

5. Dismantling and Assembly Procedures on the Basic Engine

5.1 Basic Requirements

- The aim of this Repair Manual is to provide help with carrying out repairs to the engine.

The requirements for this are as follows:

- Trained specialist staff (of at least the minimum legal age);
- and a workshop where the necessary equipment, standard tools and special tools are available
- A well-lit, unrestricted working area, free from dirt and swarf, will make the work considerably easier.
- Clean the engine thoroughly before dismantling it.
- Attention must be paid to all the information and warning notices which have been affixed.
- Particular care is called for in the vicinity of rotating, moving or hot parts.



ATTENTION

This symbol is used whenever failure to comply precisely with instructions or procedures may cause accidents which can result in injuries or death.



CAUTION

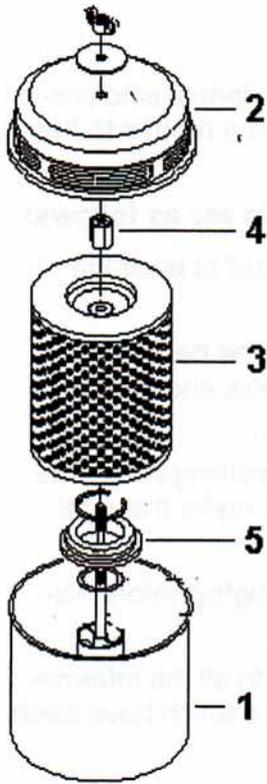
This symbol is used whenever failure to comply precisely with instructions or procedures may cause damage to the engine.



Advice and tips about special features when handling the engine.

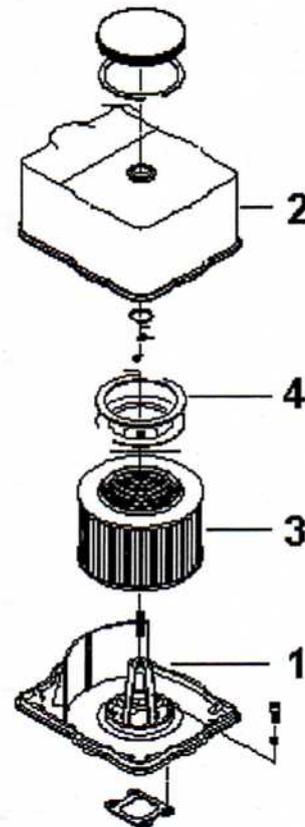
5.2 Intake Manifold (on 37E / 43E only)

Airfilter-Assy 37E / 43E



1. Filter base
2. Cover with preliminary filter
3. Strainer
4. Fitting hex-nut
5. Centering ring

Airfilter-Assy-Anbau 43F



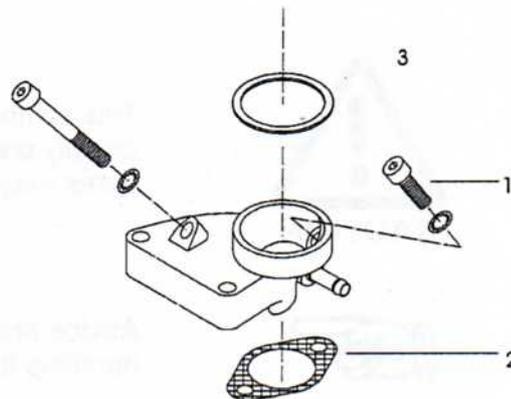
1. Filter-base
2. Cover
3. Strainer
4. Fastening strainer-cover

Intake elbow, 37E / 43E - engines



Attention:

- The socket head cap screw M 8x25 (1) must be fitted using "Loctite 415" adhesive (C).
- Generally renew the seal (2+3) 847.192.4.

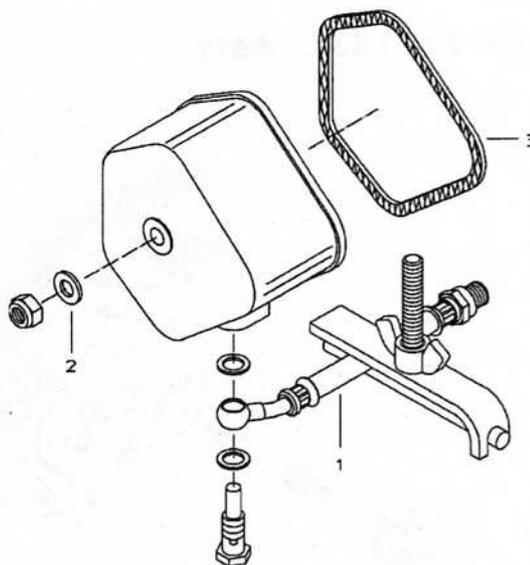


5.3 Valve Cover with Oil Return Line

37E / 43E – engines :

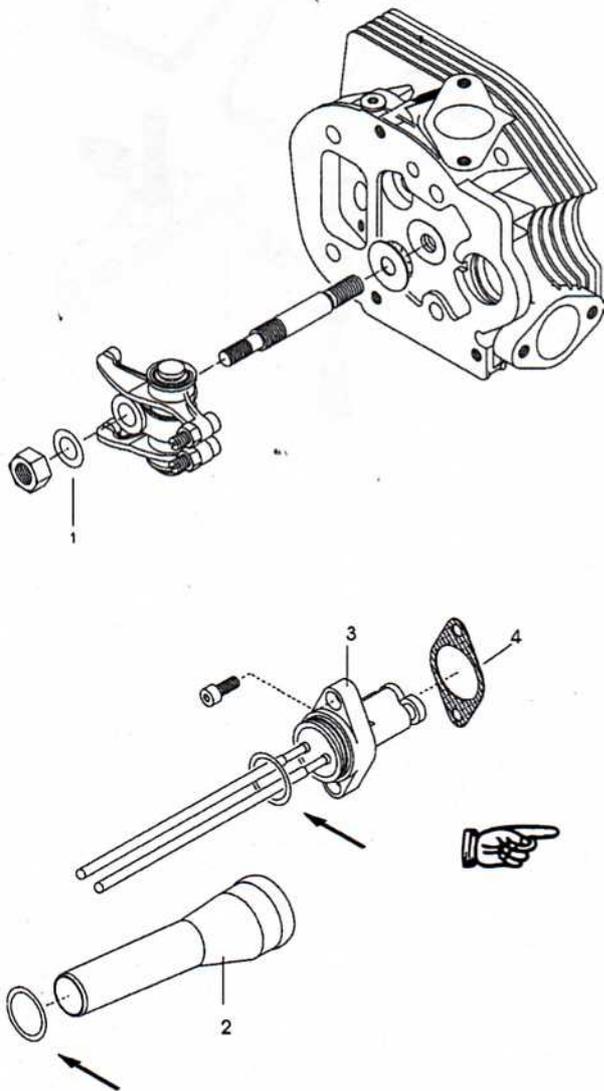
Drain the engine oil.

- Before dismantling, seal the oil return line (1) using clamp "748.115.6".
- The PVC sealing washer (2) can be used several times.
- Generally renew the valve cover seal (3).



