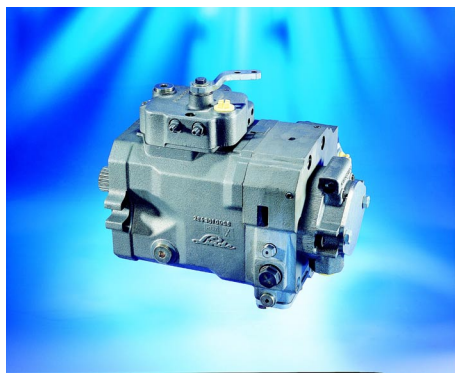
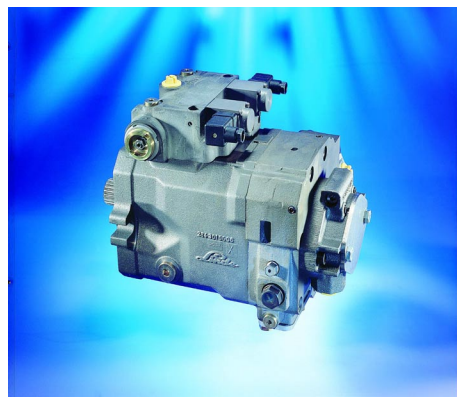
HPV-02







REPAIR MANUAL
HPV 55 ... 135-02

Repair Manual HPV 55...135-02

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Status: 06.01

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A General Hints

On handing out this r e p a i r m a n u a l we may remind you that the work described herein must not be carried out by other than experienced personnel trained for this task!

In this context we would like to draw your attention to the training courses organized and performed by LINDE FH in Aschaffenburg. For more detailed information do not hesitate to contact our sales department.

Technical modifications the pump may have gone through can be seen from the latest issue of the relevant spare parts catalogue.The serial number embossed on the name plate indicates the state of the art of the unit and consequently the spare parts to be used.

As a general rule all sealing and securing elements should be checked carefully when servicing. Our recommendation is to replace them all. Seals are available in complete kits as spare parts. Make it a rule that your workshop utilizes original LINDE spare parts only !

Any remnants of old sealants have to be removed from the sealing faces and applied a-new on re-assembling.

Screws have to be secured with the prescribed torques. Tables of tightening torques Ma for setting torque spanners are found at the end of this book.

The test run at the end of re-assembly has to take place at working temperature.

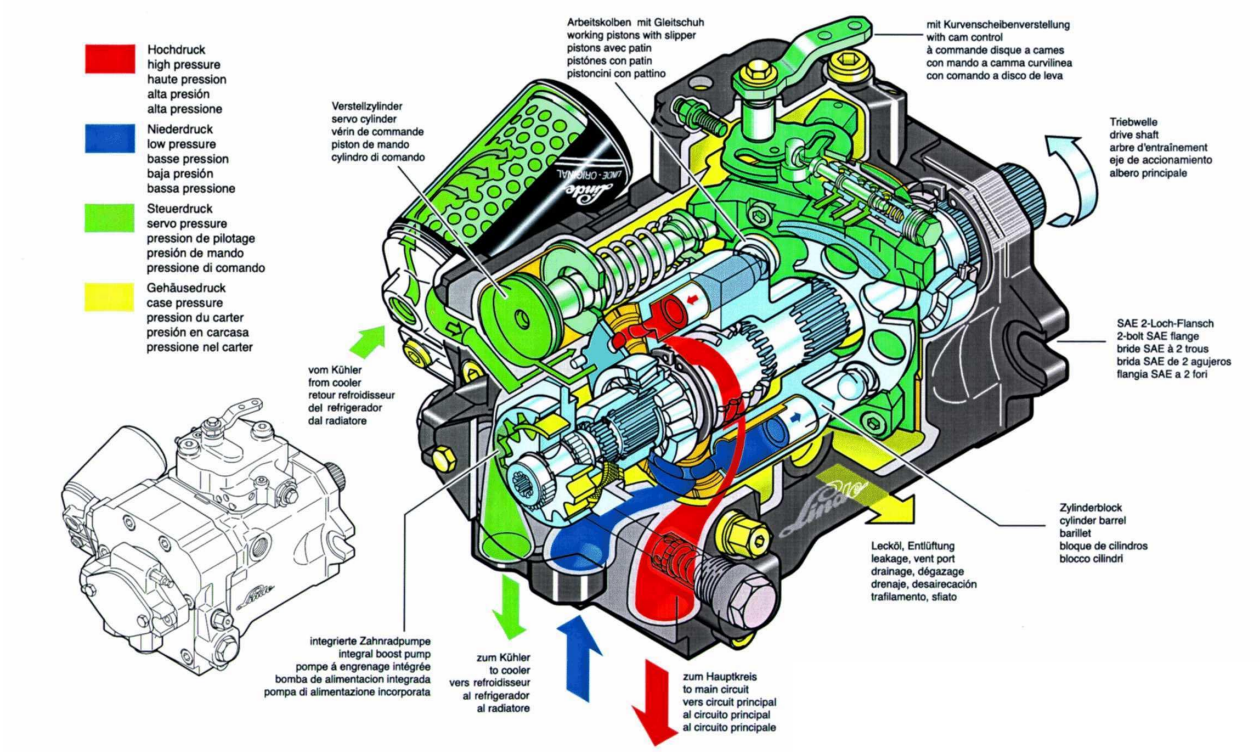
The illustrations in this shop manual have been taken from the HPV 02 pump size 105; sizes 55...135 are similar.

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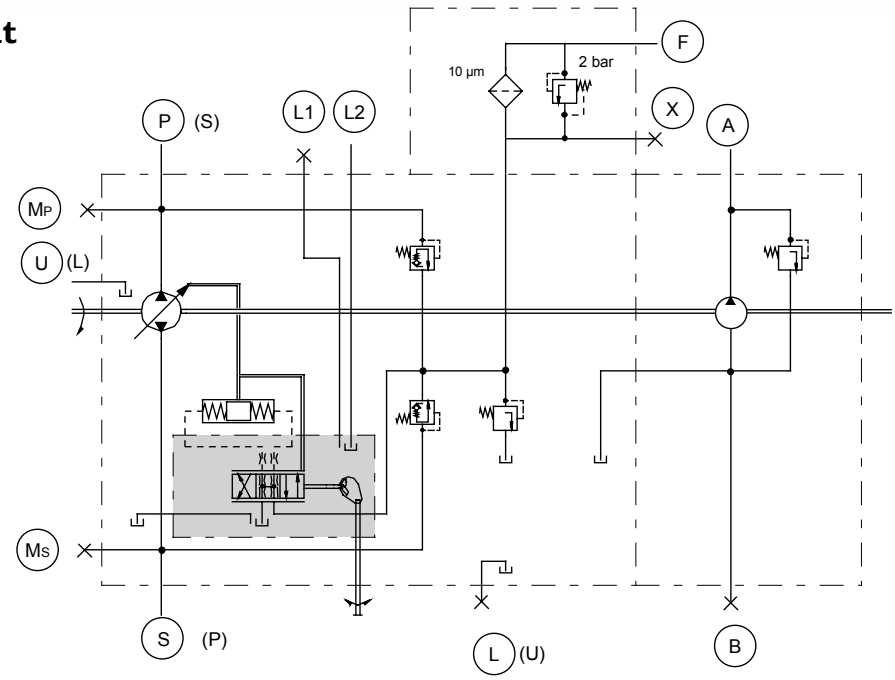
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B Sectional view

HPV...-02R with M1 type control



C Standard circuit



EXPLANATIONS	
P, S	High pressure port
A	Pressure port boost pump
B	Suction port boost pump
F	Control pressure supply, Boost
X	Control pressure gage port
Ms, Mp	High pressure gage port
L, U	Drain (filling, vent) ports and flushing return from hydr. motor
L1, L2	Vent ports

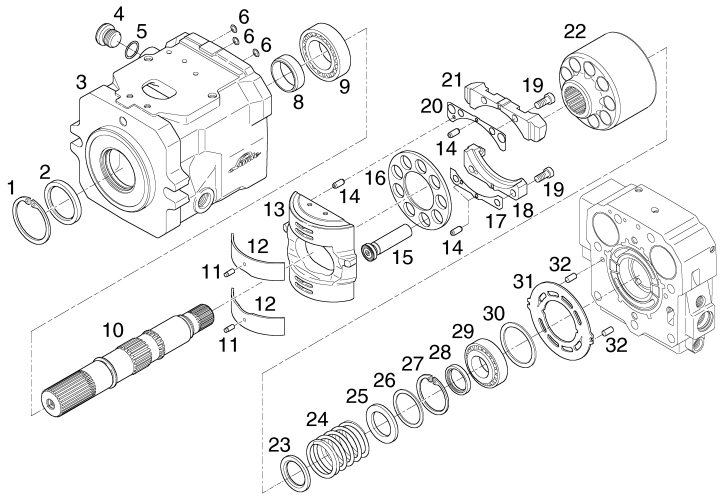
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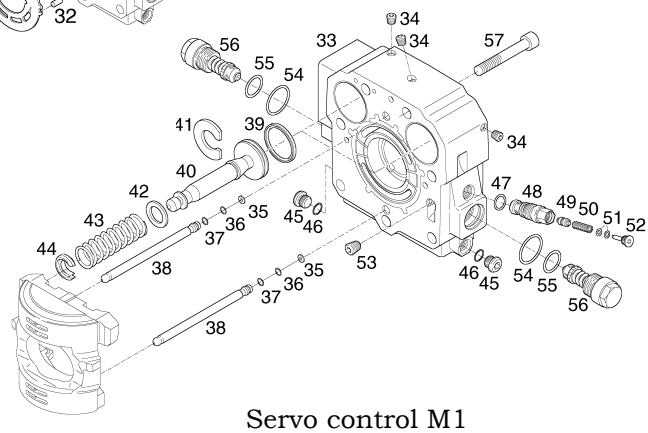
D Detail view

