



# ***Service Manual ASM 3.1 -VP1 VP1-45, -75***

*Catalog 9129 8222-06  
March 2001, GB*



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The VP1 is the worlds first variable displacement pump for truck applications. It can be close-coupled to the power take-off and is especially designed and optimized for truck hydraulic systems that will benefit from variable flow.

Truck cranes is an application that fully utilizes the benefits of a load-sensing system. The complex systems of refuse collection vehicles and sewage trucks as well as various combinations of tipper, crane, snow ploughs and salt/sand spreader can also be greatly simplified and optimized with the VP1 pump.

The VP1 provides the hydraulic system with the correct amount of fluid at precisely the right moment, effectively reducing energy consumption and heat generation. This means a smoother and quieter running system with much reduced impact on the environment.

The VP1 is highly efficient, has a small installation envelop and is extremely light. It is reliable, economical and easy to install.

The two frame sizes, VP1-45 and -75, have the same, small installation dimensions. Shaft and mounting flange follow the European ISO standard 7653-1985. The VP1 is suitable for all load-sensing systems, regardless of make.

## Features

- Variable displacement
- Energy efficiency
- Low noise level
- High power-to-weight ratio
- Compact and light
- Highly efficient
- Sturdy design
- Withstands low temperatures
- High reliability and serviceability

## Design

### Large angle - compact design

The pump design permits a large angle, 20°, between piston and slipper shoe/swashplate, providing compactness and small outer dimensions.

### Tandem coupling

The through shaft permits tandem coupling of a second pump, such as a series F1 fixed displacement pump.

### Accepts external shaft loads

Heavy duty roller bearings allow radial loads to the VP1 shaft end which makes it possible to install a gear directly on the shaft without additional bearings.

### Long life

The VP1 is designed for load sensing systems. It is sturdy, yet simple, with few moving parts. The result is a reliable pump with long service life.

### Floating valve plate

The design of the VP1 includes a so called 'floating valve plate'. The valve plate 'floats' on five pistons which results in a quieter operating pump with low internal leakage and high volumetric efficiency.

### High overall efficiency

Uniquely designed parts like the piston/slipper shoe and floating valve plate minimize mechanical losses and internal leakage, providing a very high overall efficiency.

### Retainer plate

The retainer plate (refer to the cross section illustration on page 4) is of a heavy duty design which makes the pump withstand high shaft speeds and fast speed and flow changes.

## Specifications

Frame size	VP1-45	VP1-75
<b>Max displacement</b> [cm <sup>3</sup> /rev]	45	75
<b>Max pressure</b> [bar]		
peak	— 350 —	— 350 —
continuous	— 300 —	— 300 —
<b>Response time</b> [ms]		
max-to-min	20-30	20-40
min-to-max	90-120	100-140
<b>Selfpriming speed</b> [rpm]		
2" suction line, max	2200	1700
2½" suction line, max	2400	2100
<b>Control type</b>	— LS —	
<b>Splined shaft end</b>	— DIN 5462 —	
<b>Mounting flange</b>	— ISO 7653-1985 —	
<b>Weight</b> (with control) [kg]	— 27 —	