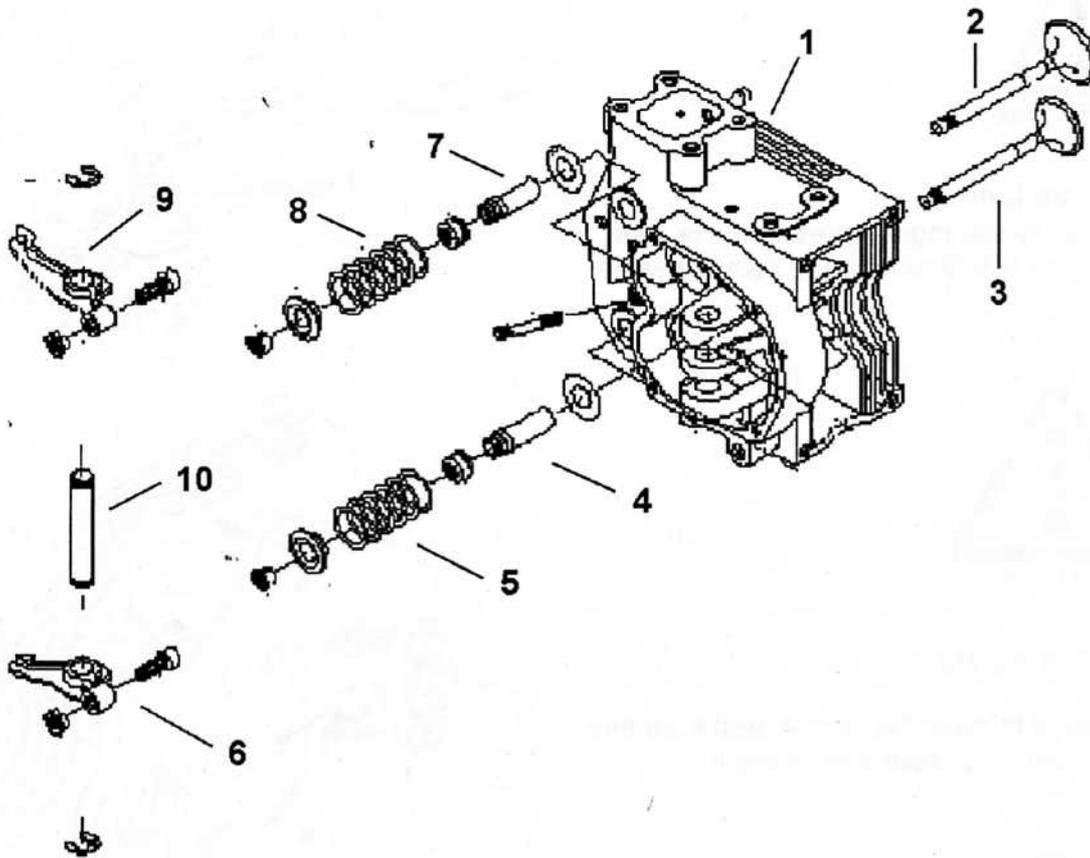
5.4 Rocker Mechanism, Valve Control

5.4.1 37E / 43E - Assy



- Completely dismantle the rocker bracket.
- 43F see page 43 no. 3.12.1
- When assembling, it is absolutely essential to insert the steel shim (1).
- Centre the rocker bracket.
- Carry out the assembly, using the tightening torque shown in the list.
- ALL ENGINES :
- Push rods of different lengths with tapered rod ends.
- Always fit tapered rod ends on the tappet side.
- Longer push rod - exhaust valve, position relative to engine mounting side.
- The push rod sheath (2) can be removed from the partly-dismantled engine (after the tappet guide (3) has been removed).
- Exchange the O-ring seals if necessary.
- Fit the tappet guide, using "Loctite 573" (A) sealing agent for the socket head cap screw.
- Generally renew the tappet guide surface seal (4).
- Before fitting the push rod sheath (2), make the two O-ring seals oil-dry and grease them slightly.
- The fitted push rod sheath might be moved out of position to start with, so check that the fit is correct.

5.4.2 Cylinderhead assy 43F – engine



- | | |
|--------------------------|-------------------------|
| 1. Cylinderhead | 6. Rocker arm, exhaust |
| 2. Intake valve | 7. Valve guide, intake |
| 3. Exhaust valve | 8. Valve spring, intake |
| 4. Valve guide, exhaust | 9. Rocker arm, intake |
| 5. Valve spring, exhaust | 10. Rocker shaft |

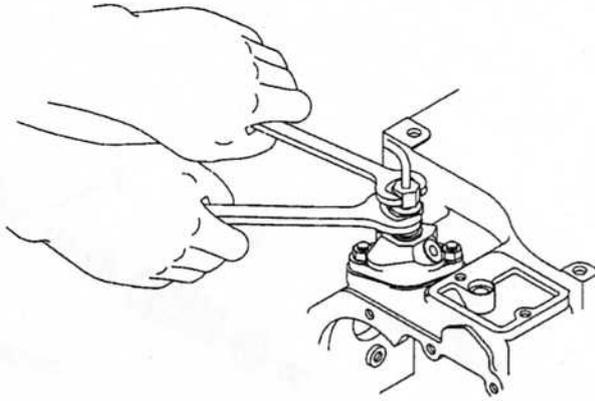
5.5 Injection system



ATTENTION

Pressure Line:

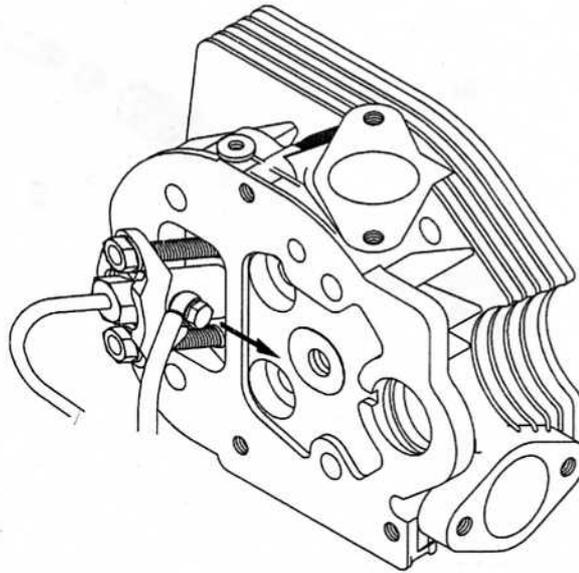
- When loosening the pressure line, use wrench SW22 to hold the delivery valve.



ATTENTION

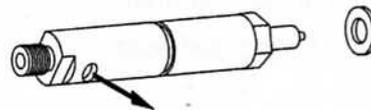
Injection nozzle

- Always remove the nozzle seal from the cylinder head seat and renew it.

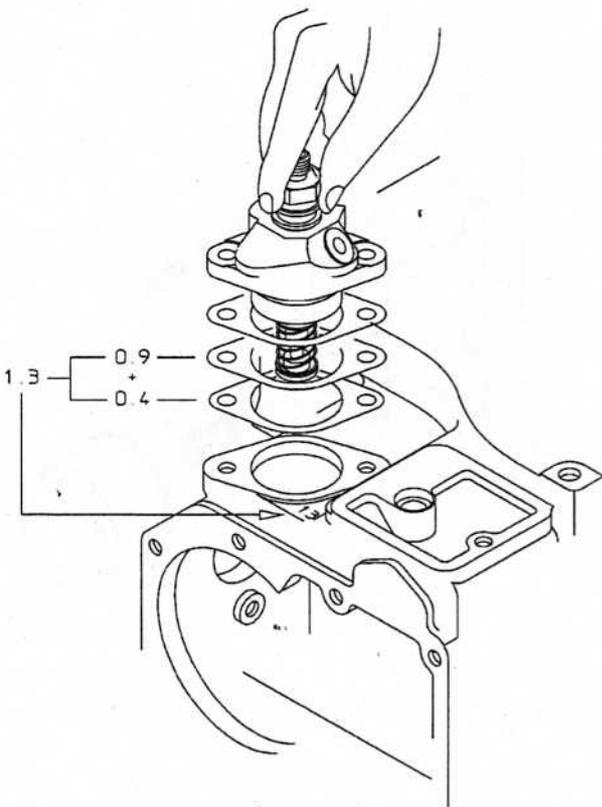


Attention:

Assembly position for the nozzle:
overflow oil line towards the
valve cover.



Injection System



Injection Pump:

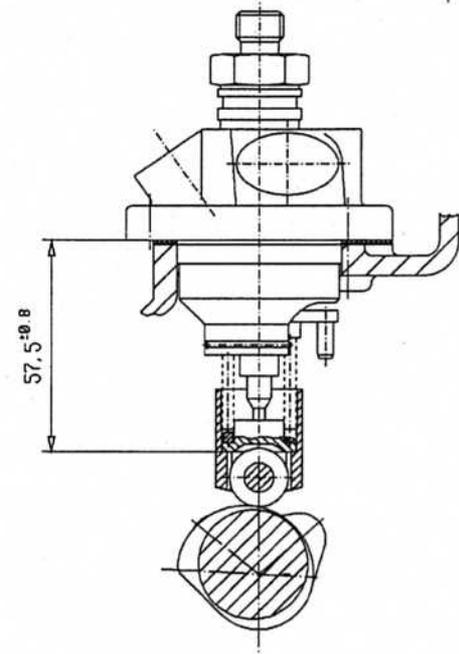
- Defined seals are always used when fitting the injection pump.
- The total thickness of the pump shims is imprinted on the surface of the crankcase, next to the injection pump.
- It is absolutely essential to keep this seal thickness when the injection pump is exchanged.
- If the rated RPMs / engine output are modified, the seal thickness must be corrected in order to set the new injection timing as required (see Chapter 4).