HPV...-02R with M1 type control

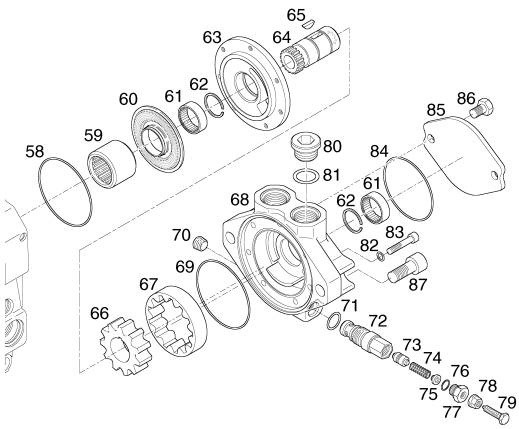
Rotating unit and housing



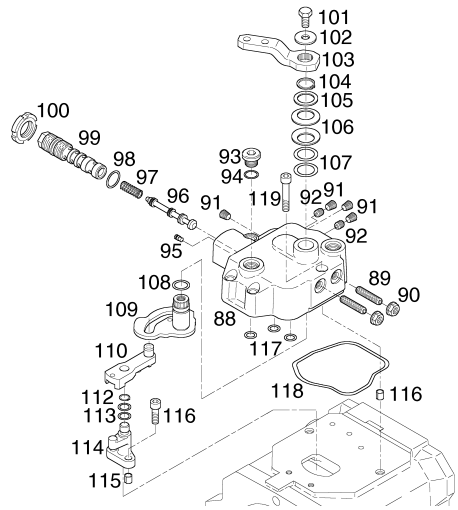
Valve plate housing and valves



Boost pump



Servo control M1

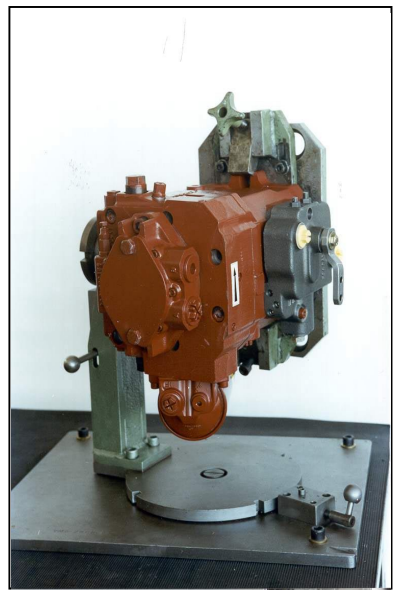


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E General view

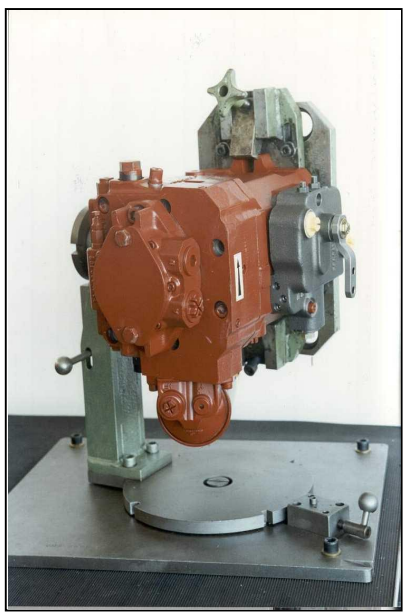


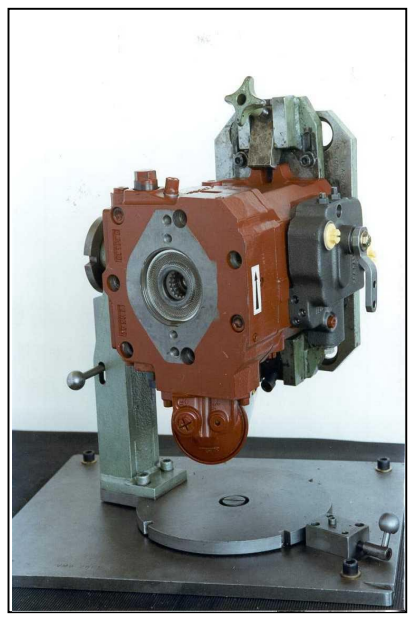


F Operations

F 1 Disassembly of pump

F 1.1 Auxiliary gear pump



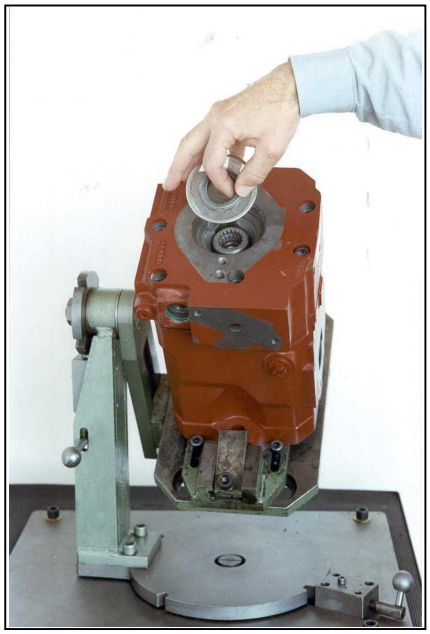


Remove both fixing bolts of the gear pump and take the gear pump off.

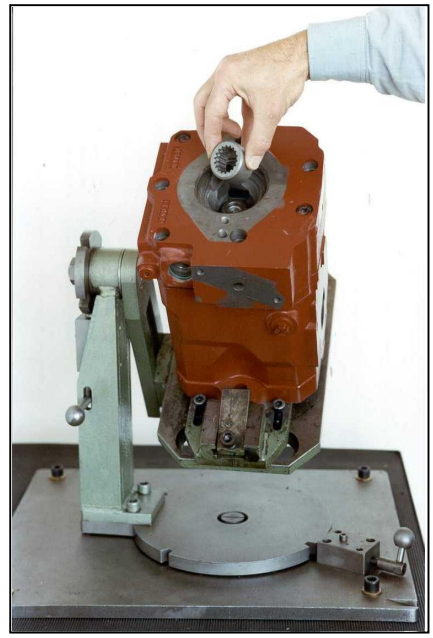
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F 1.2 Strainer

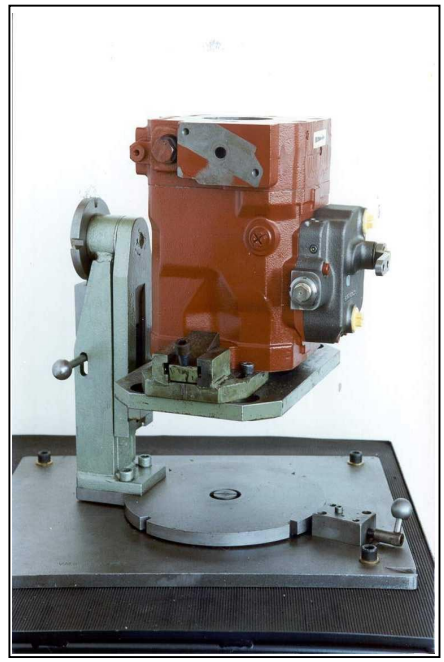


F 1.3 Coupling muff



F 1.4 Filter with flange





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F 1.5 Control M1





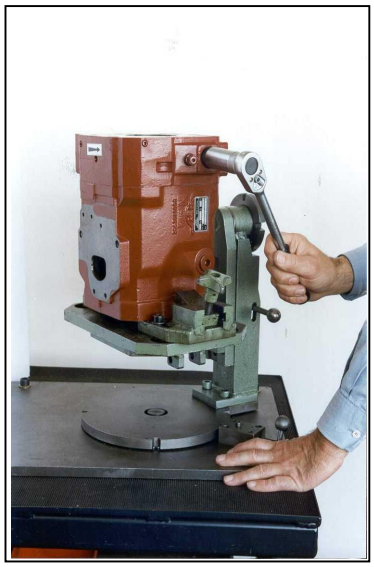
F 1.6 Spacer



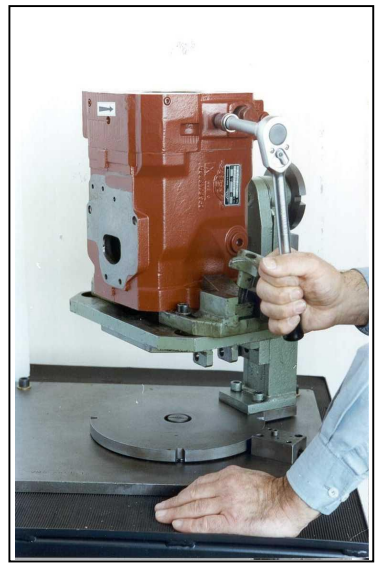


F 1.7 Valves

F 1.7.1 High pressure valves

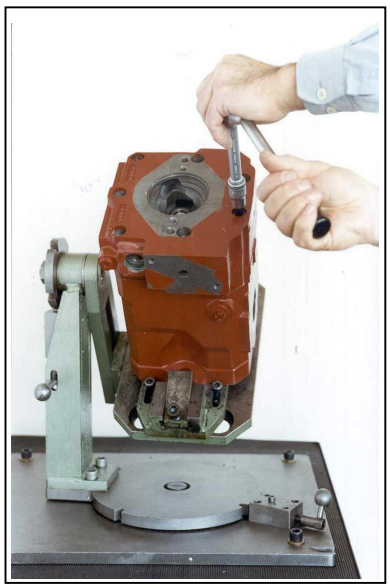


F 1.7.2 Low pressure valve

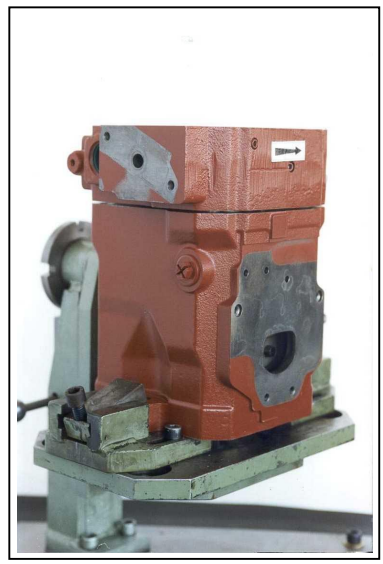


F 1.8 Valve plate housing

Loosening



Lifted from inside by spring force

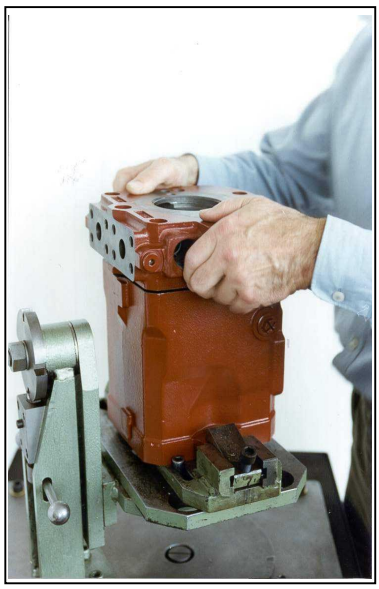


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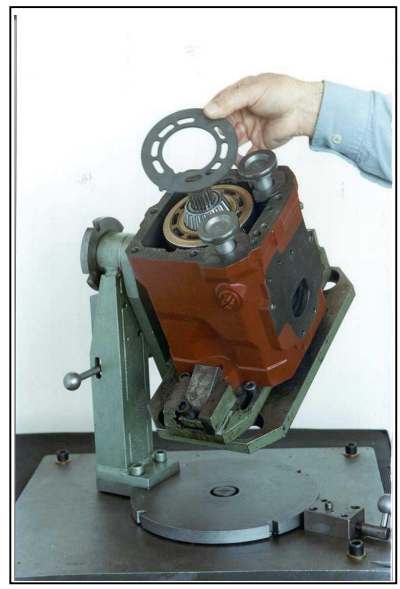
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F 1.8 Continued

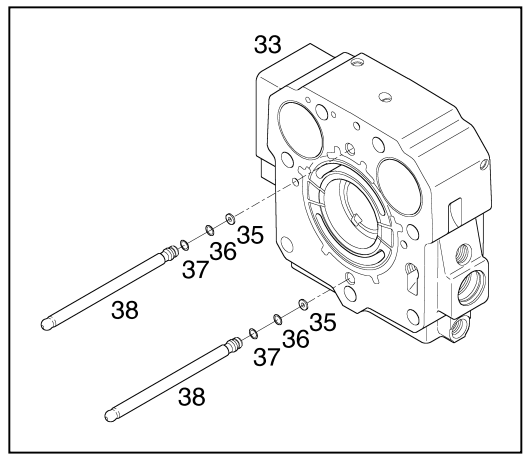
Take valve plate housing (33) off. **Caution:** Do not mix up connecting pipes (38) and shims (35) of P and S, or their axial play will have to be re-adjusted.



Take valve plate away





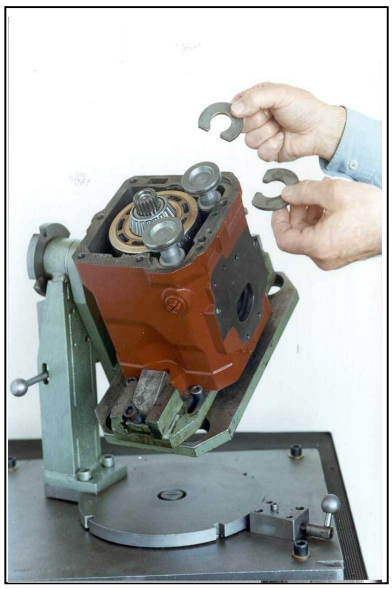


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F1.9 Take shims out

Caution: Do not mix the shims up, otherwise the mechanical zero position will have to be re-adjusted.



The rotating unit as a whole can be taken out of the pump for visual checking without further dismantling. If no damage is seen the rotating unit can be put in and the pump can be assembled again. On assembling the pump the radial shaft seal has to be replaced.
See the relevant chapters in this manual.

F 1.10 Visual check of rotating unit



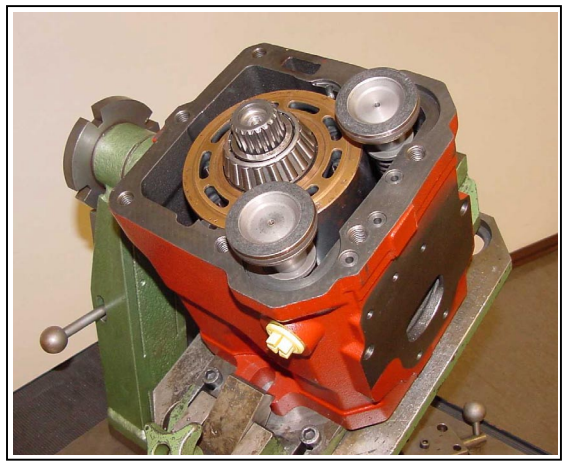


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F 1.11 Disassembly of rotating unit

To examine the drive unit thoroughly, or to exchange a part of the drive unit, the latter has to be fitted back in the pump housing.

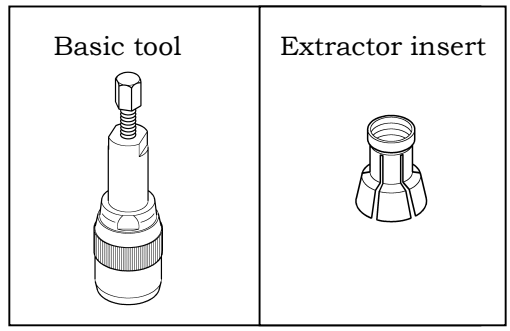


Use the three threaded pins in the device to press the cylinder barrel down **only** as much as not to damage the retainer plate (16).

