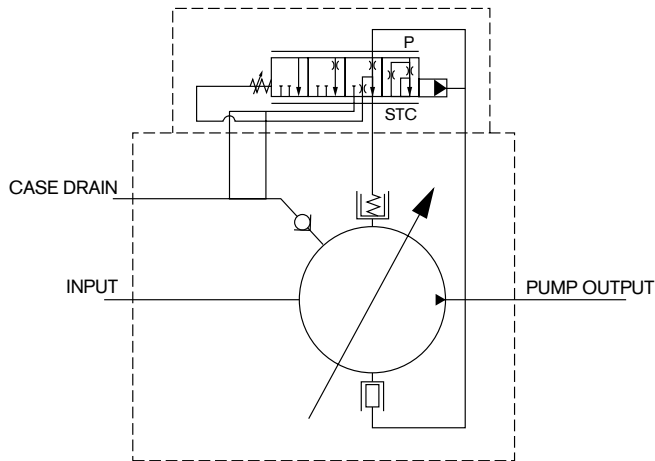


**VPV Controls**

Schematics shown illustrate VPV 45–164 controls with shock clipper integrated and no exterior plumbing required. The case drain shows an integrated check valve not present in VPV 16, 25 and 32. All controls leave the factory pre-set at 500 PSI.

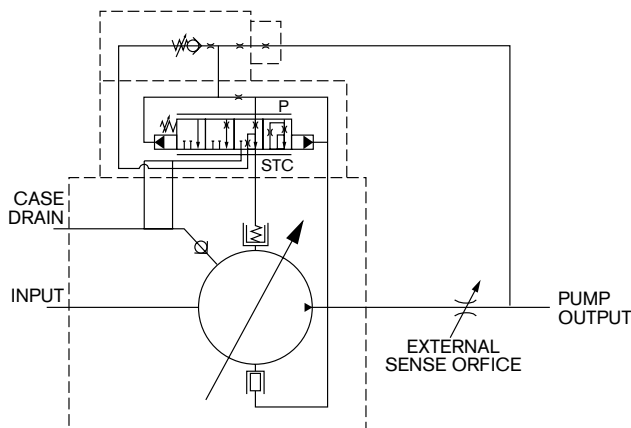
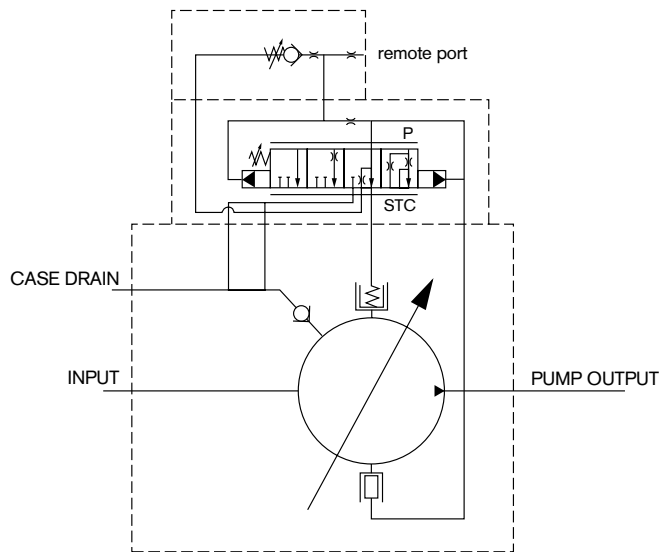


**Single Stage Compensator**

The single stage control for normal pressure compensation is a good choice where speed is important and remote capability is not required. This control available on VPV 16, 25 and 32.

**Two Stage Compensator**

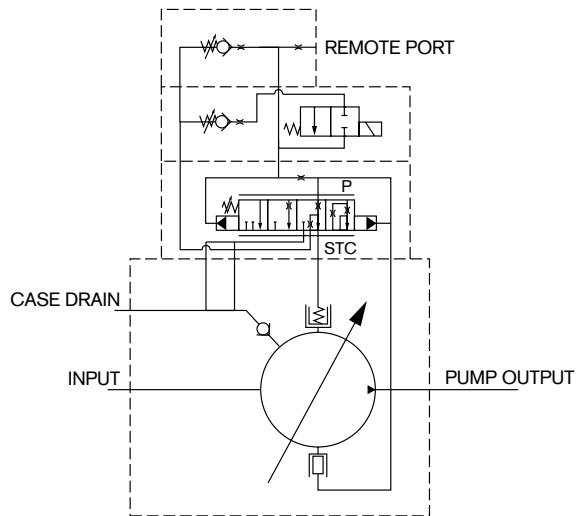
The two stage pressure compensators are the platform for most VPV controls. A remote port is standard and may, or may not be enabled according to the circuit design. This is the smoothest of the standard pressure controls, and is the standard pressure compensator for VPV 45–164.



**Load Sense Compensator**

Load sense allows the user to maintain constant flow regardless of changes in load or in pump shaft rotational speed. The Whisper™ Pump load sense accomplishes this by using an external orifice and continually senses a pressure drop of 100 PSI across this orifice. The minimum  $\Delta P$  is 200 PSI, however the pressure drop can be adjusted to meet circuit requirements. Consult factory.

## VPV Controls (continued)

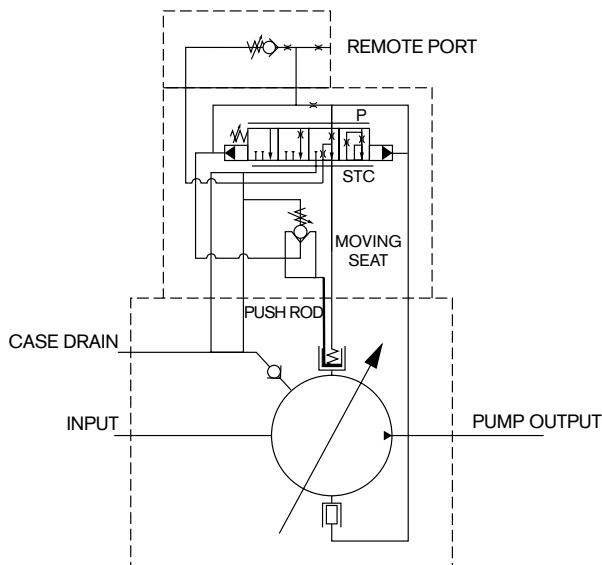
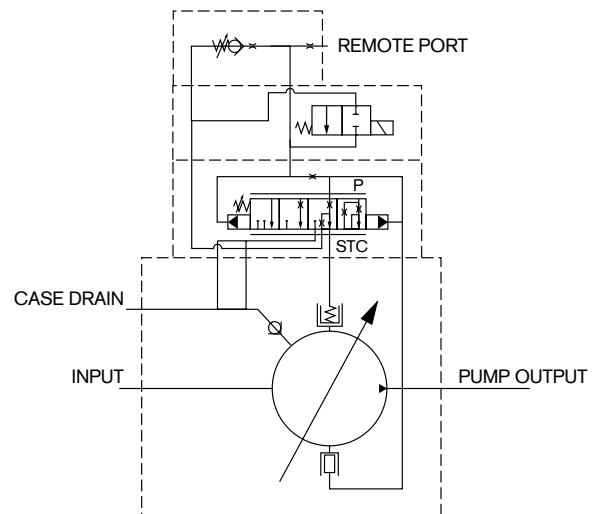


### Two Pressure Compensator

Solenoid two-pressure compensators are available in normally open (normally low, energize to high) and normally closed (normally high, energize to low) versions. These two-pressure controls can greatly reduce horsepower demand and heat generation during periods of idle cycle time, or when the machine operating cycle does not require maximum pressure.

### Solenoid Vent Compensator

Solenoid vented compensators are similar to the two-pressure controls, except that there is no adjustment possible. By venting the compensator the pump will go to minimum deadhead.



### Torque Limiting Compensator

Torque limiting for VPV limits the input torque to the pump shaft, in effect limiting the horsepower transmitted to the load. No torque or horsepower sensing is done on the load, only at the pump itself. Pump output flow rate is linear and proportional to movement of the pressure ring. This compensator is adjustable in the field as torque vs. flow requirements demand. Consult factory for adjustment procedure.

**Comparison of Sound Levels**

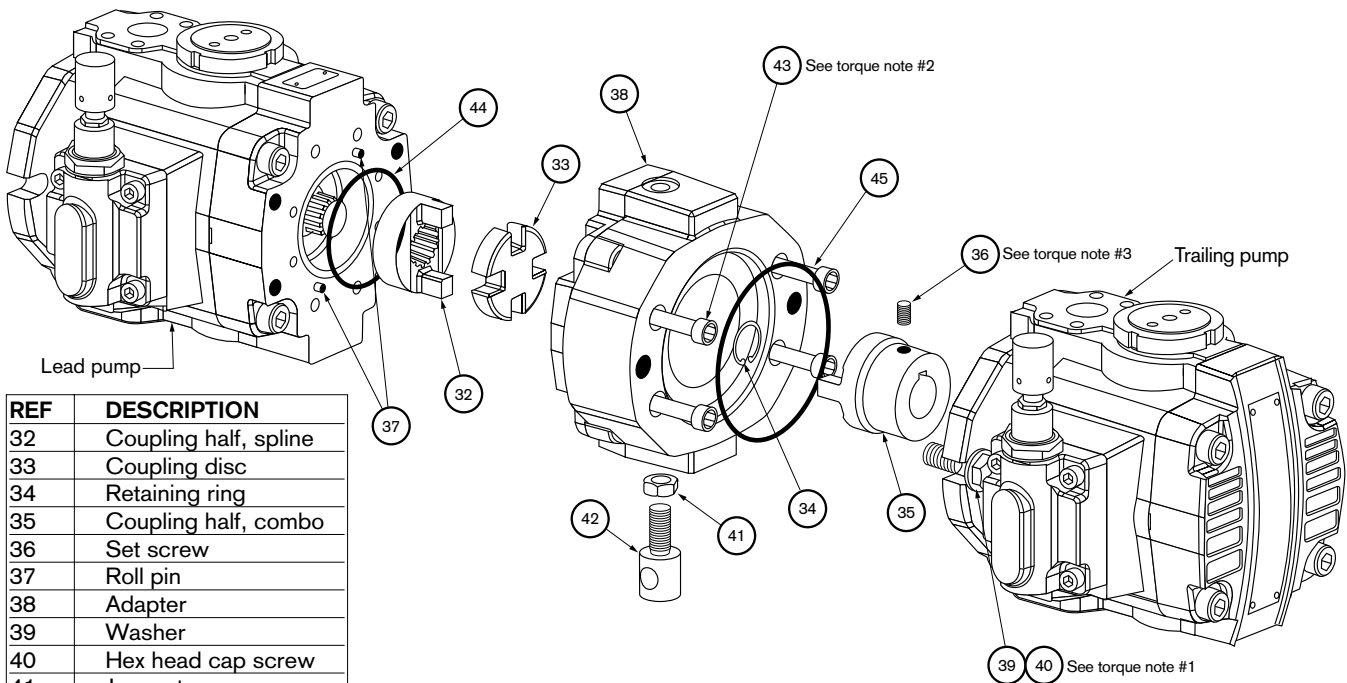
Source of Sound	Intensity (dB)	
Threshold .....	<b>0</b>	
Rustling leaves .....	<b>10</b>	Barely audible
Broadcast studio .....	<b>20</b>	
Typical bedroom at night .....	<b>30</b>	Very quiet
Typical living room .....	<b>40</b>	
Office, classroom .....	<b>50</b>	← VPV16 @ 1200 rpm & 500 psi, deadhead (49 dB)
Normal conversation .....	<b>60</b>	Moderate
Automobile interior .....	<b>70</b>	
Urban street .....	<b>80</b>	← VPV130 @ 1800 rpm & 3000 psi, full flow (76 dB) Noisy
Heavy truck (15 m) .....	<b>90</b>	Very noisy
Shout (1.5 m) .....	<b>100</b>	
Construction site .....	<b>110</b>	
Loud rock music .....	<b>120</b>	Threshold of pain
Jet airplane .....	<b>150</b>	Intolerable
Rocket engine .....	<b>180</b>	

### Trouble Shooting for VPV “Whisper Pumps™”

Some of the most common difficulties that could be experienced in the field are listed here with potential causes and their remedies.