Assembly:

- Move the acceleration lever to the "full load" position. Rotate the flywheel until the pump roller tappet is in the BDC position.
- Move the pin on the injection pump regulating lug into the "full quantity" position.
- Put on the requisite pump shims. When doing this, always place the paper seal on the crankcase surface. Always exchange damaged seals.
- Introduce the injection pump **without** any mechanical resistance.
- The pin on the regulating lug engages in the slot on the transverse lever of the control rod assembly.

To check correct assembly:

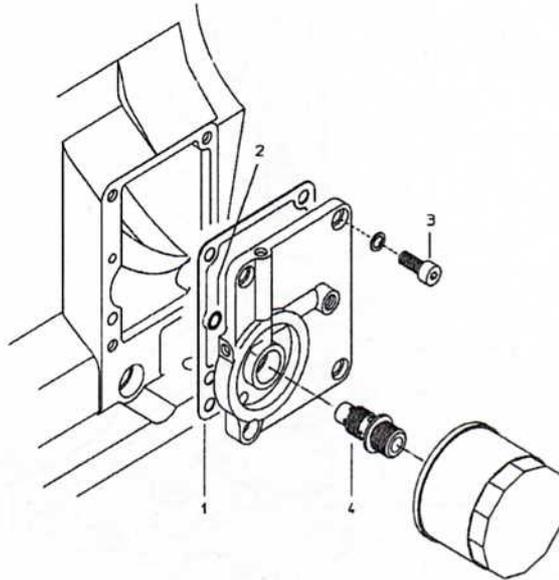
- Visual inspection through flanged bearing front cover.
- Turn the engine over using the crank handle; when the acceleration lever is moved from 'full load' to 'stop', the engine must no longer inject.
- When fitting, always tighten the securing nuts alternately.



5.6 Oil Filter, Oil Filter Cover, Oil pressure relief valve

**ATTENTION****Assembly:**

- Generally renew the seal (1) and the O-ring seal (2).
- Before fitting the cover, secure the O-ring seal by greasing it so that it sticks.
- Secure the oil filter cover fitting screws (3) with "Loctite 573" (A) sealing agent, and tighten them alternately and equally. (List of Torques).
- Wet the packing rubber of the oil filter with oil, and hand-tighten without using a tool.

**Oil pressure relief valve:**

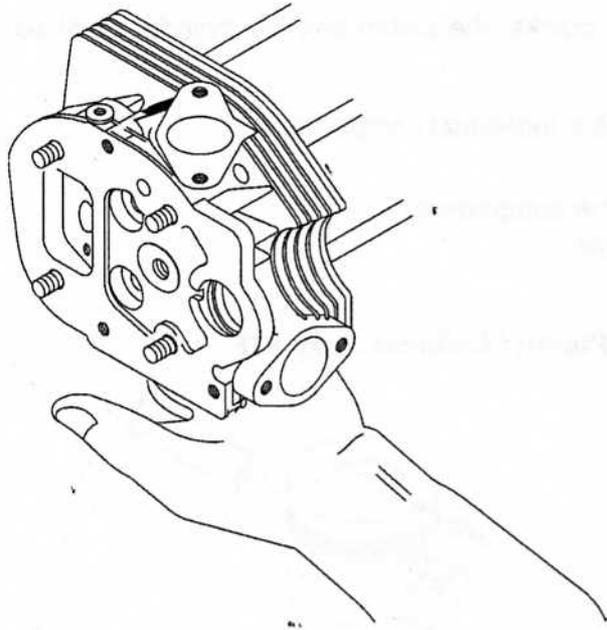
The oil pressure relief valve (4) is calibrated by the manufacturer and therefore it can only be changed completely - no repair is possible.

Control of operation: The spring loaded sleeve must be easy moveable.

 The oil pressure control sleeve:

- Ball design (engine type 43E)
- Plunger design (engine type 43F)

5.7 Cylinder Head 37E / 43E



Assembly:

- Generally use a new cylinder head seal.
- Use grease to fix the cylinder head seal in the head slot.



ATTENTION

Check the valves for:

- wear and tear on the valve guides
- the condition of the stem seals
- leakproofness and deposits



When tightening the securing nuts, lift the cylinder head slightly and align it radially. (Table of Torques).

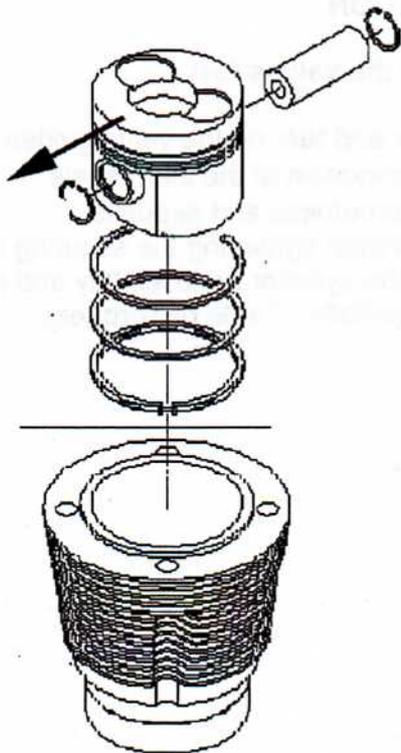
5.8 Piston, Cylinder

- If the unit shows any traces of corrosion or cracks, the piston and the cylinder must be exchanged.

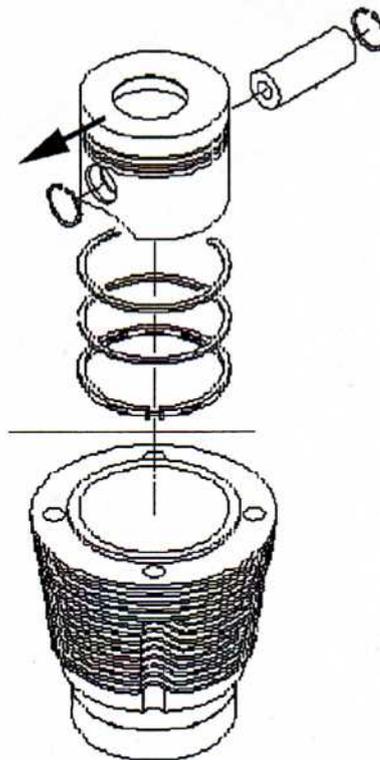
See the Table for wear measurements on the individual components.

- If the limit values are exceeded: exchange the components.
- Oversized pistons / cylinders are not available.

Piston / Cylinder Assy 37E / 43E



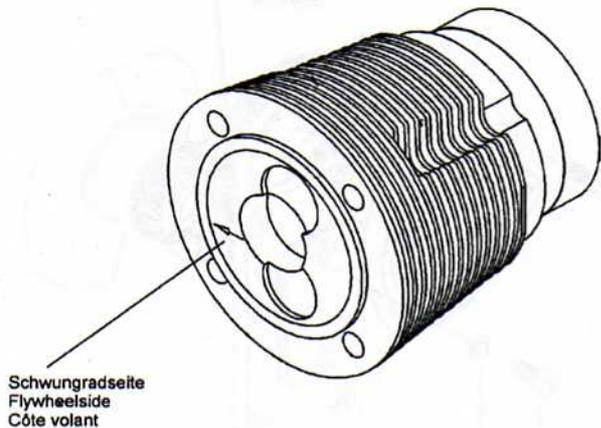
Piston / Cylinder Assy 43F



Index-arrow points to flywheel side.
Combustion chambers out of center !

Attention
Don't mix up 43E / 43F pistons !
Valves will hit the piston head !