Important:

When using the prescribed extractor insert (see tools catalogue 200 804 9000/01) make sure to grip the rollers, not the cage, to avoid damage of the cage.







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F 1.11 (continued)

Extract bearing (9).



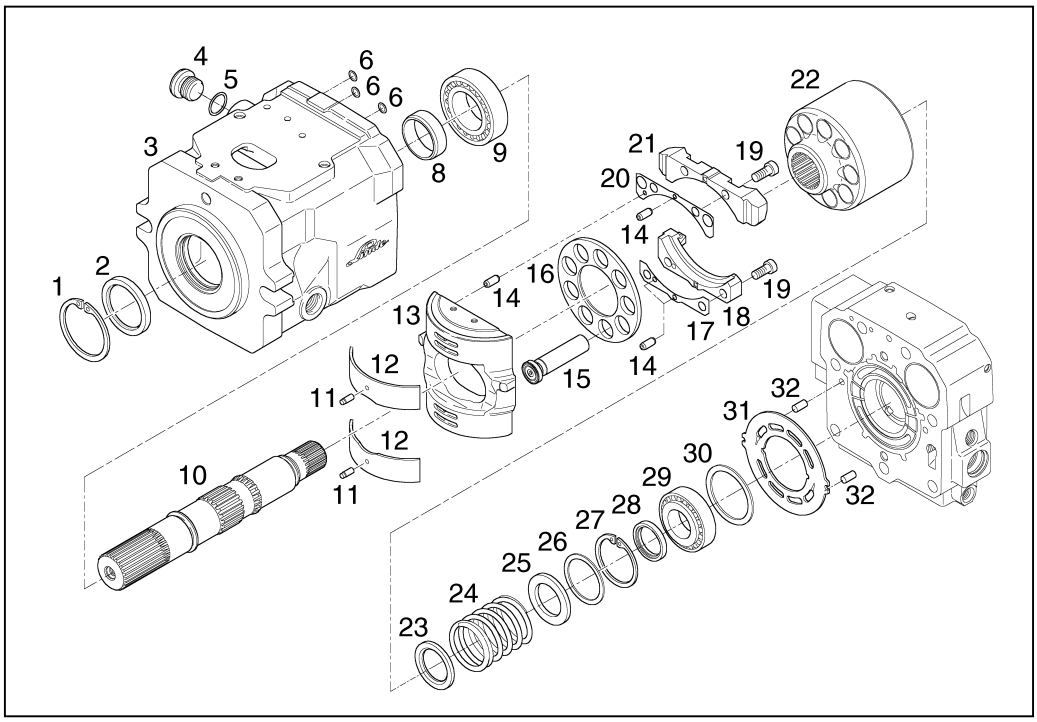
Once the bearing has been extracted pull the drive unit (cylinder barrel 22, swash plate assembly 13-21 and shaft 10) out as a whole.



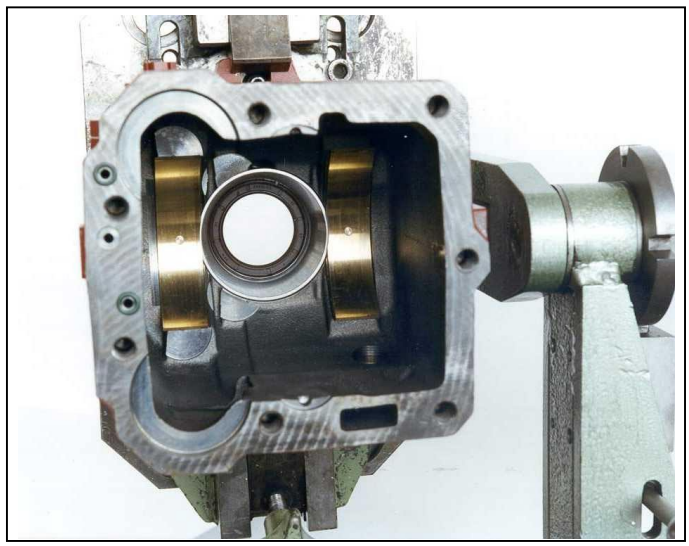
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F 1.11 (continued)



F 1.12 Give slide bearing (12) in housing (3) a visual check.



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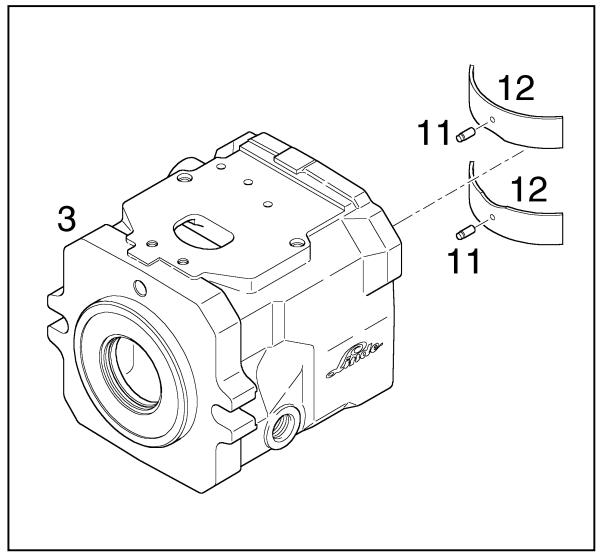
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F 1.12 (continued)

If the slide bearings strips (12) are noticeably damaged they ought to be replaced.

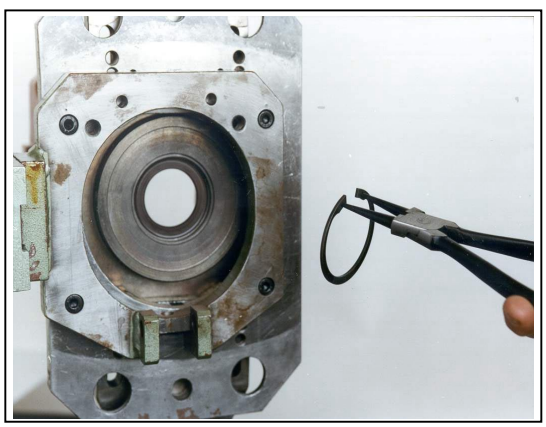


Slide bearing strips (12) and pin (11)



F 1.13 Remove shaft seal

After every pump strip-down the shaft seal (2) has to be replaced. To do this take the snap ring (1) out.

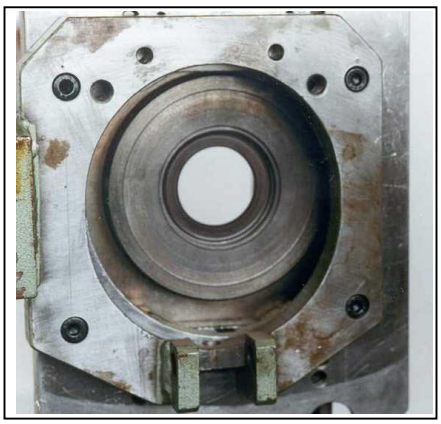


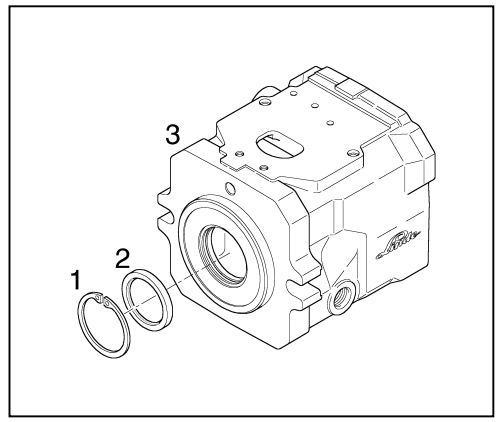
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F 1.13 (continued)

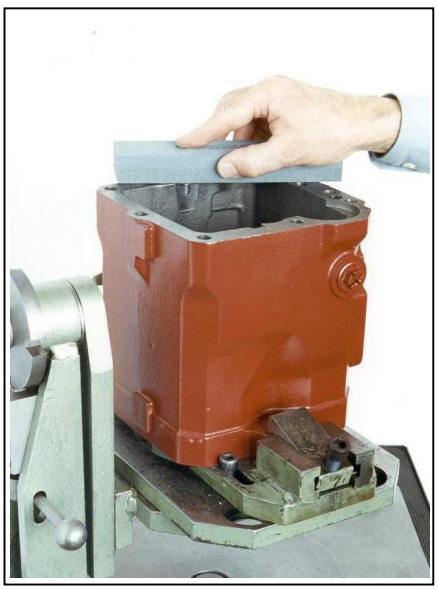
Beat shaft seal ring (2) to the outside and clean the seat from Loctite remnants.





F 1.14 Preparing pump housing for assembly

Remove Loctite remnants with a scraper from the sealing faces of the pump housing (3), then smoothen with a fine grain sand stone and wash the pump housing (3).



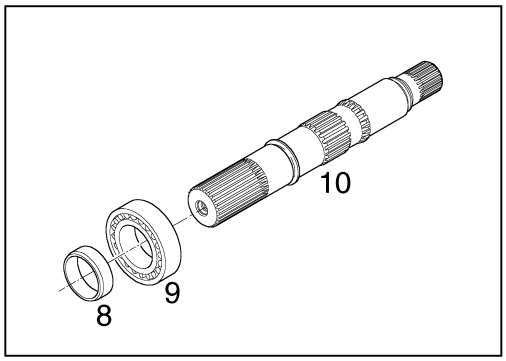
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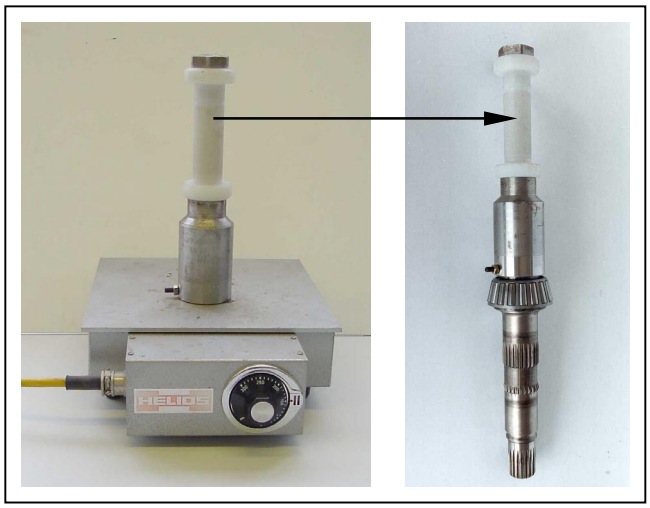
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F 2 Assembly

F 2.1 Drive shaft

If the drive shaft (10) is damaged it is replaced incl. bearing (9) and running ring (8).
If the drive shaft can be used again while the bearing and running ring cannot, proceed as follows:
-press old bearing and running ring out under a press.
-Clean the running ring seat on the shaft
-Heat the drive-side bearing up to max.150 °C and fit it.
-Apply Loctite 648 to the seating area of the running ring on the shaft.
-Warm the running ring up, together with the mounting device, to max. 150 °C on a heater and fit it to the shaft using that very mounting device. This is so **important** because the running ring is thus prevented from cooling down too fast, and at the same time it is positioned accurately.



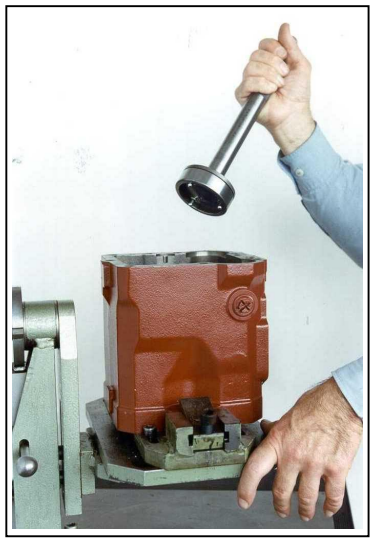


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F 2.2 Adjusting the axial play of the tapered roller bearing

The axial play of both roller bearings (9) and (29) has to be adjusted a-new whenever one of the following elements has been replaced:
-valve plate housing (33)
-pump housing (3)
-tapered roller bearing (9) or (29)
-shaft (10).
When exchanging tapered roller bearings the outer rings (of the old bearings) have to be removed from the pump housing (3) and the valve plate housing (33).Put new outer rings in by means of the pertinent device.



Insert the drive shaft (10) into the pump housing. Put shim (28) on. Warm the bearing for the PTO side (29) up to max .150 °C, mount it and allow to cool down.