TROUBLE	POTENTIAL CAUSE	REMEDY
<b>Excessive pump noise</b>	1) Coupling misalignment	1) Align the pump and motor shaft to within .006 of an inch total indicator reading. The tighter the alignment, the quieter the pump will be.
	2) The continuous pressure is significantly below 200 psi for 140 bar pumps, or 300 psi for 210 bar pumps.	2) The pumps have been sound tuned at rated pressure. Consult factory or raise minimum pressure 200 psi for single stage compensators in 2000 psi rated pumps, or 300 psi for 3000 psi rated pumps.
	3) Fluid in the reservoir is low and the pump is sucking air.	3) Fill the reservoir so that the fluid level is well above the end of the suction line <b>during all of the working cycle</b> .
	4) Restricted inlet.	4) If a suction strainer is used, check it for obstructions or dirt. <b>We do not recommend the use of strainers as they tend to be a leading cause of cavitation which manifests as excessive noise.</b> Check also for shop rags left in the reservoir.
	5) Air leak in the suction line.	5) Tighten all fittings. If it still leaks, smear grease over the joints to locate the leak.
	6) Suction line has too many elbows, or is too long.	6) The suction line should be as short and as straight as possible to reduce the resistance to flow.
	7) Air in the fluid.	7) The return line should terminate below the fluid level to prevent splashing.
	8) Suction line is too small.	8) Suction line should always be equal in size to the suction port. <b>Never</b> reduce it.
	9) Vane does not move freely.	9) Contamination in the fluid or a burr in the vane slot can cause a vane to bind up. Proper filtration and/or deburring of the vane slots is required.
	10) Vane is installed incorrectly.	10) In vane pumps built up to and including SV series 62 and VPV series 00 and A02, vanes must be mounted with the rounded edge toward the ring. In SV series 72 and VPV series B01 and later, the leading edge of the vanes must be oriented in the direction of rotation. The leading edge is identified as the low side of the vane taper.
	11) A vane is missing.	11) Make sure all vane slots have a vane in them.
	12) Port plates installed incorrectly.	12) Plates must be installed so that the arrows point in the same direction as the rotational arrows on the pump body. Port plates with ratio valves may not be installed in pump bodies prior to SV series 74, and VPV series B01. VPV series B01 requires the use of port plates with ratio valves for 45cc and larger pumps.
<b>Pump will not prime</b>	1) Shaft rotation in the wrong direction.	1) When installing a pump, always jog the electric motor to check for proper shaft rotation. Rotation should only be clockwise (right hand) for VPV pumps.
	2) Air leak in the suction line.	2) Make sure all fittings are tight.
	3) Pump is air bound.	3) Use an air bleed valve to void the pump and suction line of air.
	4) Fluid level in the reservoir is too low.	4) Fill the reservoir so that the fluid level is well above the end of the suction line.
	5) Stroke limiter is turned in too far.	5) Flow should not be reduced more than 50% of maximum. Turn CW to restrict flow, (see page 83).
	6) Suction port dust plug left in place.	6) Remove plug.
<b>Pump is unstable</b>	1) Contamination in the compensator.	1) Thoroughly clean the control orifices and check filtration.
	2) Pressure ring is not moving properly.	2) Control piston should be checked for freedom of movement.
<b>Pump is too hot</b>	1) Case drain line is installed too close to the pump inlet line.	1) The case drain and pump inlet should be separated by a baffle in the reservoir.
	2) Reservoir is undersized. Rule of thumb is a minimum or 2 to 3 times pump output flow.	2) Add a cooler.

**Adapter Kits for VPV Combinations Using "P1" Pumps**



REF	DESCRIPTION
32	Coupling half, spline
33	Coupling disc
34	Retaining ring
35	Coupling half, combo
36	Set screw
37	Roll pin
38	Adapter
39	Washer
40	Hex head cap screw
41	Jam nut
42	Support
43	Soc. head cap screw
44	O-ring, ASA-043
45	O-ring

ADAPTER KITS	
LIST NUMBER	DESCRIPTION
9 511 230 520	VPV 16 to VPV 16 Metric
9 511 230 518	VPV 16 to VPV 16 SAE
9 511 230 521	VPV 16 to SAE "F" Gear
9 511 230 673	VPV 16 Metric to SAE "F" Duo Gear
9 511 230 522	VPV 25/32 to VPV 25/32 Metric
9 511 230 523	VPV 25/32 to VPV 25/32 SAE
9 511 230 524	VPV 25/32 to VPV 16 Metric
9 511 230 525	VPV 25/32 to VPV 16 SAE
9 511 230 526	VPV 25/32 Metric/SAE to SAE "F" Gear
9 511 230 674	VPV 25/32 Metric/SAE to SAE "F" Duo Gear
9 511 230 554	VPV 25/32 Metric/SAE to SAE "G" Gear
9 511 230 531	VPV 45/63/80 to VPV 16 Metric
9 511 230 532	VPV 45/63/80 to VPV 16 SAE
9 511 230 529	VPV 45/63/80 to VPV 25/32 Metric
9 511 230 530	VPV 45/63/80 to VPV 25/32 SAE
9 511 230 527	VPV 45/63/80 to VPV 45/63/80 Metric
9 511 230 528	VPV 45/63/80 to VPV 45/63/80 SAE
9 511 230 533	VPV 45/63/80 Metric/SAE to SAE "F" Gear
9 511 230 675	VPV 45/63/80 Metric/SAE to SAE "F" Duo Gear
9 511 230 534	VPV 45/63/80 Metric/SAE to SAE "G" Gear
9 511 230 541	VPV 100/130/164 Metric to VPV 16
9 511 230 542	VPV 100/130/164 SAE to VPV 16
9 511 230 539	VPV 100/130/164 Metric to VPV 25/32
9 511 230 540	VPV 100/130/164 SAE to VPV 25/32
9 511 230 537	VPV 100/130/164 Metric to VPV 45/63/80
9 511 230 538	VPV 100/130/164 SAE to VPV 45/63/80
9 511 230 535	VPV 100/130/164 Metric to VPV 100/130/164
9 511 230 536	VPV 100/130/164 SAE to VPV 100/130/164
9 511 230 590	VPV 100/130/164 Metric/SAE to SAE "B" Spline
9 511 230 682	VPV 100/130/164 Metric/SAE to SAE "C" Spline
9 511 230 543	VPV 100/130/164 Metric/SAE to SAE "F" Gear
9 511 230 594	VPV 100/130/164 Metric/SAE to SAE "G" Gear

<b>Torque Note #1</b>	
Torque to 2000 lb/in (Torque to 225 Nm)	"VPV 100/130/164"
Torque to 1800 lb/in (Torque to 204 Nm)	"VPV 45/63/80"
Torque to 1050 lb/in (Torque to 119 Nm)	"VPV 25/32"
Torque to 780 lb/in (Torque to 88 Nm)	"VPV 16" & Type 'G' gear pump
Torque to 550 lb/in (Torque to 62 Nm)	Type 'F' gear pump
<b>Torque Note #2</b>	
Torque to 2300 lb/in (Torque to 260 Nm)	"VPV 100/130/164"
Torque to 850 lb/in (Torque to 96 Nm)	"VPV 45/63/80"
Torque to 550 lb/in (Torque to 62 Nm)	"VPV 25/32" & Type 'G' gear pump
Torque to 400 lb/in (Torque to 46 Nm)	"VPV 16" & Type 'F' gear pump
<b>Torque Note #3</b>	
Torque to 800 lb/in (Torque to 90 Nm)	"VPV 100/130/164"
Torque to 330 lb/in (Torque to 37 Nm)	"VPV 45/63/80"
Torque to 280 lb/in (Torque to 31.5 Nm)	"VPV 25/32" & Type 'G' gear pump
Torque to 200 lb/in (Torque to 22.5 Nm)	Type 'F' gear pump

### Through Drive Horsepower Limitations

The VPV pumps can be coupled with other VPV pumps, Bosch gear pumps or other pumps with standard SAE or metric mounting patterns. (VPV pumps can be coupled without losing use of stroke limiter.) VPV combination pumps are rated to carry the load of an additional pump(s) equal to the maximum load the lead VPV pump can generate (see chart).

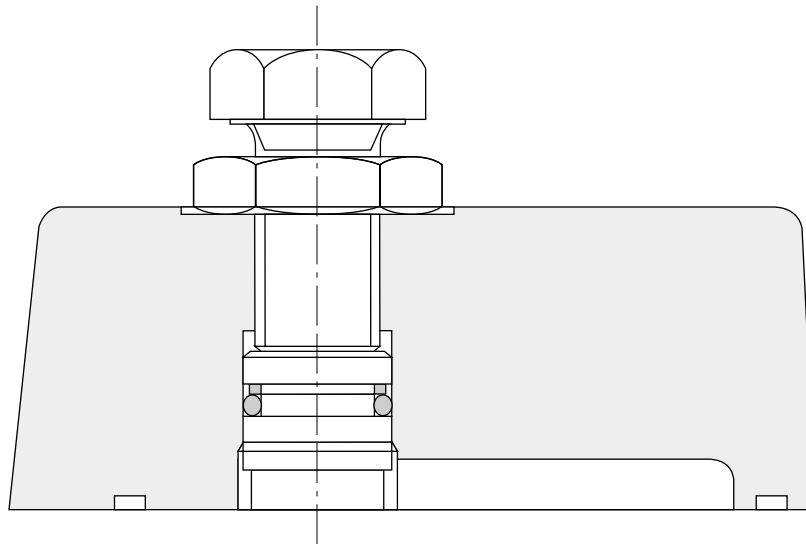
Pump	Flow @ 1750 RPM (gpm)	Maximum Pressure (psig)	Pump #1 Input Horsepower	Maximum Input Power for other pumps
VPV 16	8.03	3000	17.6	17.6
VPV 25	12.6	3000	25.3	25.3
VPV 32	15.4	3000	30.7	30.7
VPV 45	21.8	3000	43.3	43.3
VPV 63	29.6	3000	58.5	58.5
VPV 80	37.2	3000	74.6	74.6
VPV 100	46.2	3000	88.8	88.8
VPV 130	60.0	3000	117.6	117.6
VPV 164	75.8	3000	156.5	156.5

#### EXAMPLES:

VPV 100 @ 3045 psig + VPV 63 @ 3045 psig + VPV 25 @ 3045 psig  
 88.8 hp ≥ 58.5 hp + 23.3 hp

VPV 116 @ 3045 psig + VPV 16 @ 1500 psig + VPV 16 @ 1500 psig  
 17.6 hp ≥ 8.7 hp + 8.7 hp

**VPV Stroke Limiter Adjustment**



Pump Model	Nominal Stroke	Decrease in Flow Per Turn	Minimum Flow Attainable
VPV 16	1.9 mm (0.075")	53%	<0%
VPV 25	2.0 mm (0.080")	50%	0%
VPV 32	2.5 mm (0.099")	40%	20%
VPV 45	1.9 mm (0.077")	80%	<0%
VPV 63	2.7 mm (0.106")	56%	8%
VPV 80	3.4 mm (0.132")	44%	26%
VPV 100	3.0 mm (0.117")	50%	17%
VPV 130	3.8 mm (0.150")	40%	34%
VPV 164	4.7 mm (0.186")	32%	47%

- During initial start-up, volume should be at least 30% of maximum flow.
- Only make adjustments to volume control with pump running at full flow and low pressure while observing output flow.

