



**Bulletin HY14-2102-M1/US**  
**Assembly/Adjustment Guide**

**Series VP/VPO**  
**Proportional Valves**

Effective: September 1, 2002  
Supersedes: Cat. No. PMF 1005 dated 5/97

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**Pulsar™**  
**Stackable Valves**





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## Introduction

"Pulsar™ VP/VPO Series Valve Assembly and Adjustment Instructions" is furnished to assist in the process of taking this product line from the shelf to the customer. Primarily this process consists of stacking the valve, installing the selected options and making final adjustments. Ample page margin is provided for related notes.

Parker recommends performing these procedures in the order presented. Assembly drawings for the VP/VPO Series working segments and the VB Series pressure compensated inlet are included for reference.

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As in any assembly procedure, it is beneficial to anticipate the final needs of the included segments and valve stack to avoid unnecessary steps.

Additional useful assembly tools/supplies:

- O-ring pick
- pencil magnet
- 10-inch (25 cm) plastic rod
- snap-ring tool
- torque wrench, 100 foot-pounds (135 Nm)
- manual override subassembly, VPH6K1
- clean, light-weight hydraulic oil

# VALVE STACK ASSEMBLY

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## General

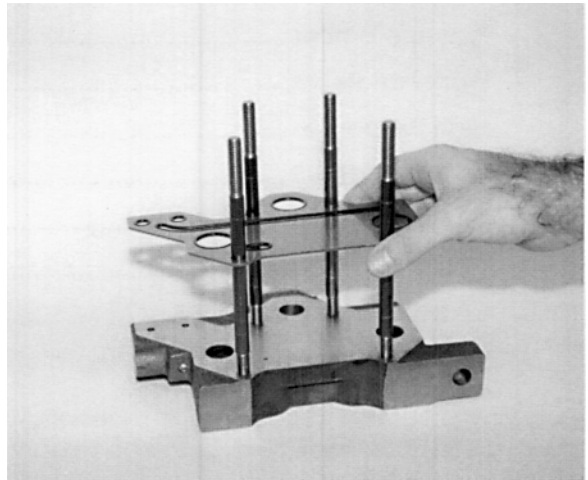
1. Assembly of a VP/VPO Series valve stack requires the following parts or kits:
  - one (1) inlet segment
  - one (1) stacking plate
  - correct number of working segments and accompanying spool kits
  - assembly kit for the appropriate number of segments
2. Have on hand:
  - clean, flat work area
  - one (1) manual override handle sub-assembly (VPH6K1)
  - clean, light-weight hydraulic oil
  - 100 ft-lb (135 Nm) torque wrench

## Assembly Procedure

### Inlet

1. Lay the inlet down to install tie rods vertically into the section. Hand tighten until each bottoms out in the threaded hole.
2. Open one seal plate kit and verify the included parts: one (1) shuttle ball and one (1) seal plate.
3. Be sure the surface of the inlet section and seal plate are clean and free of any foreign material. Place the seal plate over tie rods and onto the inlet.

**IMPORTANT!! Do not install shuttle ball between the inlet and first working segment!**



### Working Segment

4. Prepare for installation of working segments by verifying all mating surfaces are clean and free of foreign material. Slide the segment over the tie rods taking care not to allow the tie rods to damage the surface of the segment. Open the next seal plate kit and again inspect for correct parts. Install as in previous Step 3.

