Kawasaki
Hydraulic Products

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PILOT VALVE
PV48K SERIES



OVERHAUL & MAINTENANCE MANUAL

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SAFETY

Liability

Kawasaki Heavy Industries Ltd. guarantee the performance of this valve when supplied new. Disassembly of the valve will invalidate any remaining warranty. Kawasaki Heavy Industries Ltd . will not honour any warranty claim resulting from physical impact, mishandling or natural disaster.

PERSONNEL

Before carrying out any procedures on this valve the safety section of this manual must be read and understood. Work on the valve, piping and wiring must only be carried out by suitably qualified personnel.

For safe operation, servicing and checking of this valve, make sure the contents of this manual are fully understood. Keep this manual available for reference at all times.

These safety notes are intended to ensure that the valve is maintained and operated correctly and that risks to personnel are minimised.

The instructions in this manual are intended to guide a trained and skilled maintainer to carry out Overhaul and Maintenance of the valve. The procedures must be combined with current good Engineering Practices and relevant local safety instructions.

WARNINGS, CAUTIONS AND NOTES

Throughout this manual attention is drawn to specific points as follows:



WARNING!
A WARNING ALERTS THE READER TO POTENTIAL HAZARDS. FAILURE TO READ AND OBEY THE SAFETY INSTRUCTIONS MAY RESULT IN SERIOUS INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT.

CAUTION! **A caution alerts the reader to recommendations or instructions, non-observance of which could cause damage to equipment.**

Note: A note provides additional information, which should be given special attention.

OPERATION

During the Operation of the valve Observe the following:

1. Before operating machinery, clear all personnel and obstructions out of the zone of operation.
2. If the machinery operates dangerously, the pressure source must be isolated immediately.
3. If anything abnormal (i.e. abnormal noise or oil leaks) occurs, operation should be stopped immediately and the problem dealt with.
4. Before the valve is run for the first time, confirm that the hydraulic circuits and electrical wiring are correct and ensure that all fittings and connections are tight.
5. The valve must only be used within the specifications shown in the relevant data sheet.
6. Monitor the temperature of the valve during operation, if the temperature rises suddenly:
   (a) Switch off the valve.
   (b) Isolate the hydraulic and electrical supplies.
   (c) Allow the valve to cool before touching.
   (d) Investigate the sudden rise in temperature.
7. Use only the hydraulic oil specified in the relevant data sheet.
8. Make sure that all relevant filters specified in the data sheet are fitted and are in a clean and operational condition.

HANDLING

Care should be taken with the following when handling the valve:

1. Wear protective clothing when appropriate.
2. Depending on the weight and operating configuration of the main machine, it may be possible to trap fingers or strain the back.
3. Do not apply weight to, hit, drop or exert external force on the valve.
4. Wipe off any operating oil from the valve and/or floor.

REMOVAL AND REPLACEMENT

Precautions for the removal and replacement of the valve:

Removal

Ensure that:

(a) Power to the machine is switched off.

(b) Electric motors, engines etc are at rest.

(c) Pressure inside hydraulic lines is zero.

(d) Residual pressure in the accumulator circuit is released. (i.e. Operate the valve's lever several (at least ten) times).

Replacement

Ensure that:

(a) Attachment holes and surfaces are kept clean.

(b) The correct bolts are used and tightened to the specified torque values.

(c) Seals are not damaged.

MAINTENANCE AND STORAGE

Precautions for the Maintenance and Storage of the valve:

Maintenance

Ensure that:

(a) No modifications to the product are made by the customer.

(b) Trained personnel carry out maintenance and Overhaul.

Storage

Ensure that:

(a) The ambient temperature and humidity levels are not extreme.

(b) The valve is protected from dust and corrosion.

(c) Provision is made to change the valve seals if the valve is stored for long periods.

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1 DESCRIPTION AND OPERATION

1.1 General

The Pilot PV48K is a remote-control pilot valve with four reduction spools controlling secondary pressure mounted in a single valve casing. Tilting the control handle controls the output pressure.

1.2 Specifications

Primary pressure	Maximum pressure 6.9Mpa{995psi}
Secondary pressure	Maximum control pressure 0~4. 4Mpa{640psi}
Permissible back pressure	Maximum 0.3Mpa{43psi}
Nominal flow	20L/min{5.3gal/min}
Control angles	$\pm 19^{o}$, $\pm 25^{o}$ (single)
Mass	1.9kg
Port size	G-1/4(ISO 228/1) 9/16-18UNF(SAE 514)
Piping	A supply pipe approximately ϕ8mm internal diameter and a maximum of 3 metres in length should be used to achieve good responsiveness. The return oil should go directly to the tank to avoid the effects of back-pressure.

1.3 Structure

The structure of the pilot valve is as shown in the assembly cross-section (see Figure 1). There is a vertical axial hole in the casing and the reduction valves are inserted into this.

Each reduction valve comprises:

1. Spool (201)
2. Secondary pressure setting spring (241)
3. Return spring (221)
4. Spring seating (216)
5. Push rod (212)
6. Plug (211)

The secondary pressure setting spring (241) is set such that the secondary pressure is calculated as 5~10kgf/cm2 (depending on the model). Spool (201) is pushed onto the push rod (212) by return spring (221).

Tilting the control handle pushes down push rod (212), the spring seat (216) also moves down and the setting of the secondary pressure setting spring (241) is changed.

Port P, oil inlet (primary pressure) and port T outlet (tank) are in the casing (101).

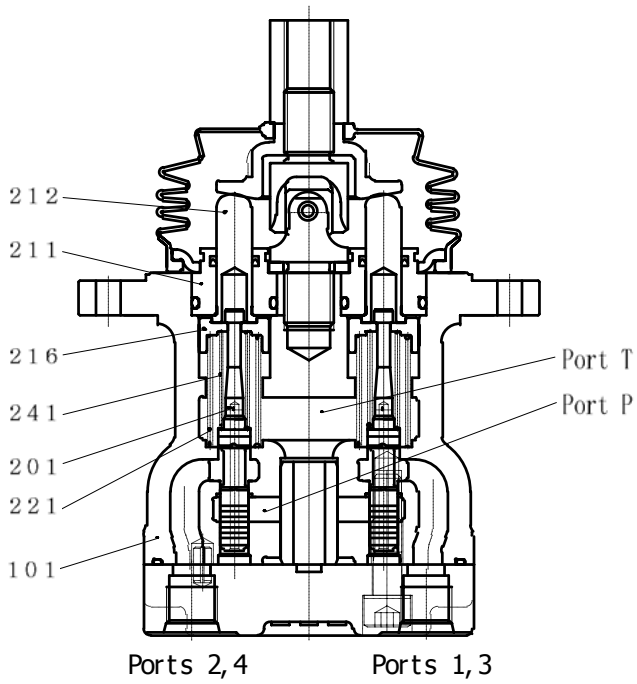


Figure 1 PV48K Valve - Cross-Section

1.4 Performance

1.4.1 Basic performance

The pilot valve controls the stroke and direction of the control valve spools. This is achieved by the output pressure of the pilot valve acting on the tip of the control valve spool.

