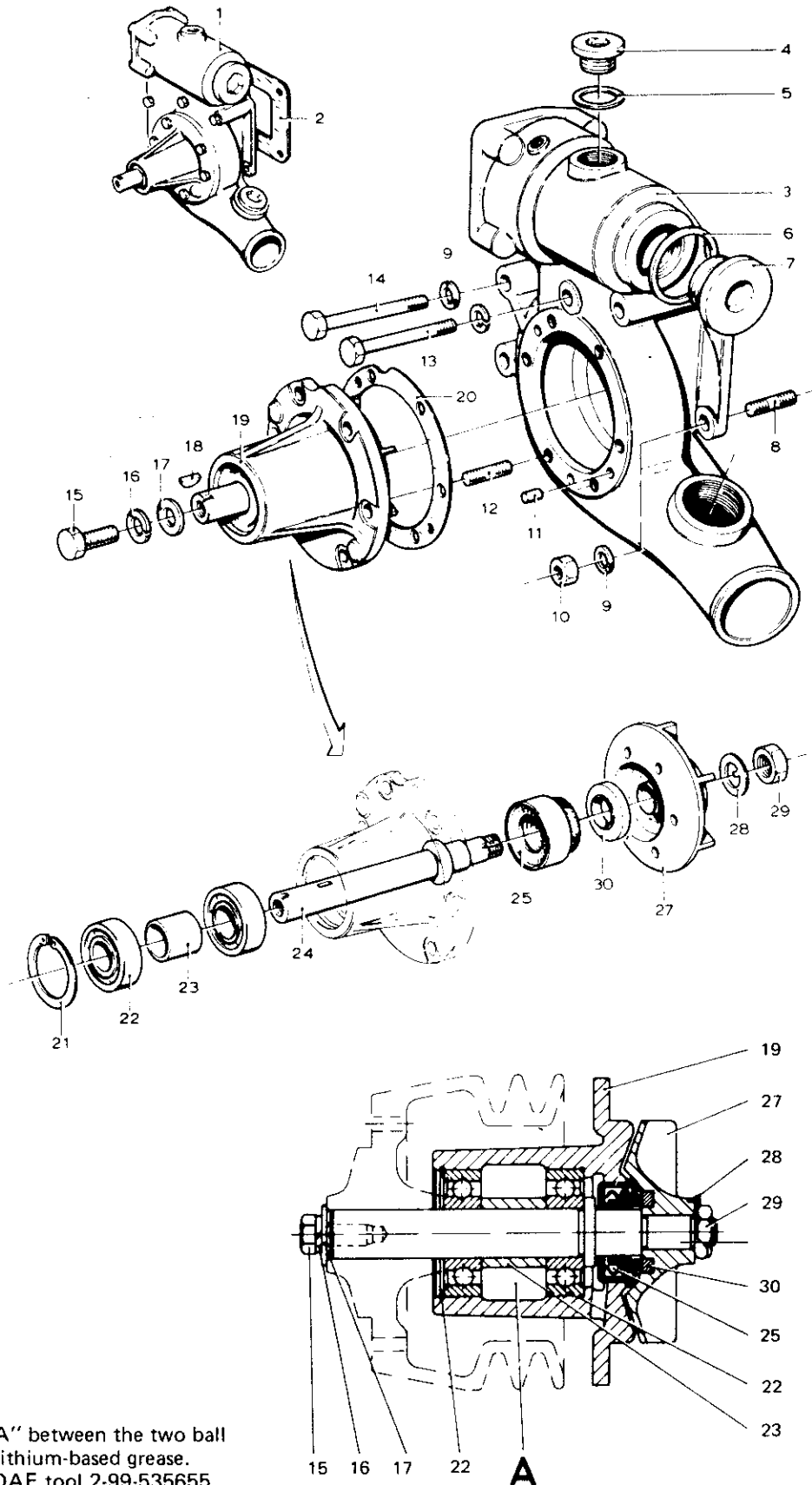
Bolts and nuts for the attachment of  
 Impeller  
 Waterpump plate  
 Waterpump  
 Vee-belt pulley  
 Thermostat housing cover

35 - 45 Nm (3.5 - 4.5 mkg)  
 23 - 25 Nm (2.3 - 2.5 mkg)  
 25 - 27 Nm (2.5 - 2.7 mkg)  
 45 - 55 Nm (4.5 - 5.5 mkg)  
 23 - 25 Nm (2.3 - 2.5 mkg)

1. Waterpump
2. Gasket
3. Pump shell
4. Plug
5. Sealing ring
6. Sealing ring
7. Plug
8. Stud
9. Spring washer
10. Nut
11. Screw
12. Stud
13. Nut
14. Washer
15. Impeller
16. Water seal
17. Shaft
18. Spacer sleeve
19. Ball bearing
20. Circlip
21. Screw
22. Spring washer
23. Washer
24. Key
25. Bearing housing complete
26. Gasket
27. Wearing ring

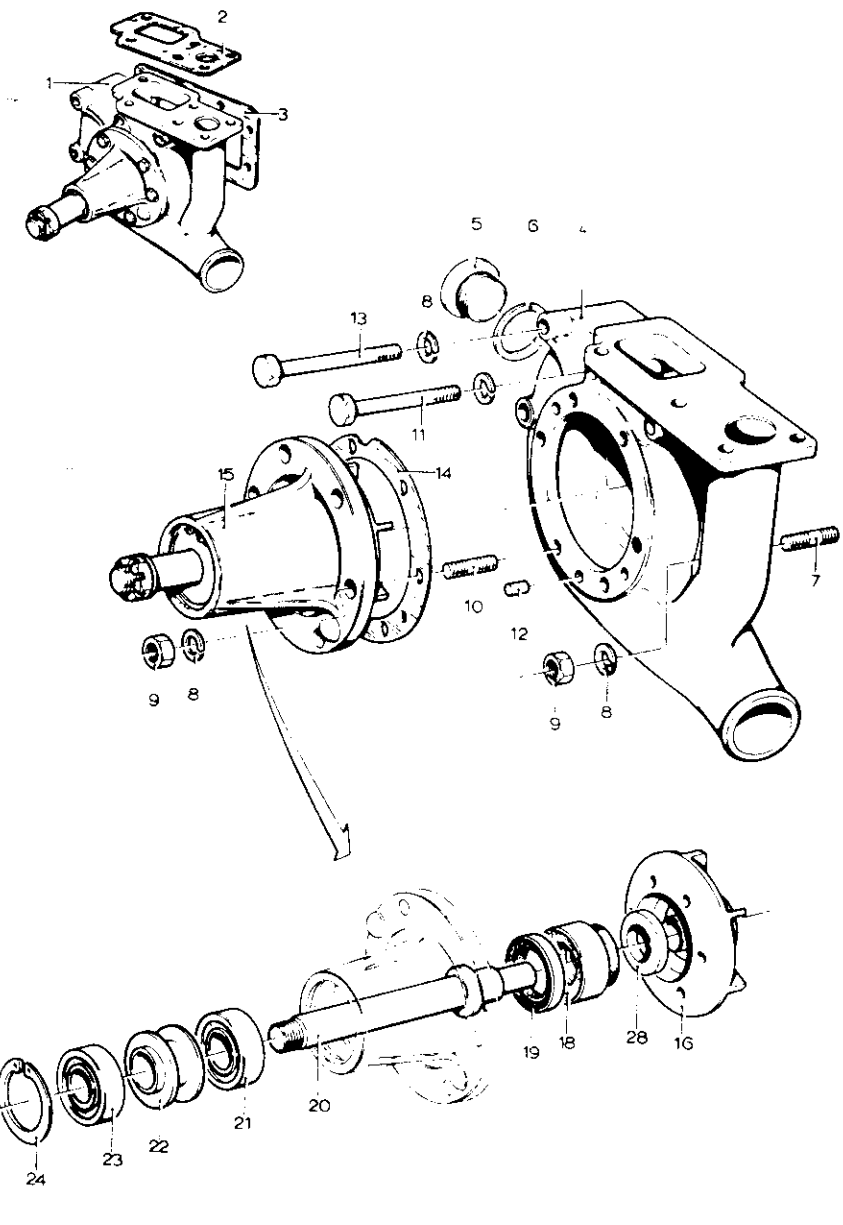


1. Waterpump
2. Gasket
3. Pump shell
4. Plug
5. Sealing ring
6. Sealing ring
7. Plug
8. Stud
9. Spring washer
10. Nut
11. Dowel pin
12. Stud
13. Screw
14. Screw
15. Screw
16. Spring washer
17. Washer
18. Key
19. Bearing housing complete
20. Gasket
21. Circlip
22. Ball bearing
23. Spacer sleeve
24. Shaft
25. Water seal
27. Impeller
28. Lock washer
29. Nut
30. Wearing ring

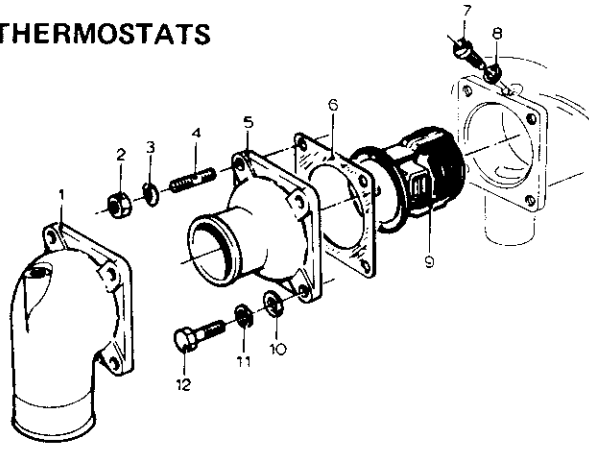


At installation fill the space "A" between the two ball bearings one-third full with a lithium-based grease.  
For fitting the water seal use DAF tool 2-99-535655.

1. Waterpump
2. Gasket
3. Gasket
4. Pump shell
5. Plug
6. Sealing ring
7. Stud
8. Spring washer
9. Nut
10. Stud
11. Screw
12. Dowel pin
13. Screw
14. Gasket
15. Bearing housing
16. Impeller
18. Water seal
19. Oil seal
20. Shaft
21. Ball bearing
22. Spacer sleeve
23. Ball bearing
24. Circlip
25. Ring
26. Castelled nut
27. Split pin
28. Wearing ring



**THERMOSTATS**



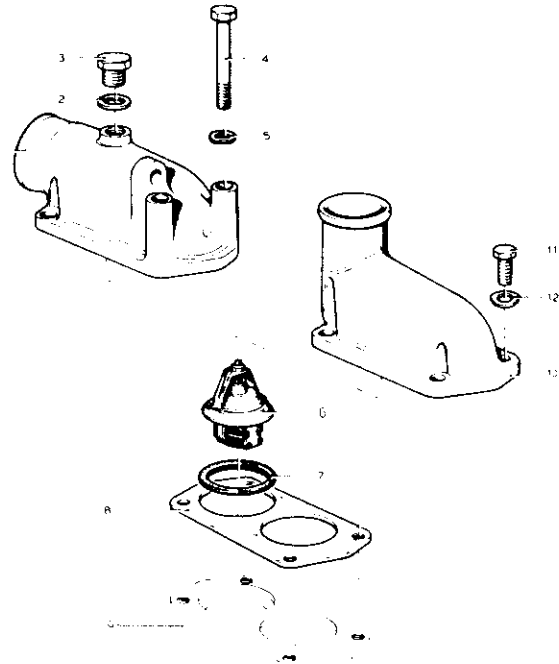
**Ether thermostat**

1. Cover
2. Nut
3. Spring washer
4. Stud
5. Cover
6. Gasket
7. Screw
8. Spring washer
9. Thermostat (ether)
10. Washer
11. Spring washer
12. Screw

To remove the thermostat first slacken screw (7).

### Wax thermostats

1. Connection flange
2. Sealing ring
3. Plug
4. Screw L = 55 mm
5. Spring washer
6. Thermostat (2 off)
7. Sealing ring
8. Gasket
9. Thermostat housing
10. Thermostat with breathing  
without breathing
11. Screw L = 18 mm
12. Spring washer



### CHECKING THE COOLING SYSTEM

To obtain an optimal engine performance, the engine cooling system must be in an optimal condition too. It is for this reason that we give below some instructions which may contribute to avoid and to remedy troubles with the cooling system.

#### Introduction

The cooling system of the DAF commercial vehicles operates under an overpressure of 0.28 kg/cm<sup>2</sup>. This overpressure is obtained by installing an over-pressure filler cap on the radiator or on the expansion tank. The advantage of such an overpressure system is that the coolant will start boiling only at a higher temperature than under atmospheric pressure. This also means an extra protection of the cooling system. For reasons of cylinder and bearing life, it is necessary that the engine reaches the required operating temperature soonest possible and that — notwithstanding any changes in engine load or in atmospheric temperature — the coolant temperature is kept at a constant level as much as possible. This can be reached by using a thermostat (if necessary, two thermostats in parallel) in the coolant circuit. DAF believe an operating temperature of abt. 80 °C (with cab heating switched off) the ideal temperature of a diesel engine. Thanks to the overpressure system, however, there is no need for alarm in case the temperature would rise to — for instance — 90 to 95 °C during a short time.

#### Temperature gauge and corresponding warning light

On the instrument panel may be installed a coolant temperature gauge, whether or not combined with a temperature warning lamp, or only a warning lamp.

These two warning instruments are controlled by a thermo-element, a so-called sensor. Such a sensor must be installed at the spot where the coolant reaches its highest temperature, i.e. ahead of the thermostat. On the other hand, care should be taken that the sensor is not influenced by the temperature of — much warmer — metal engine parts. This could occur, for instance, if a wrong type of sensor is used, which is too close to warm metal engine parts, or if the prescribed sensor ring is left out.

In most cases a warning lamp not combined with a temperature gauge is only applied at the special request of the customer. Such a warning lamp has the clear disadvantage that it only burns when the temperature is below 45 °C or above 95 °C, and consequently the driver is left in uncertainty as to the fluctuations in temperature.

A warning lamp combined with a temperature gauge has a sensor which reacts to the position of the temperature gauge pointer and, hence, only indirectly to the coolant temperature.

#### Venting and filling

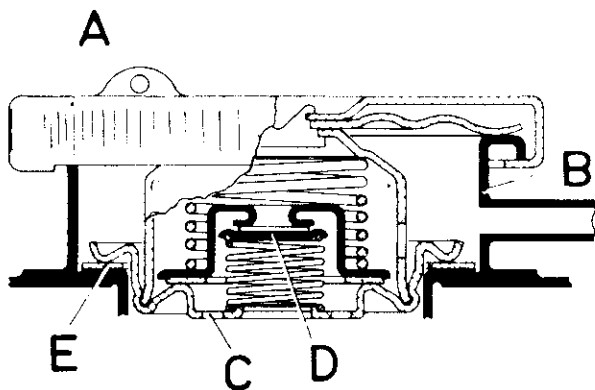
Air is a bad heat conductor and it is therefore that the presence of air in the cooling system must be avoided as much as possible. For this reason a vent line is connected with the highest points of the coolant circuit.

This vent line opens into the radiator upper part or into the expansion tank. In this connection, it is an absolute necessity that the radiator upper part or the expansion tank is installed on the highest point of the cooling system. For this reason it is important to proceed as follows when filling the cooling system:

- top up until coolant level reaches overflow pipe in radiator upper part or in expansion tank;
- run engine for a few minutes;
- top up again.