5.8.1 Piston, Cylinder assembly



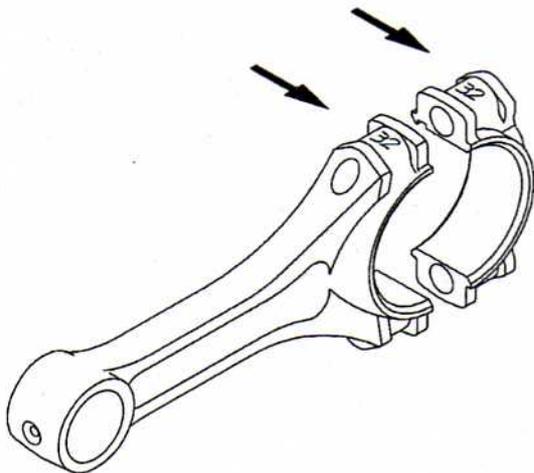
- It is absolutely essential to use a piston retaining strap for the assembly.



There is a marking on the side of the piston which points towards the side of the flywheel.
Original 37E / 43E pistons always have valve pockets. The 43F does not have any.

- Oil the piston, push it into the cylinder and assemble the complete unit.
- Always position the joints with a 120° offset.

5.9 Connecting Rod



- If the wear measurements are exceeded, exchange the bearing shells and/or con rod bearing.



When assembling, the identification numbers on the con rod and the bearing cover must be together.

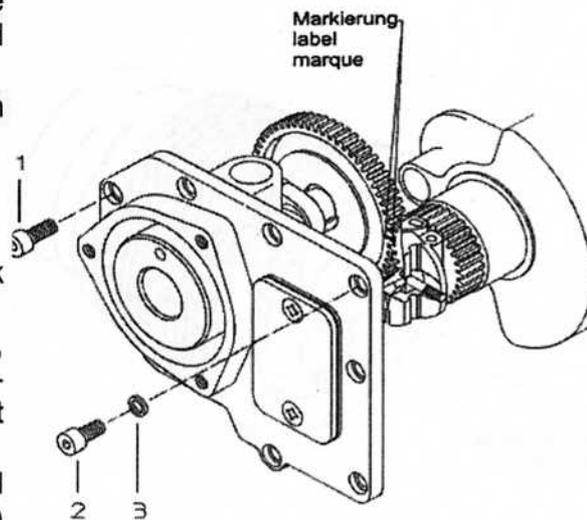
- It is absolutely essential to lubricate the bearings: List of Torques

5.10 Camshaft with Automatic Decompression

- The unit comprising the camshaft and the flanged bearing can only be exchanged complete.
- It is not possible to carry out repairs on the decompression unit.

Assembly:

- Position the flywheel on the TDC mark (crankcase / flywheel)
- When the flanged bearing is pushed in, the camshaft gearwheel mark be positioned true to the mark on the crankshaft gearwheel.
- The long securing screws on the flanged bearing are fitted using "Loctite 573" (A) sealing agent.
- Do not use any shims, etc.



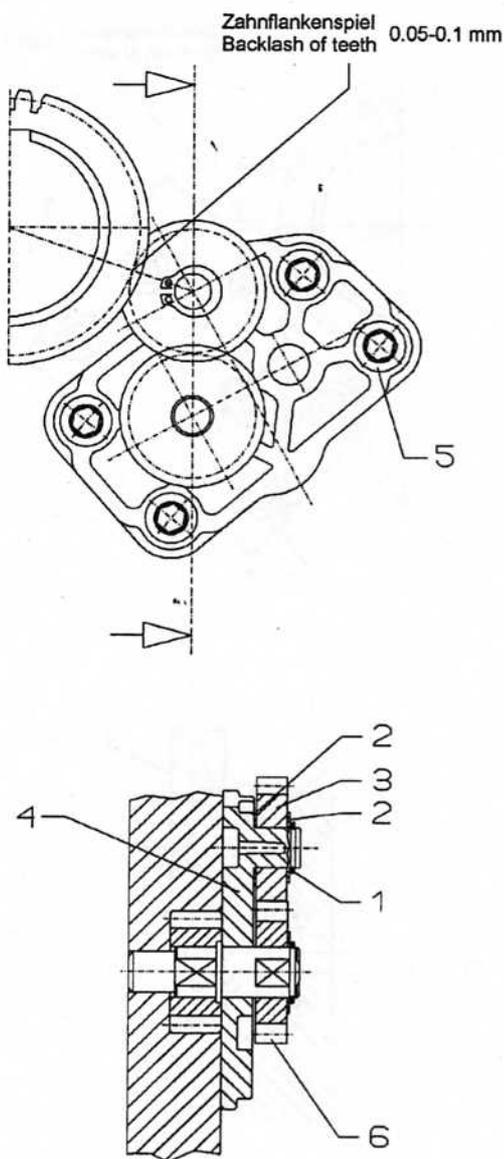
Attention:

- The top right hand securing screw (2) is shorter.
- Do not use any sealing agent here, but use a copper washer (3) instead.

43F (new series):

- The securing screws are of equal length.

5.11 Lubricating oil pump 37E / 43E



When exchanging the lubricating oil pump, no. E724.036.8 or no. 724.040.8, the assembly must be carried out as follows:

1. Dismantle the intermediate gear wheel (3).
 2. CAUTION: Remember the shims for end float.
 3. Remove the locking ring (1), washers (2) and intermediate gear wheel (3) from the lubricating oil pump.
 4. Lubricate the pump chamber in the crankcase, and the lubricating oil pump itself.
 5. Insert the lubricating oil pump into the pump chamber and secure the pump cover (4) with socket head cap screws (5); when doing this, only tighten the socket head cap screws (5) slightly - it must be possible to turn the toothed driving wheel (6) without resistance.
 6. Tighten the socket head cap screws (5) equally, with torque = 10 Nm; it must still be possible to turn the toothed driving wheel (6) without resistance.
 7. Fit the intermediate gear wheel (3), washers (2) and locking ring (1).
 8. Check the gear backlash between the intermediate gear wheel (3) and the crankshaft gear wheel.
- This must be between 0,05 and 0,1 mm.



ATTENTION

Pumps must not be operated if the gearing jams.

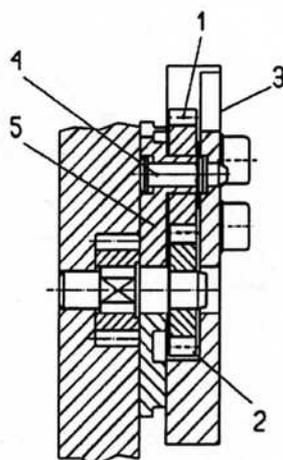
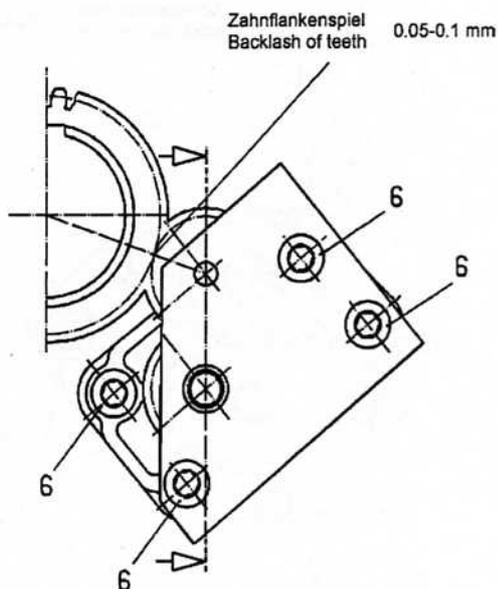


5.12 Lubricating oil pump 43E, conversion kit

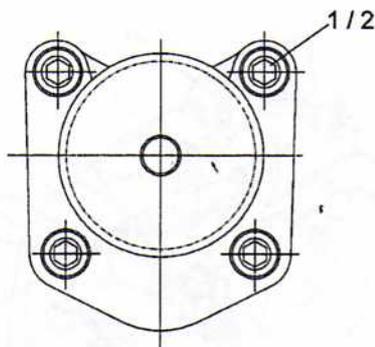
The teeth of gearwheels (1) and (2) may experience premature wear if the engines are used under difficult operating conditions. For this reason, the gearwheel (1) mounted on one side with support bracket (3) has been additionally supported by a pin (4).