## Ordering information

Example: **VP1-045-L**

Frame size  
**045** or **075**

Direction of rotation: **L**-Left hand, **R**-Right hand

### NOTE:

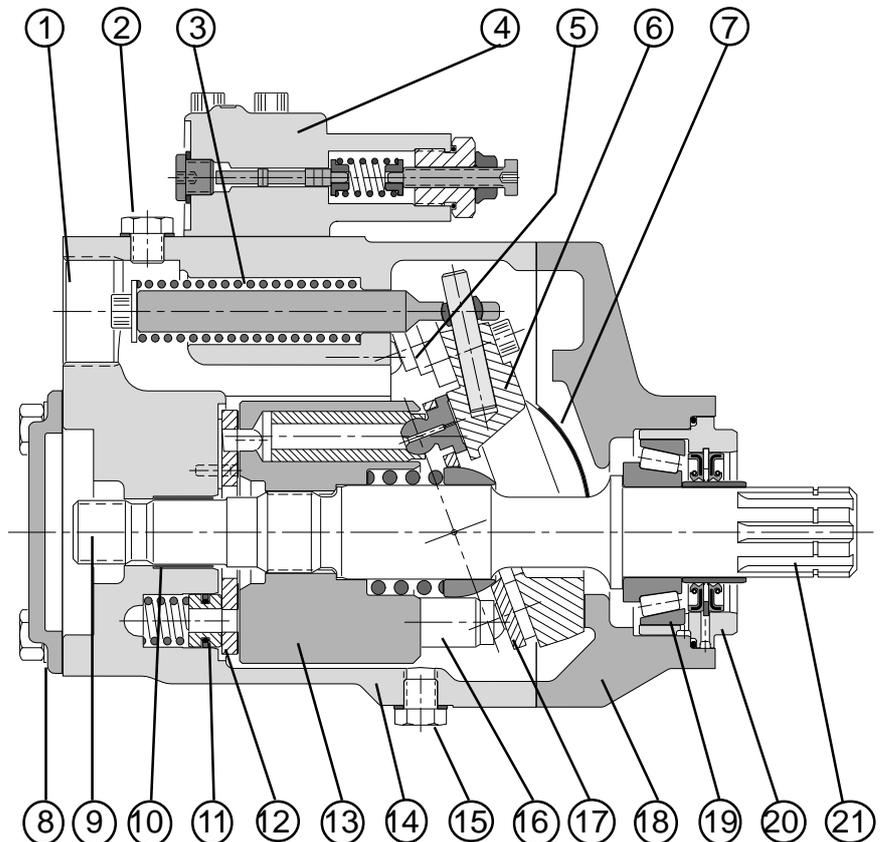
The VP1 is uni-directional. Consequently, the desired direction of rotation must be stated when ordering.

### Standard model numbers

VP1-045-R	3780334
VP1-045-L	3780335
VP1-075-R	3780336
VP1-075-L	3780337

## VP1 cross section

1. Inlet port
2. 'Top' purge plug
3. Return spring
4. Control
5. Setting piston (one of two)
6. Swash plate
7. Bearing shell
8. End cover
9. Spline (auxiliary pump mounting)
10. Plain bearing
11. Hold-down plunger
12. Bi-metal valve plate
13. Cylinder barrel
14. Barrel housing
15. 'Bottom' purge plug
16. Piston with piston shoe
17. Retainer plate
18. Bearing housing
19. Roller bearing
20. Shaft seals with carrier
21. Input shaft



## Installation and start-up

### Direction of rotation

The basic VP1 pump is uni-directional; there is a left hand and right hand version (indicated by the arrow on the side of the VP1 pump fig. 4 and 5).

Consequently, the required direction of rotation must be stated when ordering the pump.

### Installation

The VP1 can be installed (close-coupled) directly to a PTO (when manufactured according to ISO DIN 5462).

The pump can be located in any position. Before start-up, the pump must be purged; utilize the uppermost purge plug (fig. 6).

Figure 7 shows two ways of installing a gear on the VP1 shaft. On a non-geared or a geared PTO with support bearings, the pump shaft is usually installed directly in the internally splined PTO output shaft.

### IMPORTANT

Force must never be used when installing a coupling, a sleeve or a gear on the VP1 pump shaft. The tool shown in fig. 8 facilitates the installation (our P/N 370 6851).

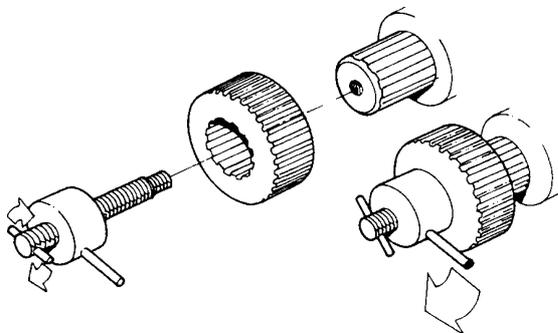


Fig. 8. Installation tool (P/N 370 6851)

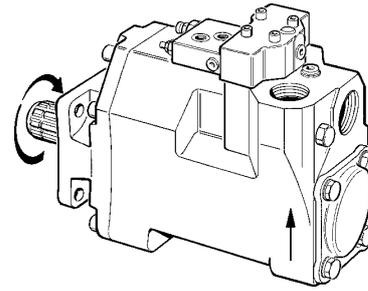


Fig. 4. Left hand rotating pump.

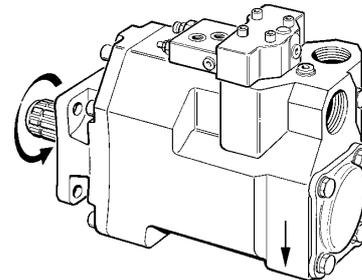


Fig. 5. Right hand rotating pump.

Before start-up, open the 'bottom' plug, purge the pump, then tighten the plug.