#### Blow-off filler cap

The filler cap on radiator or on expansion tank is of the blow-off type and has two valves. Under normal conditions both valves are closed. When cooling system pressure exceeds  $0.28 \text{ kg/cm}^2$  valve C opens. The surplus water finds its way through the overflow pipe, pressure drops to  $0.28 \text{ kg/cm}^2$  and valve C closes. As soon as under-pressure in the cooling system develops owing to the smaller volume of the cooled-off water, valve D opens. Elimination of the vacuum ensures that the cooling system is topped up from the radiator upper part or from the expansion tank.



- A. Filler cap
- B. Filler neck
- C. Pressure relief valve
- D. Vacuum valve
- E. Joint

#### Cooling problems

In case the customer has problems with the cooling system, the above will be of some diagnostic value. There is a possibility that one or more of these provisions are malfunctioning or have not been installed on the engine. It is also possible that the customer is alarmed by the high coolant temperature, although under the given conditions this is to be considered as normal.

In case the coolant temperature is inadmissibly high, a systematical inspection will mean a good help to quickly trace the cause. In this connection the following questions may be of importance:

- Does the complaint date back from the moment the new engine was put into service?  
If not:
- After how much time or after how many kilometres did the defect first become evident?
- Did the fault develop after repairs or without any special operation having been effected?
- Has the excessive temperature been recorded suddenly or gradually after a certain period?
- Is there any loss of coolant?

#### Checking

The answers to the above questions will give some insight into possible causes and this will determine in what sequence the checking operations mentioned below will have to be effected:

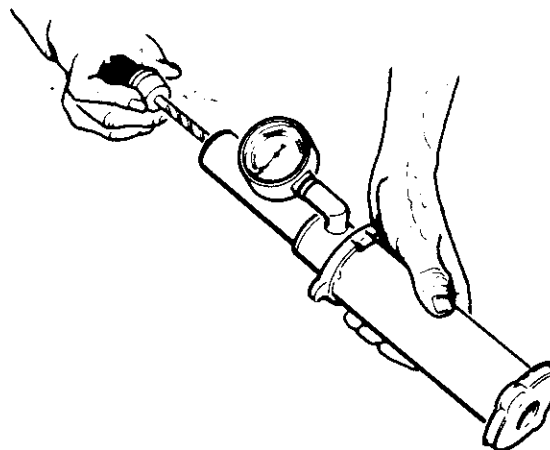
- Checking for coolant leakage on the outside.
- Clean radiator cooling block on the outside.
- Check coolant flexible tubes, hoses, nipples and banjo unions for clogging and leakages.
- Check temperature gauge and warning lamp for correct indication and correct operation.
  - Try another gauge.
  - Try another thermo-element
- Check thermostats.

Note: Keep replaced thermostats for a more detailed inspection.

- Rinse cooling system after removing thermostats.
- Check blow-off filler cap.
- Check water pump for correct operation.
- Check whether there is loss of coolant on the inside.

#### Checking blow-off filler cap

For checking whether the blow-off valve in the filler cap opens at the prescribed pressure, use a cooling system testing device as available from the local accessory trade.



- Install filler cap on testing device.
- Build up pressure by means of hand pump.
- Note on pressure gauge at what pressure blow-off valve opens.
- A blow-off gauge which opens too early or too late, should be replaced by a new one.

### Checking the thermostat

In case there is doubt as to the correct operation of the thermostat, it is useful to check first whether there may be other factors to which the incorrect opening and closing are due:

- Check whether the thermostat applied is indeed of the prescribed type.
- Check sealing of thermostat on thermostat casing. For it is possible that the material of the casing is affected to such an extent that the sealing is no longer perfect.

### Loss of coolant on the inside

Loss of coolant on the inside may be caused by:

- a defective cylinder head gasket
- a cracked cylinder head or a cracked engine block.

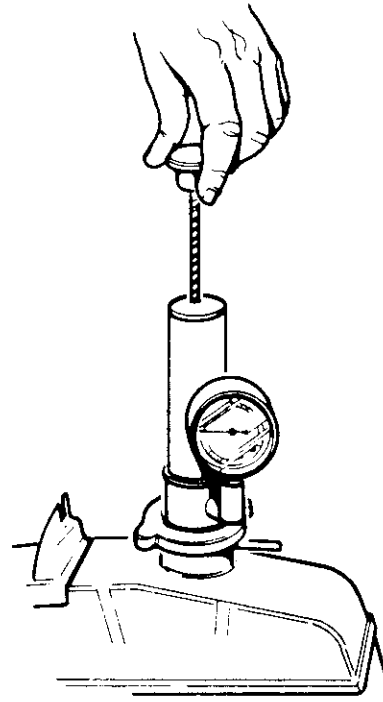
### Defective cylinder head gasket

Symptoms:

- Water oozing from exhaust pipe.
- Water spouting from filler opening.
- Engine lubricant level too high (this may also be due to dilution with fuel, however).
- Engine lubricant has emulsion-like aspect (light grey).
- Take dipstick out of oil sump and put a match to the lubricant: splashes are indicative of presence of water.

**Note:** It is also possible that the water has got into the oil via a leaking injector holder sleeve.

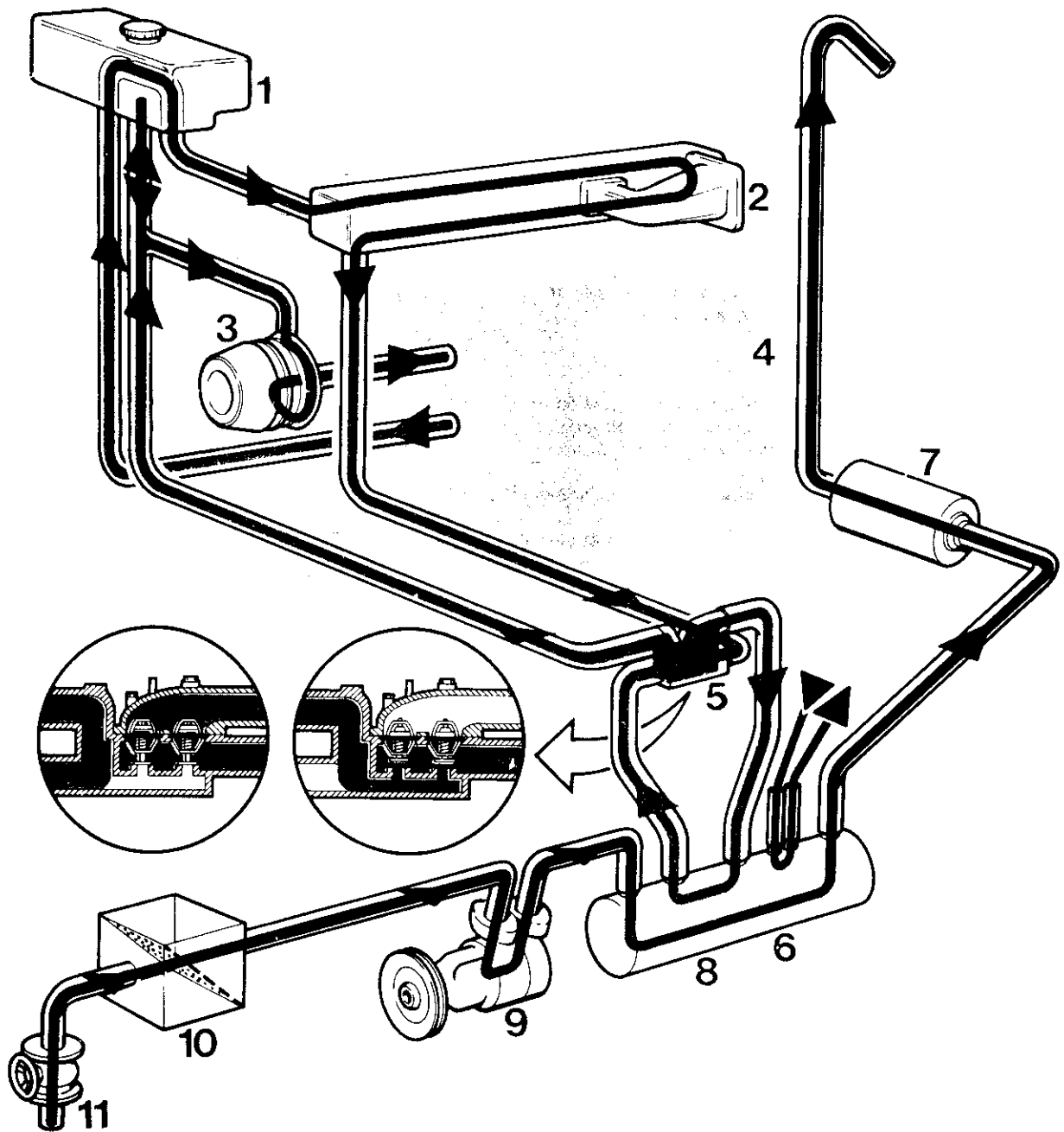
- Pressurize cooling system with hand pump (available in the local trade), which is installed on filler cap: water oozes outwards through cylinder-block and head.
- Measuring compression: a considerable difference between two adjacent cylinders is indicative of a leaking head gasket.



**Note:** In many cases it is even for a specialist impossible to see whether the head gasket is leaking.

Possible causes of a defective head gasket:

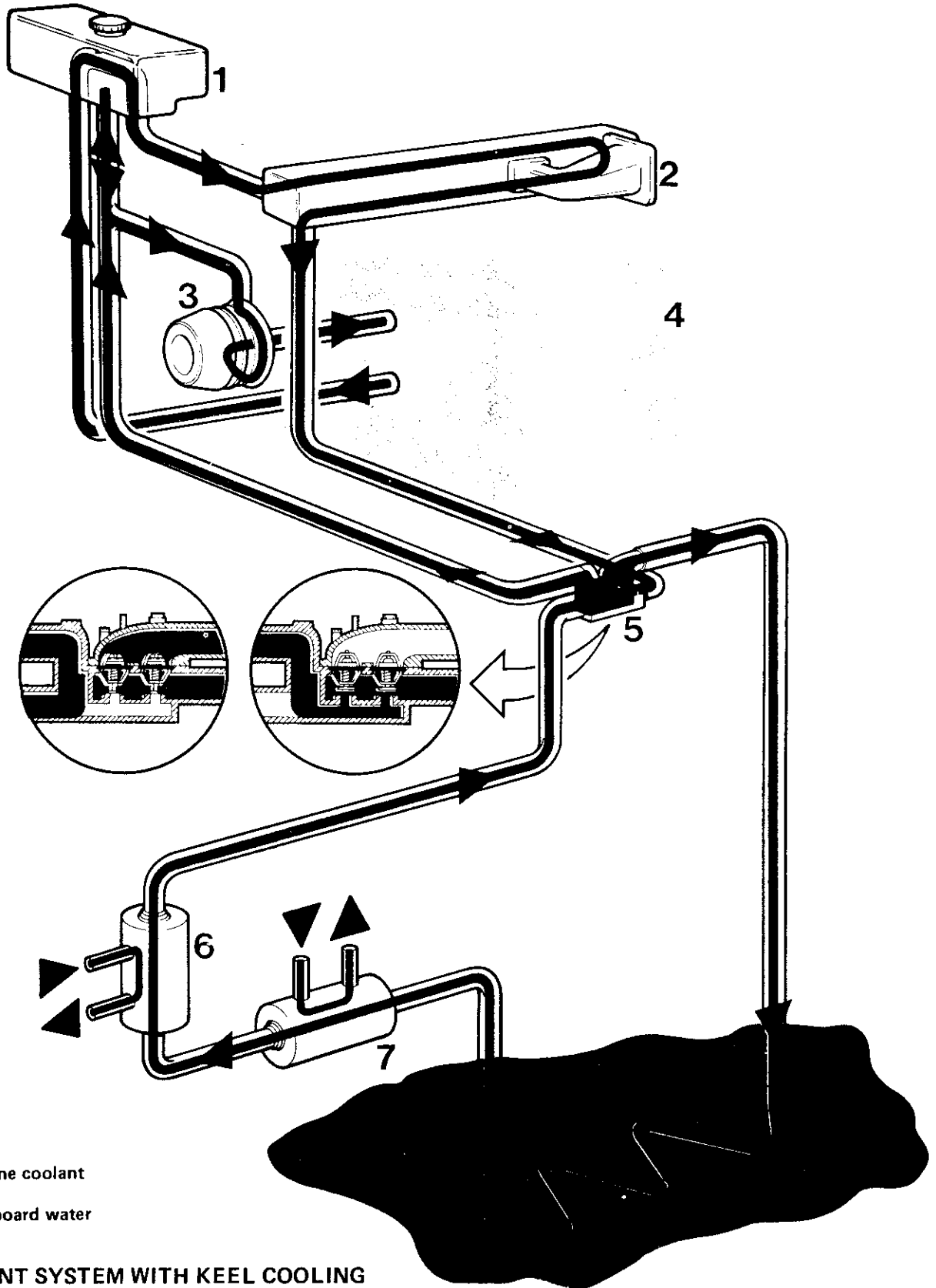
- Insufficient care taken at installation.
  - Engine block and cylinder head not cleaned or insufficiently cleaned.
  - Incorrect cylinder liner position (too high or too low) in engine block or head gasket incorrectly installed.
  - Tightening sequence and tightening torque for cylinder head bolts and nuts not observed.
  - Failure to retighten cylinder head bolts and nuts or incorrect retightening.
- Engine block and cylinder heads not checked for planeness.
- Manufacturing fault in head gasket.



Engine coolant  
 Outboard water

### COOLANT SYSTEM WITH INTERCOOLER

1. Expansion tank
2. Exhaust gas line
3. Engine coolant pump
4. Engine
5. Thermostat housing
6. Lubricating oil cooler (engine)
7. Lubricating oil cooler (reversing gear)
8. Engine coolant cooler
9. Outboard cooling water pump
10. Filter tray
11. Cock