Proceed as follows when assembling the lubricating oil pump:

1. Lubricate the pump chamber in the crankcase, and the lubricating oil pump itself.
2. Apply SILOMAT liquid sealing agent on pump cover (5) in the area of the sealing surface.
3. Insert the lubrication oil pump into the pump chamber, and secure the pump cover (5) with the support bracket (3), using socket head cap screws (6). Only tighten the socket head cap screws (6) slightly.
4. Completely crank the engine once from the flywheel, tighten the socket head cap screws evenly (6) to torque = 10 Nm.
5. Check gear backlash between gearwheel (1) and crankshaft gearwheel. This must be between 0.05 and 0.1 mm.



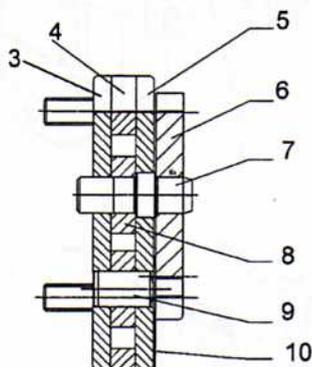
5.13 Lubricating Oil Pump 43F



For dates of construction from 6/1996 onwards, this pump is also used for 37E and 43E engines.

When exchanging lubricating oil pump no. E724.038.8, the assembly must be carried out as follows:

1. Unscrew four screws, M6 x 25 (1+2) and take out the complete oil pump.
2. The pump is supplied pre-assembled,
3. Fit the complete oil pump into the control casing. The protruding part of the oil pump shaft is received by the index bore. If the assembly is correct, the oil pump will (7) lie against the rear wall of the control housing without a gap. Ensure that the joint surfaces are clean.
4. Position screws, M6 x 25 (1) with spring lock washers (2) and tighten to 10 Nm torque.
5. Function control:
Check the gear backlash between the oil pump and the crankshaft gear wheel. It must be at least 0,05 mm. This will be guaranteed if rotary play can be seen and felt in the tooth contact engagement. The test have to be done on four points (4x90°) of the gear wheel (6).



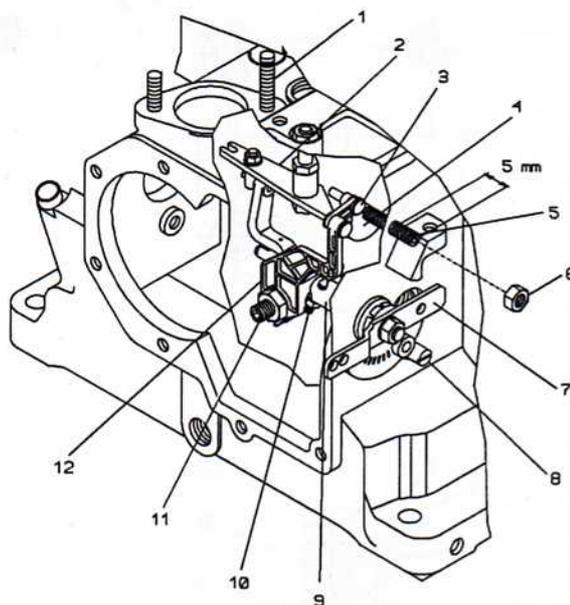
ATTENTION

- 1 Screw, M6 x 25
- 2 Spring lock washer
- 3 Cover
- 4 Housing
- 5 Cover
- 6 Gear wheel, Z=24 / m=1.75
- 7 Pump shaft
- 8 Gear wheel, Z=07 / m=3.0 (2x)
- 9 Bolt (3x)
- 10 Locking plate

5.14 Regulation Mechanism

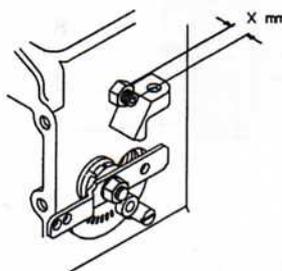
Preliminary Work:

- Dismantle the injection pump.
- Dismantle the flanged bearing with the camshaft.
- On the injection pump flange, unscrew the rear stay bolt (1) until the transverse lever (2) is released.
- Remove the stop buffer screw (10) on the eccentric shaft (9) and the external eccentric screw (8).

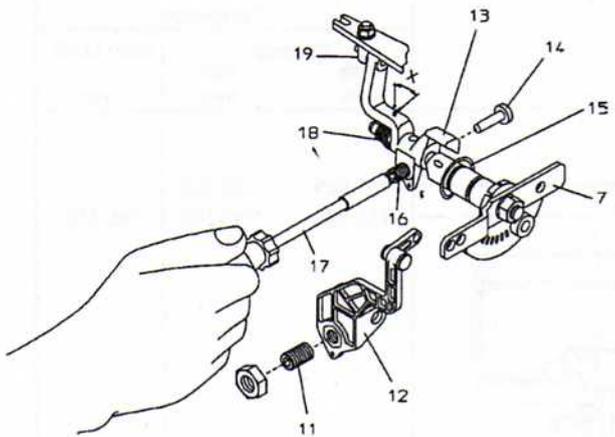


Dismantling:

- Determine and note the position of the setscrew (5).
- Remove the locking nut (6) and screw the setscrew in until the flange bolt (3) on the automatic starting enrichment lever (12) (automatic increased starting quantity - ASM) disengages from the segment (4).
- Screw the setscrew back until it protrudes about 5 mm in relation to the surface of the crankcase.
- Unhook the spring on the ASM lever (12) and remove the setscrew (11).
- Loosen the threaded bushing (16), special tool (17), by about 3 revolutions.
- Remove the annular spring from the eccentric shaft and remove the eccentric shaft, rotating it in the direction of 'stop'.
- Dismantle the complete set of levers.



5.15 Regulation Mechanism



Assembly:

ATTENTION: Insert the governor needle, and secure it with grease. Pre-assemble the eccentric shaft (9) with the requisite parts.



ATTENTION: For stationary regulation, the torsion spring can be clamped to the rest plate in order to make assembly easier.

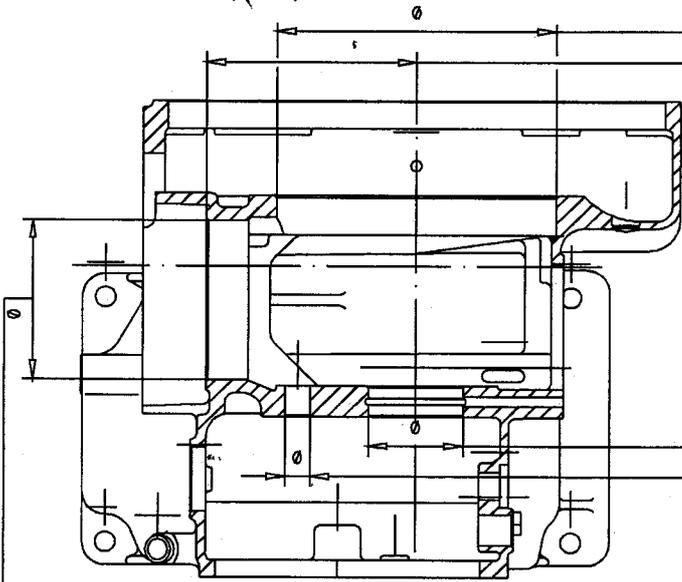
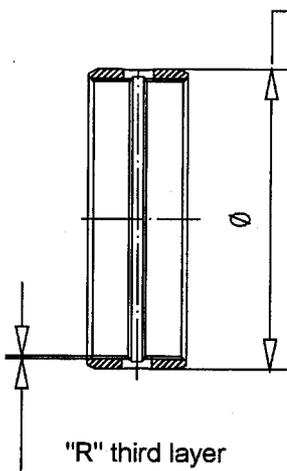


- Insert the leg of the return spring (18) into the regulating lever (13) and bend it about 5 mm to 75° (x).
- Use the special tool (17) to screw the threaded bushing (16) into the regulating lever.
- The thread must be flush with the rear side of the lever.
- Push the flange bolt (14) into the threaded bushing in the regulating lever.
- Place the automatic increased starting quantity lever (12) - without the setscrew (11) - over the regulating lever.
- Introduce the eccentric shaft into the lubricated bearing bush. When doing this, set the acceleration lever (7) approximately to the stop position.
- Push the set of levers (12 + 13) on to the eccentric shaft.
- The return spring must fit into the eccentric shaft slot without resistance.
- At the same time as this operation, turn the acceleration lever in the direction of "full load".
- Rotate the eccentric shaft while pulling it out of the bearing bush, and press the transverse lever (2) in the direction of the crankcase wall until the pin engages in the forked bolt (19) of the transverse lever.
- Move the eccentric shaft back into the bearing bush, and secure it with the annular spring (15).
- Screw in the external eccentric stop screw (8) to fix the regulating lever.