Before start-up, open the 'top' plug, purge the pump, then tighten the plug.

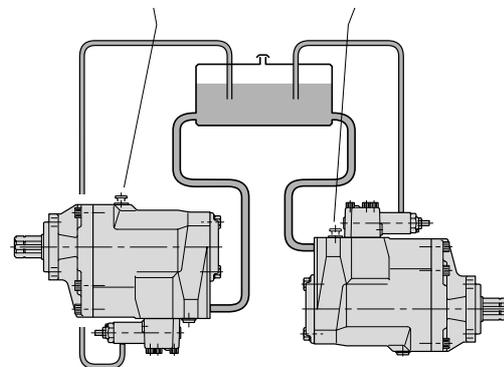


Fig. 6. VP1 should be installed below the reservoir fluid level.

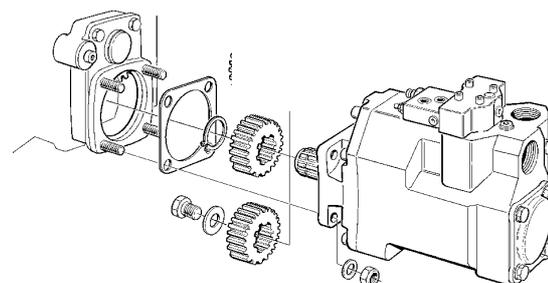
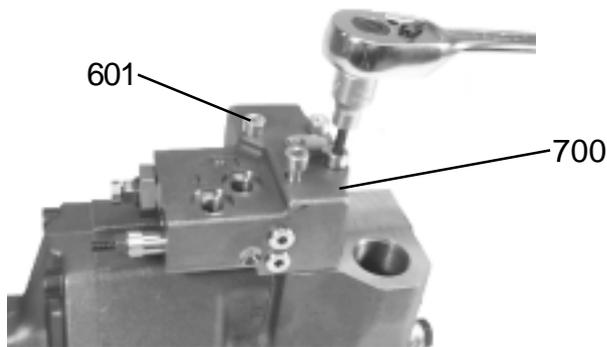
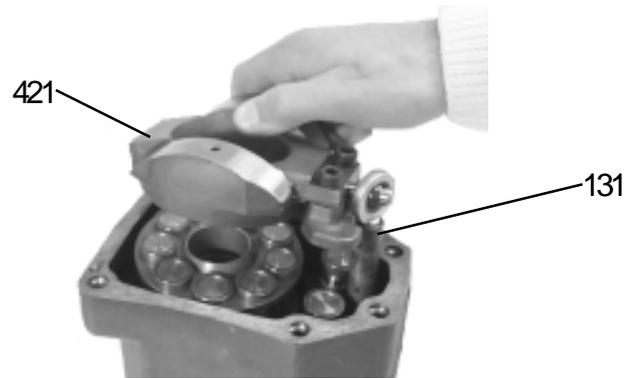


Fig. 7. VP1-to-PTO installation.

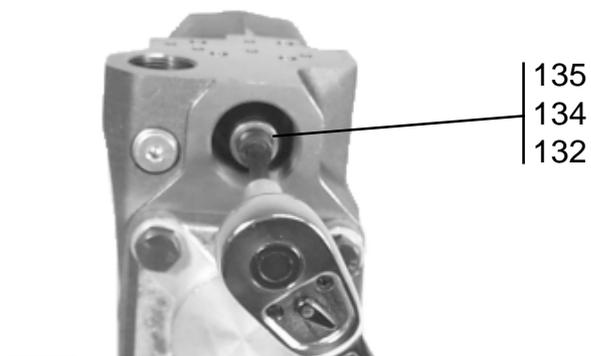
## Disassembling



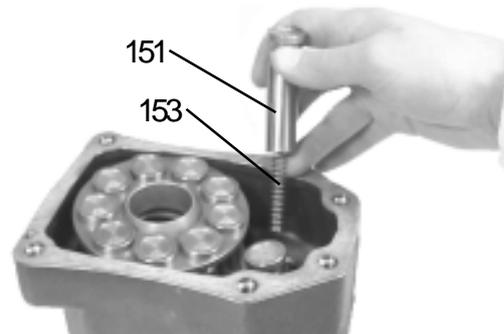
1. Remove the LS Control (item 700).