## 2000 PSI Repair Parts – VPV 16/25/32

REPAIR KITS		
SIZE	SAE	METRIC
16	9 511 230 504	9 511 230 505
25	9 511 230 506	9 511 230 507
32	9 511 230 506	9 511 230 507

SEAL KITS		
SIZE	SAE	METRIC
16	9 511 230 500	9 511 230 500
25	9 511 230 501	9 511 230 501
32	9 511 230 501	9 511 230 501

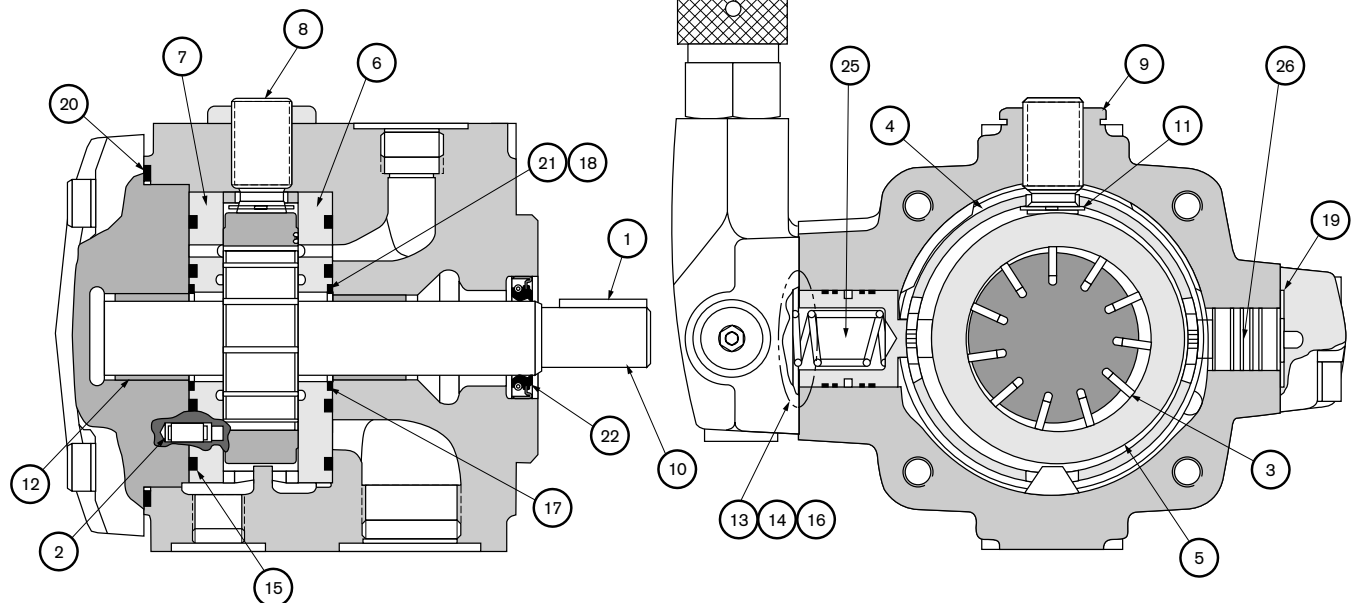
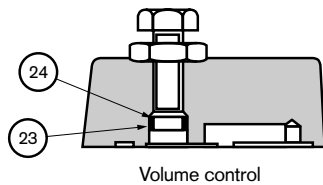
## Repair kits consists of:

REF	DESCRIPTION	QTY
1	Key	1
2	Roll pin	4
3	Vane set	1
4	Spacer ring	1
5	Pressure ring	1
6	Port plate, body	1
7	Port plate, cover	1
8	Thrust screw	1
9	Lock nut	1
10	Shaft	1
11	Retaining ring (VPV 16)	1
12	Bearing	2

## Repair kits consists of:

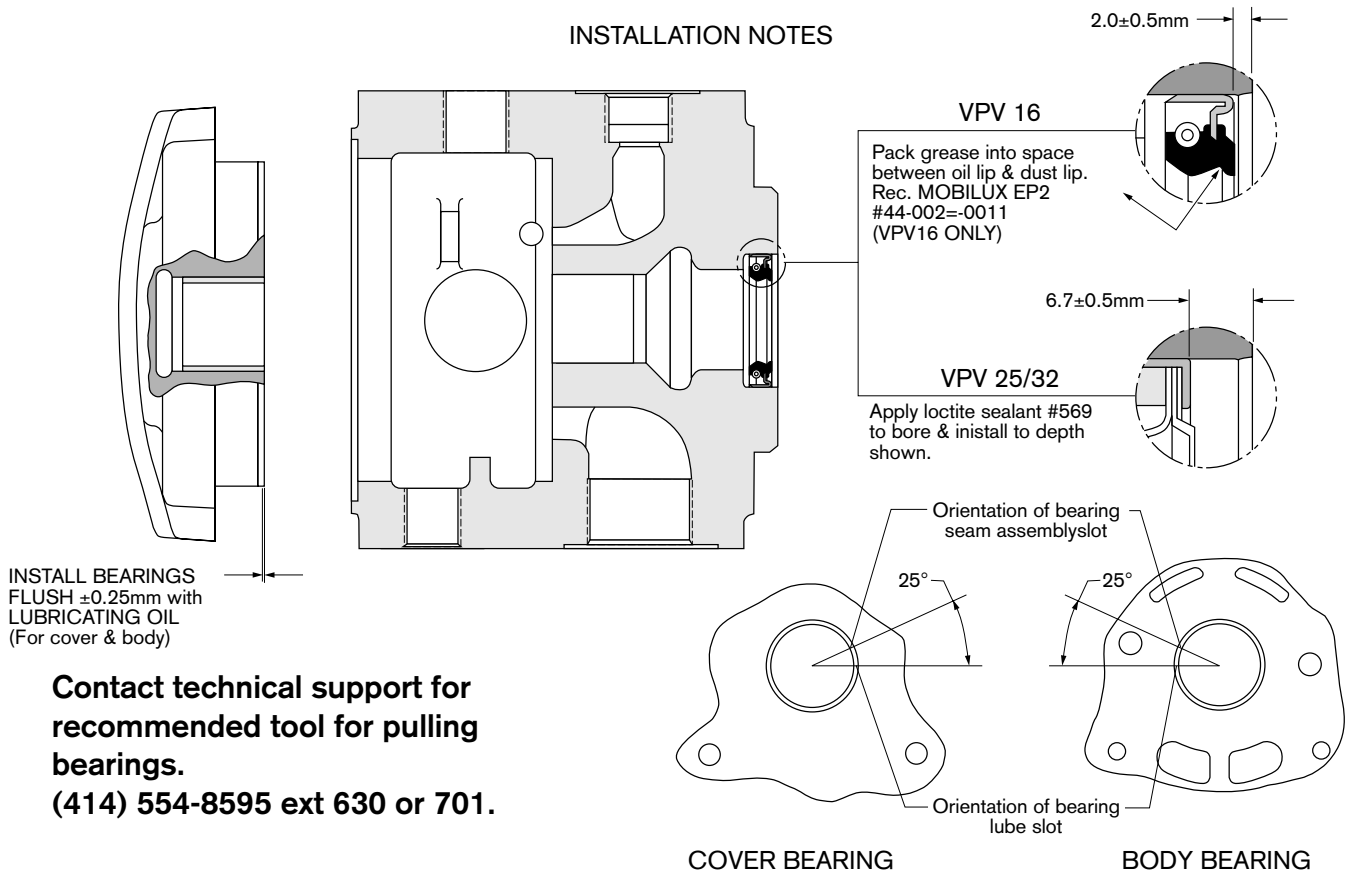
REF	DESC., VPV16/(VPV25/32)	QTY
13	O-ring, ASA-111 / (ASA-111)	1
14	O-ring, ASA-110 / (ASA-110)	1
15	O-ring, ASA-127 / (ASA-136)	2
16	O-ring, ASA-128 / (ASA-128)	1
17	O-ring, ASA-026 / (ASA-028)	2
18	O-ring, ASA-151 / (ASA-152)	2
19	O-ring, ASA-031 / (ASA-031)	1
20	O-ring, ASA-156 / (ASA-160)	1
21	Back up ring	2
22	Shaft seal	1
23	O-ring, ASA-011	1
24	Back up ring	1
25	Control piston	1
26	Bias piston	1

(All O-rings durometer rating = 75)



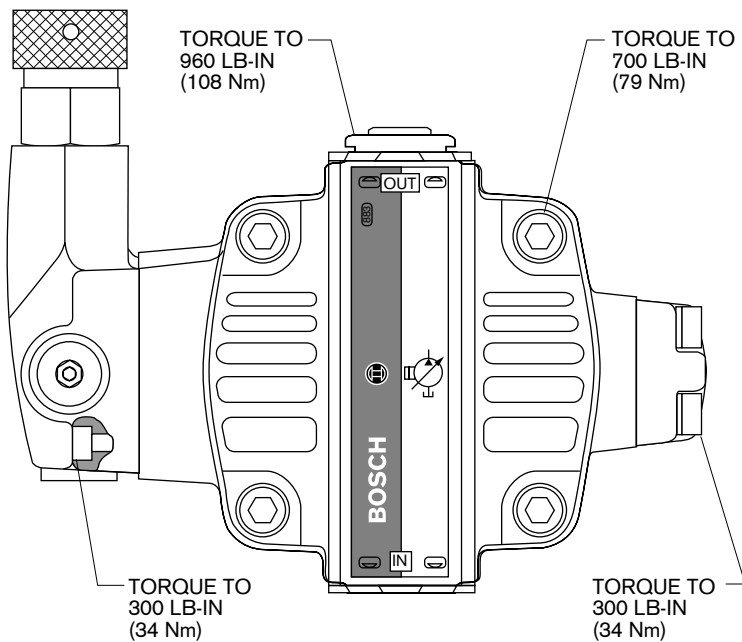
**2000 PSI Repair Parts – VPV 16/25/32**

**INSTALLATION NOTES**



**Contact technical support for recommended tool for pulling bearings.**  
**(414) 554-8595 ext 630 or 701.**

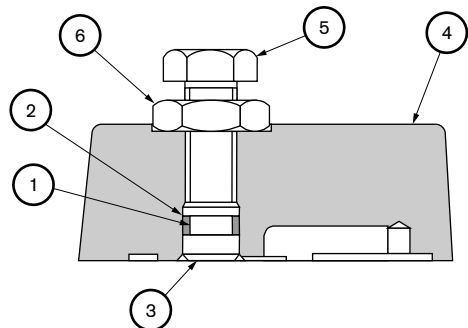
**TORQUE RATINGS**



<b>VOLUME CONTROL ASSEMBLY</b>	
9 537 232 000	

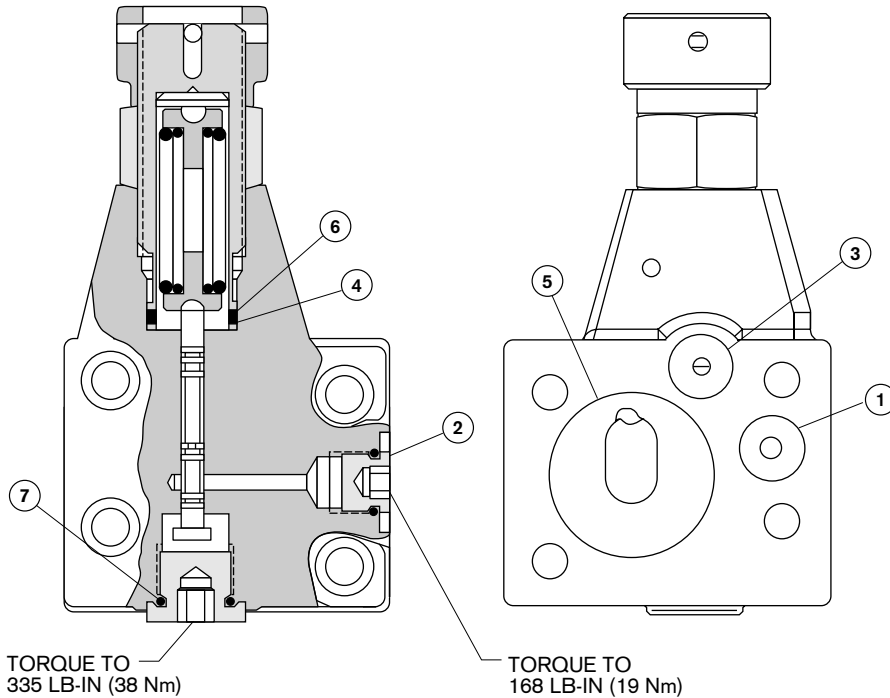
**Assembly consists of:**

REF	DESCRIPTION	QTY
1	O-ring (-011 / 75)	1
2	Back up ring	1
3	Piston	1
4	Body	1
5	Adjusting screw	1
6	Jam nut	1