To achieve satisfactory performance, the pilot valve comprises the following elements:

1. An inlet port (P) for oil fed from the hydraulic pump.
2. Multiple output ports (1,2,3 and 4) to allow pressure from the inlet port to act on the spool tips of the control valve.
3. A tank port (T) to control the output pressure.
4. A spool to connect the output port to the inlet port or tank port.
5. A mechanical assembly, which contains a spring which acts on the spool and controls the output pressure.

1.4.2 Performance of the main parts (see Figure 1)

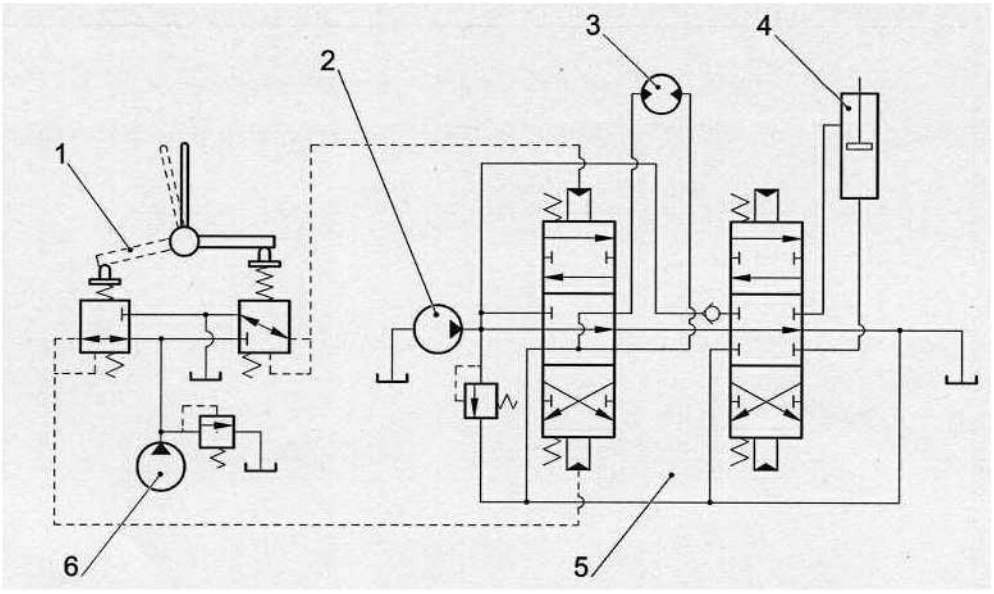
The spool (201) operates to take the supply oil pressure from the hydraulic pump. This switches the oil channel so that the port P oil pressure is directed to the output ports 1,2,3,4 or to port T. The secondary pressure setting spring (241) determines the output pressure that acts on the spool (201).

The push-rod (212), which changes the strain of the secondary pressure setting spring (241), is inserted so that it can move smoothly into the plug (211).

The return spring (221) acts to return the push-rod (212) towards zero displacement without reference to the output pressure acting on the spring seating (216) and casing (101). This acts to ensure the return to neutral of the spool (201) and also acts as a resistance spring to provide the operator with an appropriate operating "feel".

1.5 Operation

The operation of the pilot valve is described in the hydraulic circuit plan (see Figure 2) and operation explanatory figures (see Figures 3, 4 and 5). Figure 2 shows a typical example of the use of the pilot valve.



KEY:

1	Pilot valve	2	Main pump	3	Hydraulic motor
4	Hydraulic cylinder	5	Control valve	6	Pilot pump

Figure 2 Hydraulic Circuit Plan (Typical)

1.5.1 Control Handle Neutral (see Figure 3)

The force of the secondary pressure setting spring (241) (which determines the output pressure of the pilot valve) does not act on the spool (201).

Spool (201) is pressed upward by the return spring (221)

Spring seating 1 (216) and output ports (2,4) and port T are open.

The output pressure is the same as the tank pressure.

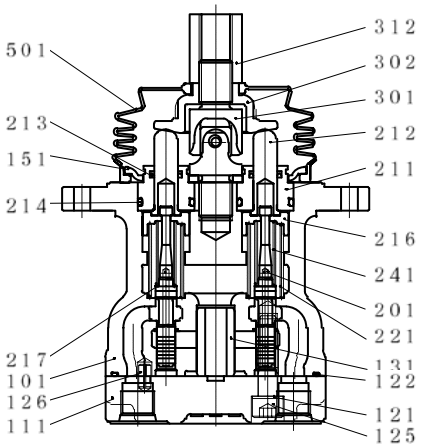


Figure 3 Control Handle in Neutral

1.5.2 Control Handle Tilted (see Figure 4)

The push-rod moves, (spring seat (216)), spool (201) moves downward, port P and ports (2, 4) are open and the oil fed from the pilot pump flows to ports (2,4) and generates pressure.