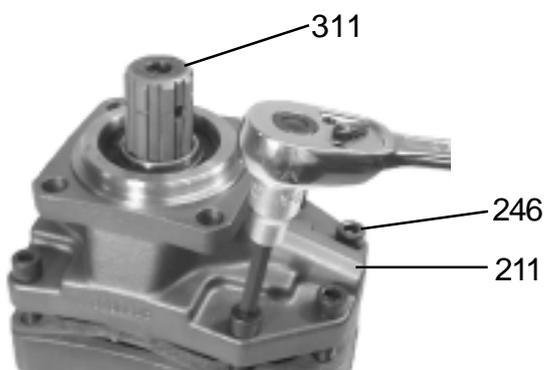
4. Remove the Swashplate (item 421) with Bar Assy (item 131).



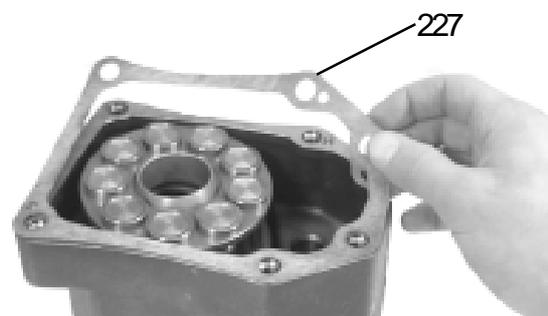
2. Remove the Hex S Screw (item 135), the Washer (item 134) and the Compression Spring (item 132). **Note!** The Bar is locited with the Pivot Head and it might come loose when removing the Hex S Screw (item 135).



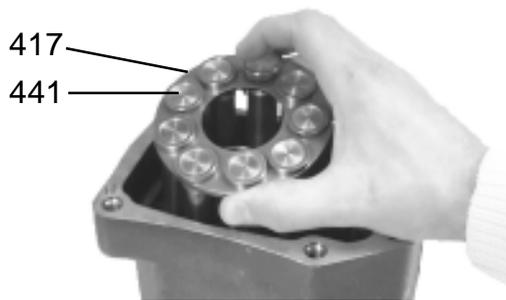
5. Remove the Setting Pistons (item 151) and the Compression Springs (item 153).



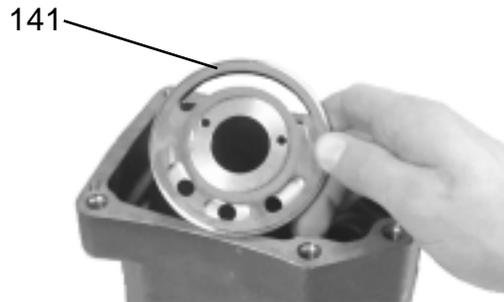
3. Remove the six Hex S Screws (item 246) and lift up the Shaft (item 311) with Bearing Housing (item 211).



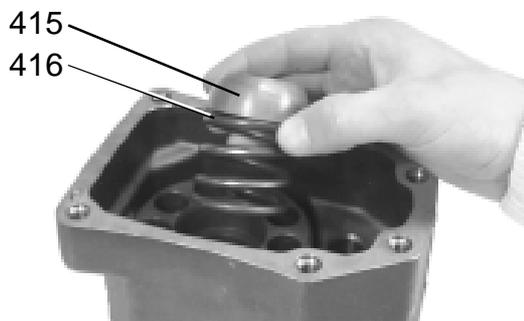
6. Remove the Gasket (item 227).



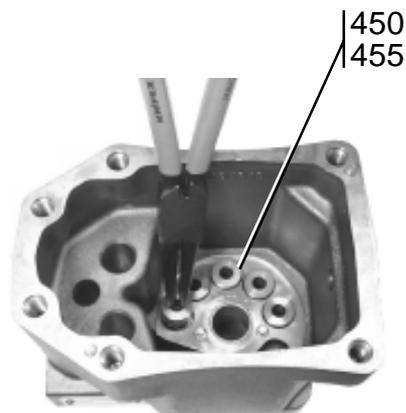
7. Remove the Plate (item 417) with Pistons (item 441).



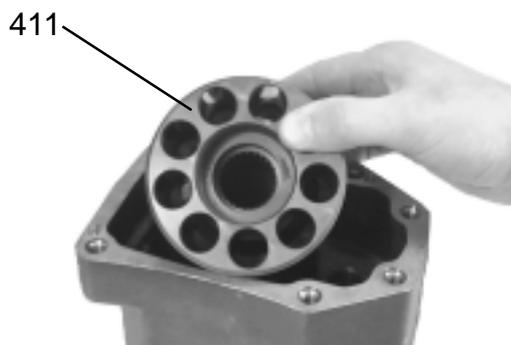
10. Remove the Valve Plate (item 141).