**2000 PSI Repair Parts – VPV 16/25/32**

**SINGLE STAGE COMPENSATOR**



<b>COMPLETE ASSEMBLY FOR SINGLE STAGE COMPENSATOR</b>	
SAE	9 511 230 513
METRIC	9 511 230 512

<b>REPAIR KIT FOR SINGLE STAGE COMPENSATOR</b>	
SAE	9 511 230 624
METRIC	9 511 230 510

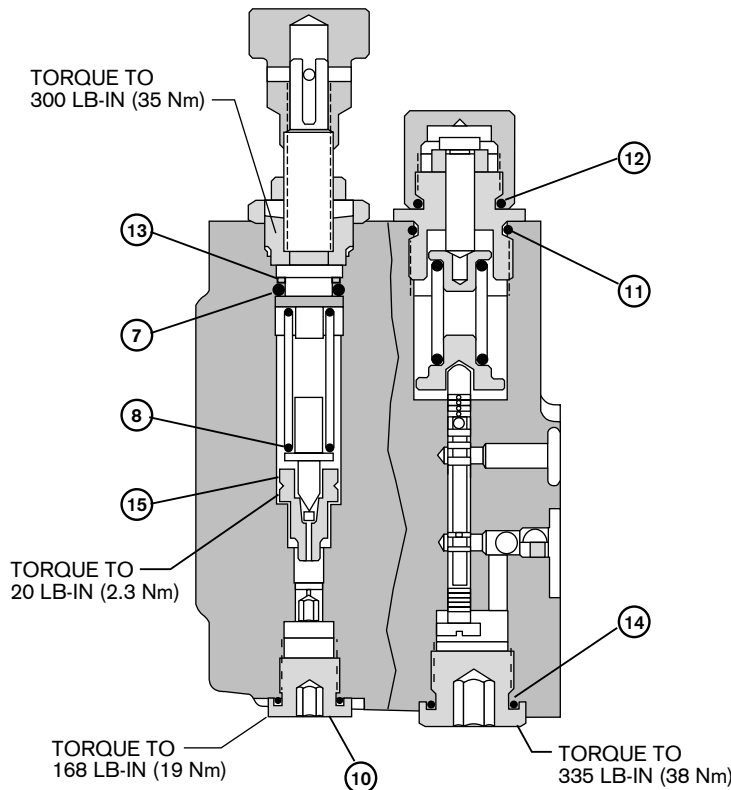
Repair kit consists of:

REF	DESCRIPTION	QTY
1	O-ring (-011 / 75)	1
2	Plug w/ O-ring	1
3	O-ring (-110 / 75)	1
4	O-ring (-018 / 75)	1
5	O-ring (-128 / 75) *	1
6	Back up ring	1
7	O-ring	1

\*=If O-ring is teardrop shape use 9 511 230 511 (SAE)

<b>BOLT KIT FOR MOUNTING SINGLE STAGE TO VPV 16/25/32 (M8 X 1.25 X 25)</b>	
<b>9 539 232 012</b>	

**TWO-STAGE COMPENSATOR**



<b>COMPLETE ASSEMBLY FOR TWO-STAGE COMPENSATOR</b>	
SAE	9 511 230 514
METRIC	9 511 230 515

<b>COMPLETE ASSEMBLY FOR LOAD SENSE</b>	
SAE	9 511 230 600
METRIC	Consult factory

<b>REPAIR KIT FOR TWO-STAGE COMPENSATOR</b>	
SAE	9 511 230 624
METRIC	9 511 230 516

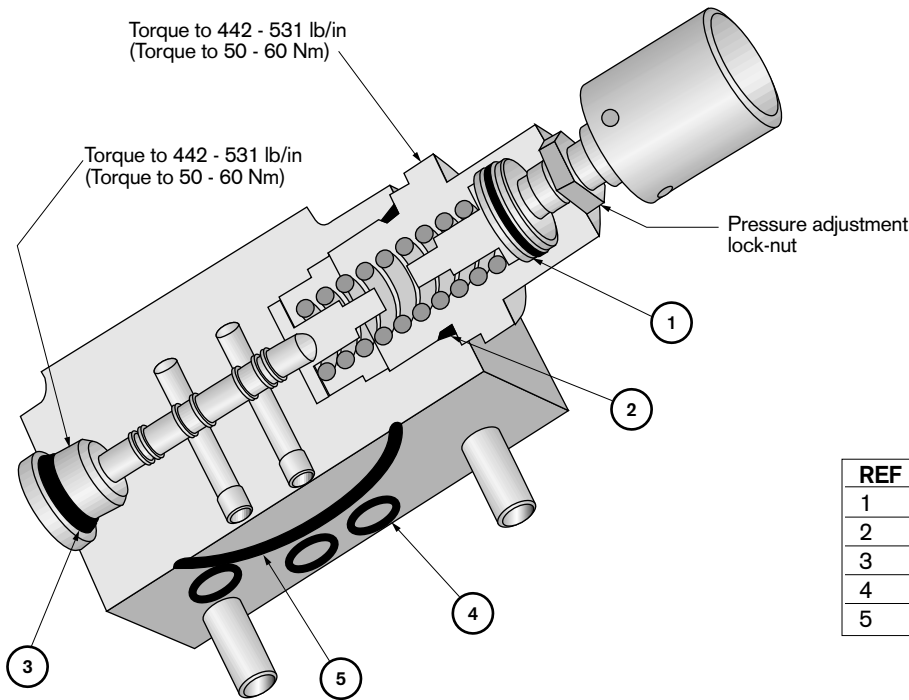
Repair kit consists of:

REF	DESC. (ASA#/durometer)	QTY
1*	O-ring (-111 / 75)	2
2*	Plug w/ O-ring	1
3*	O-ring (-110 / 75)	1
5*	O-ring (-128 / 75)	1
7	O-ring (-111 / 75)	1
8	Poppet second stage	1
10	Plug w/ O-ring	1
11	O-ring (-910 / 75)	1
12	O-ring (-908 / 75)	1
13	Back up ring	1
14	O-ring	1
15	Poppet seat w/ O-ring	1

\*=See above view for location of Ref. #1, 2, 3, 5

<b>BOLT KIT FOR MOUNTING TWO STAGE &amp; SOLENOID COMPENSATORS TO VPV 16/25/32 (M8 X 1.25 X 45)</b>	
<b>9 539 232 013</b>	

**2000 PSI Repair Parts – VPV 45 – 164**



<b>COMPLETE ASSEMBLY FOR SINGLE STAGE COMPENSATOR</b>
9 511 230 548
SAE and METRIC

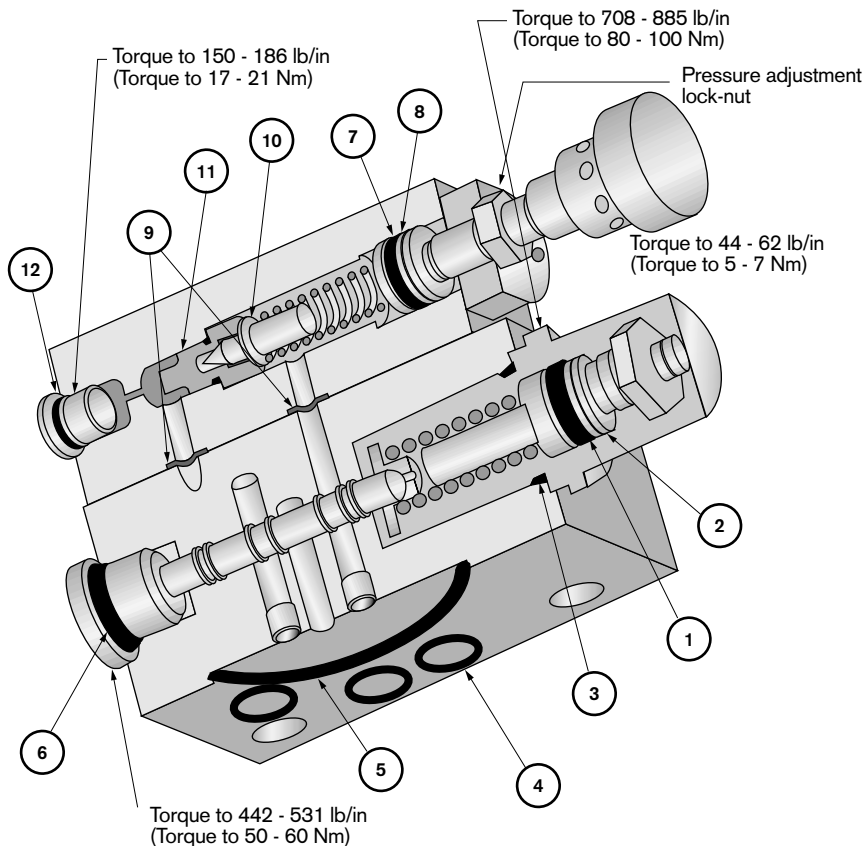
<b>SEAL KIT FOR SINGLE STAGE COMPENSATOR</b>
9 511 230 545
SAE and METRIC

Viton seal kits consist of:

REF	DESCRIPTION	QTY
1	O-ring 19mm i.d. X 2.5mm c.s.	1
2	O-ring ASA-916	1
3	O-ring 15.3mm i.d. X 2.4mm c.s.	1
4	O-ring ASA-111	3
5	O-ring ASA-143	1

**TWO-STAGE COMPENSATOR**

Note:  
Qty of 3, M6 S.H.C.S. not shown.  
Mounts 2nd stage to 1st stage compensator  
Torque to 133 - 177 lb/in  
(Torque to 15 - 20 Nm)