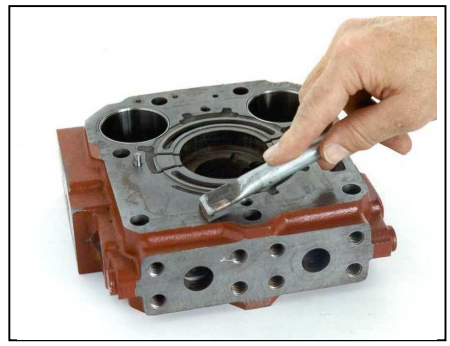
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F 2.2 (continued)

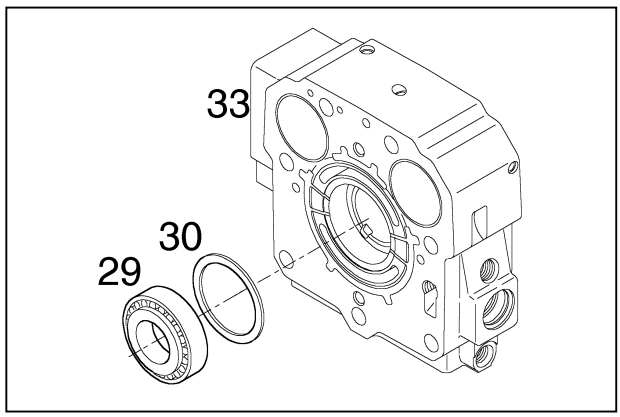
Clean the sealing face of the valve plate housing of remnants of Loctite, smoothen and wash.





The balancing washers (30) for trimming the bearing clearance are found under the outer ring of the PTO side tapered roller bearing (29) in the valve plate housing (33).





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F 2.2 (continued)



Remove one of the existing shims (30) of about 0.1-0.2 mm , the remaining ones to be put into the valve plate housing (33):



Press the outer ring with the device into its seat using a press. Deposit the valve plate housing (33) on the pump housing (3)

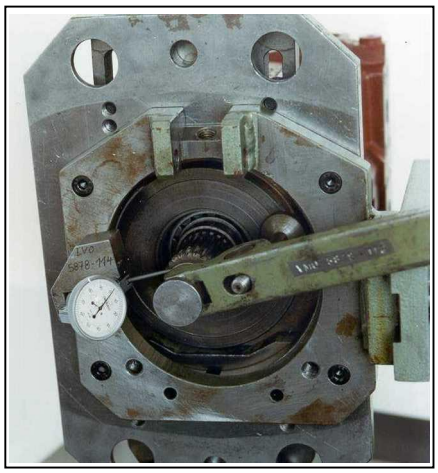


Tighten the fixing screws of valve plate housing (33) with the prescribed torque.

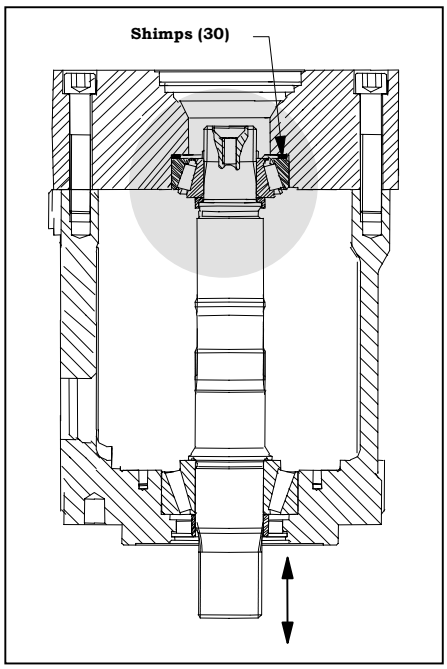
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F 2.2 (continued)



Turn the pump around, apply dial gauge to the shaft (10) and push and pull the shaft with jig Nr.VMO 6899-9326 while measuring the now existing axial play; it ought to be 0.01 ... 0,07 mm.



The increased play must be compensated by a balancing shim (30). Add this new balancing shim to those already in the valve plate housing (33); repeat the measurement.

To continue the assembly remove the valve plate housing (33) and pull the roller bearing (29) at the PTO off again with the device.

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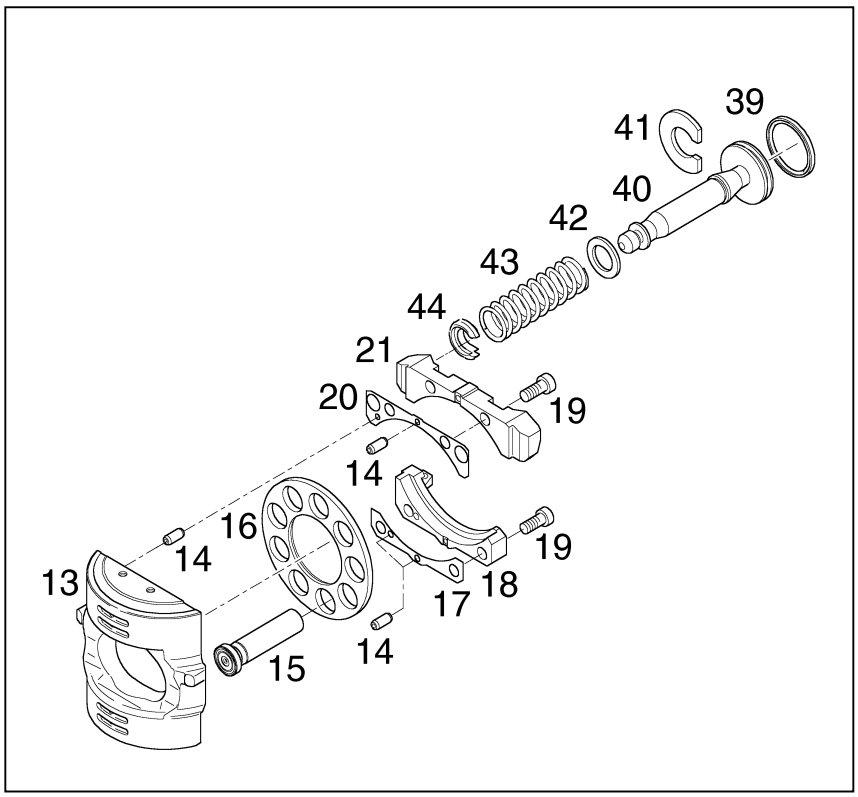
F 2.3 Assembling the swash plate



Once the swash plate assembly has been taken out it can be disassembled and examined.
In the case that

Swash plate	13
Holding plate	21
Working piston	15
Retainer plate	16

have to be replaced it is indispensable to tune the play of the slipper pad afresh.
To do that new spacer foils (17) and (20) are needed.
The axial play of the slipper pads is set in the following manner (see next page):



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F 2.3 (continued)

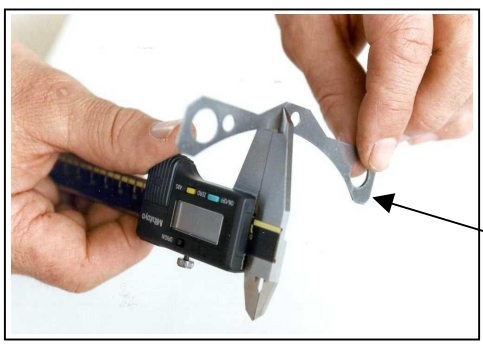


Working pistons may be exchanged but by the set..

Finding the height of slipper pad, working piston (15) and retainer plate (16).
The maximum permissible difference in height of the slipper pads is .001mm.
Working pistons are allowed to be exchanged only setwise.
Height X = ... (note down!)



Measure and take down the height of the ribs of both fixing plates (18 and 21)
Y1 = ...
Y2 = ...



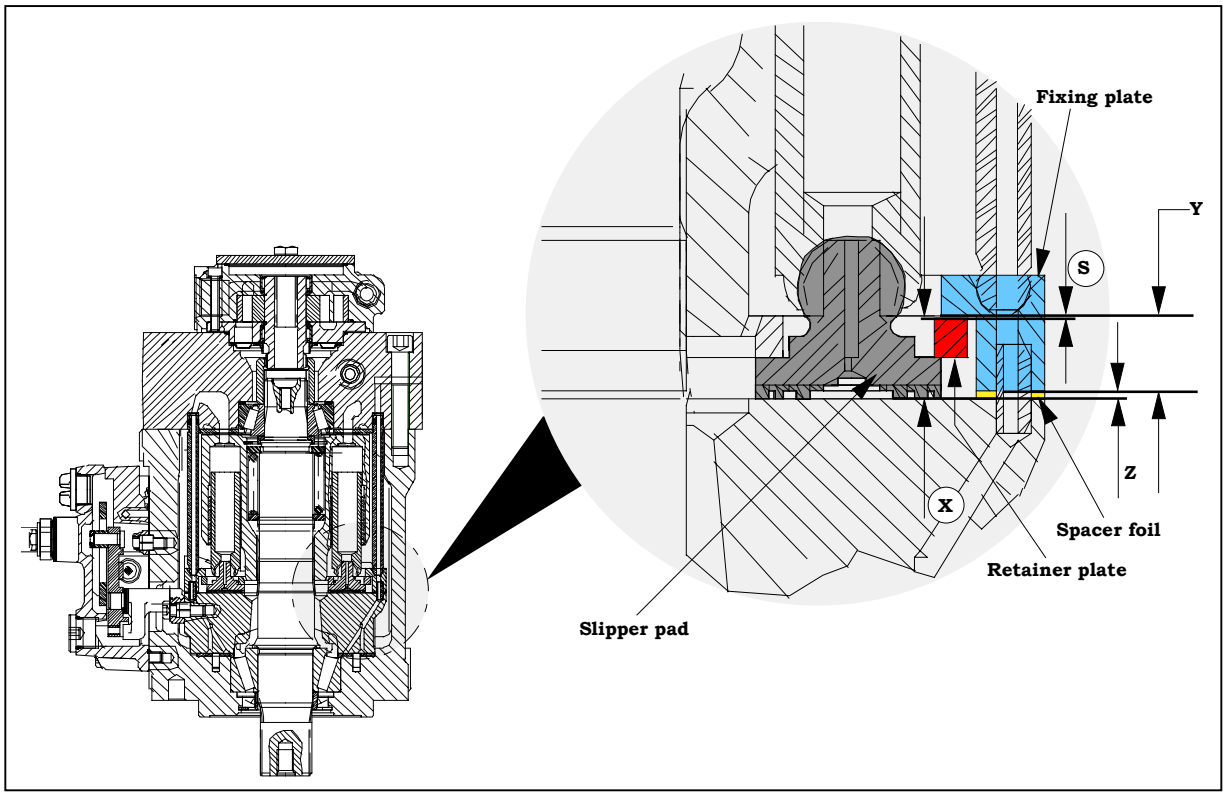
X-Y1 = Z1 (clearance of slipper pad)
X-Y2 = Z2 (clearance of slipper pad)
This slipper pad clearance has to be limited to .01 - .03 mm by means of spacer foil.

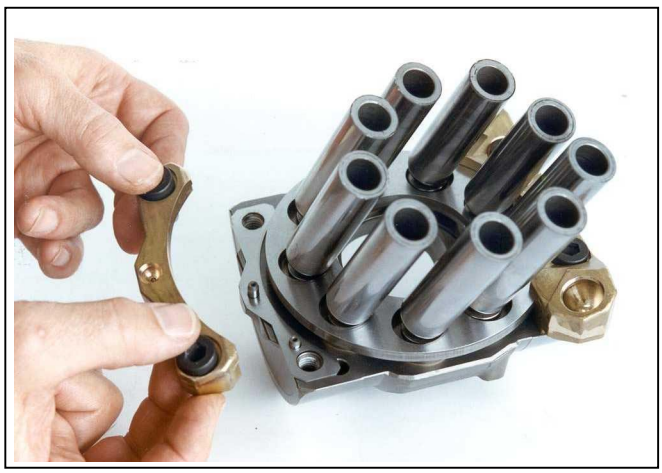
Spacer foil

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F 2.3 (continued)

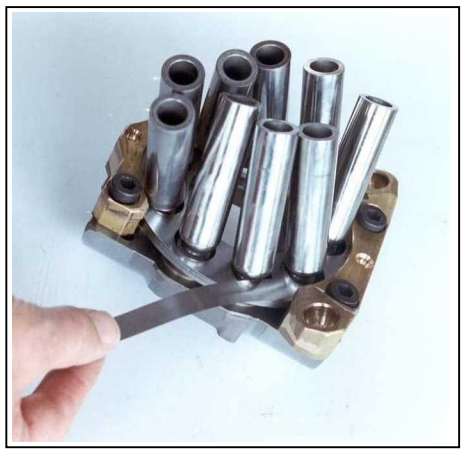


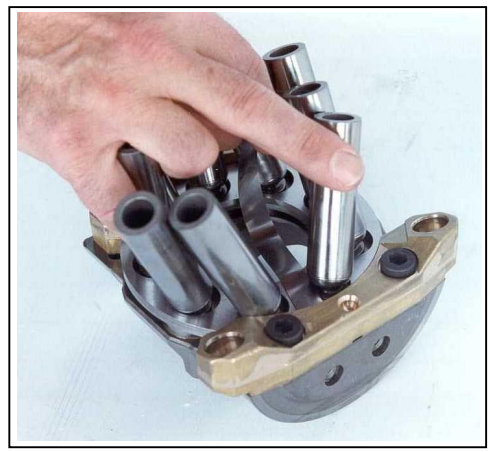


The fixing bolts have to be secured with Loctite Nr. 648. For this dose Loctite moderately in the tap holes of the swash plate (13).
Tighten the bolts (19) with the corresponding torque.