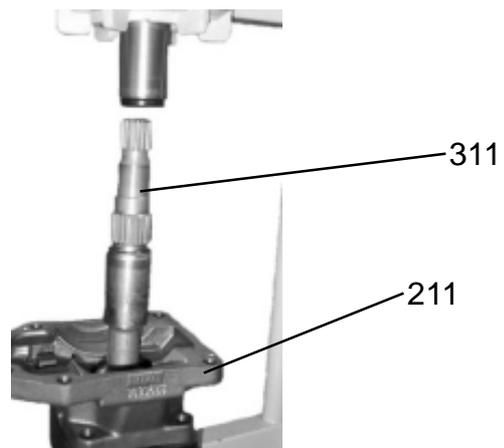
8. Remove the Ball (item 415) and the Compression Spring (item 416).



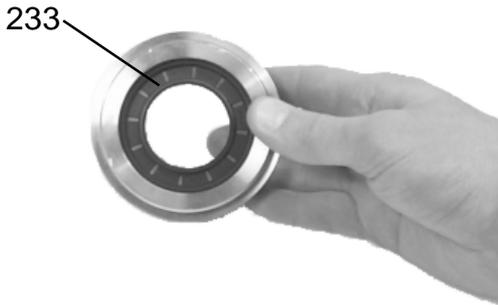
11. Remove the Bushes (item 450) and the Compression Springs (item 455) fitted under the Bushes.



9. Remove the Cylinder Barrel (item 411).



12. Place the Bearing Housing (item 211) on a tube (inside diameter 95 - 110mm) so that the Shaft (item 311) with Seal Carrier (item 231) can be pressed off. Press on the small shaft end. Remove the O-ring (item 225) from the Bearing Housing.



14. Remove the Shaft Seal (item 233).

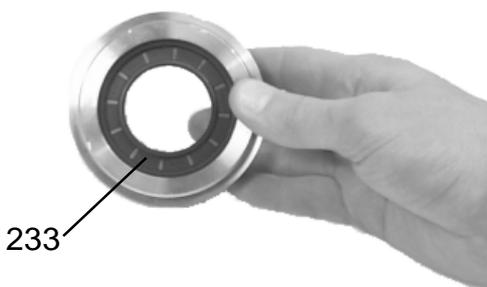
15. Remove the Retaining Ring (item 237). Remove the other Shaft Seal (item 233). If it is necessary to change the Inner Ring (item 471) but not the Bearing (item 470), hit the Inner Ring with a hammer to crack it. Press on a new Inner Ring on the Shaft.

16. If it is necessary to change the Bearing (item 470), disassemble the Bearing (item 470) and the Inner Ring (item 471) from the shaft by pressing the Bearing and Inner Ring off.

## Assembling

1. Install the Bearing (item 470) and the Inner Ring (item 471) on the shaft.

2. Install the Bearing Ring (item 470). Install the first Shaft Seal (item 233) and the Retaining Ring (item 237). **Note!** locate the opening on the Retaining Ring opposite the drain hole in the Seal Carrier.



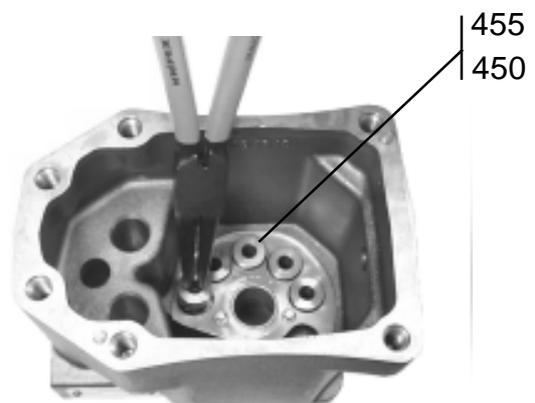
3. Install the other Shaft Seal (item 233).



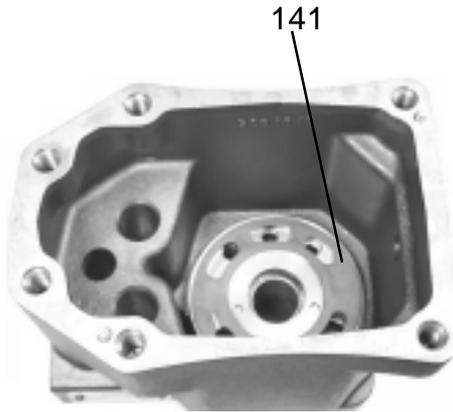
4. Install the Seal Carrier (item 231) on the shaft.