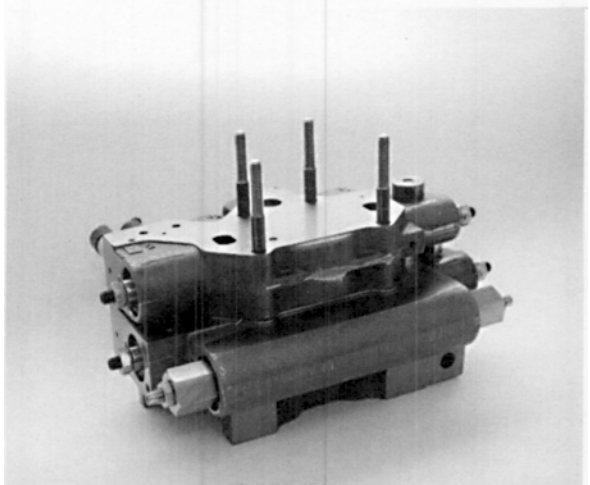
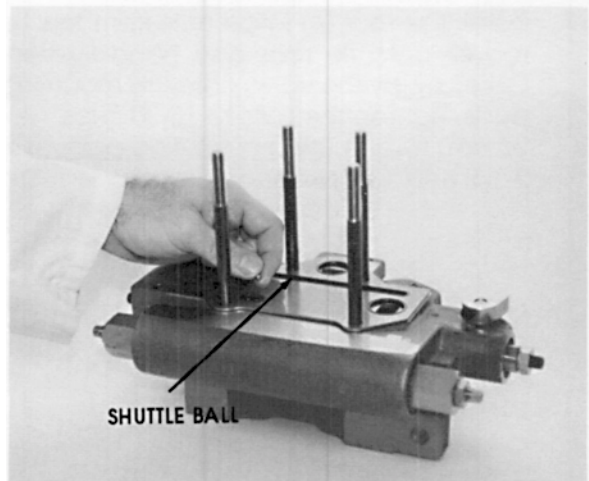
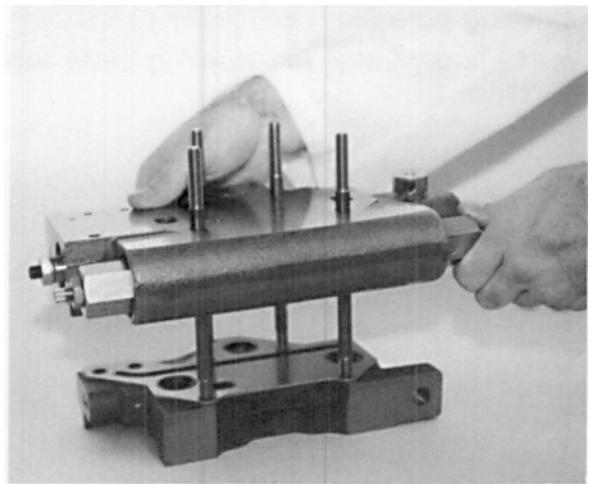
**IMPORTANT!! Shuttle ball is installed if:  
Another work segment is NEXT to be installed,**

**-OR-**

**the stacking plate section to follow is machined with a load sensing seat and sensing port for use with downstream load sensing logic.\***

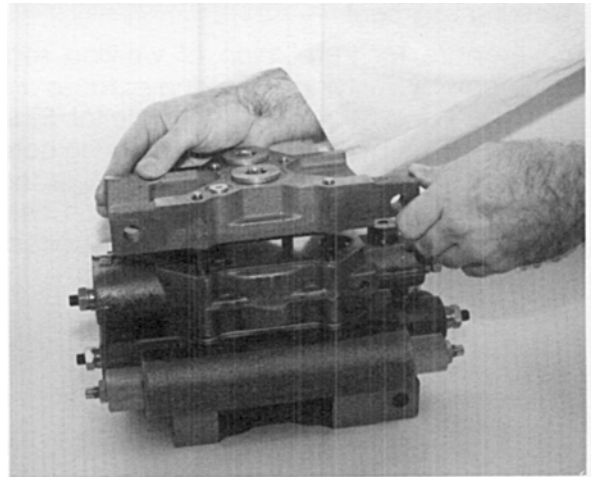
5. Repeat Steps 3 and 4 for additional spool sections.

*\*Shuttle balls ARE installed **between all** working segments, OR between the last working segment and stacking plate **only** if load sensing is to be relayed from downstream valves.*