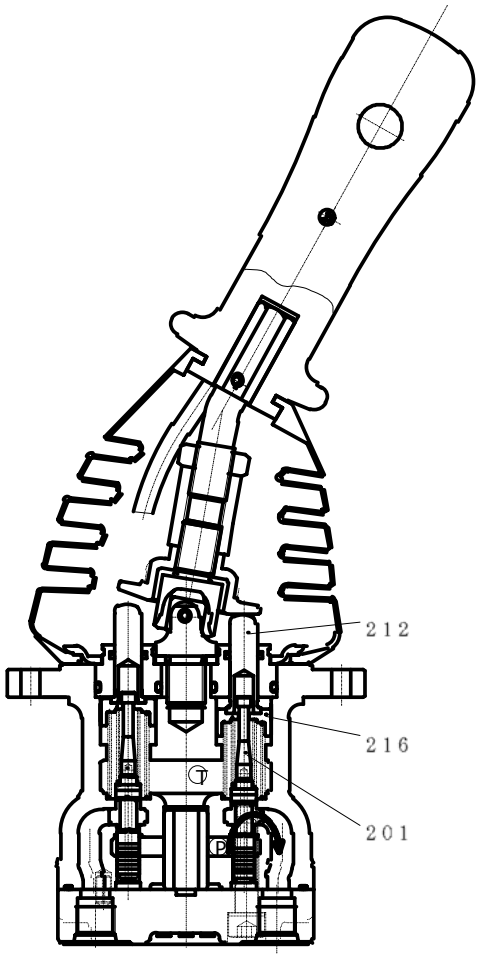


Figure 4 Control Handle Tilted

1.5.3 Control Handle Held (see Figure 5)

The pressure of ports (2,4) rises to become equal to the spring (241) force; the oil pressure and spring pressures become balanced. If the pressure of ports (2,4) exceeds the set pressure. Ports (2,4) and port P close, ports (2,4) and Port T open and if the pressure of ports (2,4) falls below the set pressure ports (2,4) and port P open and ports (2,4) and port T close. The secondary pressure is kept constant.

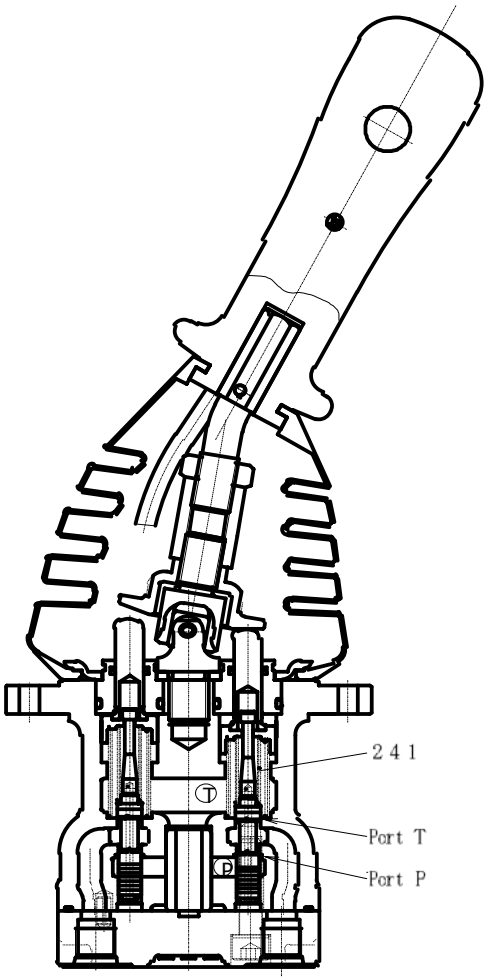


Figure 5 Control Handle Held

1.5.4 Control Handle Tilted Through a Wide Range

In some models, when the handle is pressed down beyond a certain angle, the spool top comes into contact with the inner base of the push rod and the output pressure is continuously connected to port P.

The spring seating and spring are assembled inside the push rod; when the handle is pressed down beyond a certain angle, the inner base of the push rod comes into contact with the spring. The secondary pressure gradient is altered by the force of this spring, before the push-rod base and the spring seating top come into contact. The output pressure and port P remain connected.

2 MAINTENANCE

This section details the precautions and procedures required to maintain the valve. The section does not cover the removal and refitting of the valve to a particular machine.

After assembly of the valve refer to the factory test rig manual and the valve data sheet to test the valve and check the serviceability of the valve.

2.1 Tools Equipment and Torque Settings

The following table lists the tools equipment and torque settings that will be required during disassembly and assembly of the valve.

Tool/ Equipment	Dimensions (mm)	Part Number	Part Name	Screw Size	Tightening Torque (Nm)
Hex spanner	6	125	Hex bolt	M8	20±1.5
Open-Ended Spanner	22	312	Adjustment nut	M14	68.6±4.9
Open-Ended Spanner	32	302	Disc	M14	-
Special jig (page 27, Figure 8)	24	301	Joint	M14	47.1±2.9
Fine Grade Oilstone	-	-	-	-	-
Vice	-	-	-	-	-
Anti-corrosion spray	-	-	-	-	-
Paraffin	-	-	-	-	-
Heat-proof grease	-	-	-	-	-
Fine wet/dry paper #1000, #2000	-	-	-	-	-

2.2 Adjustment Standards

Items for servicing and inspection	Standard	Notes
Leakage	Handle neutral 1000cc/min{0.26gal/ min} maximum In operation 2000cc/min{0.52gal/ min} maximum If either of these is reached, the spool should be changed. If this does not solve the problem, the entire pilot valve should be replaced.	Conditions Primary pressure 2.9Mpa {427psi} kgf/cm^2 Oil viscosity 23×10^{-6}m^2/s
Spool	To be replaced when moving parts are worn down 10µm compared to non-moving parts.	The same conditions as above are assumed when predicting possible leakage
Push-rod	To be replaced when the tip is worn down 10µm or more	
Play in control	To be replaced when there is 2mm or more play due to wear of the disc (302) and joint (301) of the control	Adjustment to be made when the play is due to e.g. loosening of parts which should be tightened.
Operating stability	When unusual noise, hunting or reduction in primary pressure occurs during operation and it is not possible to correct this by following the directions in Paragraph 3 Troubleshooting, the entire pilot valve should be replaced.	

Note: O-rings rings and other sealing materials should preferably be replaced each time the valve is disassembled but they may be re-used provided a careful check is made that they are undamaged**.**

Note: When hexagonal socket (hex) bolts (125) are loosened the seal washers (121) must be replaced.

2.3 Disassembly

2.3.1 Preparations

1. Prepare a work bench which is of adequate size to accommodate the parts, tools and equipment required.
2. Prepare the tools and materials listed in paragraph 2.1.

2.3.2 Warnings and Cautions



WARNING!
SKIN EXPOSURE TO HYDRAULIC FLUIDS, PARAFFIN AND DEGREASANT CAN BE DAMAGING TO HEALTH. WEAR PROTECTIVE CLOTHING AND BARRIER CREAMS AS NECESSARY.