F 2.3 (continued)

Check the slipper pad play with a feeler gauge. Turn the working pistons to become free (checking for movability). **Note:** Lubricate the slipper pads of the working pistons (15).

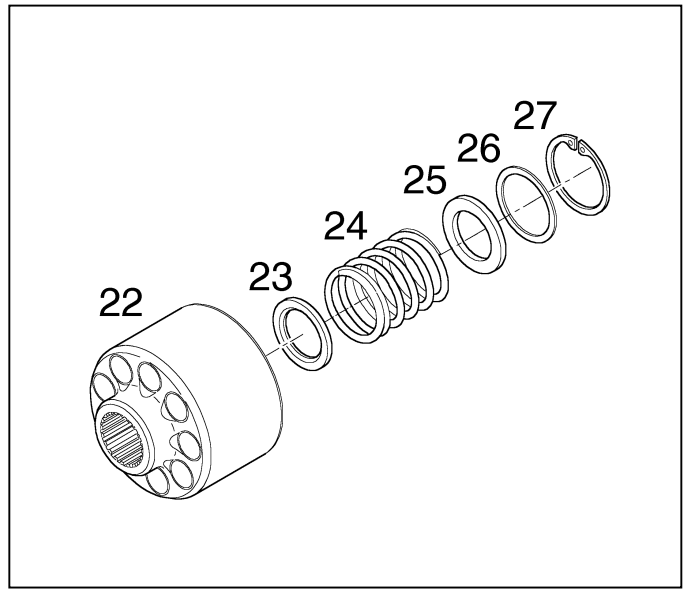




F 2.4 Setting the lift-off security of the cylinder barrel

If cylinder barrel (22), shaft (10), pump housing (3) or valve plate (31) have to be exchanged, it is necessary to set the lift-off security afresh. For this, insert the pre-assembled shaft (10) without bearing (29) in the pump housing (3). Since the lift-off security has to be checked and re-set without the spring (24) , this has to be taken out of the cylinder barrel (22) . **Caution!** Due to the strong spring force this is only feasible with a press! Put washers (23) and (25) as well as the snap ring (27) back into the cylinder barrel and slip the cylinder barrel on the shaft.





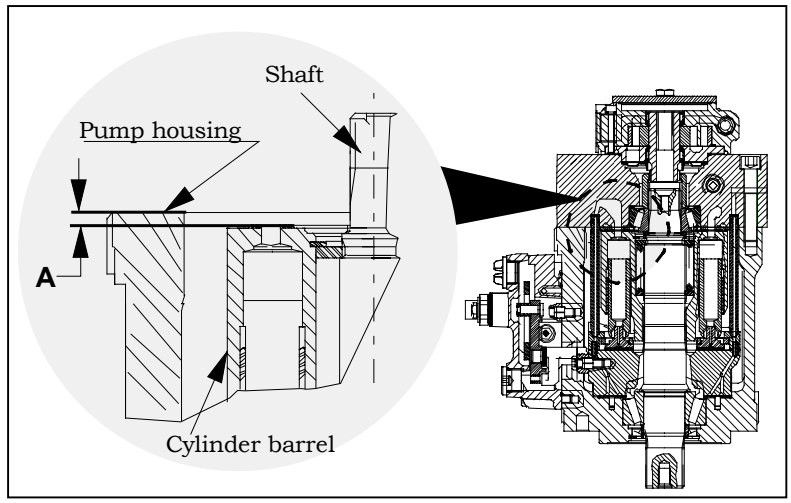
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F 2.4 (continued)

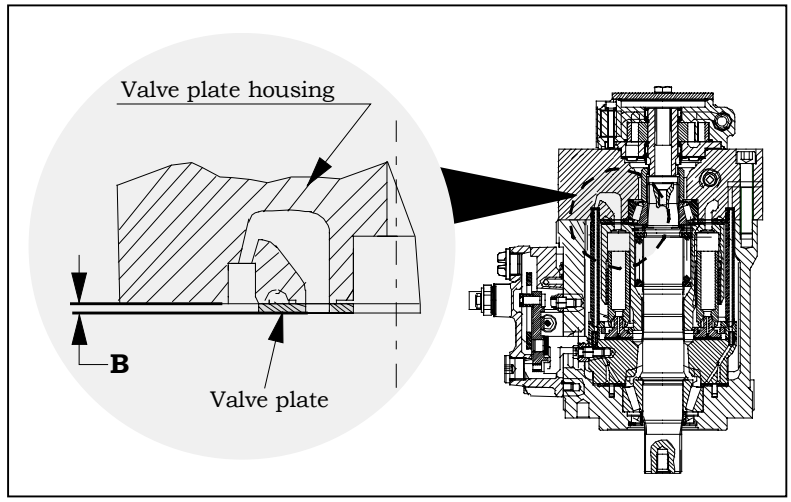
Then measure by every 90 ° the distance from pump housing (3) down on the functional face of the cylinder barrel (22). Centre shaft (10) with cylinder barrel (22) and note dimension A.





Deposit the valve plate (31) on the cleaned valve plate housing (33), and measure the distance B from the valve plate housing down to the functional face of the valve plate at 4 points (every 90 °). This is to ascertain that the valve plate rests well set. A –B = C (clearance).This clearance has to be limited to 0.1 - 0.3 mm in the cylinder barrel (22) by means of shims (26) . This provides the necessary lift-off security.





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F 2.4 (continued)

Put the shims (26) of the thickness found in place and verify the setting.

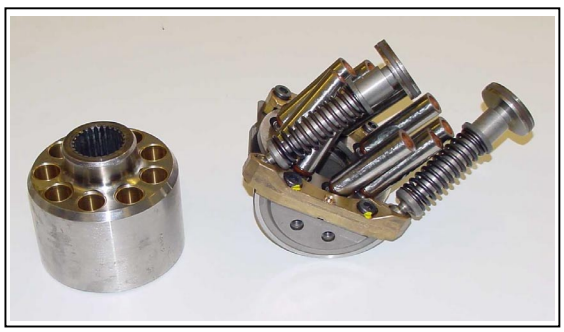


Lift the cylinder barrel (22) out and re-install the Spring (24).



F 2.5 Assembly of rotating unit

Next the swash plate assembly (13) is mounted with the cylinder barrel (22).
Hint: lubricate working pistons (15).





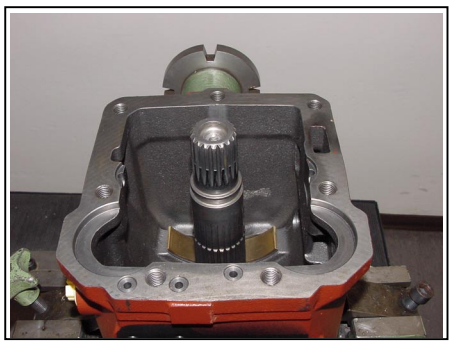


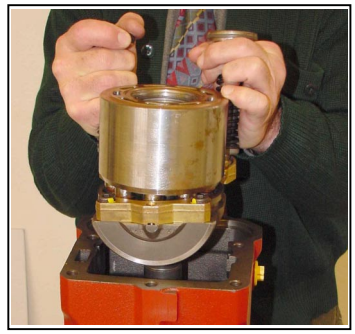
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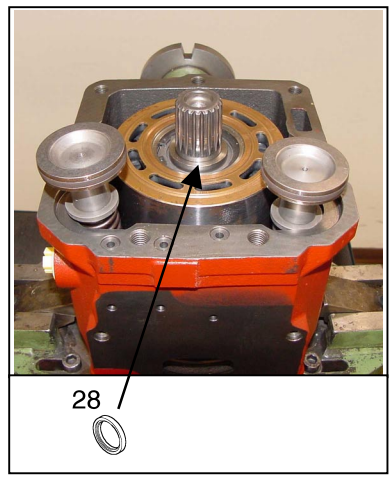
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F 2.5 (continued)

Then stand the shaft (10) in the pump housing (3). Mount swash plate assembly (13) and cylinder barrel (22) in the pump housing. **Watch** for a correct seat!
Lay the washer (28) on the shaft (10). Put the jig in place and fasten it.







Use the three grub screws lin the jig to press the cylinder barrel (22) evenly down just low enough that the washer (28) rests no longer on the cylinder barrel (22).Do not go down lower, to avoid damage of the retainer plate (16). Now heat up the roller bearing (29) near the PTO to 150 °C and fit it on the shaft (10). Allow to cool down and relieve the cylinder barrel.





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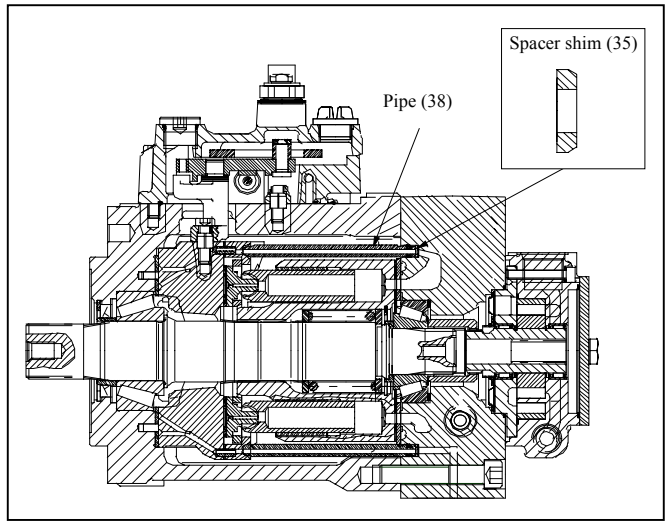
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F 2.6 Setting the axial play of the two pipes

Connecting pipe to hydrostatic bearing

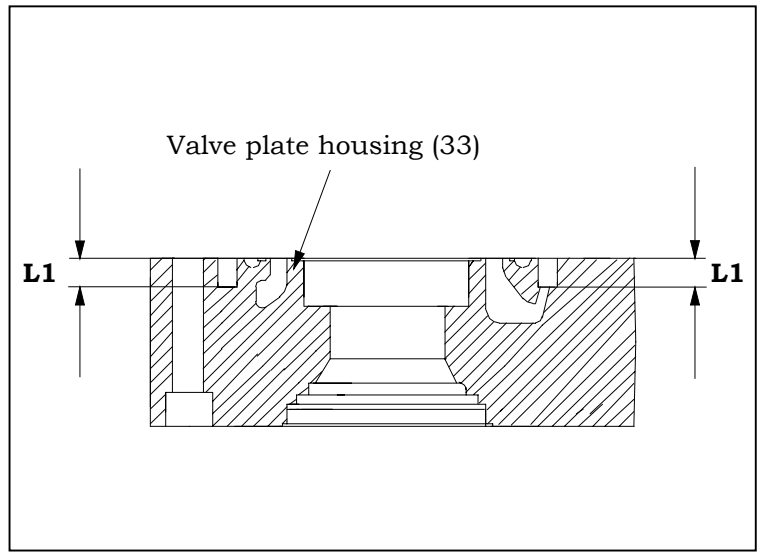
Whenever inner components of a pump have been replaced – except the valve plate –, it is necessary to check the axial play of the two connection pipes (38) and, if needed , to re-adjust it.
This play is supposed to be 0.01 – 0.15 mm
By means of knurled nut ,introduce both pipes (38) pre-assembled with O-ring (36) and back-up ring (37) into the jig, fasten by hand against end stop (seat of the ball in the holding plate), loosen and tighten again.