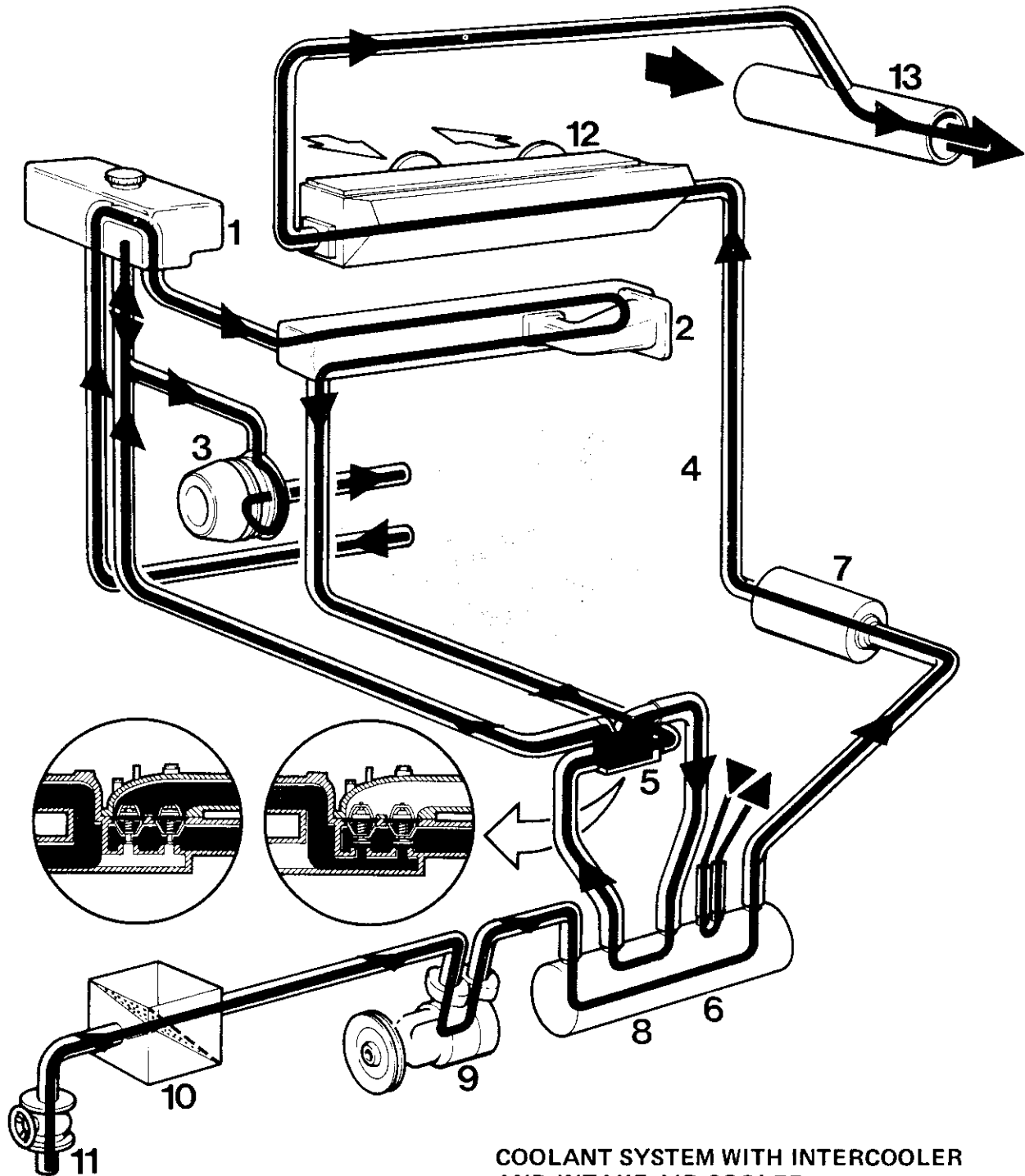


■ Engine coolant  
 ■ Outboard water

### COOLANT SYSTEM WITH KEEL COOLING

- |                        |                                      |
|------------------------|--------------------------------------|
| 1. Expansion tank      | 5. Thermostat housing                |
| 2. Exhaust gas line    | 6. Lubricant cooler (engine)         |
| 3. Engine coolant pump | 7. Lubricant cooler (reversing gear) |
| 4. Engine              | 14. Keel cooling                     |





Engine coolant  
 Outboard water

### COOLANT SYSTEM WITH INTERCOOLER AND INTAKE AIR COOLER

1. Expansion tank
2. Exhaust gas line
3. Engine coolant pump
4. Engine
5. Thermostat housing
6. Lubricant cooler (engine)
7. Lubricant cooler (reversing gear)
8. Engine coolant cooler
9. Outboard cooling water pump
10. Filter tray
11. Cock
12. Intake air cooler
13. Cooling water/exhaust gas discharge pipe

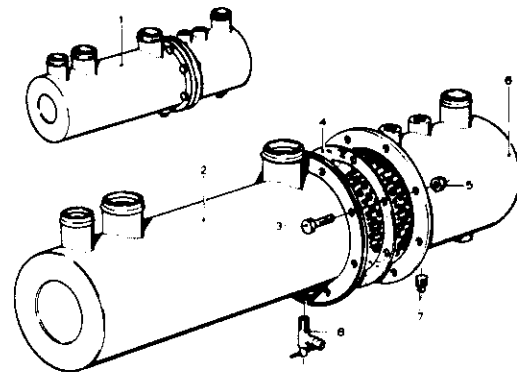
### MARINE ENGINE COOLING

DAF Marine Diesel Engines are usually equipped with intercooling or keel cooling and in given cases skin cooling may be used.

#### Intercooling

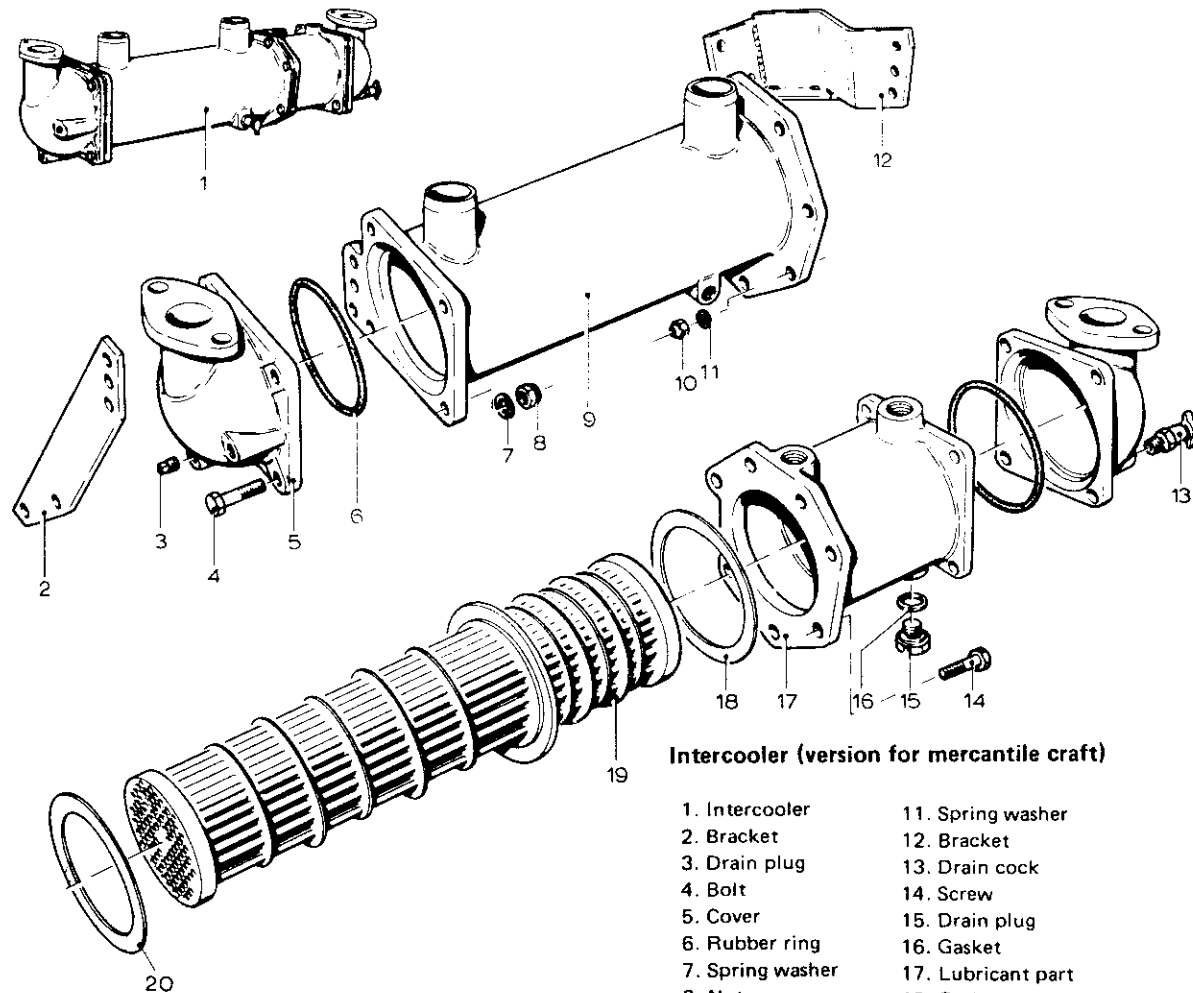
In this cooling system the cooling water of the engine is circulated in a conventional way by the water pump. The water passes through the engine block, the cylinder head and the cooled exhaust manifold and subsequently arrives via the oil cooler at the thermostat housing. When the thermostat is closed because the coolant is not yet at the operating temperature, the water flows directly to the water pump.

When the thermostat is open, the coolant is first passed to the intercooler to deliver its heat to the outboard water, which by a separate pump is forced through the intercooler. If also the lubricating oil of the reversing gear has to be cooled, this is carried out in a separate cooler arranged between the intercooler and the water pump of the engine.



Intercooler (version for yachts)

1. Intercooler
2. Cooling water part
3. Bolt
4. Gasket
5. Nut
6. Lubricant part
7. Drain plug
8. Drain cock



Intercooler (version for mercantile craft)

- |                  |                    |
|------------------|--------------------|
| 1. Intercooler   | 11. Spring washer  |
| 2. Bracket       | 12. Bracket        |
| 3. Drain plug    | 13. Drain cock     |
| 4. Bolt          | 14. Screw          |
| 5. Cover         | 15. Drain plug     |
| 6. Rubber ring   | 16. Gasket         |
| 7. Spring washer | 17. Lubricant part |
| 8. Nut           | 18. Gasket         |
| 9. Coolant part  | 19. Bunch of pipes |
| 10. Nut          | 20. Gasket         |

### Keel cooling

In this system the water pump of the engine forces the hot cooling water through a bunch of pipes included in the water circuit and arranged on or in the hull of the vessel. At this place water delivers heat to the outboard water flowing alongside. Therefore keel cooling dispenses with the outboard water pump and the intercooler.

### Skin cooling

In principle, skin cooling is for a large part identical with keel cooling. The function of the bunch of pipes is performed here, however, by a comparatively large water tank, one or more surfaces of which are formed by the hull plates of the vessel so that they are in direct contact with the cold outboard water.

### Draining

With frosty weather, water not mixed with anti-freeze must not be left anywhere in the cooling system. This applies particularly to the outboard water. For a complete removal of the outboard water, drain plugs are provided in the outboard water pump and in the intercooler.

It is absolutely required for all drain plugs to be removed in order to ensure that no water is left.

### Intake air cooling

For yachts there exists a special intercooling version of the DT615M, in which an intake manifold with outboard water cooling is applied. Due to the compression by the turbocharger the temperature of the intake air has attained a high value and the above system serves to cool down the air to its original temperature.

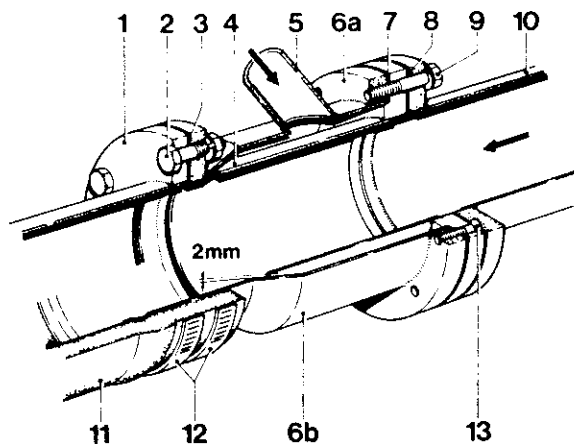
### Cooling system maintenance

Since the fouling of the sucked-in outboard water depends on local conditions no hard and fast rules can be given as to the cleaning intervals of the filtering system. The same applies to the intervals of checking whether the degree of fouling is such that the cooling effect has become insufficient. However, if these checks are regularly made, the risk of troubles with the outboard water cooling system is extremely small.

After some time sediments will be formed in the intercooling pipes so that the outboard water cooling will no longer be effective.

This will become apparent from the coolant temperature gauge reading exceeding the standard value. In such a case the intercooling flanges should be removed and the tubes pierced.

Use a rattan stick or copper wire of large thickness, with a rounded off end in order to prevent the tubes from being damaged.

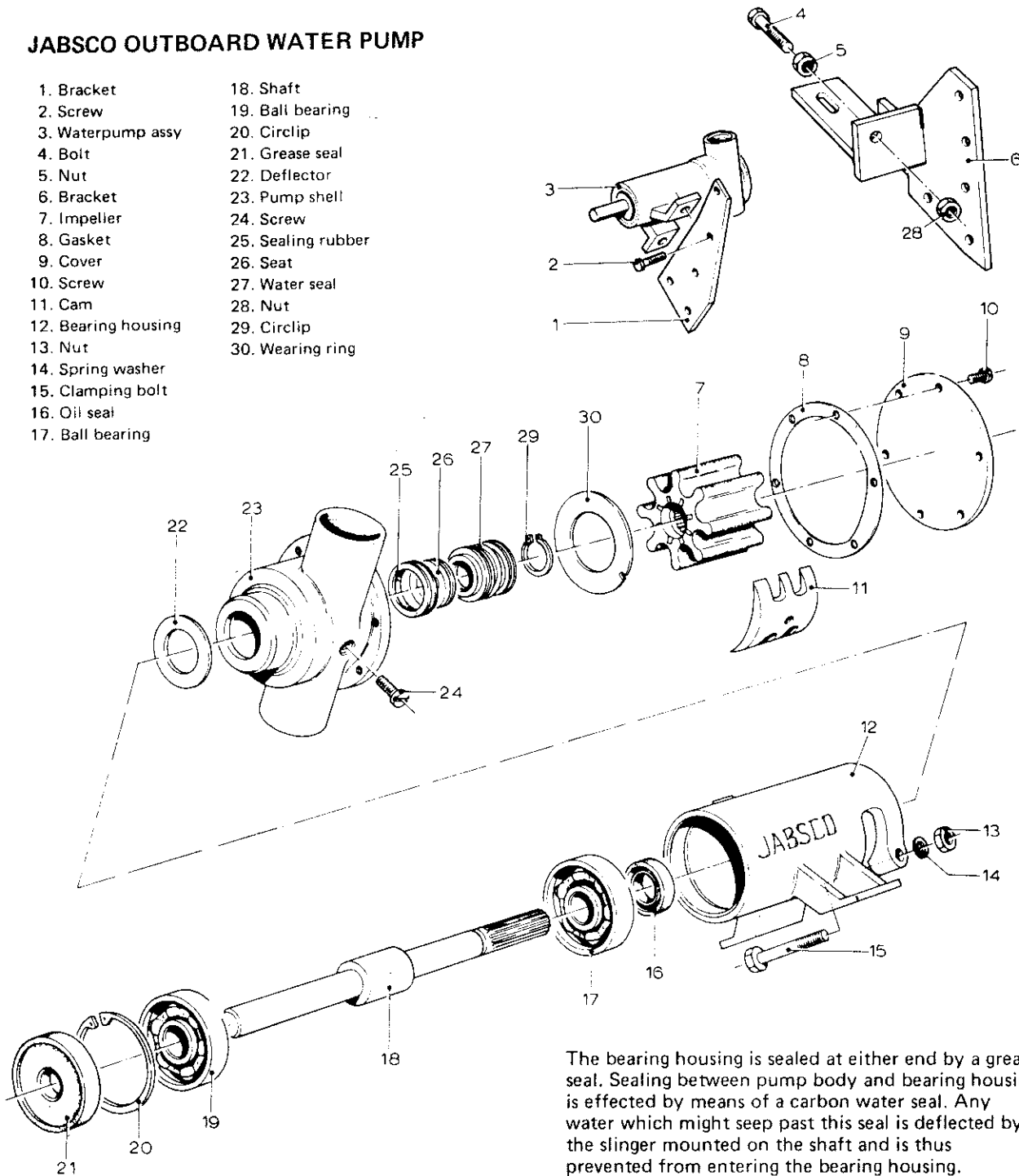


### CARRYING OFF COOLING WATER AND EXHAUST GASES

1. Flange
2. Screw
3. Gasket
4. Inner pipe
5. Cooling water pipe
- 6a. Outer pipe with flange connection
- 6b. Outer pipe with hose connection
7. Gasket
8. Gasket
9. Screw
10. Exhaust gases pipe
11. Hose
12. Hose clamp
13. Screw

### JABSCO OUTBOARD WATER PUMP

- |                     |                    |
|---------------------|--------------------|
| 1. Bracket          | 18. Shaft          |
| 2. Screw            | 19. Ball bearing   |
| 3. Waterpump assy   | 20. Circlip        |
| 4. Bolt             | 21. Grease seal    |
| 5. Nut              | 22. Deflector      |
| 6. Bracket          | 23. Pump shell     |
| 7. Impeller         | 24. Screw          |
| 8. Gasket           | 25. Sealing rubber |
| 9. Cover            | 26. Seat           |
| 10. Screw           | 27. Water seal     |
| 11. Cam             | 28. Nut            |
| 12. Bearing housing | 29. Circlip        |
| 13. Nut             | 30. Wearing ring   |
| 14. Spring washer   |                    |
| 15. Clamping bolt   |                    |
| 16. Oil seal        |                    |
| 17. Ball bearing    |                    |



The bearing housing is sealed at either end by a grease seal. Sealing between pump body and bearing housing is effected by means of a carbon water seal. Any water which might seep past this seal is deflected by the slinger mounted on the shaft and is thus prevented from entering the bearing housing.