<b>COMPLETE ASSEMBLY FOR TWO-STAGE COMPENSATOR</b>	
SAE	9 511 230 550
METRIC	9 511 230 551

<b>COMPLETE ASSEMBLY FOR LOAD SENSE</b>	
SAE	9 511 230 589
METRIC	9 511 230 588

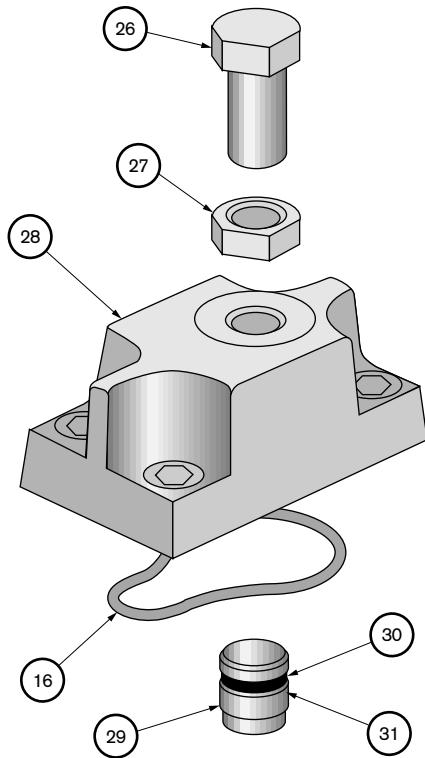
<b>REPAIR KIT FOR TWO-STAGE COMPENSATOR</b>	
SAE	9 511 230 546
METRIC	9 511 230 552

Repair kit consists of:

REF	DESCRIPTION	QTY
1	O-ring ASA-113	1
2	Back up ring	1
3	O-ring	1
4	O-ring ASA-111	3
5	O-ring ASA-143	1
6	O-ring 15.3, i.d. x 2.4mm c.s.	1
7	O-ring ASA-111	1
8	Back up ring	1
9	O-ring ASA-011	2
10	Poppet	1
11	Poppet seat w/ O-ring	1
12	Plug w/ O-ring	1

<b>BOLT KIT FOR MOUNTING TWO STAGE &amp; SOLENOID COMPENSATORS TO VPV 45/164 (M10 X 1.5 X 40)</b>
9 539 232 014

## 2000 PSI Repair Parts – VPV 45 – 164



## VOLUME CONTROL ASSEMBLY

9 537 232 002

## Repair kits consists of:

REF	DESCRIPTION	QTY
16	O-ring, ASA-146	1
26	Adjusting screw	1
27	Jam nut	1
28	Body	1
29	Piston	1
30	Back up ring	1
31	O-ring, ASA-113	1

REPAIR KITS				
SIZE	SAE	METRIC	SAE "P1"	METRIC "P1"
45	9 511 230 559	9 511 230 564	9 511 230 576	9 511 230 579
63	9 511 230 562	9 511 230 566	9 511 230 577	9 511 230 580
80	9 511 230 563	9 511 230 567	9 511 230 578	9 511 230 581
100	9 511 230 568	9 511 230 573	9 511 230 582	9 511 230 585
130	9 511 230 571	9 511 230 574	9 511 230 583	9 511 230 586
164	9 511 230 572	9 511 230 575	9 511 230 584	9 511 230 587

SEAL KITS	
SIZE	PART NUMBER
45-80	9 511 230 544
100-164	9 511 230 547

## Repair kits consists of:

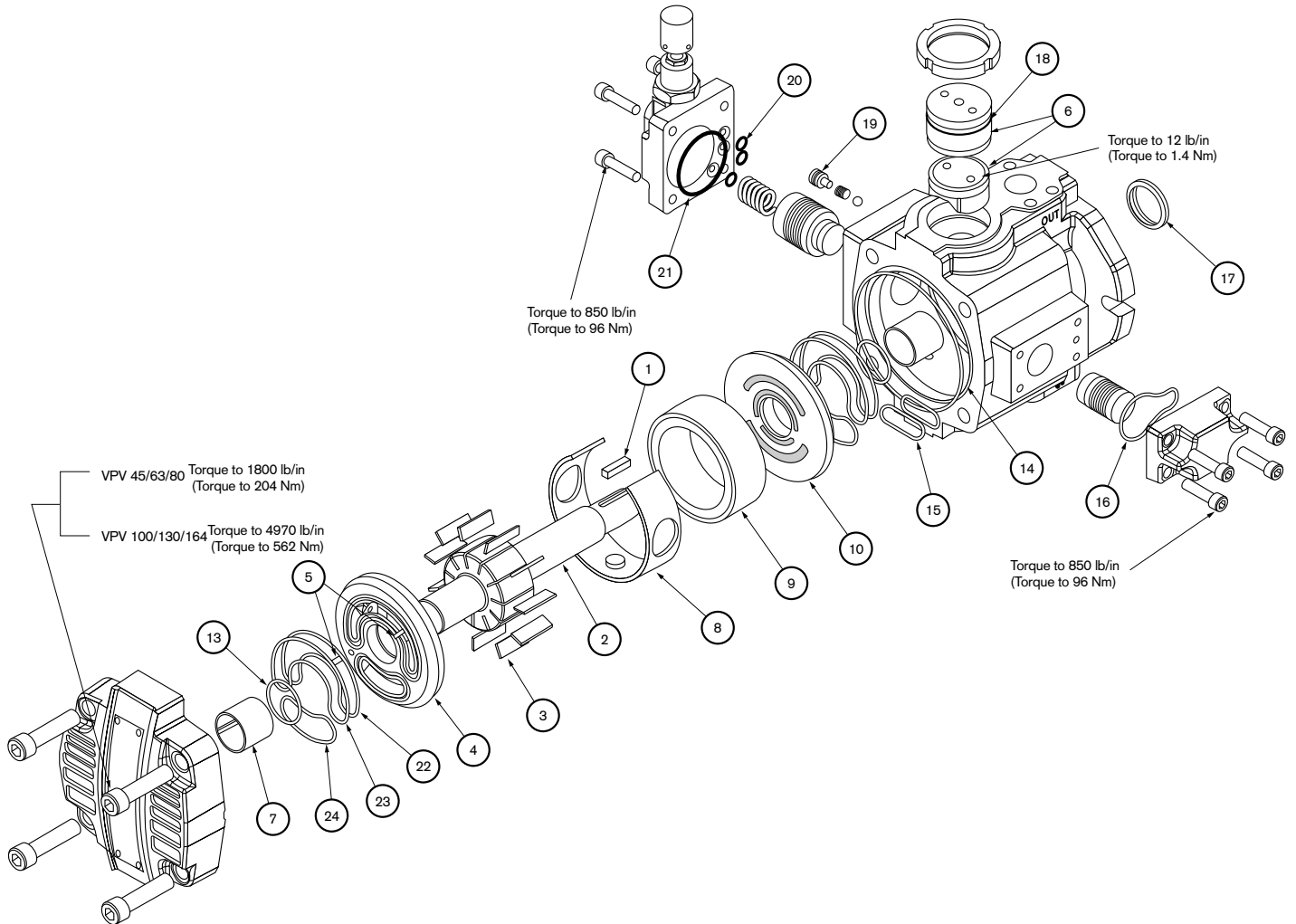
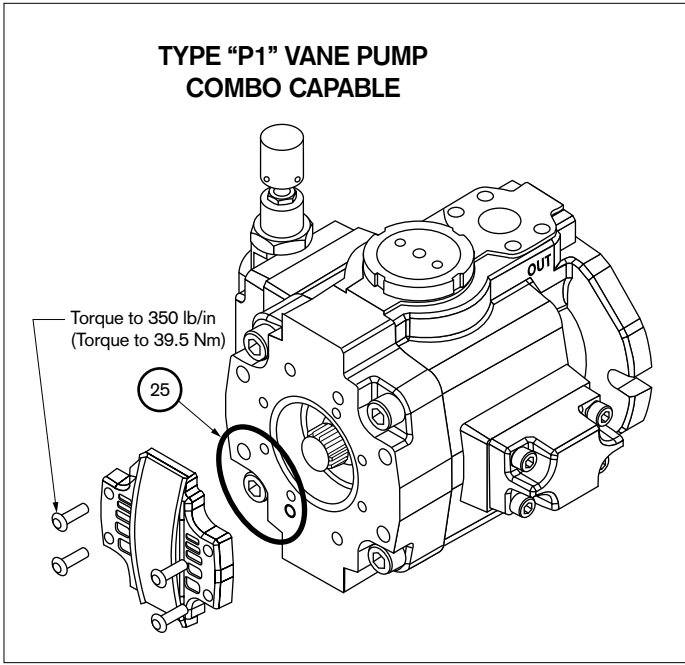
REF	DESCRIPTION	QTY
1	Key	1
2	Rotor shaft	1
3	Vane kit	1
4	Port plate, cover side	1
5	Roll pin	4
6	Thrust block kit	1
7	Bearing	2
8	Spacer ring	1
9	Pressure ring	1
10	Port plate, body side	1

## Viton seal kits consist of:

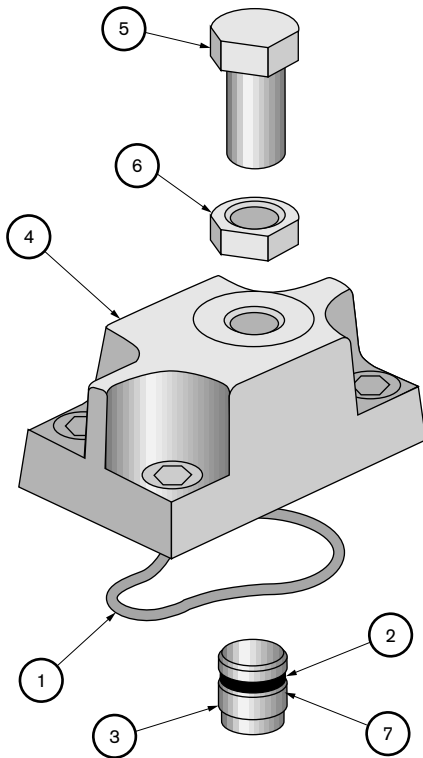
REF	DESC., VPV45/80/(VPV100/164)	QTY
13	O-ring, ASA-031 / (ASA-035)	2
14	O-ring, ASA-162 / (ASA-265)	1
15	O-ring, ASA-130 / (ASA-229)	1
16	O-ring, ASA-146 / (ASA-146)	1
17	Shaft seal	1
18	O-ring, ASA-229 / (ASA-237)	1
19	O-ring, ASA-110 / (ASA-110)	1
20	O-ring, ASA-111 / (ASA-111)	3
21	O-ring, ASA-143 / (ASA-143)	1
22	O-ring, ASA-157 / (ASA-160)	2
23	Back up ring	2
24	O-ring, ASA-139 / (ASA-152)	2
24	O-ring, ASA-043 / (ASA-043)	1

(All o-rings durmoeter rating = 75)

**2000 PSI Cutaway – VPV 45 – 164**



**3000 PSI Repair Parts – VPV 16/25/32**



**VOLUME CONTROL ASSEMBLY**  
9 537 232 004

Repair kits consists of:

REF	DESCRIPTION	QTY
1	O-ring, (-011/75)	1
2	Back up ring	1
3	Piston	1
4	Body	1
5	Adjusting screw	1
6	Jam nut	1
7	O-Ring ASA-113	1

REPAIR KITS				
SIZE	SAE	METRIC	SAE "P1"	METRIC "P1"
16	9 511 230 606	9 511 230 607	9 511 230 608	9 511 230 609
25	9 511 230 598	9 511 230 599	9 511 230 623	9 511 230 622
32	9 511 230 598	9 511 230 599	9 511 230 623	9 511 230 622

SEAL KITS		
SIZE	SAE	METRIC
16	9 511 230 605	9 511 230 605
25/32	9 511 230 558	9 511 230 597

Repair kits consists of:

DESCRIPTION	QTY
Key	1
Rotor shaft	1
Vane kit	1
Port plate, cover side	1
Roll pin	4
Thrust block kit	1
Bearing	2
Spacer ring	1
Pressure ring	1
Port plate, body side	1

Viton seal kits consist of:

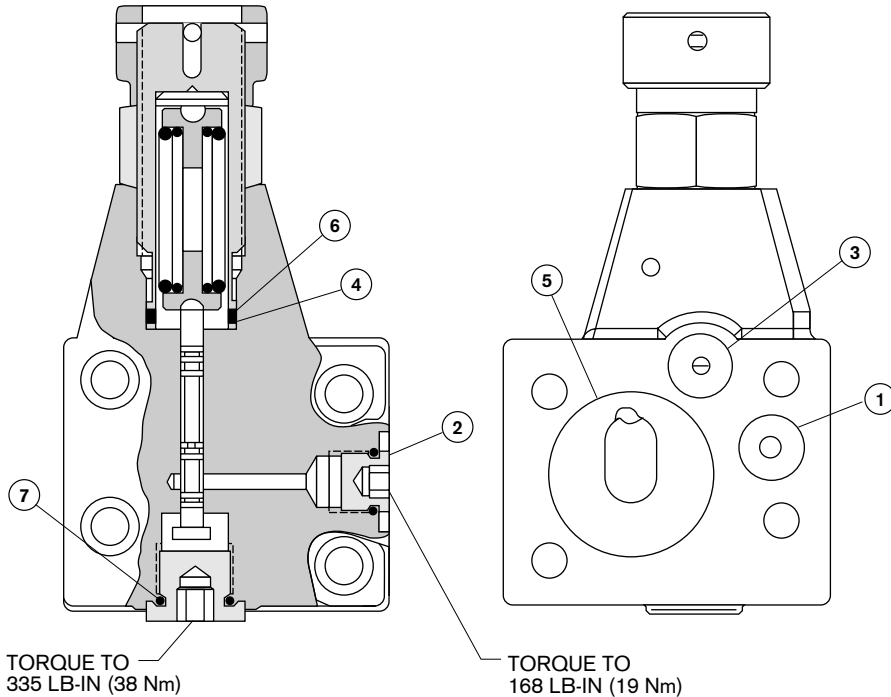
Desc., VPV16/(VPV25/32)	QTY
O-ring, ASA-111 / (ASA-111)	1
O-ring, ASA-110 / (ASA-110)	1
O-ring, ASA-127 / (ASA-136)	2
O-ring, ASA-128 / (ASA-128)	1
O-ring, ASA-026 / (ASA-028)	2
O-ring, ASA-151 / (ASA-152)	2
O-ring, ASA-031 / (ASA-031)	1
O-ring, ASA-156 / (ASA-160)	1
Back up ring	2
Shaft seal	1
O-ring, ASA-011	1
Back up ring	1
Control piston	1
Bias piston	1

(All o-rings durmoeter rating = 75)

**3000 PSI Repair Parts – VPV 16/25/32**

**ATTENTION:** These compensators are rated for 210 bar (3000 psi) operation. Install only on pumps rated at 210 bar (3000 psi). Activating shock clipper is highly recommended on all applications greater than 140 bar (2000 psi). Install unrestricted line back to tank.

**SINGLE STAGE COMPENSATOR**



<b>COMPLETE ASSEMBLY FOR SINGLE STAGE COMPENSATOR</b>	
SAE	9 511 230 595
METRIC	9 511 230 596

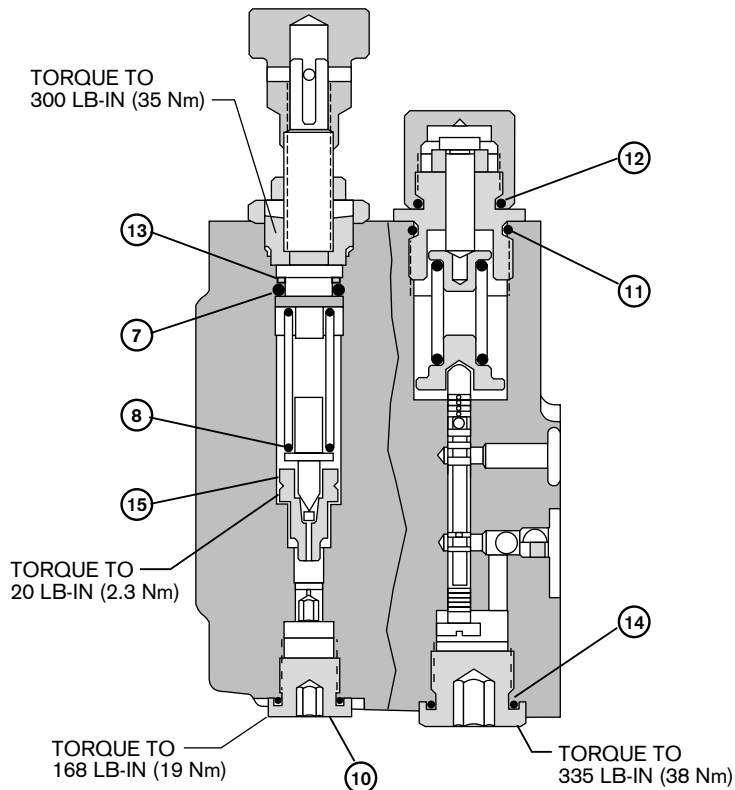
<b>REPAIR KIT FOR SINGLE STAGE COMPENSATOR</b>	
SAE	9 511 230 625
METRIC	9 511 230 626

Repair kit consists of:

REF	DESCRIPTION	QTY
1	O-ring (-011 / 75)	1
2	Plug w/ O-ring	1
3	O-ring (-110 / 75)	1
4	O-ring (-018 / 75)	1
5	O-ring (-128 / 75)	1
6	Back up ring	1
7	O-ring	1

<b>BOLT KIT FOR MOUNTING SINGLE STAGE TO VPV 16/25/32 (M8 X 1.25 X 25)</b>	
9 539 232 012	

**TWO-STAGE COMPENSATOR**



<b>COMPLETE ASSEMBLY FOR TWO-STAGE COMPENSATOR</b>	
SAE	9 511 230 601
METRIC	9 511 230 602

<b>COMPLETE ASSEMBLY FOR LOAD SENSE</b>	
SAE	9 511 230 603
METRIC	9 511 230 604

<b>REPAIR KIT FOR TWO-STAGE COMPENSATOR</b>	
SAE	9 511 230 627
METRIC	9 511 230 628

Repair kit consists of:

REF	DESC. (ASA#/durometer)	QTY
1*	O-ring (-111 / 75)	2
2*	Plug w/ O-ring	1
3*	O-ring (-110 / 75)	1
5*	O-ring (-128 / 75)	1
7	O-ring (-111 / 75)	1
8	Poppet second stage	1
10	Plug w/ O-ring	1
11	O-ring (-910 / 75)	1
12	O-ring (-908 / 75)	1
13	Back up ring	1
14	O-ring	1
15	Poppet seat w/ O-ring	1

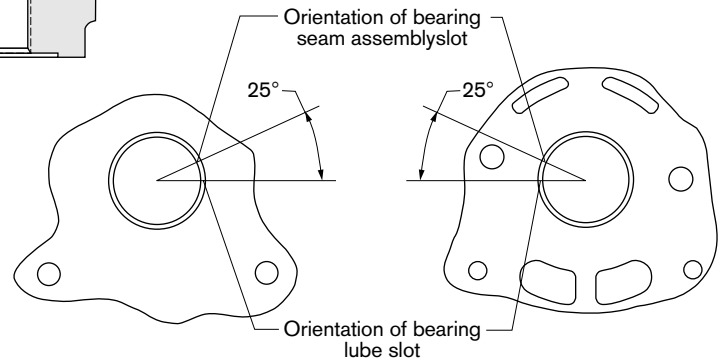
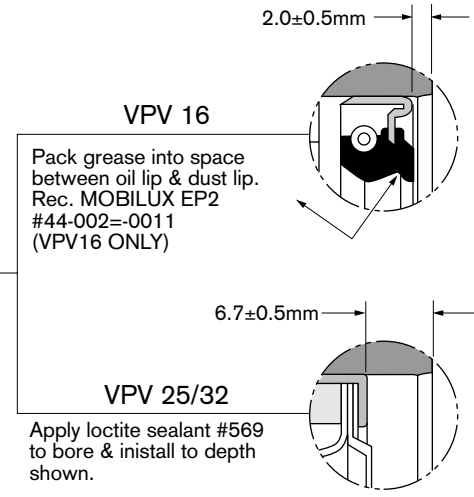
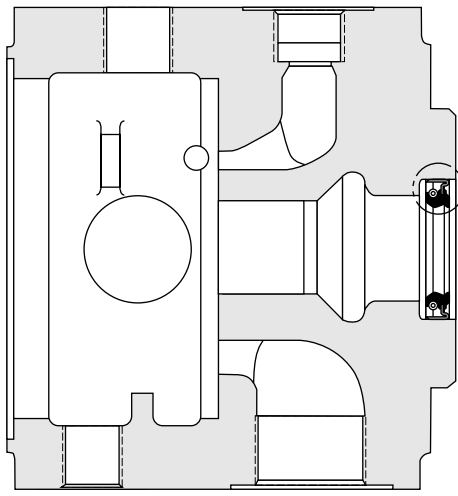
\*=See above view for location of Ref. #1, 2, 3,5

<b>BOLT KIT FOR MOUNTING TWO STAGE &amp; SOLENOID COMPENSATORS TO VPV 16/25/32 (M8 X 1.25 X 45)</b>	
9 539 232 013	

**3000 PSI Repair Parts – VPV 16/25/32**

**INSTALLATION NOTES**

INSTALL BEARINGS  
FLUSH  $\pm 0.25\text{mm}$  with  
LUBRICATING OIL  
(For cover & body)

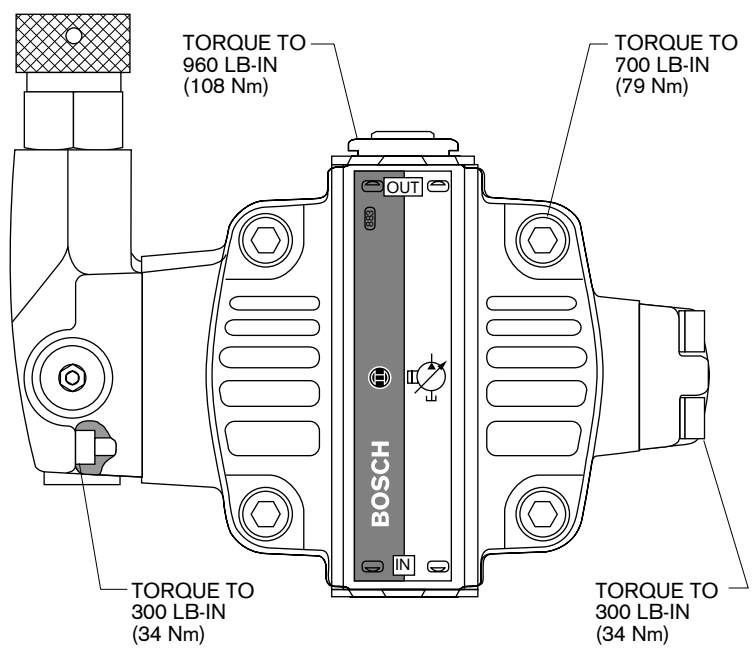


COVER BEARING

BODY BEARING

Contact technical support for recommended tool for pulling bearings.  
(414) 554-8595 ext 630 or 701.