Measure the depth of drilling L1 in the valve plate housing for the side in question and make a note





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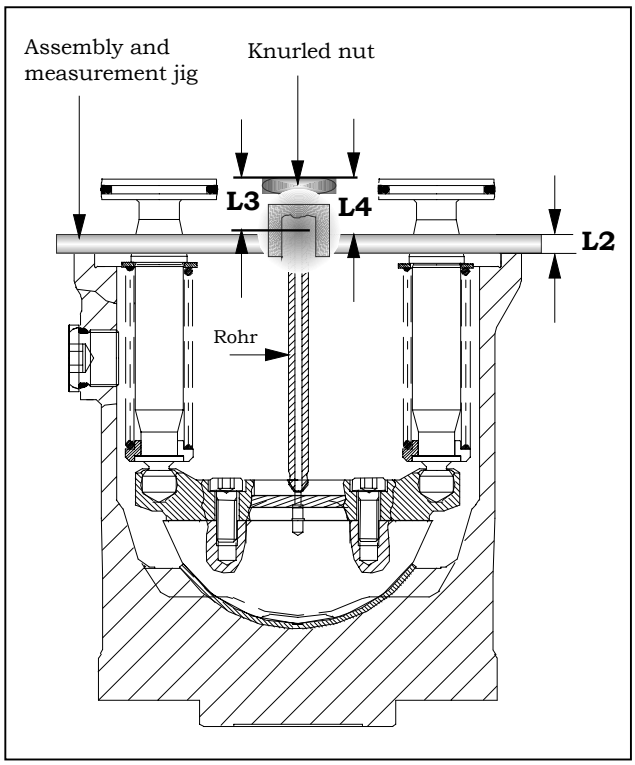
F 2.6 (continued)

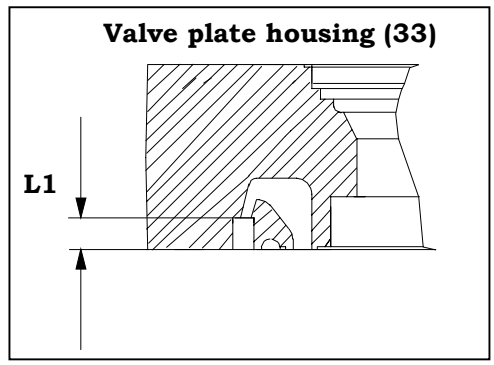


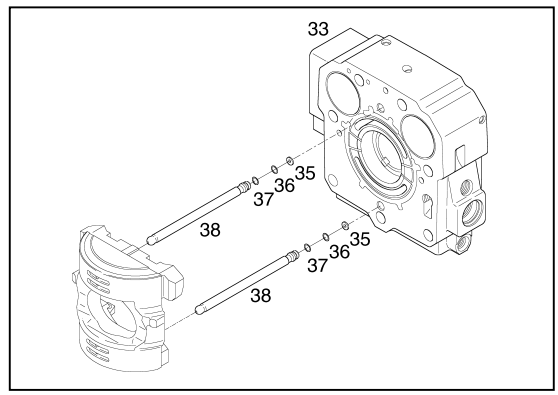
Measure heights L2/L3/ and L4 for each side and make a note.
L2 = thickness of the plate, measure !
L3 = depth of the drilling in the knurled nut machined to be 44 ± 0,005 mm.
L4 = distance from the plate of the jig to the rest face of the knurled nut

Insert the figures found into the formula:

L2 + L4 – L3 = L5;
L1 – L5 = A (axial play)
This axial play has to be limited to 0,01 – 0,15 mm by means of shims (35).
The shims determined are then located with some grease in the respective drillings of the valve plate housing (33).
Be careful not to mix up sides!







Attention: The Assembly and measurement jig and the connecting pipes (38) are still needed for the next step F 2.7 , **do not dismount!**

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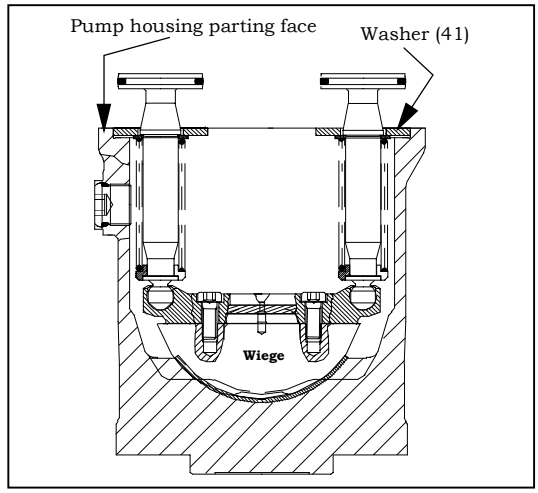
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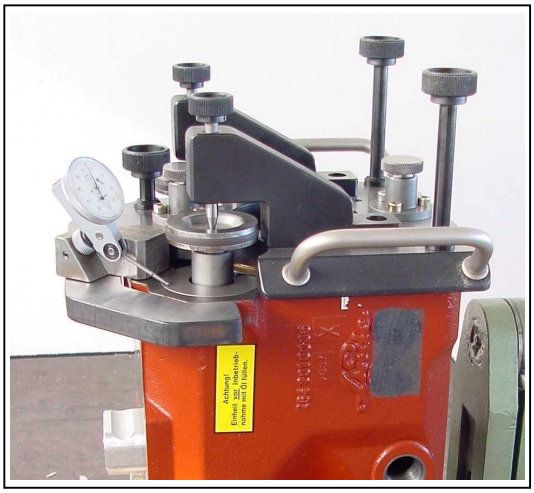
F 2.7 Checking and setting the mechanical zero position

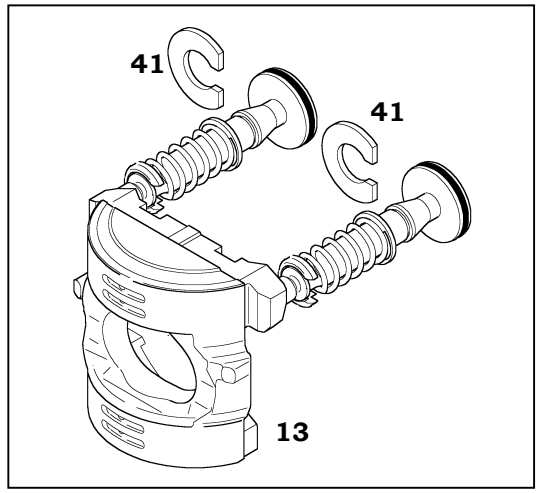
Every time a pump is assembled the mechanical zero position must be checked and adjusted if need be.

Procedure:
Utilize the control piston centering feature of the assembly jig to bring the swash plate (13) in zero position by means of a micrometer gauge. Do not tighten too firmly. Put one washer (41) each on the spring plate (42) of the control piston (40).
Select the washer in such a way that the pump housing parting face is on one level with the upper side of the washers or that the washers exceed the pump housing parting face by 0.2 mm maximum.At the same time the maximum allowable difference in height between the two sides is 0.06 mm.









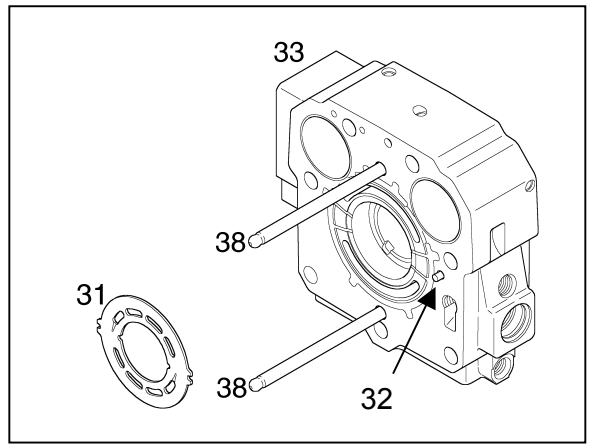
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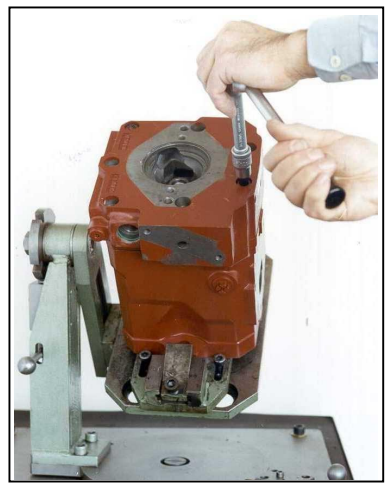
F 2.8 Mounting the valve plate housing.

For easier mounting of the valve plate housing (33) it is recommended to use the guide pins and the swash plate lock. **Hint:** Lubricate the running face of the cylinder barrel (22)! Next lay the valve plate (31) on the cylinder barrel (22).
Connecting pipes (38) should stand upright in the valve plate housing (33), so as to avoid jamming while being assembled.
Coat the parting face of pump housing with liquid sealant Loctite 5203. Mount the valve plate housing (33) and take care that the centering pins (32) do enter the slots destined for them in the valve plate.
Fasten the valve plate with fixing screws crosswise.









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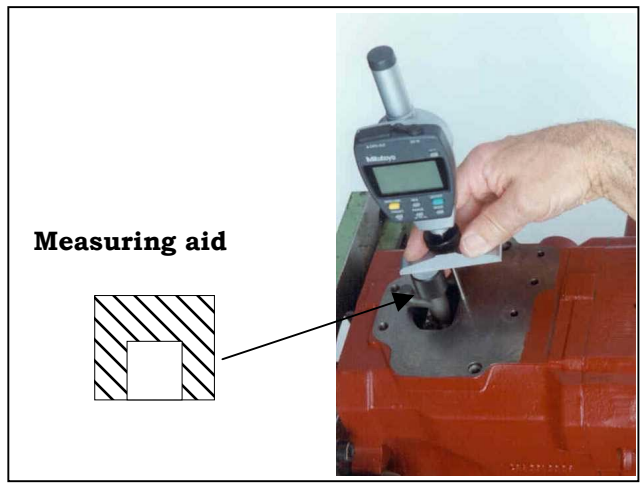
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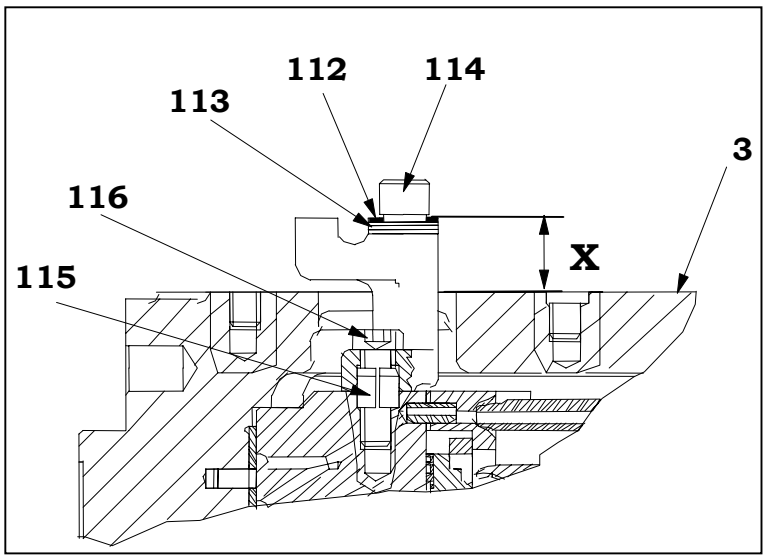
F 2.9 Mounting the spacer.

The setting height **X** results from the thicknesses of the snap ring (112) and the shims (113). Correction is only required in cases where corresponding pump parts have been exchanged. The spacer (114) is to be fixed with cylinder head screws (116); Loctite 648 to be applied. N.B.: Mind the position of the dowel pins (115)!

The measuring aid shown facilitates control of setting height „**X**“







3 pump housing
112 snap ring
113 shim
114 spacer
115 dowel pin
116 cylinder head screw

Attention:
Values of “X” for HPV pumps with:
Control M1 and spacer p.n. 584 323 1900
- X = 19,2 + 0,1 mm
- Control H1, E1, and spacer p.n.506 323 1902
  X = 25,4 + 0,1 mm

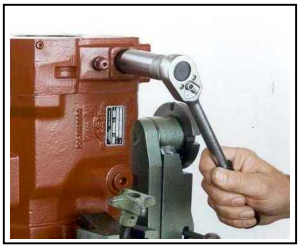
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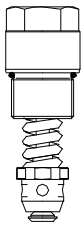
F 2.10 Fitting the pressure relief valves.

Watch the obligatory tightening torques! See table.