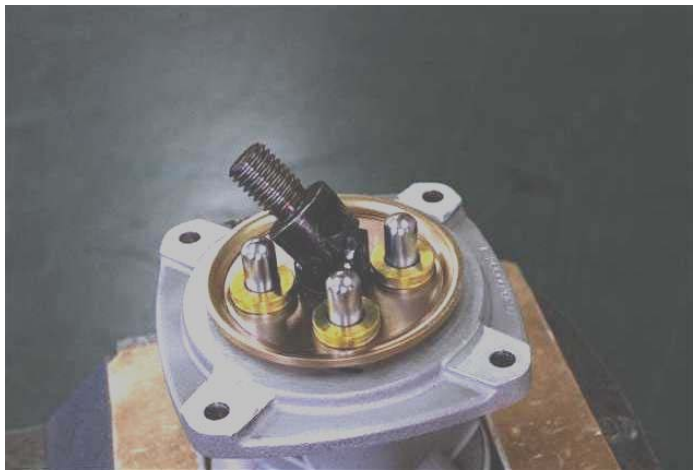
CAUTIONS! Care should be exercised when handling all parts.

Parts can be damaged by use of excessive force. Care should be exercised during maintenance, do not hit or force any part. This may cause burring or other damage resulting in deterioration in performance.

Parts can be damaged by corrosion caused by humidity and dust. If parts are to be left in a disassembled condition make sure that all parts are protected from dust and humidity.

2.3.3 Sequence of disassembly

No.	Operation	Notes
1.	Rinse the pilot valve in paraffin	Place blind plug in all ports.
2.	Secure the pilot valve in a vice using a copper or aluminium faced jaws. Remove the handle assembly from the valve.[See Figure 10-1 & 10-2 Cross Section]	
3.	Detach the bellows (501) [See Photo 7-1] [If outer bellows is attached ,then this bellows may not be attached.]	Take care not to damage the bellows (501)  Photo 7-1

No.	Operation	Notes
4.	Use a spanner applied to both the adjustment nut (312) and disc (302) and loosen and then remove them. [See Photos 7-2, 7-3, 7-4]	   Photos 7-2, 7-3, 7-4

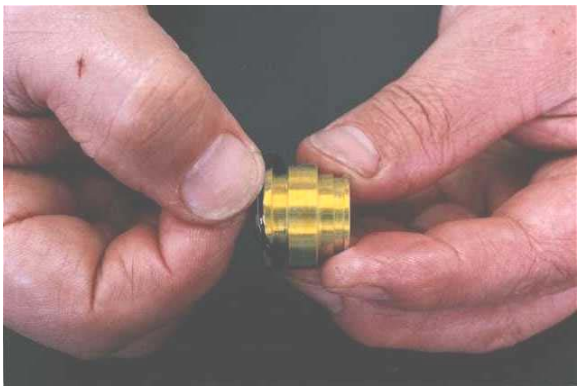
No.	Operation	Notes
	**WARNING!** **ITEMS UNDER TENSION. THE RETURN SPRING (221), PLATE (151) AND PUSH-ROD (212) WILL RISE AS JOINT (301) IS LOOSENED. MAKE SURE THE ITEMS DO NOT FLY OUT AND DAMAGE PERSONNEL IN THE VICINITY.**	
5.	Using the jig, turn the joint (301) counter-clockwise to loosen it [See Photos 7-5, 7-6]	Photo 7-5 shows the jig attached.   Photos 7-5 & 7-6

No.	Operation	Notes
6.	Remove the plate (151) (When the return spring (221) is strong [See Photo 7-7] (When the return spring (221) is weak) [See Photo 7-8]	  Photos 7-7 & 7-8
	WARNING! **ITEMS UNDER TENSION. THE RETURN SPRING (221) TENSION WILL BE RELEASED WHEN PLUG (211) IS REMOVED. MAKE SURE THE ITEM DOES NOT FLY OUT AND DAMAGE PERSONNEL IN THE VICINITY.**	
7.	When the return spring (221) is weak, the plug (211) is held in the casing (101) by the friction of the O-ring. Remove this using a screwdriver. [See Photo 7-9]	Use the groove around the plug and take care to apply force evenly to avoid damage  Photo 7-9

No.	Operation	Notes
8.	Remove the push-rod (212), plug (211), reduction valve assembly and return spring (221) from the casing (101). [See Photo 7-10]	Note the location in relationship with the casing aperture.  Photo 7-10
9.	Secure the pilot valve in the vice so that the port plate (111) is at the top.	
10.	Loosen the hex bolt (125) with the Allen wrench. [See Photo 7-11]	 Photo 7-11

No.	Operation	Notes
11.	Remove the port plate (111) and O-ring (122) from the casing (101). [See Photos 7-12 & 7-13] Extract the bush (131) from the casing (101).	  Photos 7-12 & 7-13
CAUTION!	**The surface of the spool (201) and the spring (216) can be damaged by mis-handling. Take care not to damage the surface of the spool during removal and do not push the spring seating down more than 6mm.**	
12.	The reduction valve is disassembled by pressing down the spring seating (216) and flexing the secondary pressure spring (241), sliding the spring seating (216) sideways and removing it from the spool (201) via the larger aperture. [See Photo 7-14]	Take care not to damage the surface of the spool (201).  Photo 7-14

No.	Operation	Notes
13.	Take the spool (201), spring seating (216), secondary pressure spring (241) and washer #2 (217) apart [See Photo 7-15]	Take care not to damage the surface of the spool (201). Keep these parts together until reassembly.  Photo 7-15
14.	Remove the secondary spring (246) and spring seating (218) from the push-rod (212). [See Photo 7-16]	 Photo 7-16
15.	Extract the push-rod (212) from the plug (211). [See Photo 7-17]	 Photo 7-17

No.	Operation	Notes
16.	Detach the O-ring (214) and seal (213) from the plug (211). Detach the seal (213) using a small screwdriver. [See Photos 7-18 & 7-19]	  Photos 7-18 & 7-19
17.	Cleaning of parts: 1. Wash the parts by placing in an initial bath containing paraffin (or similar cleaning fluid).	To reduce the risk of damage if dirty parts are initially washed in oil. To remove the dirt and oil. Soak thoroughly so that dirt and oil float to the surface. Dirty paraffin could result in damage to the parts, and deterioration in performance after reassembly. Ensure the contamination of the paraffin is thoroughly monitored and controlled.
	2. Place the parts in a finish wash container, rotate this slowly until even the inner areas of the parts are clean. (Finish wash) Wipe of the paraffin on the parts using clean cloth.	If compressed air is used for drying, dust and moisture in the compressed air may damage the parts and make corrosion more likely.
18.	Prevention of corrosion of parts Coat the parts with the anti-corrosion preparation.	If the parts are left to stand for some time after cleaning, they may start to corrode and the performance after reassembly will be impaired.