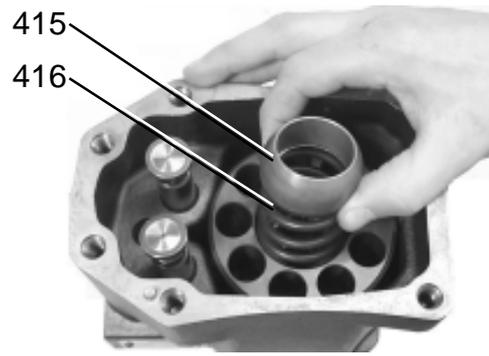
5. Install the O-ring (item 225) in the Bearing Housing (item 211). Install the Shaft with Seal Carrier in the Bearing Housing (item 211). Place the Bearing Housing on a tube (inside diameter 65mm and outside diameter max 80mm) and press down the Shaft with Seal Carrier. Press on the seal carrier and make sure that the lubrication holes are opposite each other.



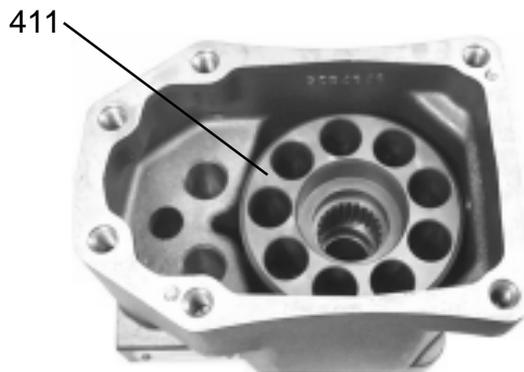
6. Install the Compression Springs (item 455) and the Bushes (item 450).



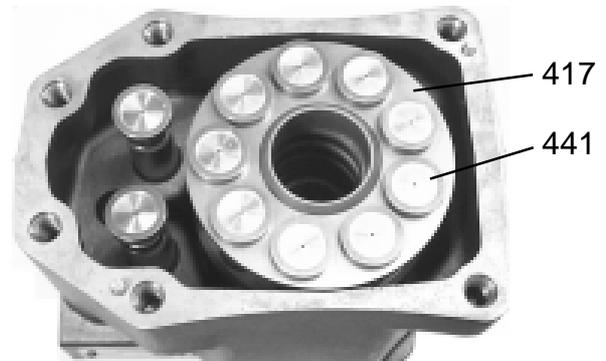
7. Install the Valve Plate (item 141).



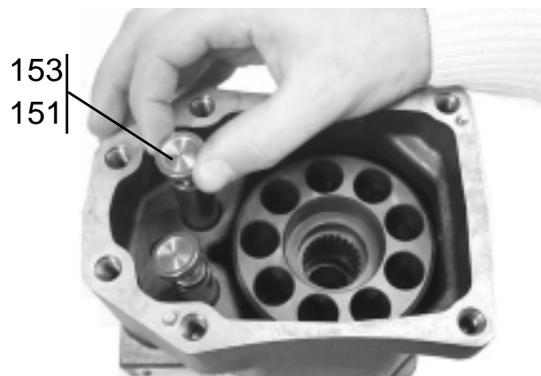
10. Install the Compression Spring (item 416) and the Ball (item 415).



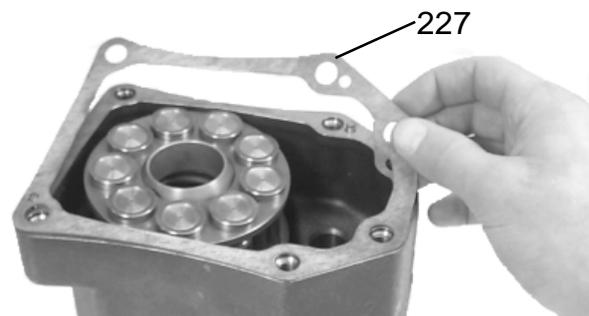
8. Install the Cylinder Barrel (item 411).