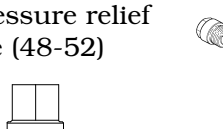
HPV-02	HD-Ventil	Ma/Nm	ND-Ventil	Ma/Nm
55	VD-9	140	DBE-6	30+5
75	VD-12	140	DBE-6	30+5
105	VD-12	140	DBE-6	30+5
135	VD-18	250	DBE-8	40

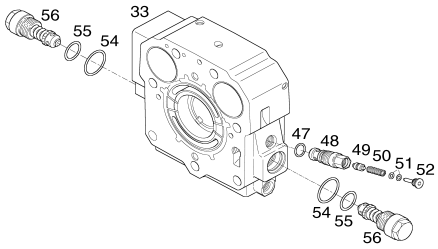


High pressure relief valve (56)



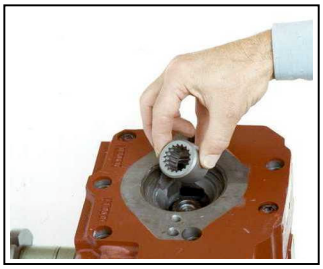
Low pressure relief valve (48-52)

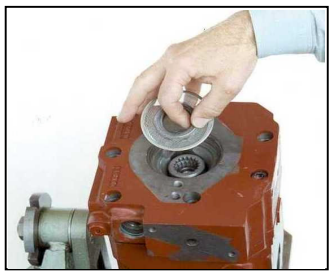




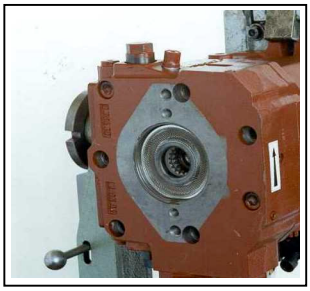
F 2.11 Mounting the gear pump.

Put coupling muff (56) and strainer (60) in place.

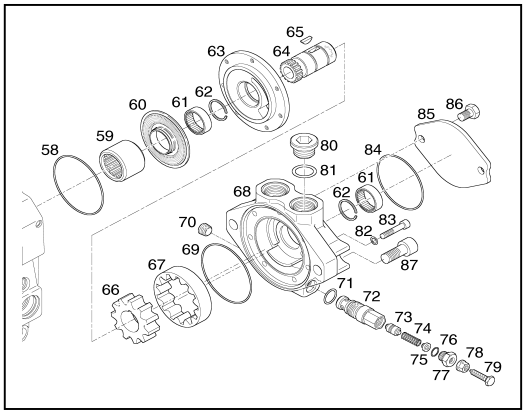




Attach gear pump with O-ring (58).







Note: Please refer to Service Information E 101 / 00 D regarding modification of the directions of suction and rotation as well as spare parts assemblies.

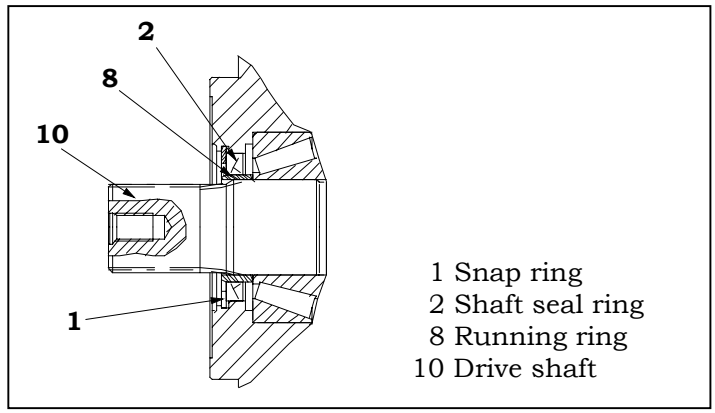
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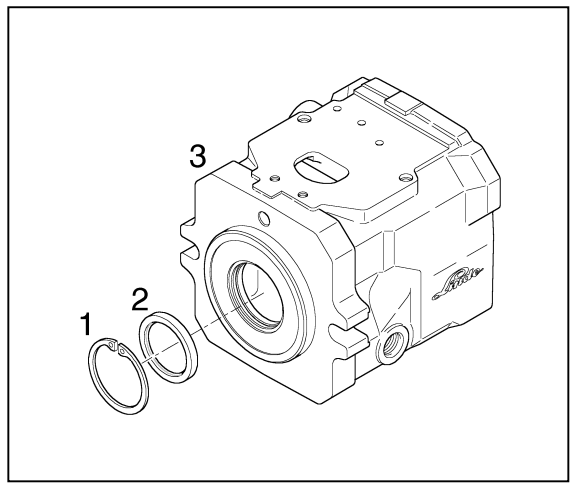
F 2.12 Applying the shaft seal (2)

For this operation the protective sleeve and, for precise positioning, the drive-in mandrel are necessary. Apply Loctite 270 sealant to the outside of the shaft seal ring (2) and mount it. Wipe excess Loctite off. Let the securing ring (1) snap in.

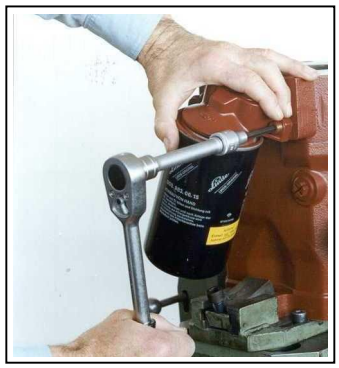








F 2.13. Fitting the filter



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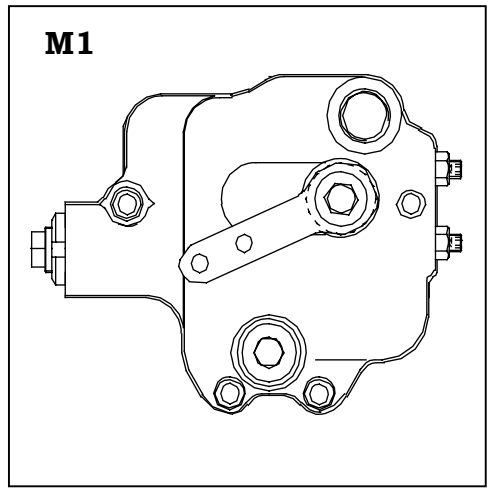
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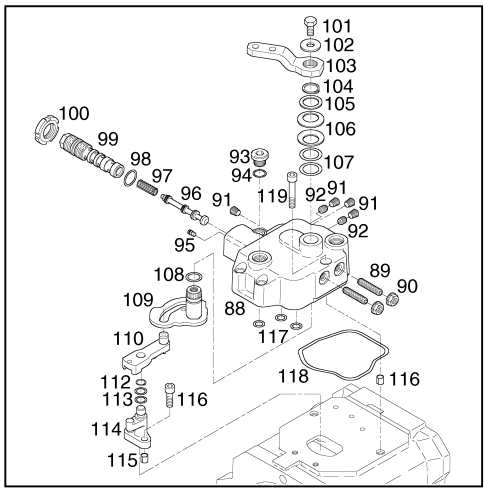
G 1 Mounting the control device

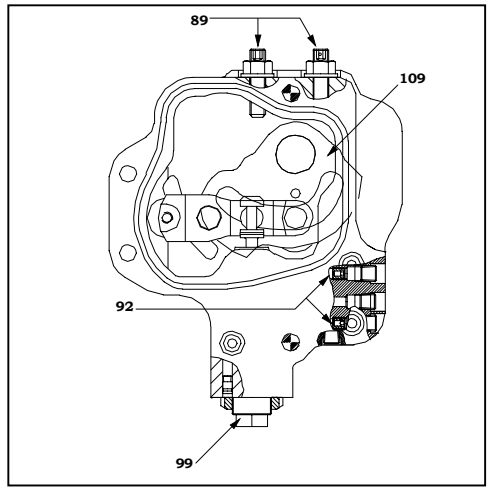
Note: Everytime the control device has been attached it is indispensable to check and if need be adjust the hydraulic zero position of the HPV pump during start-up.The relevant testing instructions and service information bulletins have to be adhered to.
If it is to be replaced by an H1 or E1 type control the spacer (114) must be exchanged and measured accordingly, see chapter F 2.9.These control device assemblies are interchangeable as a whole.

G 1.1 M1 type control





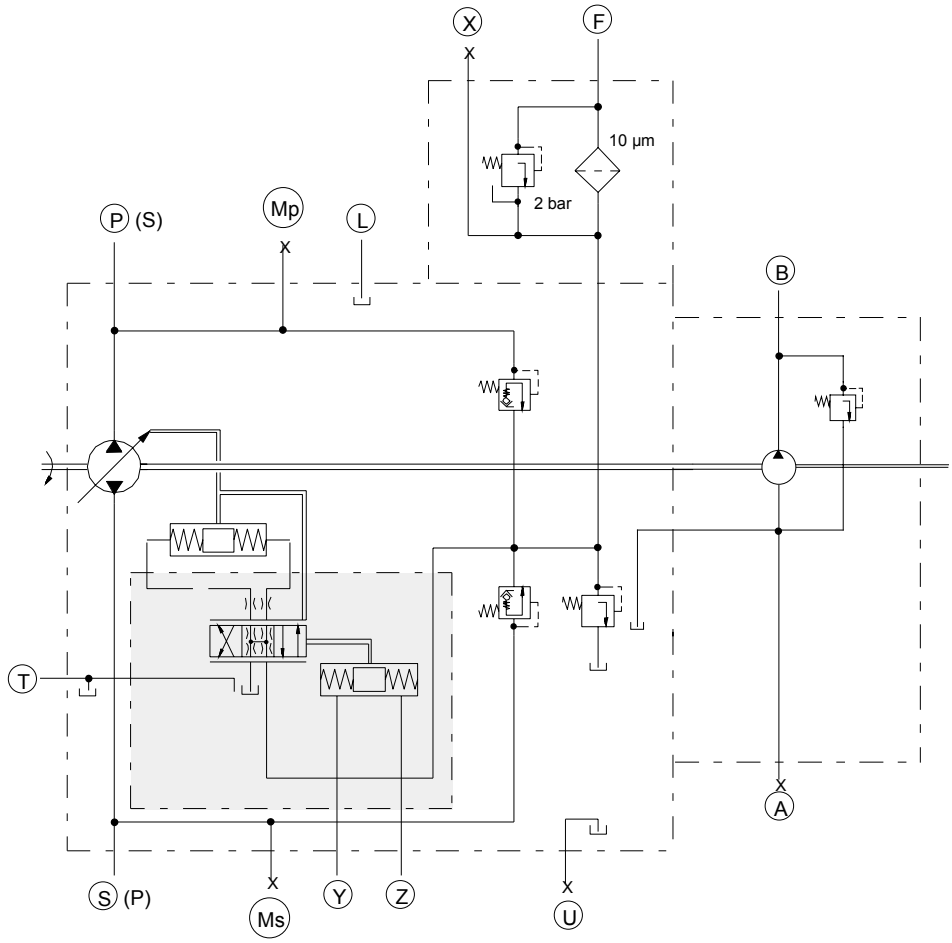




89 end stop screws for max. displacement
92 restrictors
99 pilot housing (hollow screw)
109 cam

G 1.2 Circuit H1 type control

HPV...-02L with H1 type control



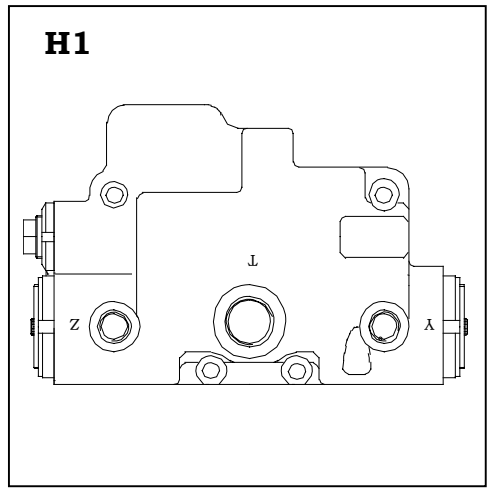
EXPLANATIONS	
P, S	High pressure port
A	Pressure port boost pump
B	Suction port boost pump
F	Control pressure supply, Boost
X	Control pressure gage port
Ms, Mp	High pressure gage port
L, U	Drain (filling, vent) ports and flushing return from hydr. motor
L1, L2	Vent ports