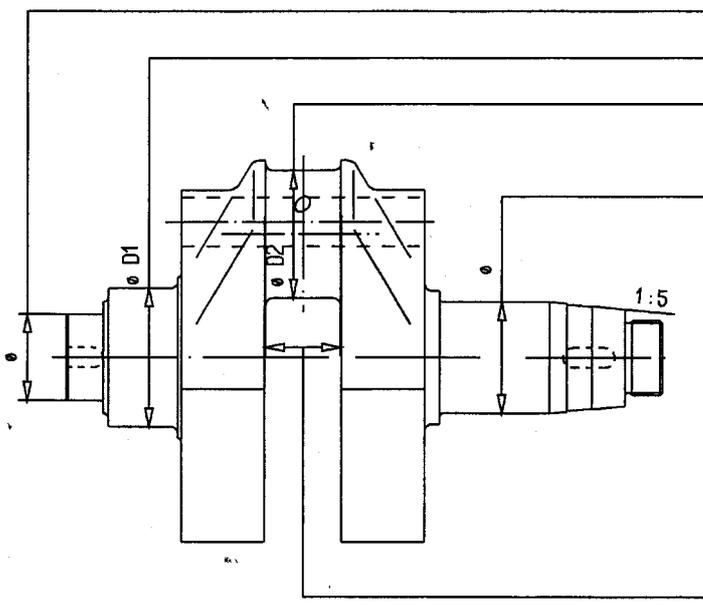
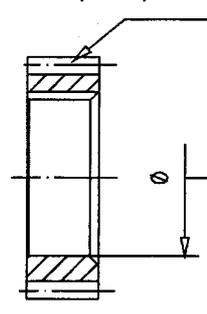
Function Check:

- Move the acceleration lever (7) into the 'full load' position.
- The regulating lever (13) must press AGAINST the governor via the return spring.
- Move the flanged bolt (3) on the automatic increased starting quantity lever into the bore on the segment (4) by adjusting the setscrew (5).
- Move the setscrew (5) and the locking nut into the previously determined positions, and lock them.
- Screw in the stay bolt on the injection pump flange; assemble the flanged bearing with the camshaft.

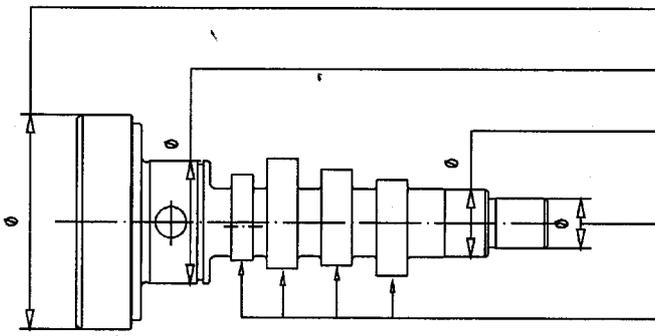
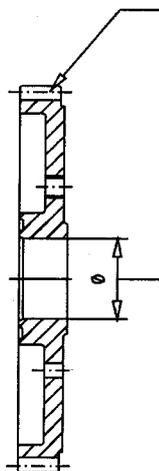
6. Measurement Tables - Wearing Parts

Part. Description	Dimension		
	Original max. mm	min. mm	max. Limit mm
Crankcase 37E, 43E, 43F 	180.025	180.000	135.250
	135.325	135.300	
	61.019 16.018	61.000 16.000	61.035 16.070
	104.035	104.000	
Main bushing 37E, 43E, 43F 	61.105	61.068	
	0.070	0.030	0.100
	inner diameter not fixed can only be checked when bush is pressed into crankcase via the bearing play, radial play: Bearing bush will have to be replaced when galvanically applied Layer "R" wears off (recognisable on shiny gold bronze color) and / or when scoring appears around circumference. The inner diameter should not be used to determinate wear, only the radial bearing play is important.		

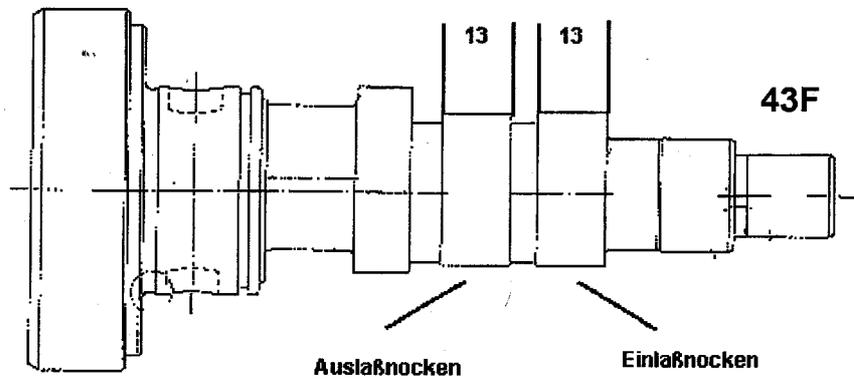
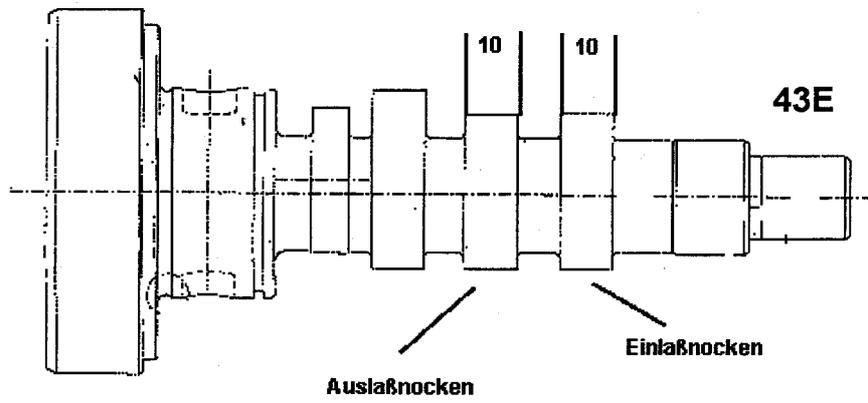
MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension																											
	max. mm	Original min. mm	max. Limit mm																									
<p>Crankshaft 37E, 43E, 43F</p>  <p>Radial Bearing play D1 _____ D2 _____</p> <p>Regrind Stages The crank pin and journal can be reground in 2 steps of 0.25 mm each and fitted with under size bearings</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2"></th> <th rowspan="2">ØD1</th> <th rowspan="2">ØD2</th> <th colspan="2">corresponding bearing</th> </tr> <tr> <th>D1</th> <th>D2</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">1</td> <td style="text-align: center;">55.760</td> <td style="text-align: center;">51.710</td> <td style="text-align: center;">775.039.4</td> <td style="text-align: center;">470.023.4</td> </tr> <tr> <td style="text-align: center;">55.740</td> <td style="text-align: center;">51.690</td> <td></td> <td></td> </tr> <tr> <td rowspan="2" style="text-align: center;">2</td> <td style="text-align: center;">55.510</td> <td style="text-align: center;">51.460</td> <td style="text-align: center;">775.040.4</td> <td style="text-align: center;">470.024.4</td> </tr> <tr> <td style="text-align: center;">55.490</td> <td style="text-align: center;">51.440</td> <td></td> <td></td> </tr> </tbody> </table>		ØD1	ØD2	corresponding bearing		D1	D2	1	55.760	51.710	775.039.4	470.023.4	55.740	51.690			2	55.510	51.460	775.040.4	470.024.4	55.490	51.440			<p>35.018</p> <p>56.010</p> <p>51.960</p> <p>45.020</p> <p>30.250</p> <p>0.070</p> <p>0.070</p>	<p>35.002</p> <p>55.990</p> <p>51.940</p> <p>45.009</p> <p>30.198</p> <p>0.030</p> <p>0.030</p>	<p>*</p> <p>*</p> <p>*</p> <p>*</p> <p>30.350</p> <p>0.100</p> <p>0.130</p> <p>allowable wear to be determined by radial bearing play</p>
				ØD1	ØD2	corresponding bearing																						
	D1	D2																										
1	55.760	51.710	775.039.4	470.023.4																								
	55.740	51.690																										
2	55.510	51.460	775.040.4	470.024.4																								
	55.490	51.440																										
<p>Gearwheel Crankshaft 37E, 43E, 43F</p>  <p>Heat gear to 90-100°C to obtain shrink-fit.</p>	<p>34.985</p>	<p>34.965</p>	<p>Tooth edges smooth, no scoring and wear.</p>																									