#### Draining

If there is danger of frost the pump has to be drained by loosening the end-cover screws and allowing all the water in the pump to flow out.

#### Running dry

Do not allow the pump to run dry for more than 10 seconds.

#### Operating temperature

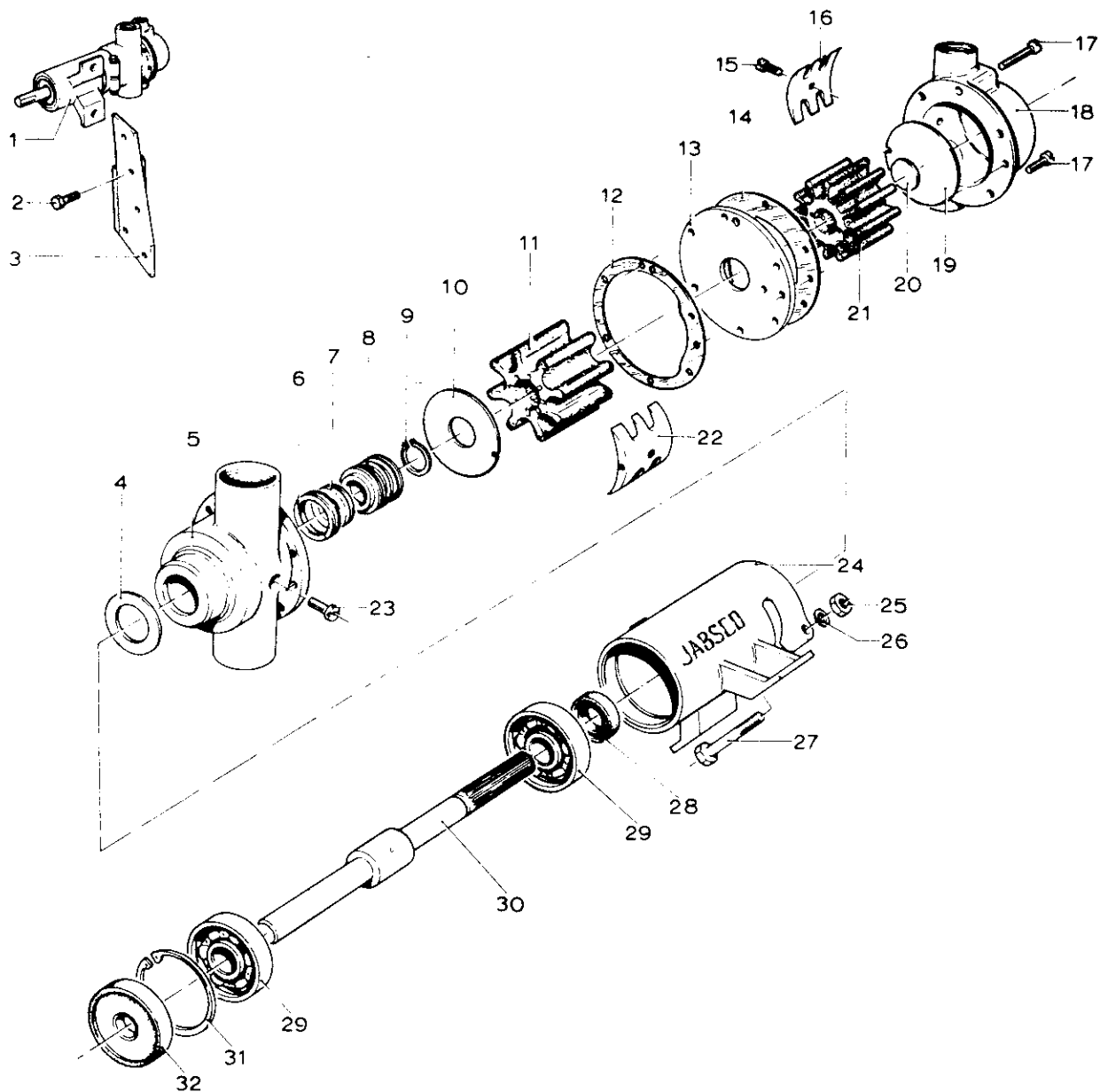
The operating temperature of the pump must not exceed approx. 45 °C.

#### General

The Jabsco marine pump comprises two main components, viz.: a bronze pump body and a cast iron bearing housing, clamped together by means of a bolt.

The plastic impeller rotates within the pump body. Owing to the shape of the flexible impeller vanes water is drawn in and is forced along under pressure.

# JABSCO OUTBOARD WATER PUMP (twin version)



Moisten the new impeller with water and introduce it into the pump body bore with a rotary motion until its splines engage with the splines of the pump shaft. Push impeller fully into pump bore.

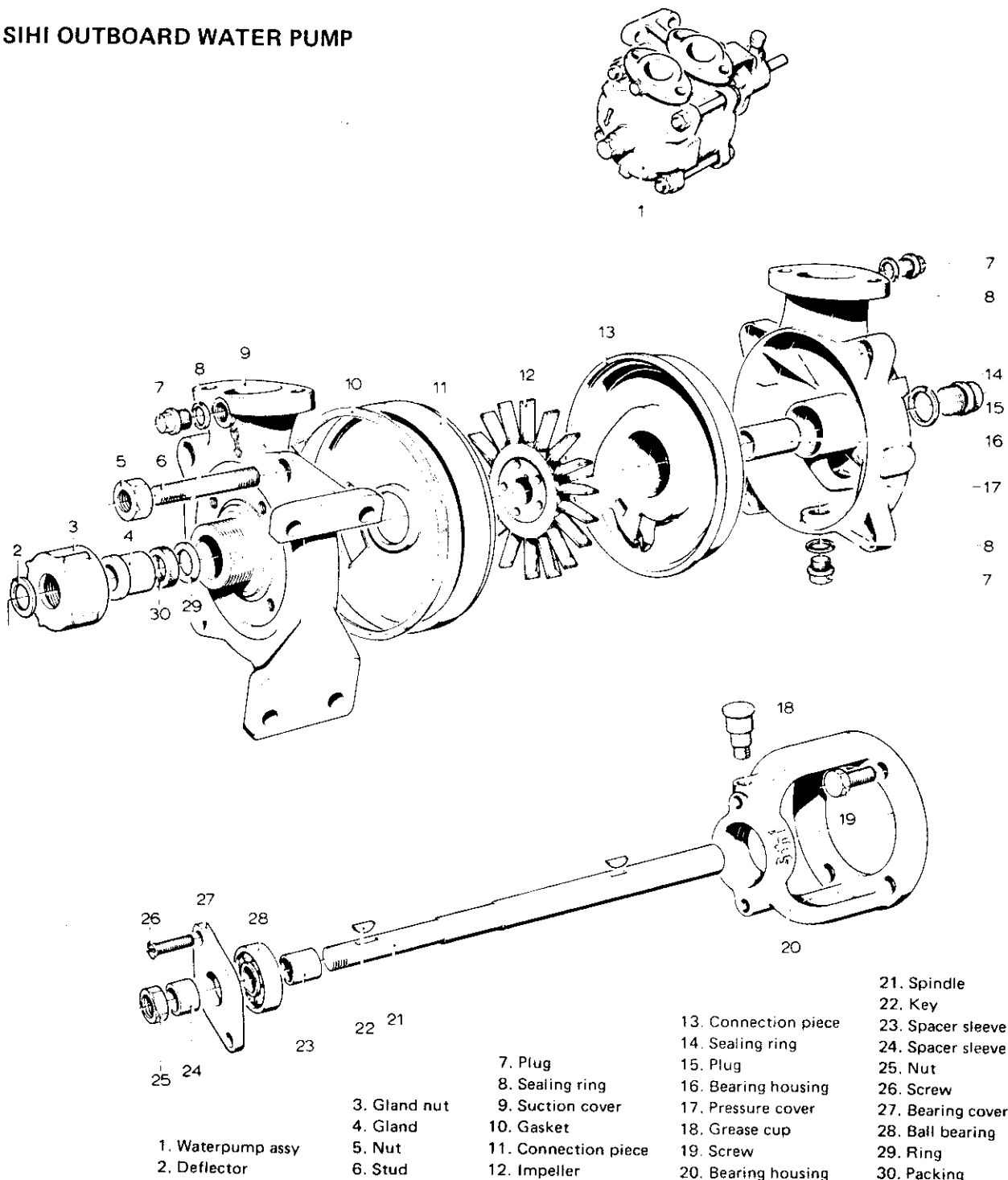
If the vanes of a used impeller do not full return to their initial position, the impeller should be installed reversely to ensure that the full pump capacity is maintained.

Use a standard 0.25 mm thick end-cover gasket.

A thicker gasket will reduce the pump capacity while a thinner one will damage the impeller beyond repair.

- |                   |                     |
|-------------------|---------------------|
| 1. Waterpump assy | 17. Screw           |
| 2. Screw          | 18. Pump shell      |
| 3. Bracket        | 19. Wearing plate   |
| 4. Deflector      | 20. Plug            |
| 5. Pump shell     | 21. Impeller        |
| 6. Sealing rubber | 22. Cam             |
| 7. Seat           | 23. Screw           |
| 8. Water seal     | 24. Bearing housing |
| 9. Circlip        | 25. Nut             |
| 10. Wearing ring  | 26. Spring washer   |
| 11. Impeller      | 27. Clamping bolt   |
| 12. Gasket        | 28. Oil seal        |
| 13. Cover         | 29. Ball bearing    |
| 14. Gasket        | 30. Spindle         |
| 15. Screw         | 31. Circlip         |
| 16. Cam           | 32. Grease seal     |

### SIHI OUTBOARD WATER PUMP



#### General

The Sihi outboard water pump is a self-priming pump consisting of five main components. The bronze impeller with rubber coated blades rotates in a chamber bounded by two bronze partitions clamped tight between two cast iron flanges. On the driven side the pump shaft is supported in a ball bearing which requires regular lubrication by means of a grease cup. The non-driven side is supported in a water-lubricated plain bronze bearing. The pump shaft is sealed in the usual way by means of a stuffing box. A slinger arranged on the pump-shaft prevents any water leaking along the shaft from reaching the ball bearing.

#### Draining

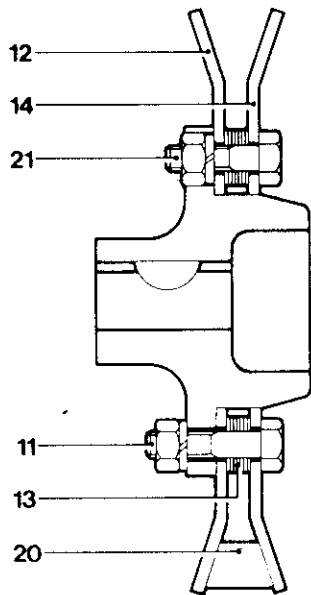
If there is danger of frosts the pump has to be drained completely by removing the plugs in the inlet flange and in the delivery flange. During draining turn the shaft by hand until water escapes no longer.

#### Running dry

The pump must never run without water.

#### Lubrication

Lubricate the ball bearing after every 300 working hours by one turn of the grease cup.



### Adjustable pulley

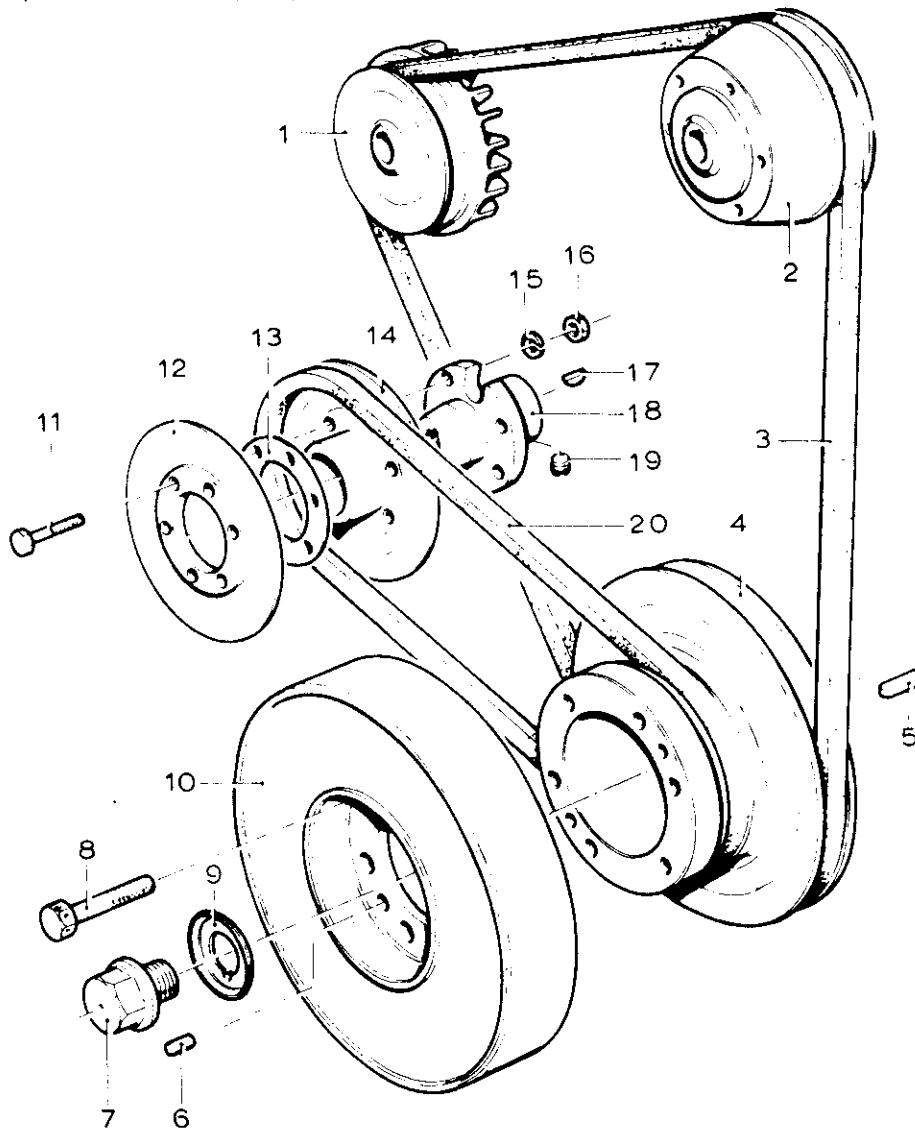
When installing a new V-belt, put eight 0.5 mm-spacers between the pulley halves.

### Outboard waterpump

Since the outboard water pump is non-adjustably attached to the engine block, Vee-belt tension has to be adjusted by changing the position of the pulley. For this purpose the pulley consists of two separate halves (12 & 14) with in between spacers 13, held together by two bolts 21. The assembly is attached to the pump hub by means of four bolts 11.