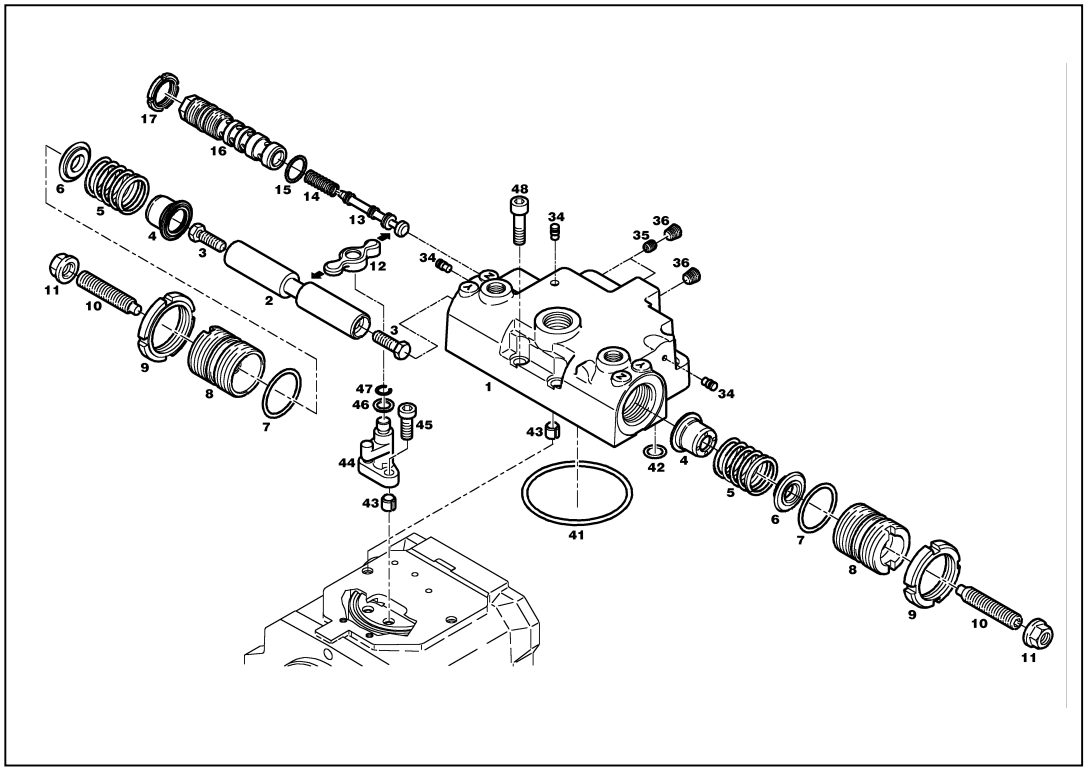
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G 1.2 H1 type control





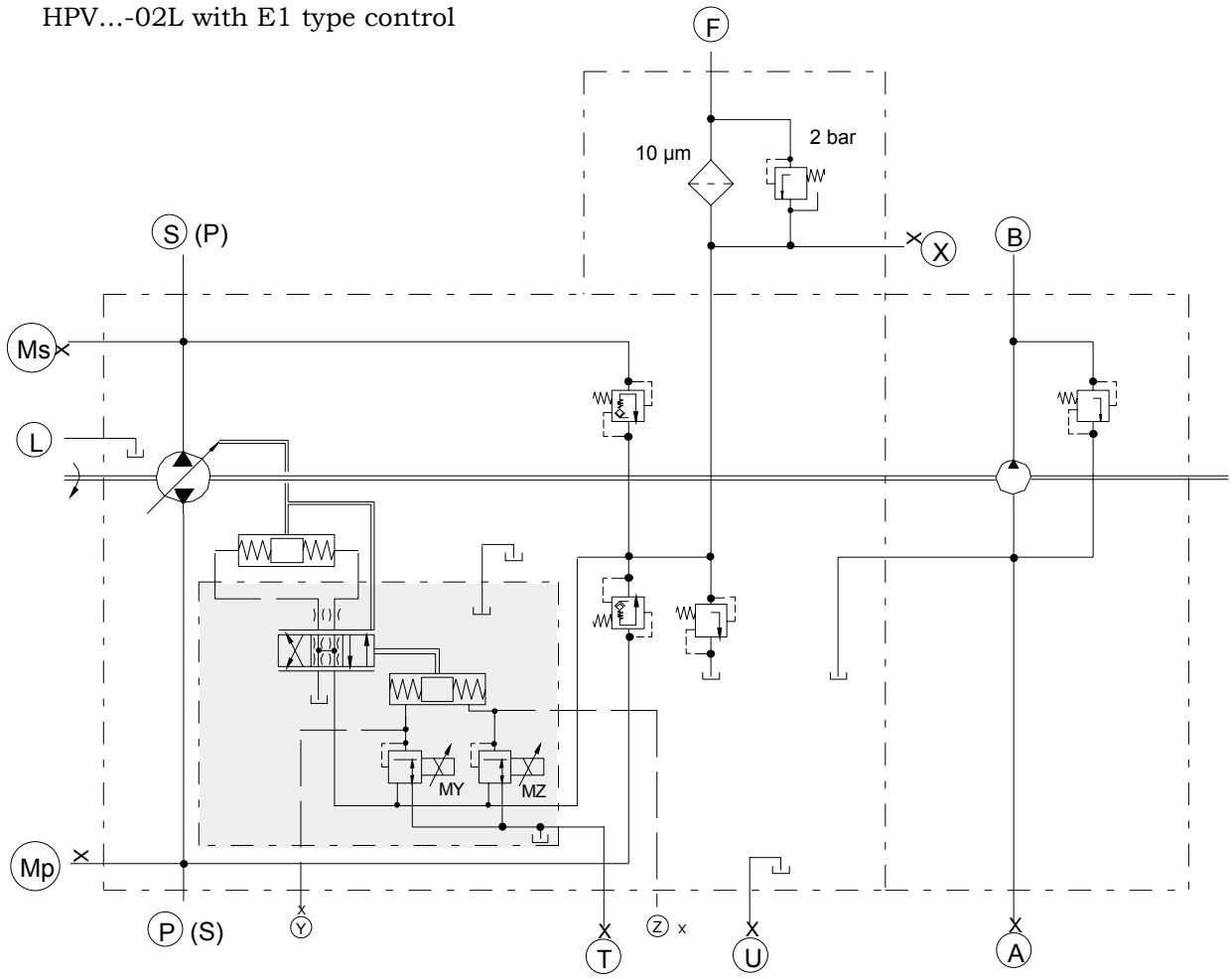


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G 1.3 Circuit E1 type control

HPV...-02L with E1 type control



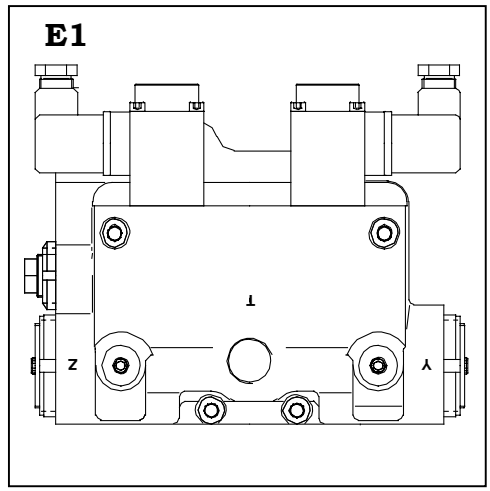
EXPLANATIONS	
P, S	High pressure port
B	Pressure port boost pump
A	Suction port boost pump
F	Control and boost pressure supply
T	Tank and vent port
X	Boost pressure gage port
Y, Z	Control pressure gage port
MY, MZ	Proportional solenoid
Ms, Mp	High pressure gage port
U	Drain, flushing return from hydr. motor
L	Oil filling, tank and vent port

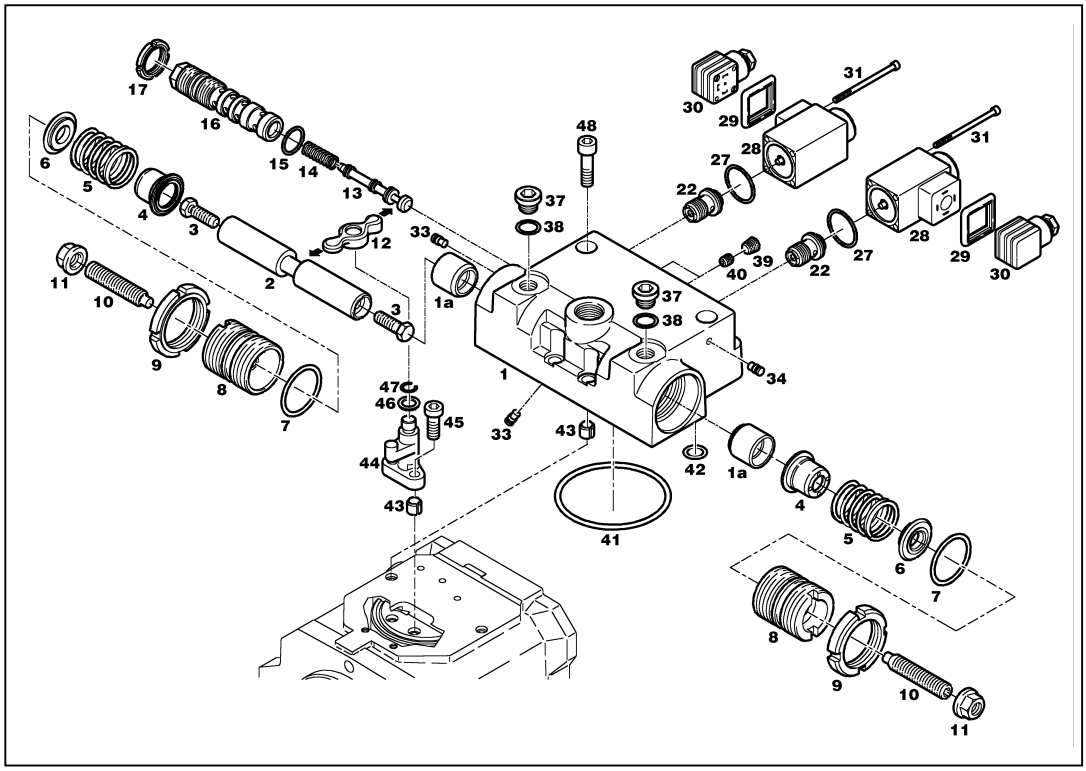
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G 1.3 E1 type control







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H Tightening torques M_A for screws

Table 1: Screw surface black or phosphated or electrogalvanized.

Dimension		M_A (Nm)						
		4.6	4.8	5.8/22H/45H	6.8	8.8	10.9	12.9
Standard thread	M4	1	1,3	1,7	2	2,7	3,8	4,6
	M5	2,1	2,7	3,4	4,1	5,5	8	9,5
	M6	3,6	4,7	5,9	7,1	9,5	13	16
	M8	8,5	11	14	17	23	32	39
	M10	17	23	29	34	46	64	77
	M12	30	40	50	60	80	110	135
	M14	47	62	78	94	125	180	215
	M16	73	100	122	146	195	275	330
	M20	145	190	240	289	385	540	650
	M24	250	330	410	495	660	930	1100
	M30	510	675	840	1000	1350	1850	2250
	M36	880	1170	1470	1760	2350	3300	3900
Fine pitch thread	M8x1	9,5	12	16	19	25	35	42
	M10x1	20	26	32	39	52	72	95
	M10x1,25	18	24	30	37	49	68	82
	M12x1,25	33	44	55	66	88	125	150
	M12x1,5	31	41	52	62	83	115	140
	M14x1,5	52	70	87	105	140	195	235
	M16x1,5	79	105	130	157	210	295	350
	M18x1,5	115	150	190	230	305	425	510
	M20x1,5	160	210	265	320	425	600	720
	M22x1,5	215	285	355	425	570	800	960
	M24x2	270	360	450	540	720	1000	1200
	M27x2	395	525	655	785	1050	1500	1800
	M30x2	540	725	905	1085	1450	2050	2500
	M36x3	930	1250	1560	1870	2500	3500	4100

Table 2: Screws with liquid glue on their threaded portion.

Dimension		M_A (Nm)						
		4.6	4.8	5.8/22H/45H	6.8	8.8	10.9	12.9
Standard thread	M4	1,1	1,4	1,8	2,2	2,9	4,1	4,9
	M5	2,2	3	3,7	4,5	6	8,5	10
	M6	3,7	5	6,2	7,5	10	14	17
	M8	9	12	16	19	25	35	41
	M10	18	25	31	37	49	69	83
	M12	32	43	54	65	86	120	145
	M14	50	67	85	100	135	190	230
	M16	80	105	130	160	210	295	355
	M20	155	205	260	310	410	580	690
	M24	265	355	445	530	710	1000	1200
	M30	540	725	905	1080	1450	2000	2400
	M36	980	1300	1620	1950	2600	3700	4300
Fine pitch thread	M8x1	10	13	17	20	27	38	45
	M10x1	20	27	34	41	55	77	93
	M10x1,25	19	26	32	39	52	73	88
	M12x1,25	36	47	59	71	95	135	160
	M12x1,5	35	45	55	68	90	125	150
	M14x1,5	55	75	95	110	150	210	250
	M16x1,5	85	112	140	170	225	315	380
	M18x1,5	120	160	205	245	325	460	550
	M20x1,5	170	230	290	345	460	640	770
	M22x1,5	230	305	380	460	610	860	1050
	M24x2	290	390	490	585	780	1100	1300
	M27x2	430	575	720	860	1150	1600	1950
	M30x2	600	800	1000	1200	1600	2250	2700
	M36x3	1040	1400	1750	2100	2800	3900	4600

Source: LINDE works-standard WN 14029

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