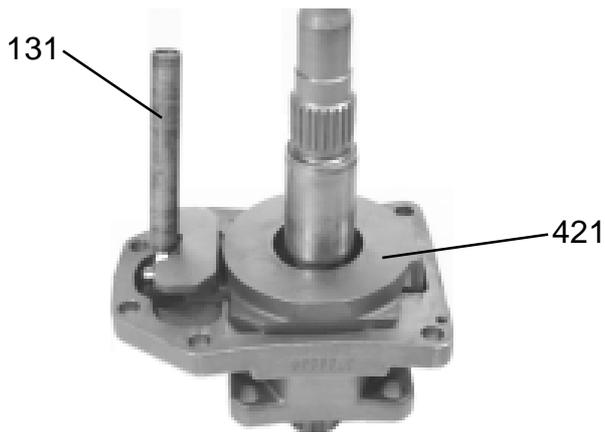
11. Install the Plate (item 417) with Pistons (item 441).



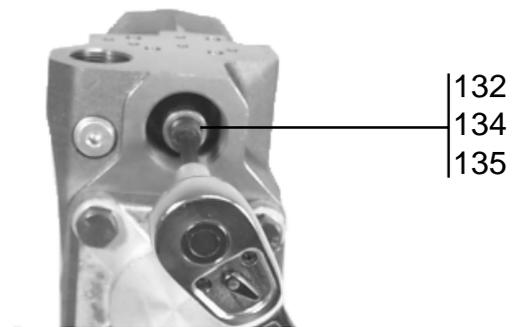
9. Install the Compression Springs (item 153) and the Setting Pistons (item 151).



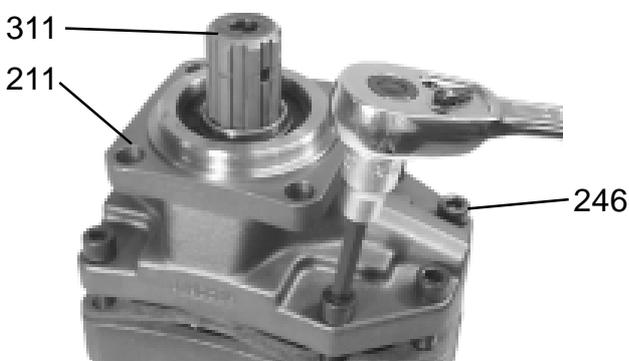
12. Install the Gasket (item 227).  
**Note!** Use a new Gasket.



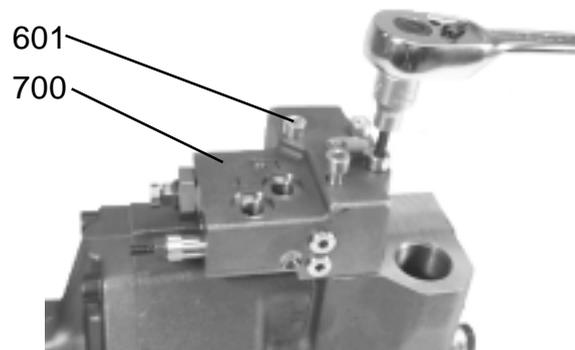
13. Install the Swashplate (item 421) and the Bar Assy (item 131).



16. Install the Hex S Screw (item 135) together with the Washer (item 134) and the Compression Spring (item 132) according to the specified tightening torque  $30 \pm 5 \text{ Nm}$ .

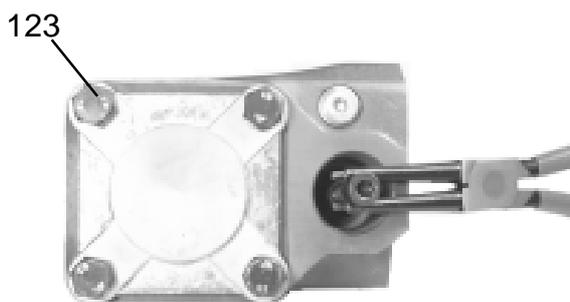


14. Install the Shaft (item 311), Bearing Housing (item 211), Swashplate (item 421) and Bar Assy (item 131). Hold the Swashplate against the Bearing Housing until the Splines on the Shaft enters the splines on the Cylinder Barrel. Assembly the Hex S Screws (item 246) according to the specified tightening torque  $60 \pm 10 \text{ Nm}$ . "Note, to facilitate assembly use two longer screws and push the parts together until you can fit the original screws".



17. Install the LS Control (item 700). Tighten the screws (item 601) to the specified tightening torque  $24 \pm 5 \text{ Nm}$ .

**Note!** If the Cover (item 121) is removed, install the Cover with a new Gasket (item 122) and the Screws (item 123) according to the specified tightening torque  $60 \pm 10 \text{ Nm}$ .