For tension the Vee-belt proceed as follows:

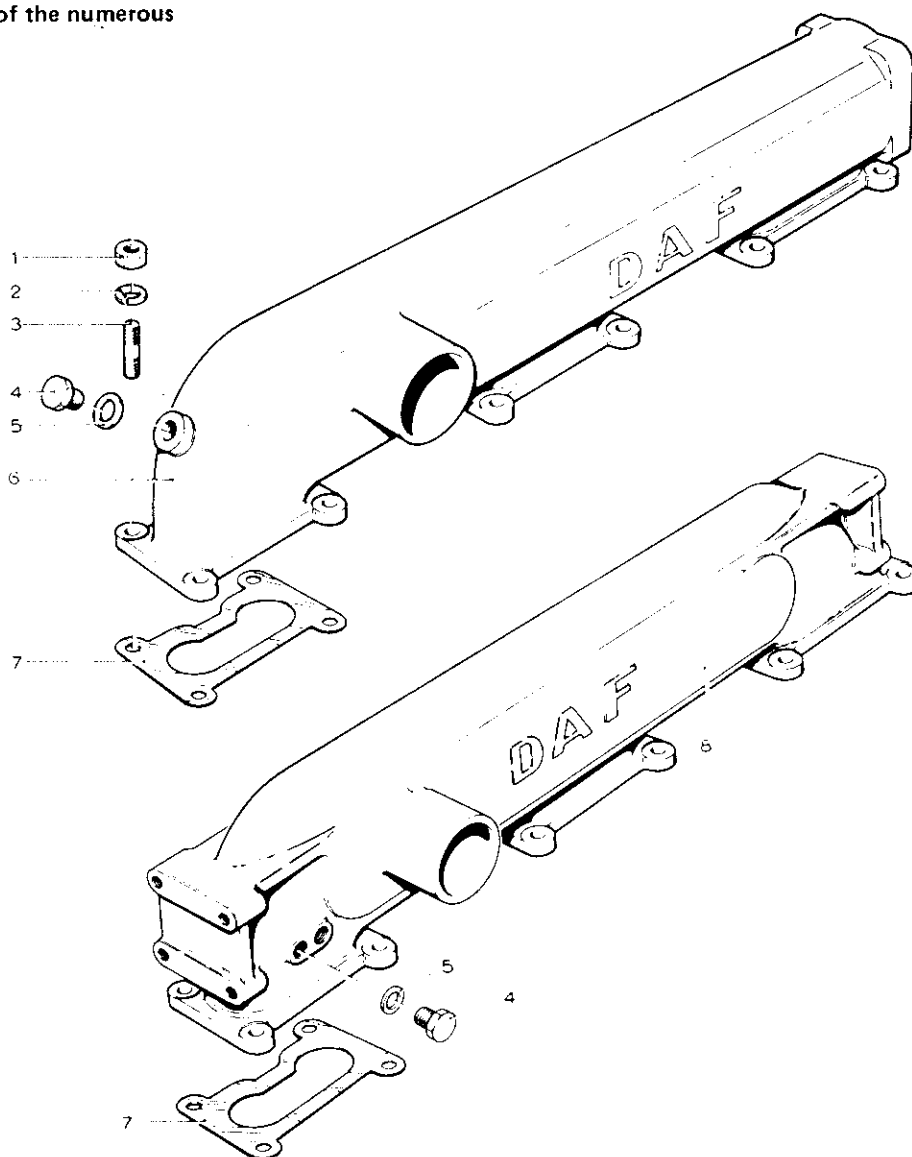
1. Unscrew the four bolts 11 and take the pulley off the pump.
2. Unscrew two bolts 21.
3. Remove two (or a multiple of two) spacers.
4. Re-assemble the two pulley halves.
5. **Important:** Put half the number of removed spacers between the inner pulley half and the pump hub, and the remaining spacers under the nut of the bolts 11.



1. Generator pulley
2. Waterpump pulley
3. Vee-belt
4. Crankshaft pulley
5. Key
6. Dowel pin
7. Cranking bolt
8. Screw
9. Lock washer
10. Vibration damper
11. Bolt
12. Pulley half
13. Spacers
14. Pulley half
15. Spring washer
16. Nut
17. Key
18. Hub
19. Screw
20. Vee-belt

## MANIFOLDS

This section deals with some of the numerous manifold versions.



### INTAKE MANIFOLDS

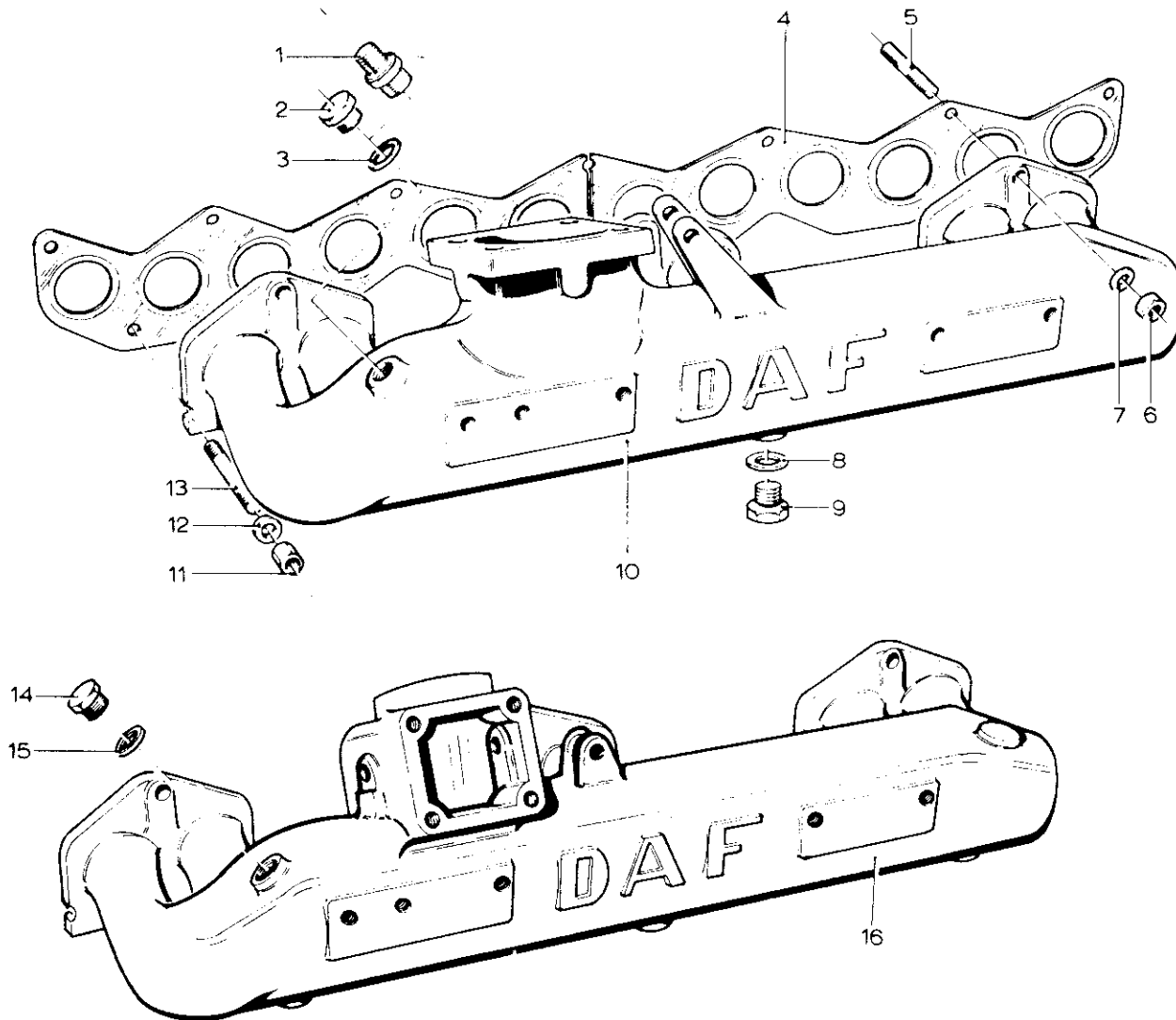
1. Nut
2. Spring washer
3. Stud
4. Plug
5. Sealing ring
6. Intake manifold
7. Gasket
8. Intake manifold

#### Tightening torques

Bolts and nuts for the attachment of manifolds glow plug

43 - 47 Nm (4.3 - 4.7 mkg)  
3.5 - 4.5 Nm (0.35 - 0.45 mkg)





## INTAKE MANIFOLDS

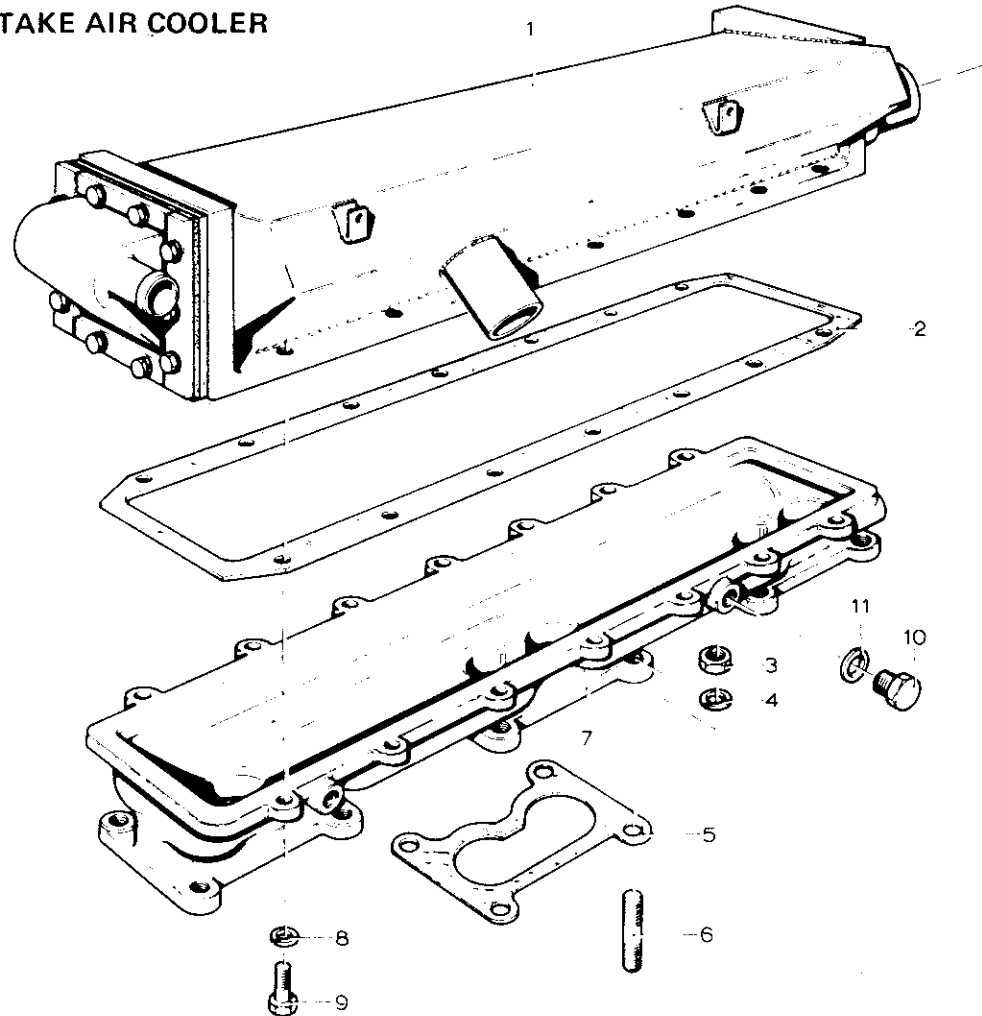
- |                   |                     |
|-------------------|---------------------|
| 1. Adapter nipple | 9. Plug             |
| 2. Plug           | 10. Intake manifold |
| 3. Sealing ring   | 11. Nut             |
| 4. Gasket         | 12. Spring washer   |
| 5. Stud           | 13. Stud            |
| 6. Nut            | 14. Plug            |
| 7. Washer         | 15. Sealing ring    |
| 8. Sealing ring   | 16. Intake manifold |

## INSTRUCTIONS FOR REPAIR

Make sure that intake and exhaust manifolds are fitted free from stress. After renewing the exhaust manifold gaskets run the engine to operating temperature and **immediately thereafter** retighten the manifold nuts to the prescribed torque.

## WATER-COOLED INTAKE AIR COOLER

1. Air cooler
2. Gasket
3. Nut
4. Spring washer
5. Gasket
6. Stud
7. Intake manifold
8. Spring washer
9. Cap screw
10. Plug
11. Sealing ring

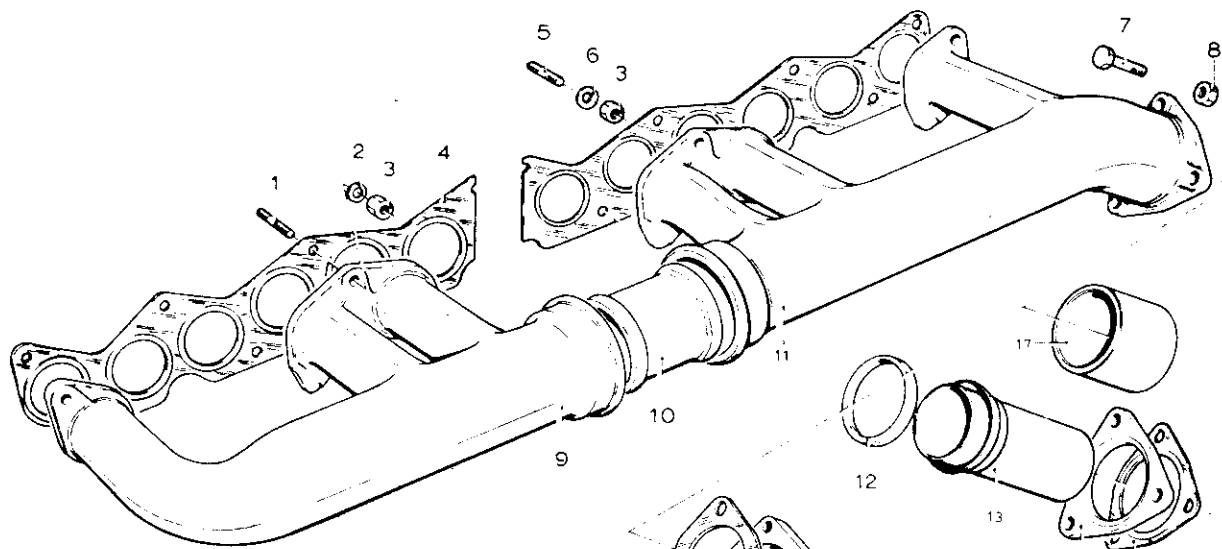


### Intake air cooling

The DT615M with intercooling is an engine equipped with intake air cooling. Due to the compression in the turbo-charger there is an increase in the air temperature. In the intake air cooler the outboard water cools down the air to a considerable extent.

The lower the temperature of the air, the higher the oxygen weight content and it is precisely the oxygen content which determines the amount of fuel which can be burnt.

Hence, engines with air intake cooling will develop a higher power than engines without such a cooling system.