2.4 Assembly

2.4.1 Preparations

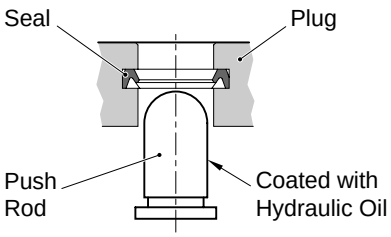
1. Prepare a work bench which is of adequate size to accommodate the parts, tools and equipment required.
2. Prepare the tools and materials listed in paragraph 2.1.
3. When assembling make sure that all metal particles and foreign bodies are removed from the parts and all burr and impact marks are removed using the oilstone.
4. All O-rings and backup rings are to be replaced.
5. Take care not to damage the O-rings and backup rings when fitting them (Apply a small quantity of grease to allow them to be fitted smoothly).
6. When fitting the parts, some grease may be applied to keep them in place.
7. Bolts etc are to be tightened to the torque values shown in Paragraph 2-1. Measure the torque using a torque wrench.
8. When Assembly is complete, block all ports with blind plugs to keep out dust and moisture.

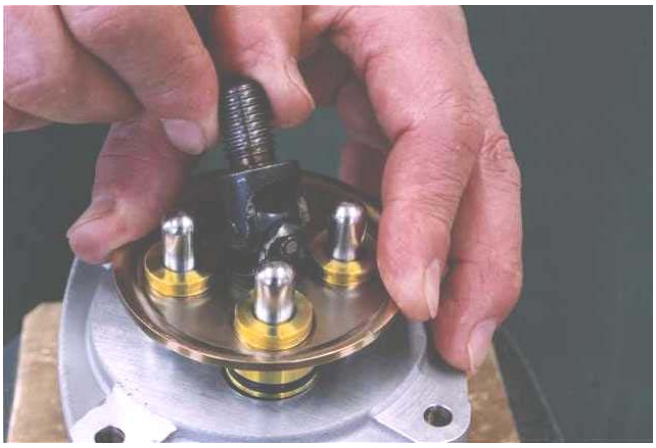
2.4.2 Sequence of Assembly

No.	Operation	Notes
1.	Fit the bush (131) and O-ring (122) into the casing (101). [See Photo 7-20]	 Photo 7-20
2.	Attach the port plate (111) to the casing (101) using hex bolts (125) and seal washers (121) [See Photos 7-21 & 7-22]	Note the fitting position so that the spring pin (126) can be inserted into the casing aperture. The sealing washers should be replaced with new washers.   Photos 7-21 & 7-22

No.	Operation	Notes
3.	Tighten the hex bolts (125) to the specified torque [See Photo 7-23]	Slowly tighten the bolt alternately.  Photo 7-23
CAUTION!	**The surface of the spool (201) and the spring (216) can be damaged by mis-handling. Take care not to damage the surface of the spool during assembly and do not push the spring seating down more that 6mm.**	
4.	Insert, in this order, the washer #2 (217), secondary spring (241) and spring seating (216) onto the spool (201). [See Photo 7-24]	 Photo 7-24
5.	Press down the spring seating (216) to flex the secondary pressure spring (241) while sliding the spring sideways through the larger aperture to attach it to the spool (201). [See Photo 7-25] Fit the return spring (221) into the casing (101).	Do not press the spring seating down more than 6mm  Photo 7-25

No.	Operation	Notes
6.	Fit the reduction valve assembly into the casing (101) [See Photo 7-26]	Fit in the locations noted in step 8 of the disassembly procedure.  Photo 7-26
7.	Fit the O-ring (214) into the plug (221). [See Photo 7-27]	 Photo 7-27
8.	Fit the seal (213) into the plug (211). [See Photo 7-28]	Fit the lip of the seal (213) as shown below.  Photo 7-28

No.	Operation	Notes
9.	Fit the push-rod (212) into the plug (211) [See Photo 7-29 and Figure 6] Fit the secondary spring (246) and spring seating (218) into the push-rod (212). [See Photo 7-30]  Figure 6 Push rod Plug & Seals	Apply hydraulic oil to the surface of the push-rod.   Photos 7-29 & 7-30

No.	Operation	Notes
	**WARNING!** **ITEMS UNDER TENSION. THE PLUG ASSEMBLY AND PLATE (151) HAVE TO BE ASSEMBLED AGAINST SPRING TENSION. MAKE SURE THE ITEM DOES NOT FLY OUT AND DAMAGE PERSONNEL IN THE VICINITY.**	
CAUTION!	**The surface of the spool (201) and aperture (101) can be damaged by mis-handling. Take care not to damage the surface of either during assembly.**	
10.	Fit the plug assembly into the casing (101). When the return spring (221) is weak, it is held in place by the friction of the O-ring (214)[(See Photo 7-31] When the return spring (221) is strong, use the plate (151) to insert all four simultaneously and temporarily secure them with the joint (301). [See Photo 7-32)	  Photos 7-31 & 7-32
11.	Attach the plate (151).	

No.	Operation	Notes
12.	Tighten the joint (301) to the casing (101) to the specified torque using the special jig. [See Photos 7-33 & 7-34]	Photo 7-33 shows the jig attached. Screw down to a position where the four push-rods (212) are in contact equally.   Photos 7-33 & 7-34
CAUTION!	**Excessive tightening or wrong positioning of the disc can cause the valve to malfunction.**.	
13.	Attach the disc (302) onto the joint (301) [See Photo 7-35]	 Photo 7-35

No.	Operation	Notes

14.	Install the adjustment nut (312), tighten up the discs (302) with a spanner on both and tighten the adjustment nut to the specified torque [See Photo 7-36]	Do not allow the position of the disc (302) to shift during tightening.  Photo 7-36
15.	Apply grease to the rotating part of the joint (301) and end of the push-rod (212). [See Photo 7-37]	 Photo 7-37
16.	Attach the bellows (501). [If outer bellows is attached, then this bellows may not be attached]. [See Photo 7-38]	Take care not to tear the bellows.  Photo 7-38
17.	Fit the handle assembly into the valve. [See Figure 10-1 & 10-2 Cross Section]	
18	Spray anti-corrosion preparation into each port and insert blind plugs.	

3 TROUBLESHOOTING, SPARES & TOOLS

3.1 Troubleshooting

The table below shows the faults, the possible causes and the possible solutions. However, problems with a machine are often not caused by one part but by its relationship with other parts. It should be noted that it may be necessary to deal with problems other than those listed below.