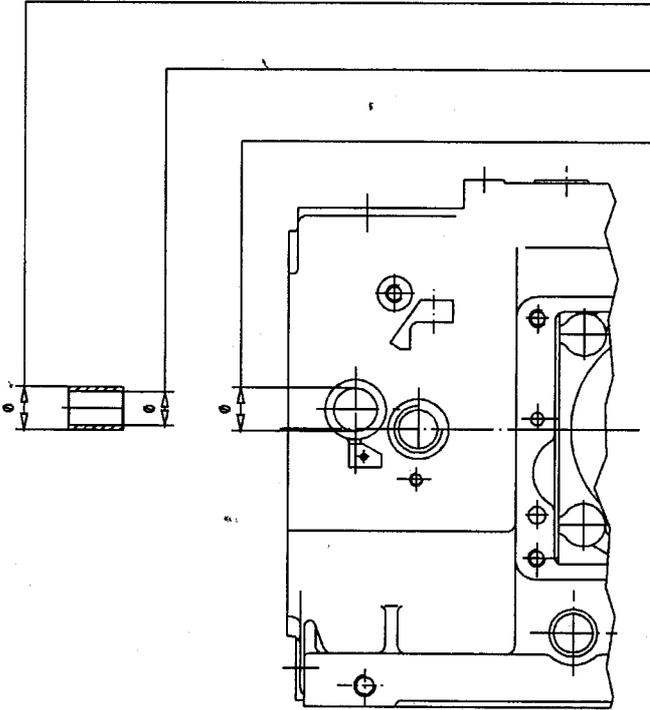
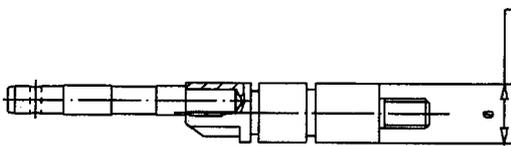
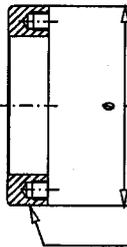
MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension		
	max. mm	Original min. mm	max. Limit mm
<p>Camshaft 37E, 43E, 43F</p> 	<p>70.000</p> <p>40.018</p> <p>22.048</p> <p>15.930</p>	<p>69.954</p> <p>40.002</p> <p>22.035</p> <p>15.910</p>	<p>69.904</p> <p>15.860</p> <p>renew if scored</p>
<p>Gearwheel Camshaft 37E, 43E, 43F</p> 	<p>21.989</p>	<p>21.976</p>	<p>Heat gear to 90-100°C to obtain shrink-fit.</p> <p>Tooth edges smooth, no scoring and wear.</p>

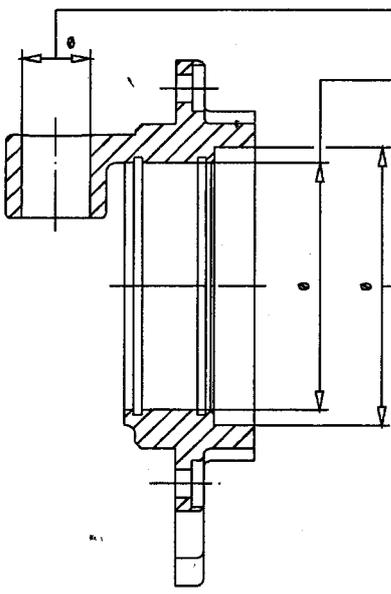
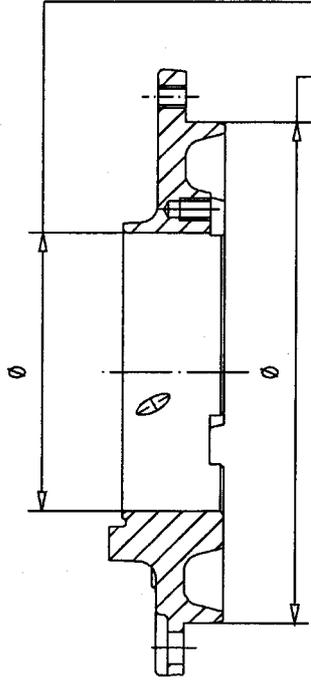
Comparison of 43E / 43F - Camshafts



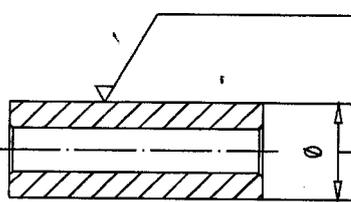
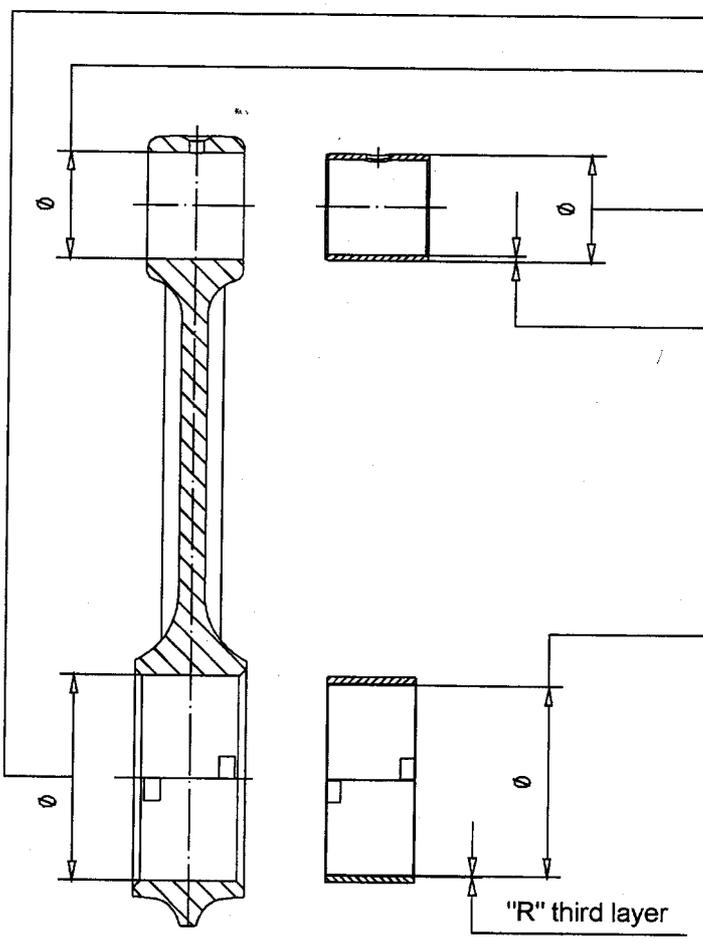
MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension		
	Original max. mm	min. mm	max. Limit mm
Crankcase 37E, 43E, 43F 	20.074 16.110 16.095 20.021	20.054 16.090 16.075 20.000	16.145
Excentric Shaft 37E, 43E, 43F 	16.020	16.012	16.000
Angle Ring 37E, 43E, 43F 	65.000	64.810	renew if scored