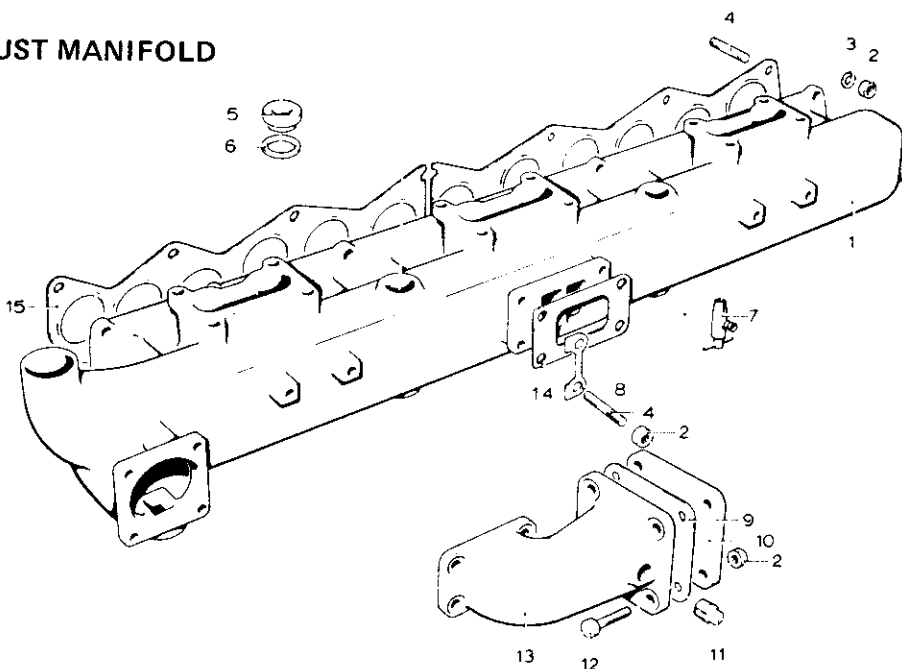


### EXHAUST MANIFOLD

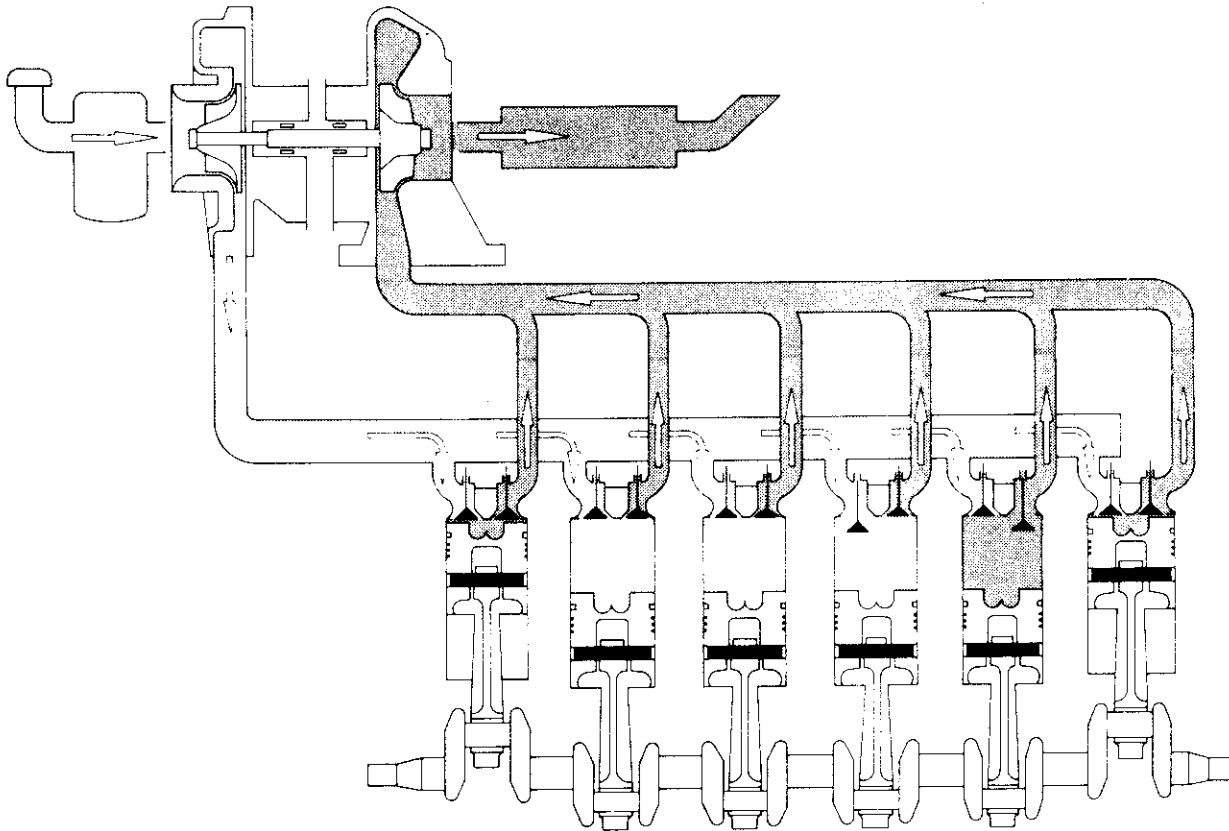
- |                      |                  |
|----------------------|------------------|
| 1. Stud              | 12. Sealing ring |
| 2. Washer            | 13. Exhaust pipe |
| 3. Nut               | 14. Flange       |
| 4. Gasket            | 15. Gasket       |
| 5. Stud              | 16. Exhaust pipe |
| 6. Washer            | 17. Sealing ring |
| 7. Bolt              |                  |
| 8. Nut               |                  |
| 9. Exhaust manifold  |                  |
| 10. Exhaust manifold |                  |
| 11. Exhaust manifold |                  |

### WATER-COOLED EXHAUST MANIFOLD (marine version)

- |                     |
|---------------------|
| 1. Exhaust manifold |
| 2. Nut              |
| 3. Washer           |
| 4. Stud             |
| 5. Plug             |
| 6. Sealing ring     |
| 7. Drain cock       |
| 8. Lock plate       |
| 9. Gasket           |
| 10. Welding flange  |
| 11. Plug            |
| 12. Bolt            |
| 13. Bend            |
| 14. Gasket          |
| 15. Gasket          |



## TURBOCHARGER



### OPERATION

The turbocharger delivers under pressure air, necessary for combustion, to the cylinders. The air charge in the cylinder is therefore greater than in the case of a naturally aspirated engine. A larger quantity of fuel may be injected, resulting in a higher engine output.

The exhaust gases are used to rotate the turbine wheel. The compressor wheel, which forces the air to the cylinders, is secured to the rotor shaft, which is integral with the turbine wheel.

### MOUNTING TURBOCHARGER ON ENGINE

- Inspect the air intake tube, replacing it at signs of ageing.
- Check the exhaust manifold for metal particles which might break off, for particles of gasket and other foreign matter.
- Check the oil return line, both on the inside and on the outside for damages which might restrict the oil flow. The same applies in the case of the oil supply line.
- Check the flange connecting the compressor to the exhaust manifold for flatness and ensure that it is clean.
- Place a new gasket on the exhaust manifold. Ensure that the gasket does not hinder the flow of the exhaust gases; it is even preferable that the opening in the gasket is all around approx. 1.5 mm away from the edge of the exhaust port in the manifold.
- Change the engine lubricating oil, using the correct type of oil, and fit a new oil filter element.
- Do not yet connect the oil return line. Fill the compressor via the oil inlet port with engine oil until the oil flows out of the return port.
- Check oil pressure at turbocharger connection of supply line.
- Reconnect all air hoses and lines, check joints for leaks.
- Connect all parts free from stress to turbocharger. Smear the screw thread with a heat-resistant grease such as graphite grease or a molybdene-disulfide grease.

## INSTRUCTIONS FOR MAINTENANCE AND OPERATION

For turbocharged engines strict observance of instructions for maintenance and operation is even more important than for engines of which combustion air is aspirated.

1. Change engine oil at regular intervals.
2. Service engine oil filter at regular intervals.
3. Check oil pressure at spot where oil enters turbo-charger.
4. Service the air cleaner in accordance with instructions. Check max. permissible underpressure in inlet manifold.
5. Check oil lines, suction line between turbocharger

and air cleaner, as well as exhaust and silencer.

6. Do not run engine at full speed immediately after starting (so-called revving up).
7. Before stopping the engine, allow it to run at tick-over a short moment.
8. Check rotor-shaft play at regular intervals (for instance, every 100,000 km).
9. When re-fitting the turbocharger on the engine carefully check whether all supply and return lines are thoroughly cleaned.  
Fill bearing housing with clean engine oil before connecting oil supply line.

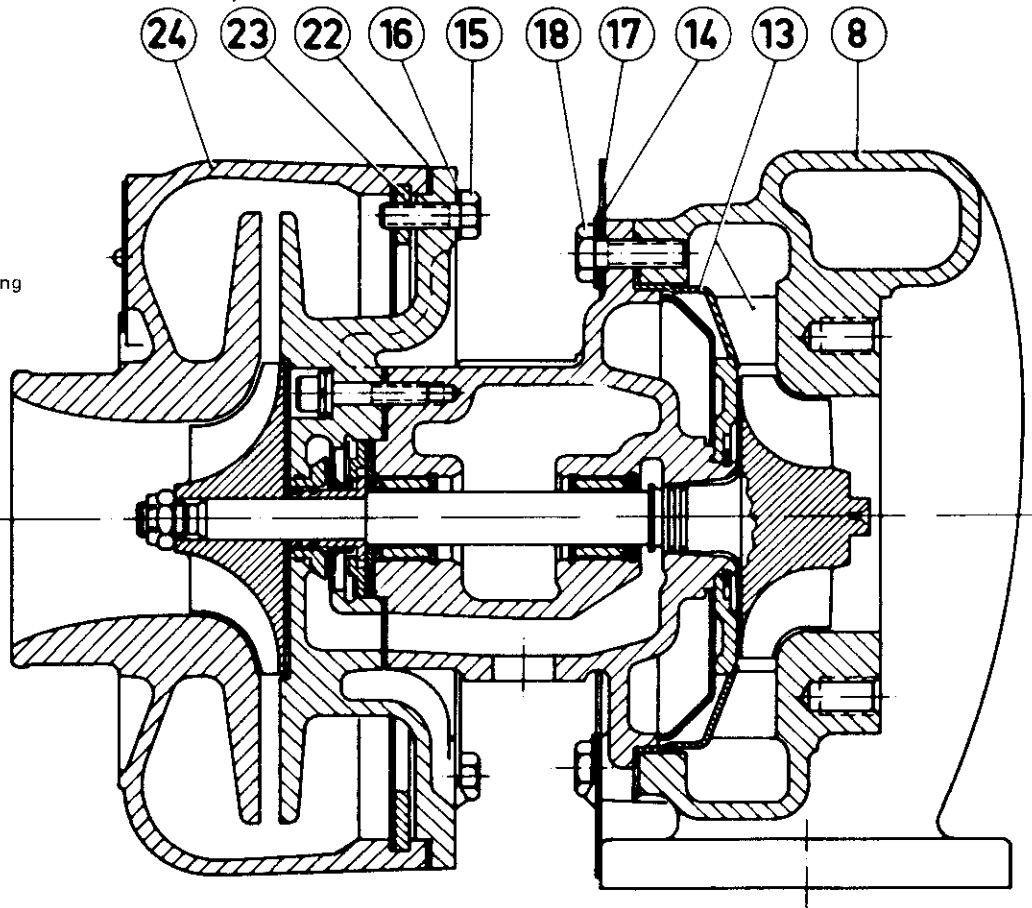
## FAULT FINDING CHART

If the engine fails to give its normal performance, first investigate all other causes before studying the possibilities mentioned below.

Failure	Possible causes	Remedy
Excessive smoking and loss of power.	In general caused by lack of air at too low filling pressure. Fouled air filter and/or fouled air filter connection. Deformed suction line (excessive under-pressure ahead of turbocharger; possible oil leaks on compressor side). Fouled exhaust and/or silencer (excessive pressure beyond turbocharger).	Clean air cleaner and – if necessary – renew element. Inspect suction line.  Clean or replace.
Rubbing of turbine or compressor wheel.	Mostly excessive bearing clearance, caused by: – temporary interruption of lubrication. – insufficient oil pressure, – foreign particles from oil lines and ducts, – fouled or damaged oil filter (line), – poor oil quality owing to late changing, – leak in oil delivery line, – too quick cold-starting at very cold engine (avoid loading directly after engine fires!).	Renew turbocharger. As long as turbocharger has not been renewed, do not fully load engine to prevent further damage; pay special attention to smoking!
Excessive smoking and loss of power together with abnormal sounds.	Leaks at connections and flanges of suction and exhaust tubes.  Rubbing of turbine and/or compressor wheel.	Inspect connections and flanges; if necessary, renew gaskets.  Disconnect lines, inspect turbine housing and compressor cover at spots where turbine wheel and compressor wheel rubbed; if necessary, check bearing clearance.

#### TURBOCHARGER, type 3A

- 8. Turbine housing
- 13. Nozzle ring
- 14. Heat shield
- 15. Setscrews
- 16. Spring washer
- 17. Spring washer
- 18. Setscrew
- 22. Sealing ring
- 23. Ring
- 24. Compressor housing

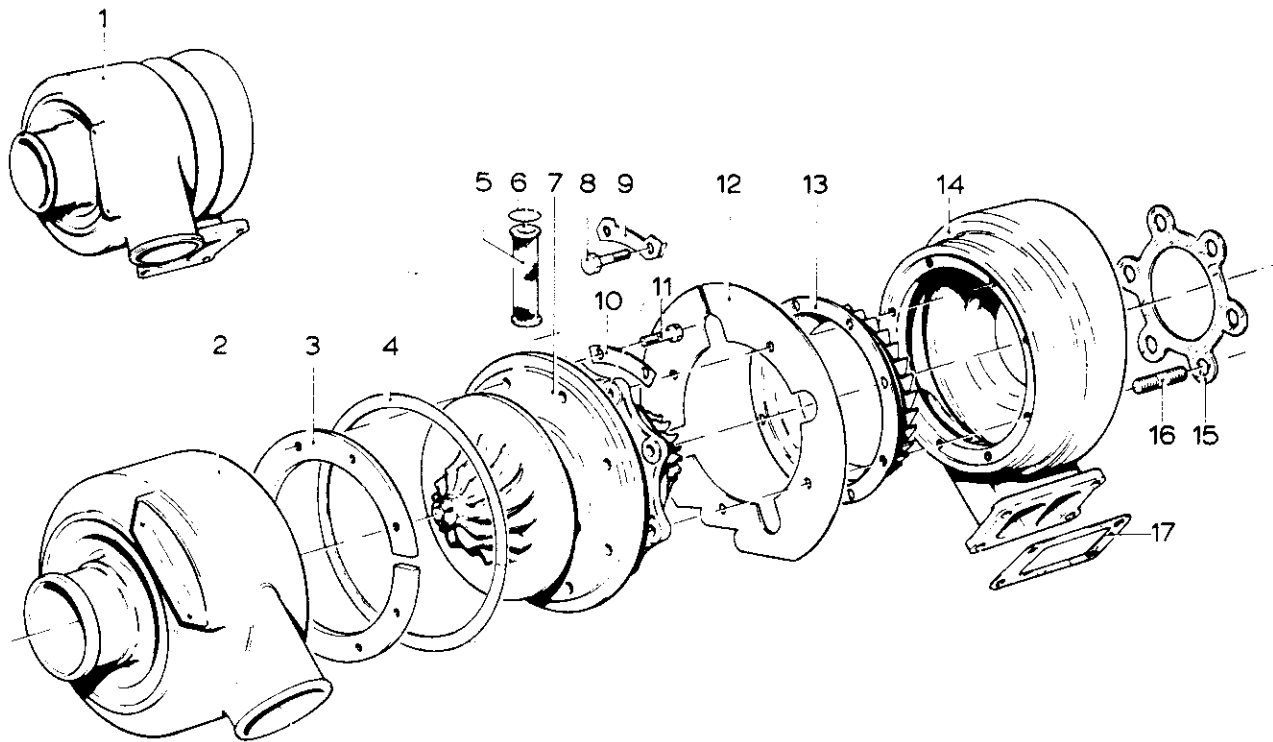


#### SPECIFICATIONS

Make	Holset
Type	3A
Inlet vacuum	max. 0.05 bar
Exhaust back pressure	max. 0.05 bar
Delivery pressure under load at 2000 r.p.m.	0.04 - 0.044 bar
Oil delivery pressure under normal load	min. 2.0 bar
Oil delivery pressure at idling speed	min. 0.7 bar
Oil pressure must show at the turbocharger inlet within 3-4 seconds of the engine firing.	