The table below does not list all possible causes and solutions. It may be necessary for the repair technician to investigate other solutions.

Fault	Cause	Solution
Secondary pressure does not rise	Inadequate primary pressure	Ensure primary pressure
	Bending or displacement of the secondary pressure spring (241)	Replace with new part
	Abnormally large gap between spool (201) and casing (101)	Replace spool (201)
	Play in control handle	Disassemble/re-assemble and replace control handle.
Secondary pressure is unstable	Sliding parts are catching	Fix catching parts.
	Variations in tank line pressure	Return directly to oil tank
	Air in pipe	Operate several times to remove air
Secondary pressure is high	High tank line pressure	Return directly to oil tank
	Sliding parts are catching	Fix catching parts

3.2 Parts

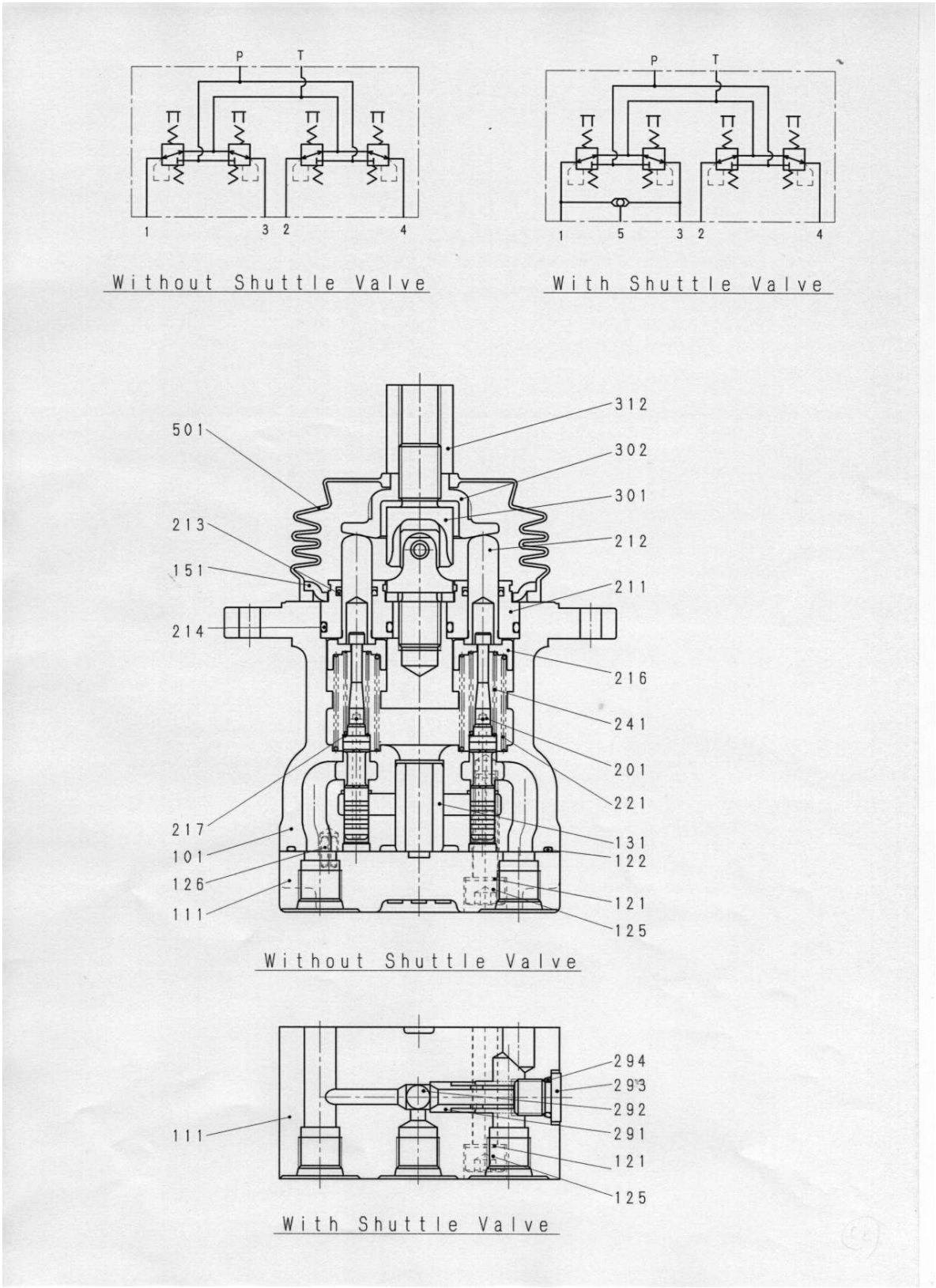


Figure 7 Parts Breakdown

No	Screw Size	Tightening Torque
125	M8	20.6±1.5 Nm
301	M14	47.1±2.9 Nm
312	M14	68.6±4.9 Nm
315	M14	49.0±3.5 Nm

3.2.1 Part List

Pilot valve PV48KC1206

No.	Part name	Part number	Q'ty/ unit	Class
101	Casing	P- VZ331701046	1	/
111	Port plate	P- VZ333600437	1	C
121	Seal washer	P- 5DT01X01121	2	C
122	O-ring	P- VZ3319000211	1	C
125	Socket screw	P- 0SBM865	2	D
126	Pin; spring	P- 0SPV510	1	D
131	Bush	P- VZ333400157	1	C
151	Plate	P- VZ333600316	1	C
201	Spool	P- VZ033201847	4	/
211	Plug	P- 5DT01X00211	4	C
212	Push rod	P- 5DT01X06212	4	C
213	Seal	P- 5DT61X20213	4	C
214	O-ring	P- 00RBP20	4	D
216	Seat; spring	P- VZ032700191	4	C
217	Washer	P- 5DT01X00217	4	C
221	Spring	P- VZ033401234	4	C
241	Spring	P- VZ033401803	4	C
291	Seat	P- VZ3318001341	1	C
292	Ball	P- 0DW516	1	C
293	Plug	P- 0R0MH12	1	C
294	O-ring	P- 00RBP10	1	D
301	Joint	P- 5DT61X01301	1	C
302	Circular plate	P- VZ333600280	1	C
312	Adjusting nut	P- 5DT61X00311	1	C
315	Nut	P- 5DT61X00315	1	C
323	Lever	P- VZ334100046	1	C
402	Knob	P- VZ333100101A	1	C
434	Pin; spring	P- VZ035400224	1	C
457	Bush	P- VZ3334002152	1	C
501	Boot	P- VZ332100026	1	C
	Ass'y seal kit	P- VZ033850106	1	A