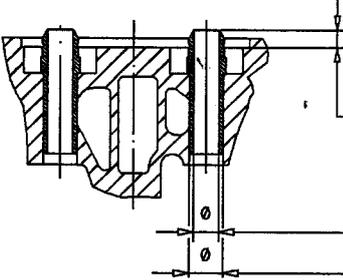
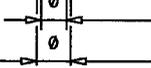
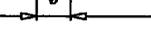
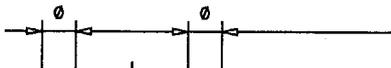
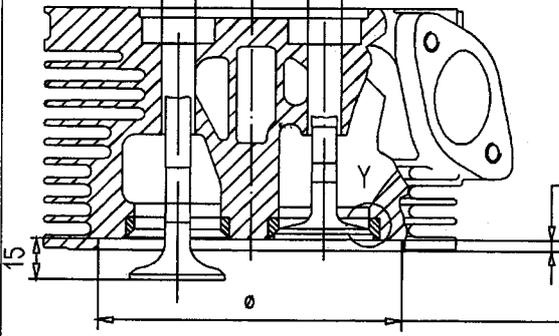
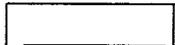
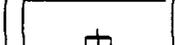
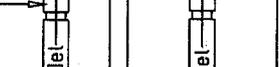
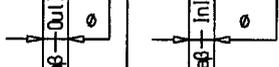
MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension		
	max. mm	Original min. mm	max. Limit mm
Flange Bearing 37E, 43E, 43F 	22.021	22.000	22.080
	79.991	79.961	
	90.054	90.000	
Main Bearing Flange 37E, 43E, 43F 	99.956	99.934	
	180.068	180.043	180.040

MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension		
	Original max. mm	min. mm	max. Limit mm
<p>Piston Pin 37E, 43E, 43F</p> 	26.000	26.996	renew if scored
<p>Connecting Rod with Bearings 37E, 43E, 43F</p> 	<p>55.619</p> <p>29.013</p> <p>29.075</p> <p>1.495</p> <p>0.070</p>	<p>55.600</p> <p>29.000</p> <p>29.035</p> <p>1.483</p> <p>0.030</p>	<p>inner diameter only to be checked via radial bearing play:</p> <p>0.130</p> <p>Both bearing shells will have to be renewed when the galvanically applied layer "R" wears off (recognisable on shiny gold-bronze color) and / or when scoring appears around circumference.</p>

MEASUREMENT TABLES, WEARING PARTS

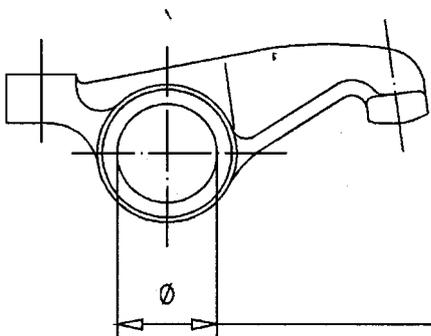
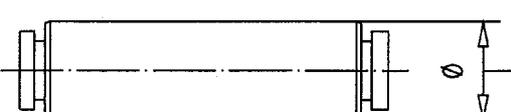
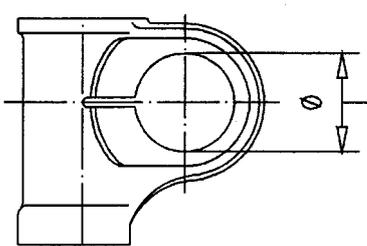
Part. Description	Dimension		
	Original max. mm	Original min. mm	max. Limit mm
<p>Cylinderhead 37E, 43E</p> 	5.800	5.000	see note
	9.009	9.000	
	12.030	12.012	
	11.980	11.969	
	4.100	3.900	renew if scored
	109.200	109.150	
	8.930	8.918	
	45°	45°	
	4.200	3.800	
	2.000	1.850	
	36.300	35.700	
	34.300	33.700	
<p>Note: To check wear of valve shaft and valve guide, insert valve guide and put dial gauge to "measuring point". Move valve lateral. If movement is more than 0.15 mm replace both parts.</p>			

MEASUREMENT TABLES, WEARING PARTS

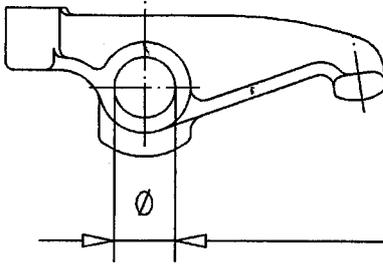
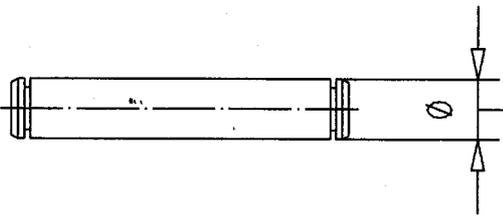
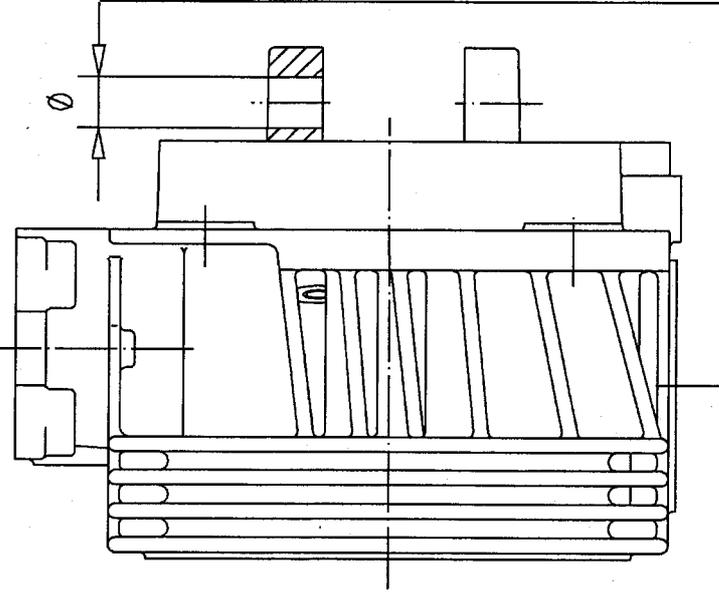
Part. Description	Dimension		
	max. mm	Original min. mm	max. Limit mm
<p>Cylinderhead 43F</p>	8.015	8.000	see note
	12.030	12.012	
	11.985	11.974	
	5.100	5.000	see note
	109.200	109.150	
	7.930	7.918	
	44°40'	45°	
	3.200	2.800	
	1.000	0.860	renew if scored
	42.150	41.850	
38.150	41.850		

Note: To check wear of valve shaft and valve guide, insert valve guide and put dial gauge to "measuring point". Move valve lateral. If movement is more than 0.15 mm replace both parts.

MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension		
	max. mm	Original min. mm	max. Limit mm
Rocker arm 37E, 43E 	20.021	20.000	20.060
Rocker shaft 37E, 43E 	19.980	19.959	19.950
Rocker arm assy 37E, 43E 	19.996	19.994	

MEASUREMENT TABLES, WEARING PARTS

Part. Description	Dimension		
	max. mm	Original min. mm	max. Limit mm
Rocker arm 43F 	14.011	14.000	14.050
Rocker shaft 43F 	13.984	13.966	13.955
Cylinderhead 43F 	14.018	14.000	14.060

MEASUREMENT TABLES, WEARING PARTS

Part. Description

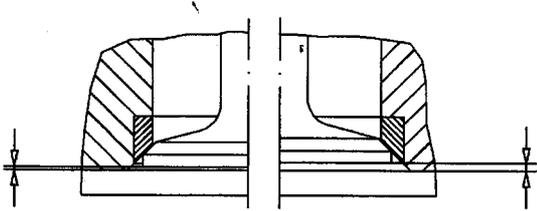
Dimension

max.
mm

Original
min.
mm

max. Limit
mm

Valve protrude and valve in recess 37E, 43E, 43F



Auslaß - Outlet

Einlaß - Inlet

		37E	43E	43F
Inlet	protrude			
	in recess	0-0.1	0-0.1	2.5-2.6
Outlet	protrude			
	in recess	0-0.1	0-0.1	2.5-2.6