#### Tightening torques

Bolts and nuts for the attachment of:	
Compressor housing	8.3 Nm (0.83 mkg)
Turbine housing	16.6 Nm (1.66 mkg)
Turbocharger on manifold	43 - 47 Nm (4.3 - 4.7 mkg)
Adapter to turbocharger	43 - 47 Nm (4.3 - 4.7 mkg)



- |                       |                  |                     |
|-----------------------|------------------|---------------------|
| 1. Turbocharger       | 7. Core assembly | 13. Nozzle ring     |
| 2. Compressor housing | 8. Screw         | 14. Turbine housing |
| 3. Ring               | 9. Lock plate    | 15. Gasket          |
| 4. Gasket             | 10. Lock plate   | 16. Stud            |
| 5. Oil strainer       | 11. Screw        | 17. Gasket          |
| 6. Snap ring          | 12. Heat shield  |                     |

## CONSTRUCTION

The turbocharger consists of a turbine and a compressor part. Turbine wheel and shaft are integral, the compressor wheel is attached to the shaft with a nut. The turbine shaft rotates in a plain bearing. Endwise forces are taken up by a thrust plate and washer.

## INSPECTION

**Attention:** Never let the engine run after the air ducting between air cleaner and turbocharger has been disconnected as dirt entering the turbocompressor will damage the compressor or the engine.

- The inlet vacuum, measured in the ducting immediately ahead of the compressor inlet, should not exceed 0.05 bar. Excessive vacuum at this point is an indication of a dirty air cleaner and/or flat air hoses.
- Back pressure in the exhaust pipe should not exceed 680 mm head of water. A higher back pressure indicates exhaust system fouling.

## INSTRUCTIONS FOR REPAIR

Separate parts of the core assembly are not serviced. The core assembly must always be renewed as a whole.

### Dismantling

- Clamp unit upright in vice on turbine inlet flange.
- Remove the eight setscrews and lift cover off bearing housing.
- Remove the "V" clamp and lift the turbine housing clear of the bearing housing.

### Re-assembly

Re-assembly of the turbocharger is a reversal of the dismantling procedure.

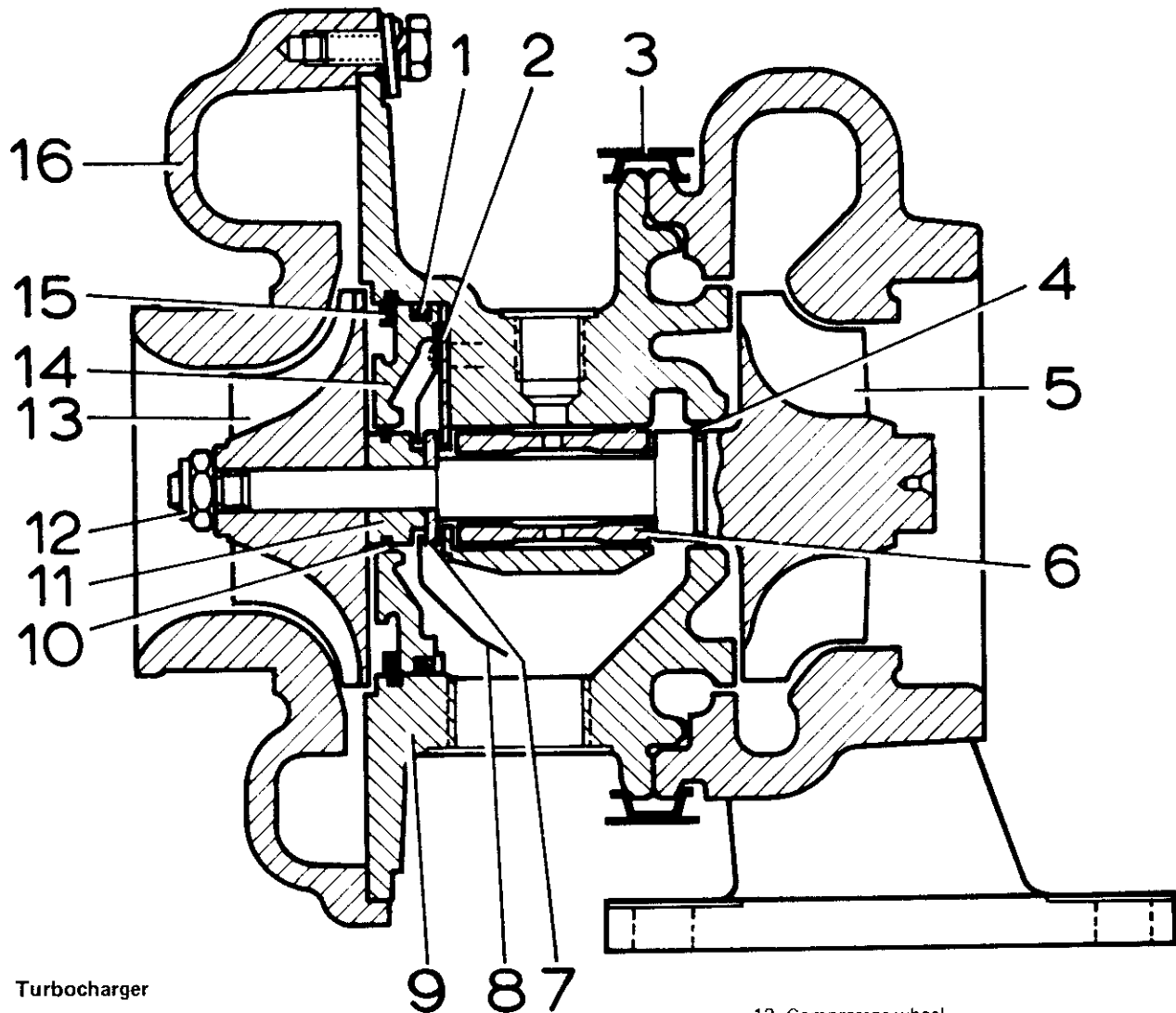
No gasket is fitted between compressor cover and bearing housing.

When installing the turbocharger apply a heat-resistant grease to such bolts, nuts and studs which will become hot.

Of the greases that will fit the purpose we mention:

- a graphite grease, such as Shell Grafina,
- a molybdene-disulfide (MoS<sub>2</sub>) grease, such as Molykote paste.

### TURBOCHARGER, TYPE 3LD



#### Turbocharger

- |                   |                  |                    |                  |                        |
|-------------------|------------------|--------------------|------------------|------------------------|
| 1. O-ring         | 4. Sealing ring  | 7. Thrust washer   | 10. Sealing ring | 13. Compressor wheel   |
| 2. Thrust plate   | 5. Turbine wheel | 8. Oil slinger     | 11. Spacer       | 14. Insert             |
| 3. Clamping plate | 6. Bearing       | 9. Bearing housing | 12. Nut          | 15. Washer             |
|                   |                  |                    |                  | 16. Compressor housing |

### SPECIFICATIONS

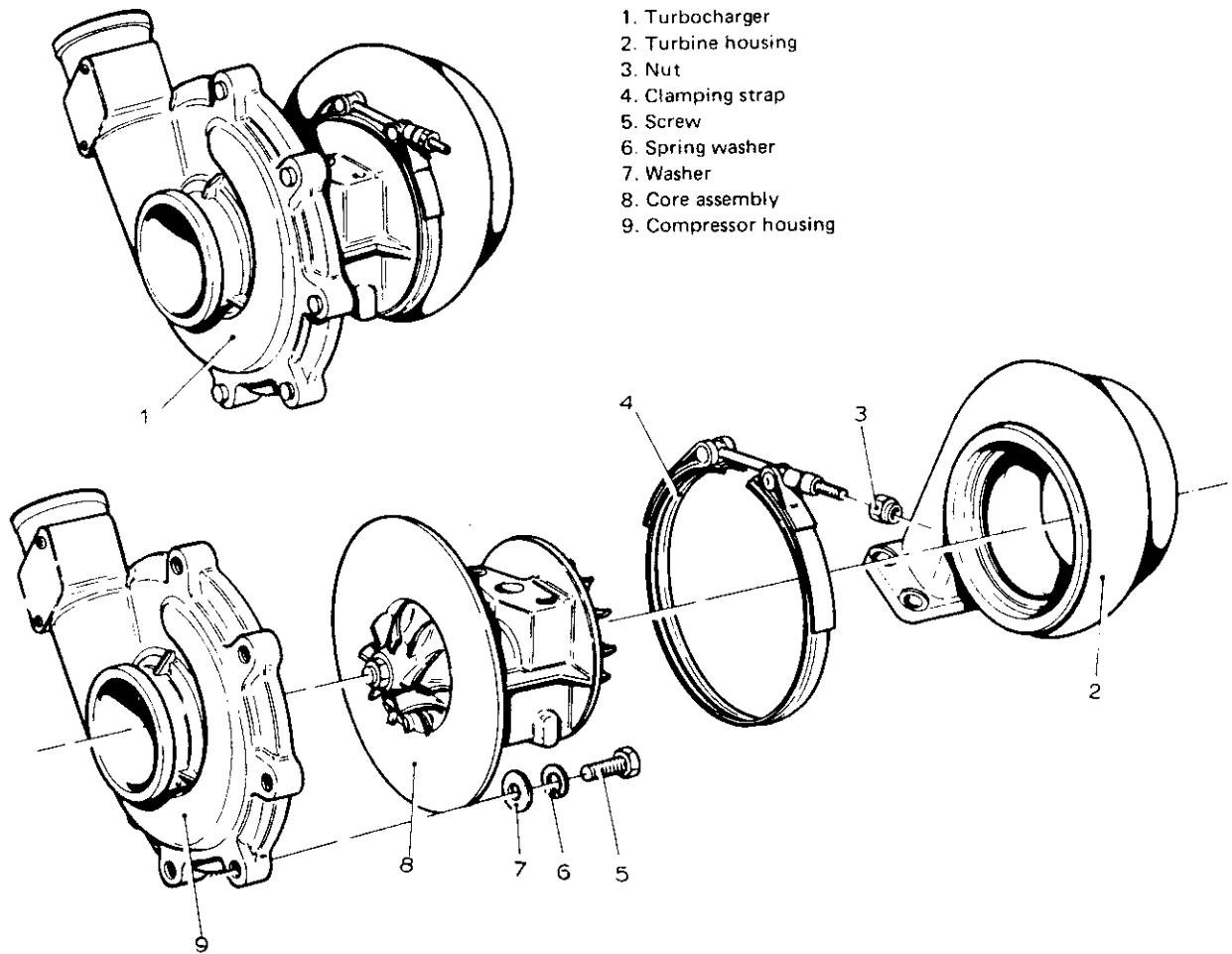
Make	Holset
Type	3LD
Inlet vacuum	max. 0.05 bar
Exhaust back pressure	max. 0.068 bar
Delivery pressure under load at 2000 r.p.m.	0.56 - 0.61 bar
Oil delivery pressure under normal load	min. 2.0 bar
Ditto, at idling speed	min. 0.7 bar

#### Tightening torques

Bolts and nuts for the attachment of Compressor cover	8.3 Nm (0.83 mkg)
Turbine housing "V" clamp	16.8 Nm (1.66 mkg)
Turbocharger on manifold	43 - 47 Nm (4.3 - 4.7 mkg)
Adapter on turbocharger	43 - 47 Nm (4.3 - 4.7 mkg)

Within 3 to 4 seconds after the engine has fired the oil pressure must show at the turbocharger inlet.





1. Turbocharger
2. Turbine housing
3. Nut
4. Clamping strap
5. Screw
6. Spring washer
7. Washer
8. Core assembly
9. Compressor housing

## CONSTRUCTION

The turbocharger consists of a turbine and a compressor part. Turbine wheel and shaft are integral, the compressor wheel is attached to the shaft with a nut. The turbine shaft rotates in a plain bearing. Endwise forces are taken up by a thrust plate and washer.

## INSPECTION

**Attention:** Never let the engine run after the air ducting between air cleaner and turbocharger has been disconnected as dirt entering the turbocompressor will damage the compressor or the engine.

- The inlet vacuum, measured in the ducting immediately ahead of the compressor inlet, should not exceed 0.05 bar. Excessive vacuum at this point is an indication of a dirty air cleaner and/or flat air hoses.
- Back pressure in the exhaust pipe should not exceed 680 mm head of water. A higher back pressure indicates exhaust system fouling.

## INSTRUCTIONS FOR REPAIR

Separate parts of the core assembly are not serviced. The core assembly must always be renewed as a whole.

### Dismantling

- Clamp unit upright in vice on turbine inlet flange.
- Remove the eight setscrews and lift cover off bearing housing.
- Remove the "V" clamp and lift the turbine housing clear of the bearing housing.

### Re-assembly

Re-assembly of the turbocharger is a reversal of the dismantling procedure.

No gasket is fitted between compressor cover and bearing housing.

When mounting the turbocharger apply a heat-resistant grease to such bolts, nuts and studs which will become hot.

Of the greases that will fit the purpose we mention:

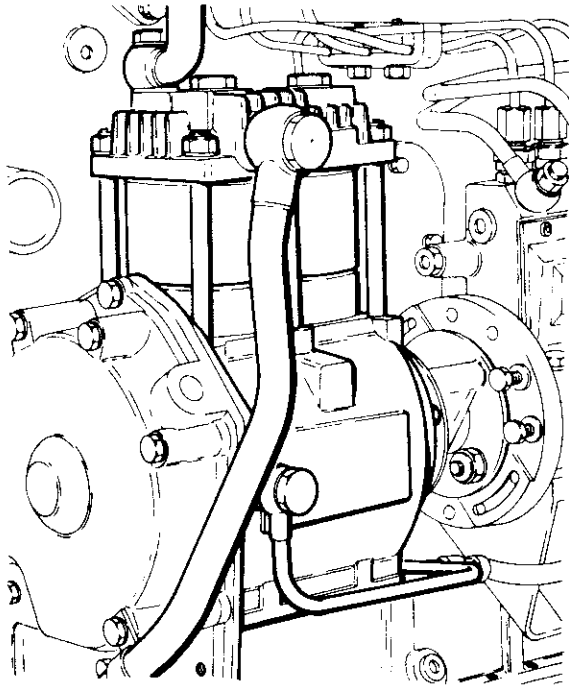
- a graphite grease, such as Shell Grafina,
- a molybdene-disulfide (MoS<sub>2</sub>) grease, such as Molykote paste.

### CONTENTS

Sub - group	Subject	Page(s)
80	Compressor	1-6

## INTRODUCTION

It is mainly in its construction that the Clayton-Dewandre air compressor, DAF part no. 635401, differs from other compressors applied by DAF. The main part of the compressor is the crank case with flange. Two separate cylinders which are slightly tapered at the lower end of the outside circumference, are entered into this flange. The cylinder head is placed on top of the cylinders. Six long studs through the crank case flange extend to the cylinder head. The cylinders are clamped between crank case and cylinder head by screwing on these studs nuts, which are partly countersunk in the cylinder head.