PV48K1207

No.	Part name	Part number	Q'ty/ unit	Class
101	Casing	P- VZ331701046	1	/
111	Port plate	P- VZ333600499	1	C
121	Seal washer	P- 5DT01X01121	2	C
122	O-ring	P- VZ3319000211	1	C
125	Socket screw	P- VZ0362001841	2	C
126	Pin; spring	P- 0SPV510	1	D
131	Bush	P- VZ333400157	1	C
151	Plate	P- VZ333600316	1	C
201	Spool	P- VZ033201847	4	/
211	Plug	P- 5DT01X00211	4	C
212	Push rod	P- 5DT01X06212	4	C
213	Seal	P- 5DT61X20213	4	C
214	O-ring	P- 00RBP20	4	D
216	Seat; spring	P- VZ032700191	4	C
217	Washer	P- 5DT01X00217	4	C
221	Spring	P- VZ033401234	4	C
241	Spring	P- VZ033401803	4	C
301	Joint	P- 5DT61X01301	1	C
302	Circular plate	P- VZ333600280	1	C
312	Adjusting nut	P- 5DT61X00311	1	C
315	Nut	P- 5DT61X00315	1	C
323	Lever	P- VZ334100046	1	C
402	Knob	P- VZ333100101A	1	C
434	Pin; spring	P- VZ035400224	1	C
457	Bush	P- VZ3334002152	1	C
501	Boot	P- VZ332100026	1	C
	Ass'y seal kit	P- VZ033850066	1	A

Class Code	Meaning
A	Parts supplied sub-assembled
C	Parts individually supplied
/	Parts not supplied
D	Standardised parts commonly available