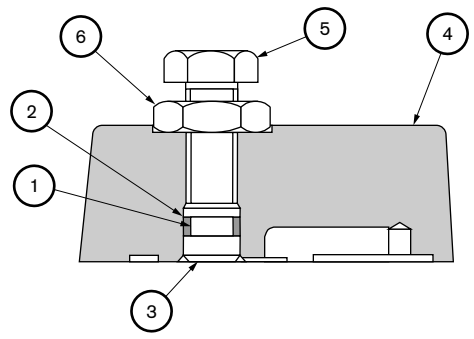
**TORQUE RATINGS**



**VOLUME CONTROL ASSEMBLY**  
9 537 232 000

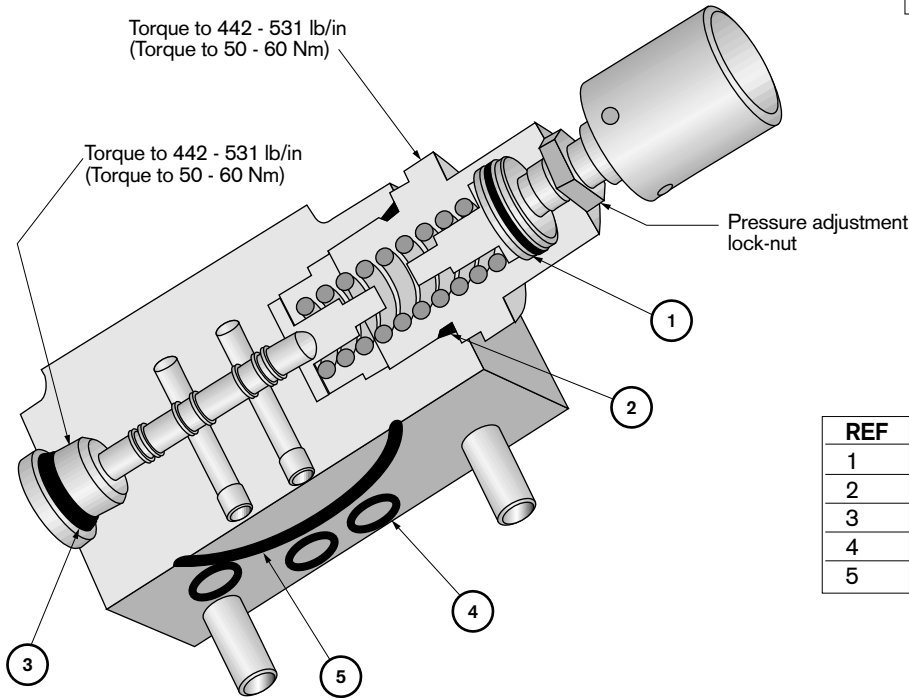
Assembly consists of:

REF	DESCRIPTION	QTY
1	O-ring (-011 / 75)	1
2	Back up ring	1
3	Piston	1
4	Body	1
5	Adjusting screw	1
6	Jam nut	1



**3000 PSI Repair Parts – VPV 45 – 164**

**ATTENTION:** These compensators are rated for 210 bar (3000 psi) operation. Install only on pumps rated at 210 bar (3000 psi).



**COMPLETE ASSEMBLY FOR SINGLE STAGE COMPENSATOR**  
Consult factory.

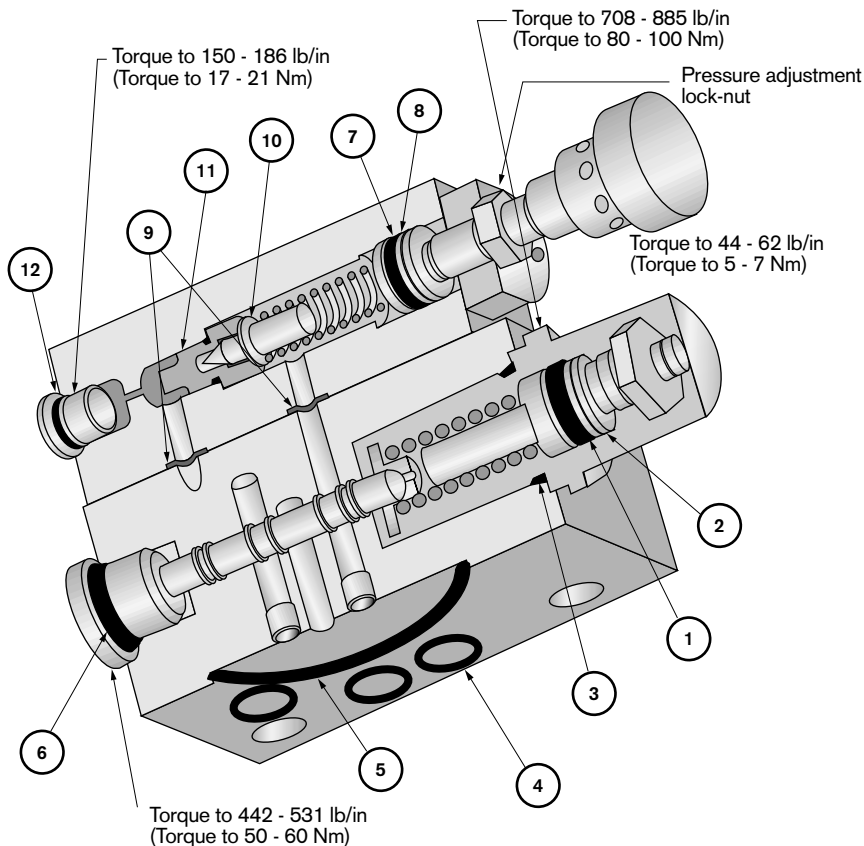
**SEAL KIT FOR SINGLE STAGE COMPENSATOR**  
Consult factory.

Viton seal kits consist of:

REF	DESCRIPTION	QTY
1	O-ring 19mm i.d. X 2.5mm c.s.	1
2	O-ring ASA-916	1
3	O-ring 15.3mm i.d. X 2.4mm c.s.	1
4	O-ring ASA-111	3
5	O-ring ASA-143	1

**TWO-STAGE COMPENSATOR**

Note:  
Qty of 3, M6 S.H.C.S. not shown.  
Mounts 2nd stage to 1st stage compensator  
Torque to 133 - 177 lb/in  
(Torque to 15 - 20 Nm.)



**COMPLETE ASSEMBLY FOR TWO STAGE COMPENSATOR**

SAE	9 511 230 610
METRIC	9 511 230 611

**COMPLETE ASSEMBLY FOR LOAD SENSE**

SAE	9 511 230 612
METRIC	9 511 230 613

**REPAIR KIT FOR TWO-STAGE COMPENSATOR**

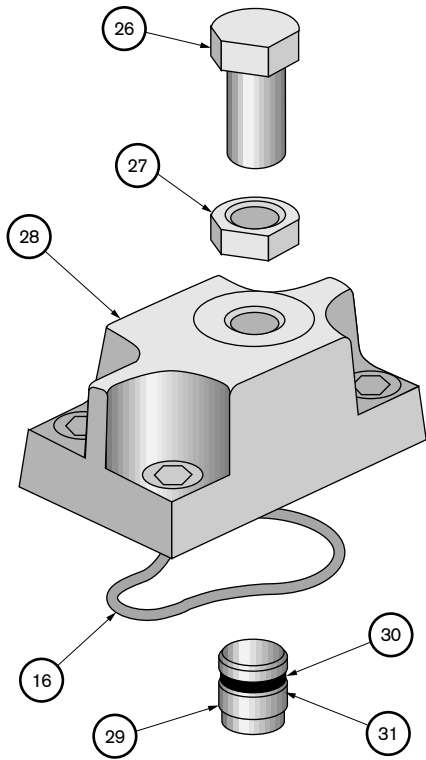
SAE	9 511 230 660
METRIC	9 511 230 661

Repair kit consists of:

REF	DESCRIPTION	QTY
1	O-ring ASA-113	1
2	Back up ring	1
3	O-ring	1
4	O-ring ASA-111	3
5	O-ring ASA-143	1
6	O-ring 15.3, i.d. x 2.4mm c.s.	1
7	O-ring ASA-111	1
8	Back up ring	1
9	O-ring ASA-011	2
10	Poppet	1
11	Poppet seat w/ O-ring	1
12	Plug w/ O-ring	1

**BOLT KIT FOR MOUNTING TWO STAGE & SOLENOID COMPENSATORS TO VPV 45/164 (M10 X 1.5 X 40)**  
9 539 232 014

**3000 PSI Repair Parts – VPV 45 – 164**



**VOLUME CONTROL ASSEMBLY**  
9 537 232 005

Repair kits consists of:

REF	DESCRIPTION	QTY
16	O-ring, ASA-146	1
26	Adjusting screw	1
27	Jam nut	1
28	Body	1
29	Piston	1
30	Back up ring	1
31	O-ring, ASA-113	1

REPAIR KITS				
SIZE	SAE	METRIC	SAE "P1"	METRIC "P1"
45	9 511 230 639	9 511 230 644	9 511 230 642	9 511 230 646
63	9 511 230 639	9 511 230 644	9 511 230 642	9 511 230 646
80	9 511 230 641	9 511 230 645	9 511 230 643	9 511 230 647
100	9 511 230 650	9 511 230 654	9 511 230 652	9 511 230 656
130	9 511 230 650	9 511 230 654	9 511 230 652	9 511 230 656
164	9 511 230 651	9 511 230 655	9 511 230 653	9 511 230 657

SEAL KITS		
SIZE	SAE	METRIC
45-80	9 511 230 658	9 511 230 658
100-164	9 511 230 659	9 511 230 659

Repair kits consists of:

REF	DESCRIPTION	QTY
1	Key	1
2	Rotor shaft	1
3	Vane kit	1
4	Port plate, cover side	1
5	Roll pin	4
6	Thrust block kit	1
7	Bearing	2
8	Spacer ring	1
9	Pressure ring	1
10	Port plate, body side	1

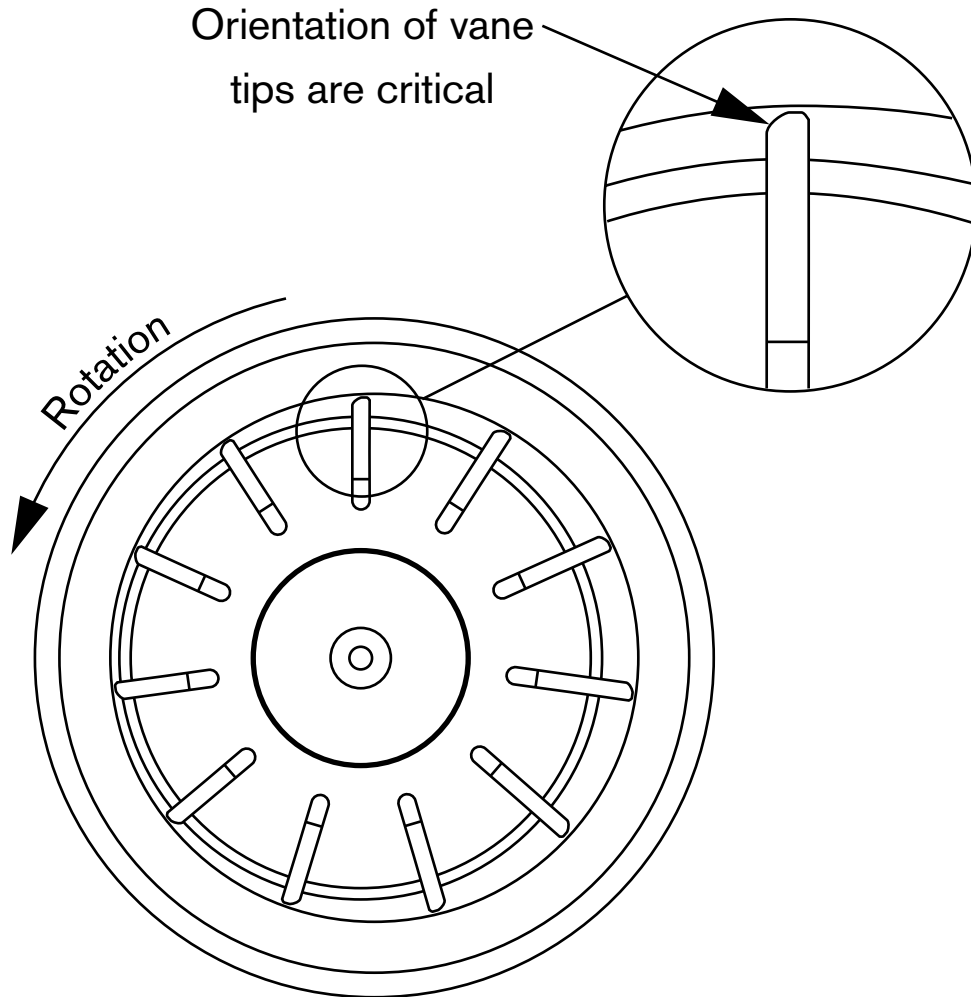
Viton seal kits consist of:

REF	DESC., VPV45/80/(VPV100/164)	QTY
13	O-ring, ASA-031 / (ASA-035)	2
14	O-ring, ASA-162 / (ASA-265)	1
15	O-ring, ASA-130 / (ASA-229)	1
16	O-ring, ASA-146 / (ASA-146)	1
17	Shaft seal	1
18	O-ring, ASA-229 / (ASA-237)	1
19	O-ring, ASA-110 / (ASA-110)	1
20	O-ring, ASA-111 / (ASA-111)	3
21	O-ring, ASA-143 / (ASA-143)	1
22	O-ring, ASA-157 / (ASA-160)	2
23	Back up ring	2
24	O-ring, ASA-139 / (ASA-152)	2
24	O-ring, ASA-043 / (ASA-043)	1

(All o-rings durmoeter rating = 75)

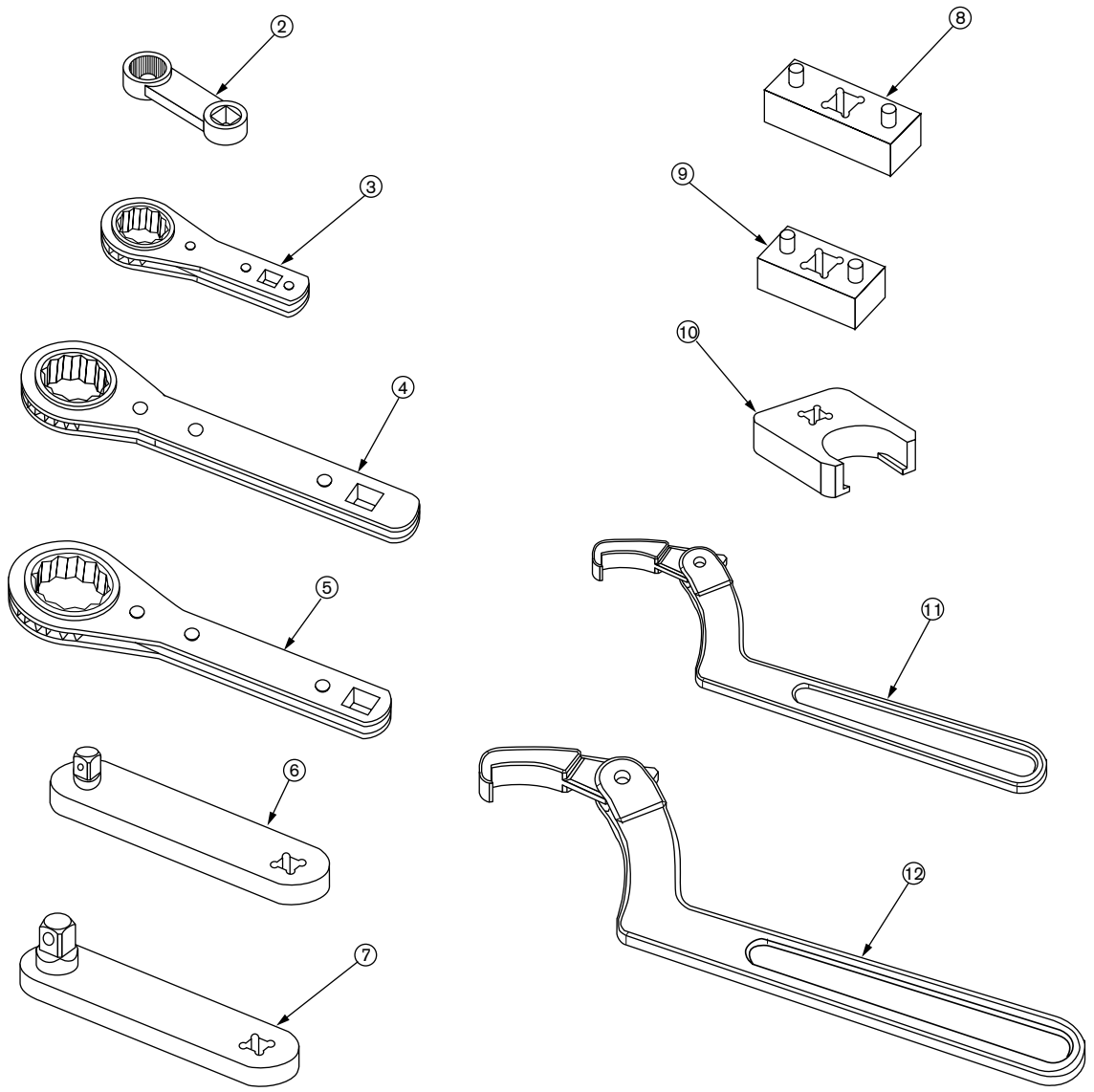
Vane Tip Orientation

Orient vanes as shown when servicing VPV Whisper™ Pumps.



Looking into pump body  
from cover side

**VPV Tool Kit**

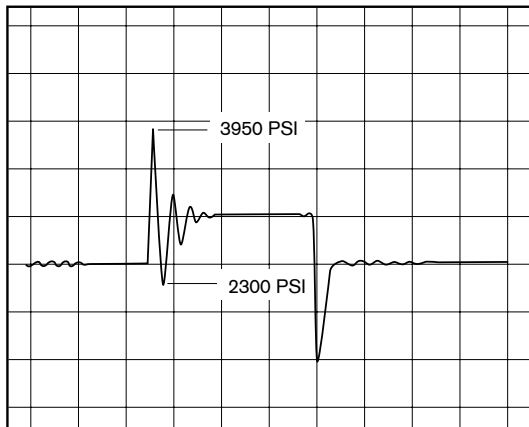
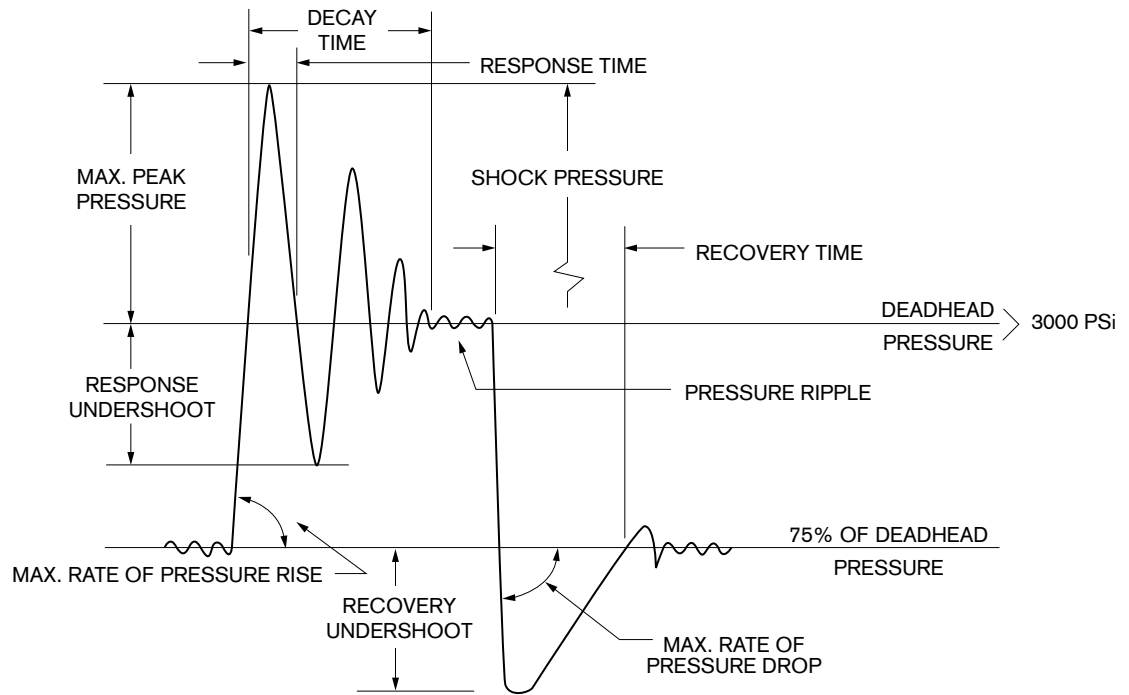


**VPV tool kit consists of:**

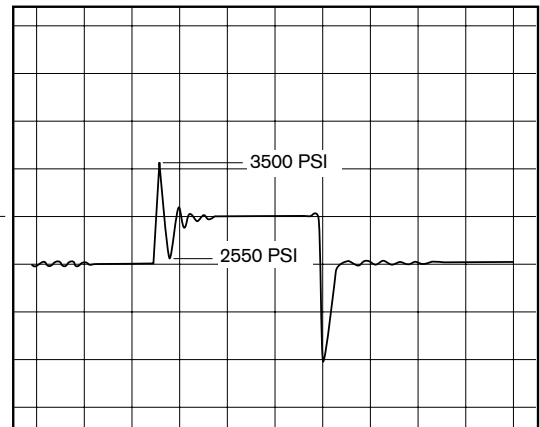
**VPV tool kit**  
9 511 230 557

ITEM #	DESCRIPTION
1	Wrench adapter, 13mm
2	Wrench adapter, 17mm
3	Wrench adapter, 19mm, VPV25/32
4	Wrench adapter 24mm, VPV45/63/80
5	Wrench adapter, 30mm, VPV100/130/164
6	Extension bar, 3/8" socket
7	Extension bar, 1/2" socket
8	Spanner socket, VPV100/130/164
9	Spanner socket, VPV45/63/80
10	Crowfoot, VPV16/25/32, locknut
11	Spanner wrench, VPV45/63/80
12	Spanner wrench, VPV100/130/164

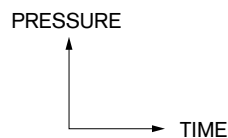
**Reaction Characteristics and Shock Clipper Function**



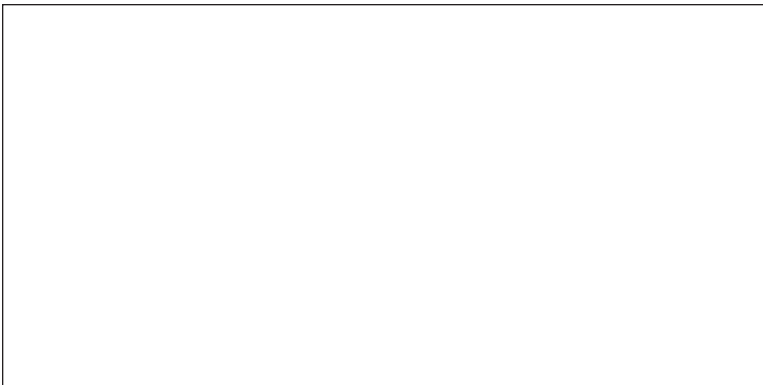
VPV 16, Single stage compensator, plot with shock clipper inactive. (Response overshoot of 950 PSI, response undershoot of 700 PSI)



VPV 16, Single stage compensator, plot with shock clipper active. (Response overshoot of 500 PSI, response undershoot of 450 PSI)



**For More Information, Contact Your Local Distributor:**



Visit us on the World Wide Web at <http://www.boschat.com>

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