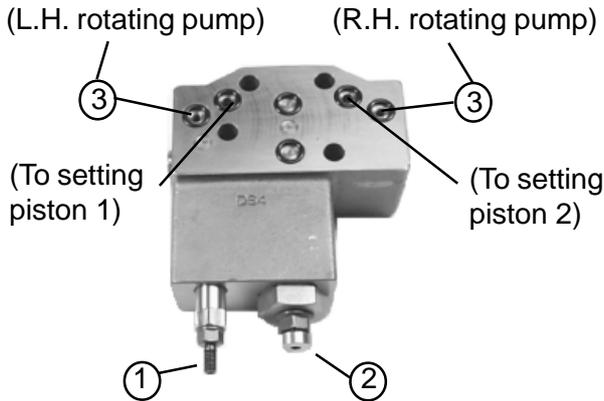


15. Pull out the Bar (item 131) with a long screw.

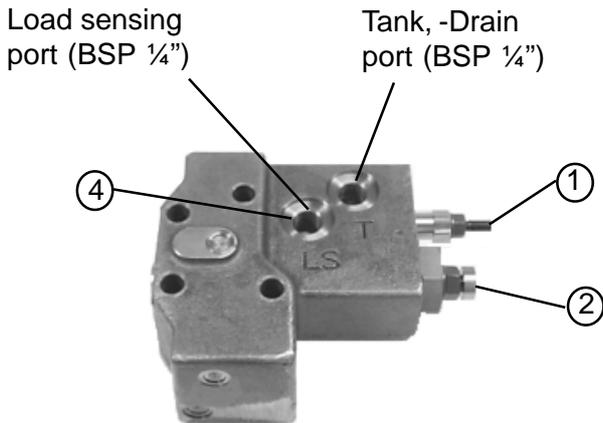
## Tightening Torques

Item	Tightening Torque	
246	$60 \pm 10$	Nm
135	$30 \pm 5$	Nm
123	$60 \pm 10$	Nm
601	$24 \pm 5$	Nm

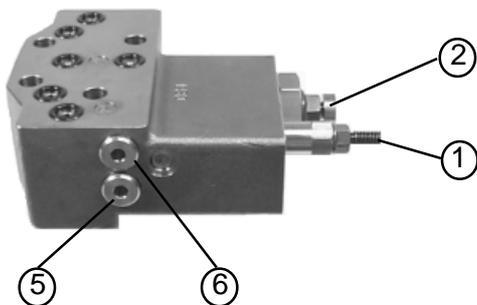
## LS Control



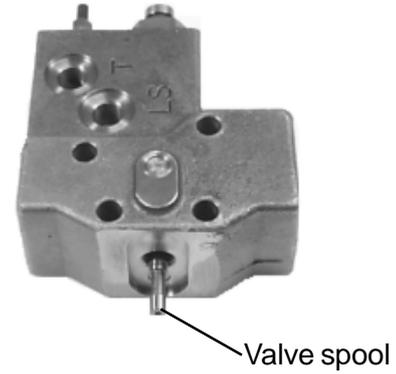
1. Signal pressure limiter adjustment
2. Differential pressure adjustment
3. System pressure dampening nozzle (2.0 mm)



4. Load sensing orifice (1.0 mm; fixed)



5. Return line nozzle (0.6 mm)
6. Bleed-off nozzle (0.6 mm)



## LS control adjustments

### LS signal pressure limiter

The cartridge is factory set at 275 bar but is adjust-able to 350 bar.

### LS load sensing valve

From factory, the Dp (stand by pressure) is set to 25 bar but is adjustable between 20 - 35 bar.

The 25 bar setting and the standard orifice sizes will usually provide an acceptable directional valve characteristic as well as system stability.

For additional information, contact Mobile Controls Division.



## Parts specification

Item	Description
110	Barrel Housing
117	Guide Pin
118	Hex Socket Plug
119	Seal Washer
121	Cover
122	O-ring
123	Hexagon Screw
126	Hex Socket Plug
127	Seal Washer
131	Bar Assy
132	Compression Spring
134	Washer
135	Hex Socket Screw
141	Valve Plate
151	Piston Assy
153	Compression Spring
211	Bearing Housing
225	O-ring
227	Gasket
231	Seal Carrier
233	Shaft Seal
237	Retaining Ring
246	Hex Socket Screw
251	Bearing Cap
252	Sunk Head Screw
311	Shaft
411	Cylinder Barrel
415	Ball
416	Compression Spring
417	Plate
420	Swashplate Assy
441	Piston Assy
451	Bush
452	Piston Seal
453	X-ring
455	Compression Spring
460	Plain Bearing
470	Tapered Roller Bearing
471	Inner Ring







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