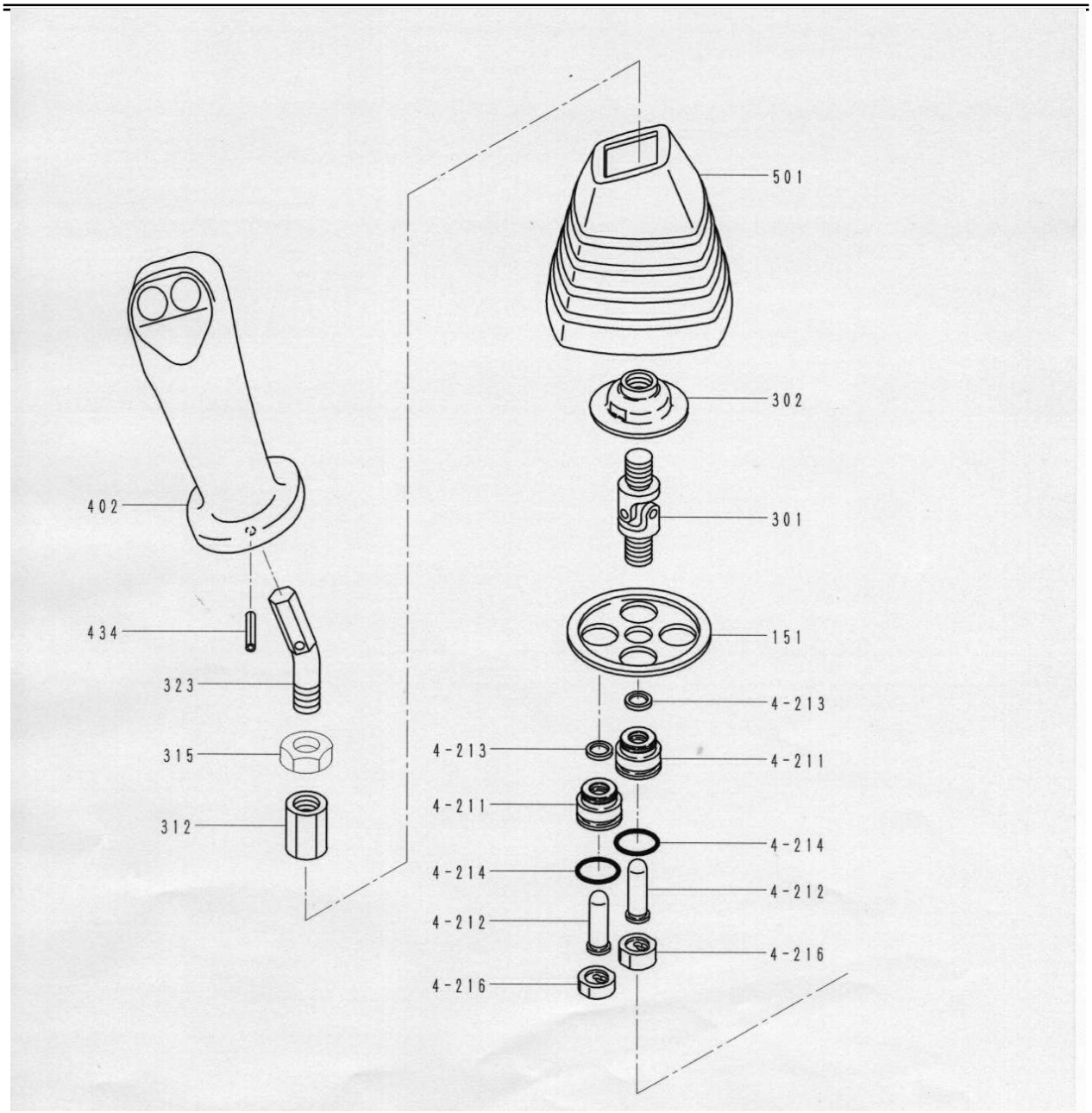


Figure 8-1 PV48K Exploded View

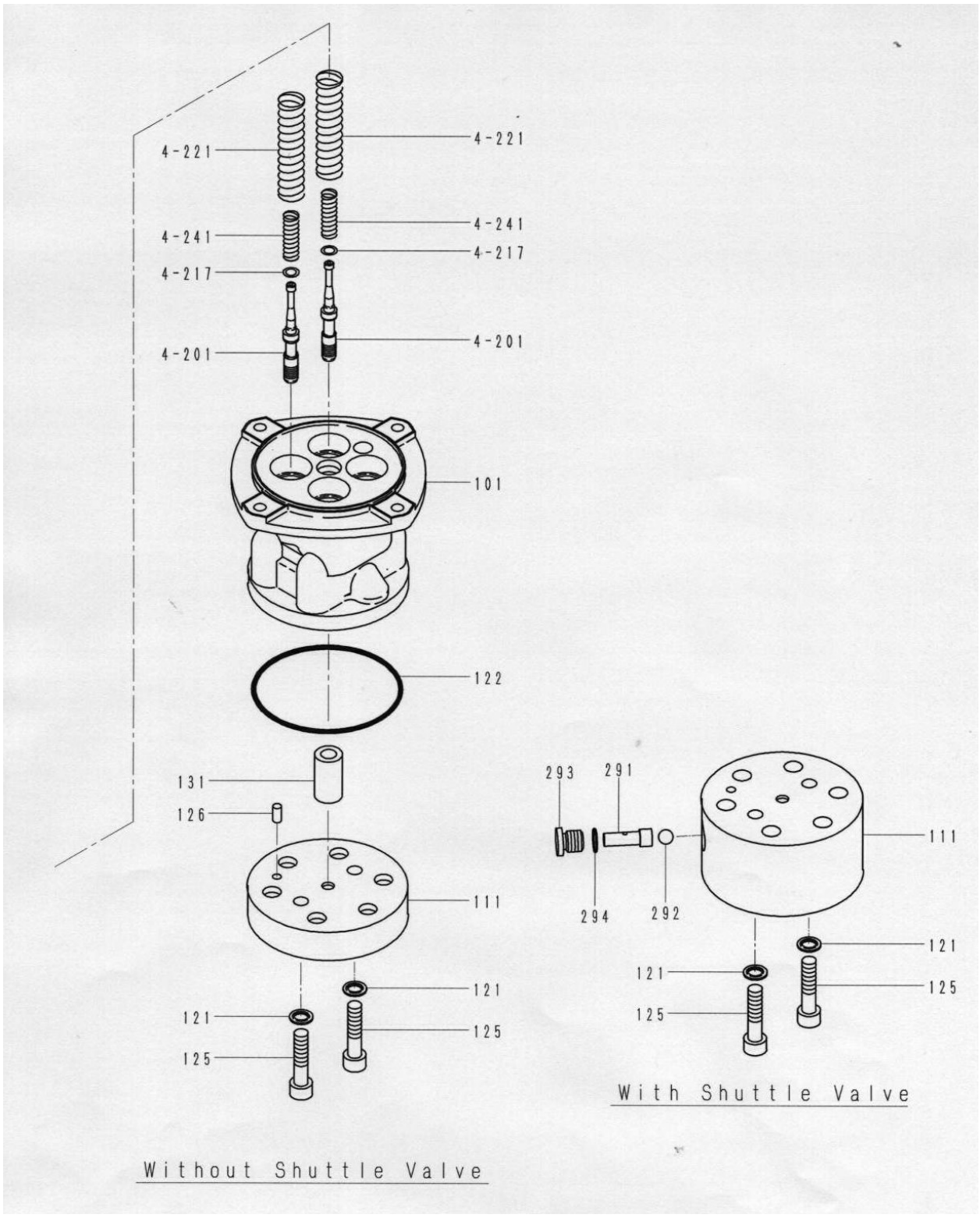
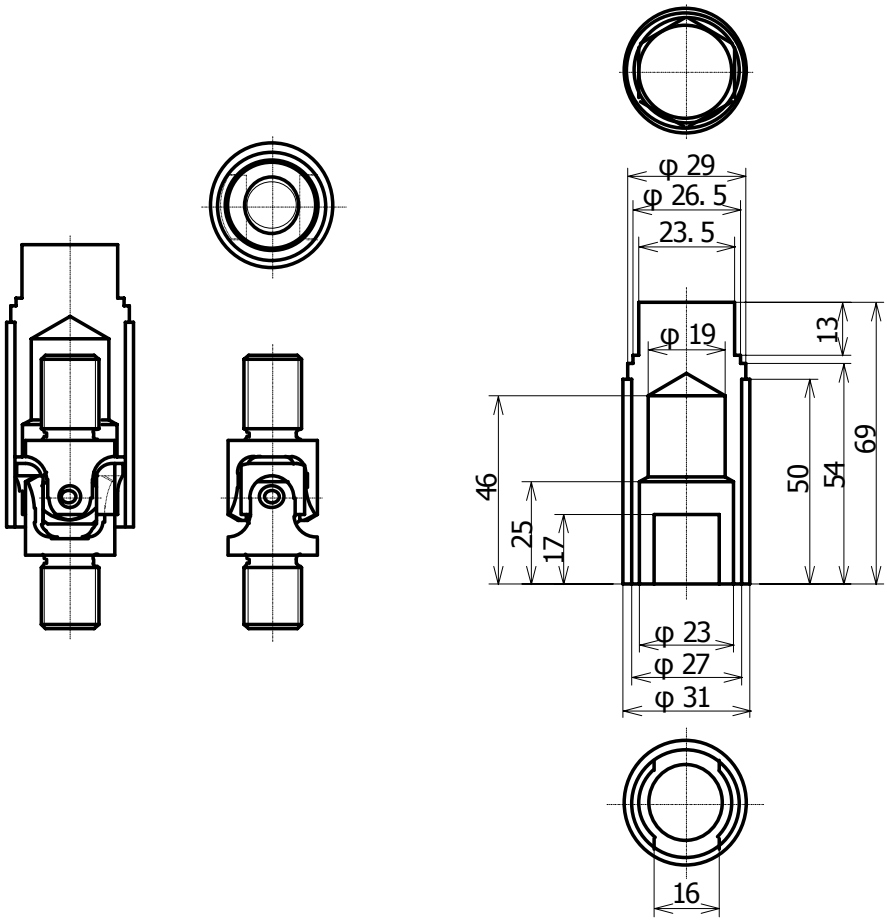
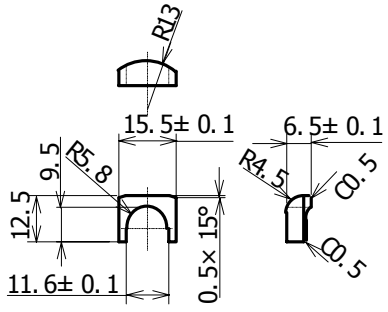


Figure 8-2 PV48K Exploded View





Note:

2x inserts (as show right) are required as UJ inserts (These inserts are required to support the UJ vertically. Refer to Page 10 Para. 5 Photos 7-5)

Figure 9 Special Jig

Intentionally Blank

Figure 10-1

Intentionally Blank

Figure 10-2

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