The crankshaft is supported in three bushes, two at the front end and one at the rear. Each of the pistons has one oil scraper ring and four compression rings, installed in pairs in two piston ring grooves. The valves are located in the cylinder head, the valve seats have been pressed into the cylinder head. Inlet valve and inlet valve spring are kept in position by a valve holder which has been pressed into the cylinder head. In the case of the pressure valve there is a plug to keep valve, valve guide and valve spring in position. The compressor is connected to the lubricating oil circuit of the engine. The crankshaft bearings are pressure-lubricated, cylinder walls and gudgeon pins have splash-lubrication. Oversize cylinders and pistons are not available, so that in case of excessive wear renewal is required.

## MAINTENANCE

The compressor should be inspected at the intervals prescribed in the Maintenance Books. Apart from the usual inspection for any leaks, the cylinder head nuts should be retightened and the pressure valves checked. On the outcome of this check depends whether there is required a complete inspection. When the air compressor output is insufficient this may be due to the valves or to cylinder wear. To find out proceed as follows:

- Disconnect pressure line from compressor.
- Let the compressor operate for a certain time until operating temperature has been reached.
- Hold during 10 seconds a piece of white cardboard at abt. 5 cm from the pressure outlet: a large oil stain is indicative of excessive cylinder wear. A greasy deposit on the cardboard is to be considered as normal.
- Reconnect the pressure line and let the compressor run until operating pressure has been reached.
- Let the engine run at idling speed.
- Disconnect air suction line and hold your hand in front of the air inlet: an air stream on your hand is indicative of a leaking intake valve.

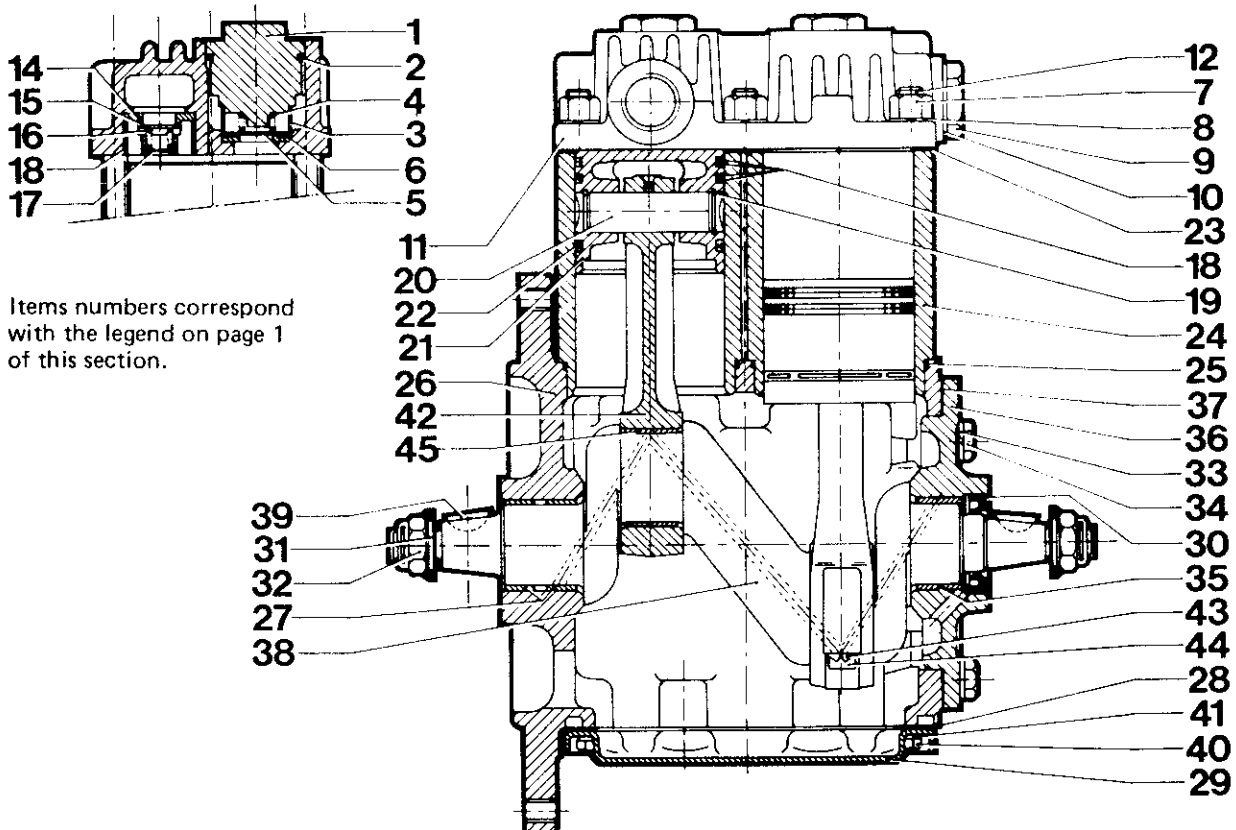
### SPECIFICATIONS

#### General

Make	Clayton-Dewandre
Model	PCGA 918, DAF no. 635401
Type	two cylinders, air-cooled
Bore	57.15 mm
Stroke	50.80 mm
Swept volume	250 cc
Capacity	255 litres/min.
Operating speed	1300 r.p.m.
Operating pressure	8 bar (8 kg/cm <sup>2</sup> )
Max. permissible ovality	0.038 mm
Max. permissible taper	0.127 mm
Max. permissible gudgeon pin play in control bushing	0.038 mm
Compression ring gap	0.076 - 0.381 mm
Oil scraper ring gap	0.254 - 0.558 mm
Max. permissible ovality	0.038 mm
After pressing-in, line-bore bearing bushes to a bearing play of	0.025 mm
End play	0 - 0.330 mm

#### Tightening torques

Cylinder head nuts	22 Nm (2.2 mkg)
Intake valve holder	41 - 47 Nm (4.2 - 4.8 mkg)
Pressure valve seat	7 - 11 Nm (0.7 - 1.1 mkg)
Pressure valve plug	88 Nm (9 mkg)
Conrod bearing cap bolts	14 - 16 Nm (1.4 - 1.6 mkg)
Bottom cover bolts	14 Nm (1.4 mkg)



## INSTRUCTIONS FOR REPAIR

### Cylinder head overhaul

The construction of the cylinder head attachment enables to take off the cylinder head without removing the compressor from the engine.

- Take off all compressor connections.
- Mark cylinder head and cylinders to ensure that at re-assembly everything is installed at the right place.
- Unscrew cylinder head nuts.
- Use a soft tipped hammer to tap on the cylinder head, meanwhile firmly hold cylinders to prevent them from coming off which would cause damage to their sealing rings.
- Take off cylinder head.
- Screw two 1/4"-bolts into inlet valve holder. Grip these bolts between the jaws of a vice and take off the holder by softly tapping against the cylinder head.
- Remove the valve seats, for instance with an inside puller; if required, the cylinder head may be heated to max. 150 °C.
- Thoroughly clean the cylinder head.

### Intake valve

- When pressing the intake-valve seat into the cylinder head, the flat side should rest on the cylinder head.
- Install valve, valve spring and supporting ring.
- Press spring guide into cylinder head until it butts.
- Lock the spring guide in position by three punch strokes in the cylinder head edge.

### Pressure valve

- Press pressure valve seat into cylinder head in such a manner that the flat side rests against the head.
- Install valve guide so that it is clamped in the cylinder head. Place valve on valve seat and install the spring.
- Fit sealing ring on plug and tighten the plug to the prescribed torque.

### Cylinder head

- Install head gaskets on cylinders.
- Place cylinder head on cylinders, paying due attention to marks made at dismantling.
- Tighten cylinder head nuts to the prescribed torque.

### Cylinder and piston overhaul

Dependent on the place of the compressor on the engine, cylinders, pistons and connecting rods can be renewed without removing the engine crankcase.

### Dismantling

**Note:** If it is expected that not all parts need renewal, the following marks should be made before dismantling:  
Cylinder head relative to cylinders;  
cylinders relative to crankcase;  
pistons relative to crankcase;  
pistons relative to connecting rods;  
connecting rods relative to crankcase.

- Remove bottom cover.
- Remove cylinder head, see above.
- Separate cylinders from their sealing rings in the crankcase by tapping.
- Withdraw cylinders from crankcase, taking care not to damage pistons.
- Remove connecting rod bearing caps and take out connecting rods with pistons on the upper side of the crankcase.

### Cleaning and inspection

- Pay special attention to carefully cleaning the cylinder seats on the flange of the crankcase.
- Measure internal dia. of cylinders. In case the maximum permissible ovality and/or taper are exceeded, the cylinder should be renewed. Likewise, cylinders which are scored should be renewed.
- Measure play of gudgeon pin. In case the maximum permissible play is exceeded, renew connecting rod.

### Re-assembly

**Note:** Don't forget any marks on the various parts!

- Install pistons and connecting rods.
- Check piston ring caps.
- Install rings on pistons.
  - a. The four compression rings are fitted in pairs into the two grooves; the recesses in the rings should be on top (this side is marked as such by the indication "TOP").
  - b. The ring gaps must not be in line and none of the gaps must be positioned straight under the gudgeon pin.
- Remove one of the central cylinder head studs (if the compressor has not been removed from the engine this should be the central stud at the front side); this will facilitate subsequent assembly operations.
- Install pistons and connecting rods in the cylinders.
- Install cylinders with pistons and connecting rods in crankcase, use new sealing rings.
- Fit connecting rods on crankshaft; preferably use new connecting rod bearing shells.
- Install bottom cover, stud and cylinder head.

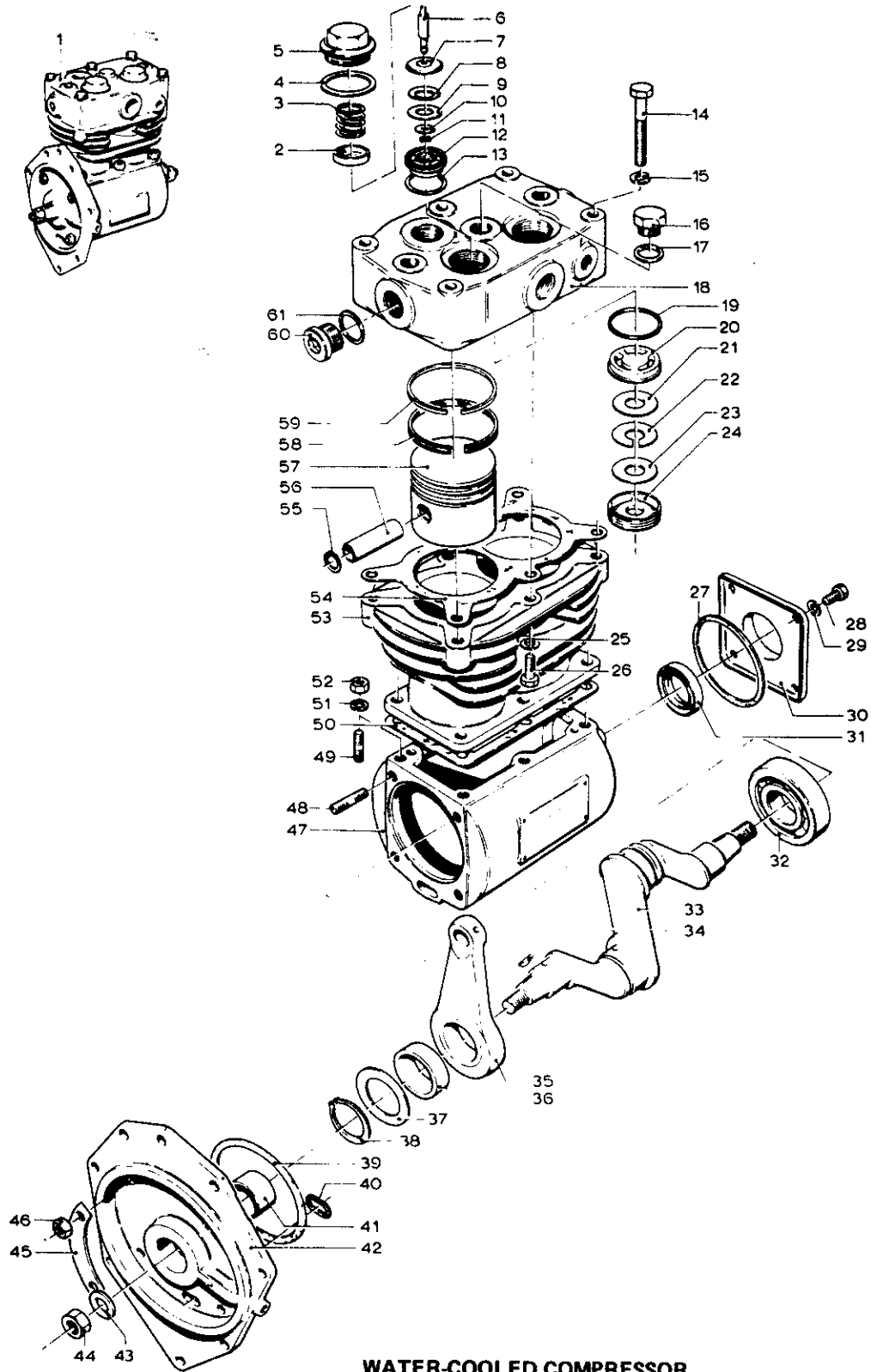
### Complete overhaul

A complete overhaul includes, apart from an overhaul of cylinder head, pistons and connecting rods, also overhaul of the crankshaft and its bearing.

### Dismantling

- Take off cylinder head, cylinders, pistons and connecting rods (see above).
- Mark position of crankshaft and rear cover in relation to the crankcase.
- Remove rear cover.
- Remove crankshaft from crankcase by tapping on the front side.
- Remove oil seal and, if required, bearing bushes.

1. Compressor
2. Spring retainer
3. Spring
4. Sealing ring
5. Plug
6. Pin
7. Valve guide
8. Spring washer
9. Valve
10. Washer
11. Circlip
12. Valve seat
13. Sealing ring
14. Screw
15. Spring washer
16. Plug
17. Sealing ring
18. Cylinder head
19. Sealing ring
20. Valve seat
21. Valve
22. Spring washer
23. Washer
24. Valve guide
25. Spring washer
26. Screw
27. O-ring
28. Screw
27. O-ring
28. Screw
29. Spring washer
30. Cover
31. Oil seal
32. Ball bearing
33. Crankshaft
34. Key
35. Conrod
36. Bearing bush
37. Washer
38. Circlip
39. O-ring
40. O-ring
41. Bearing housing
42. Cover
43. Washer
44. Nut
45. Lock plate
46. Nut
47. Crankcase
48. Stud
49. Stud
50. Gasket
51. Spring washer
52. Nut
53. Cylinder block
54. Gasket
55. Circlip
56. Gudgeon pin
57. Piston
58. Scraper ring
59. Compression ring
60. Plug
61. Sealing ring.



**WATER-COOLED COMPRESSOR**  
 Type E9 KZ 142  
 DAF no. 245942

### **Inspection**

- Inspect crankshaft bearing journals; any damage and/or ovality exceeding the maximum permissible value calls for renewal.

### **Re-assembly**

- After pressing-in, the new bearing bushes should be line-bored to a value which gives a bearing clearance of 0.025 mm.
- Install oil seal, the lip facing the crankcase inside.
- Install crankshaft.
- Check crankshaft axial play.
- Complete re-assembly (see above).