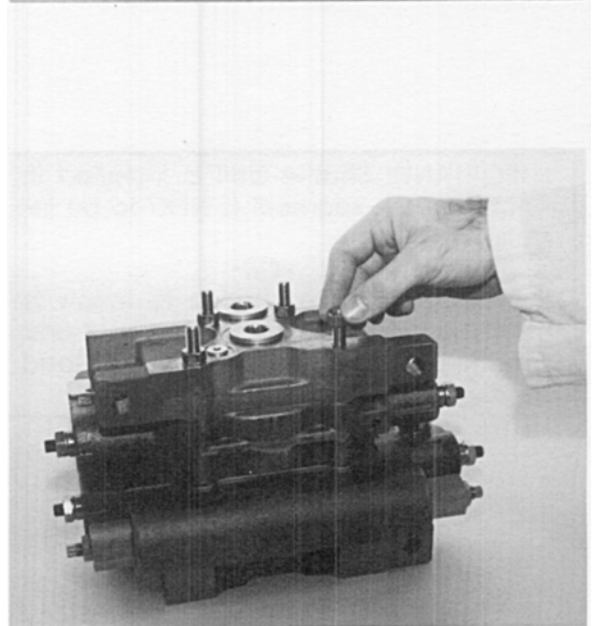


### Stacking Plate

6. Carefully install the stacking plate segment.

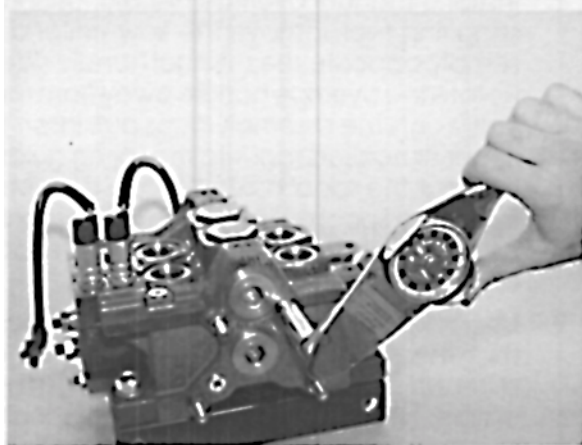
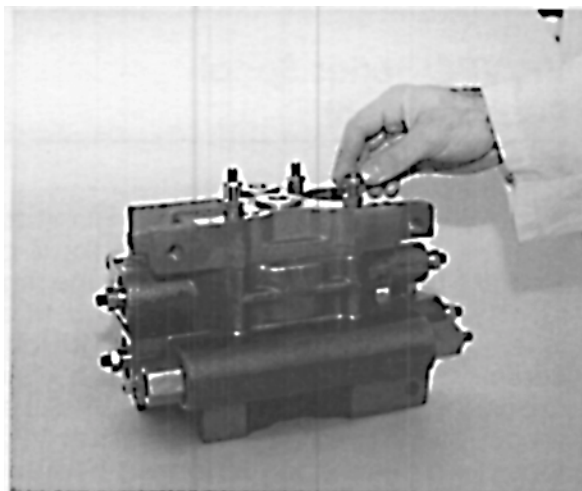


7. Install the four (4) large nuts from the tie rod kit onto tie rods and hand tighten. Carefully lay the valve onto the mounting pads. Tighten the nuts to 15-20 ft-lbs. (20-27 Nm) torque using a crossing pattern in 2-1/2 ft-lb. (3.4 Nm) increments.



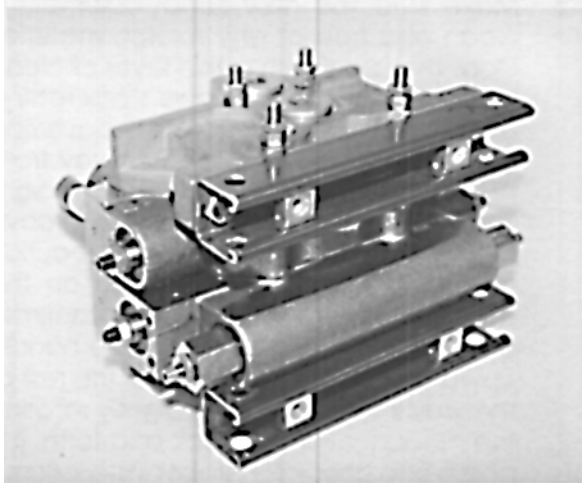


8. Install all four (4) small nuts onto tie rods and tighten to 15-20 (20-27 Nm) ft-lbs. torque using any pattern.



9. Install manual handle and shift each spool. Check that each spool operates freely to full "on" in both directions and returns to neutral with spring force only.

**Note:** Stacks that include the VPO style body may utilize the VPO Mounting Spacer kit, No. VPOMK1, to accommodate this taller segment.



## SEGMENT ALTERATIONS

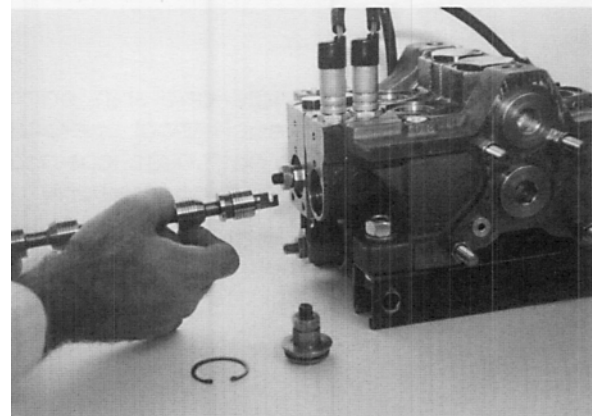
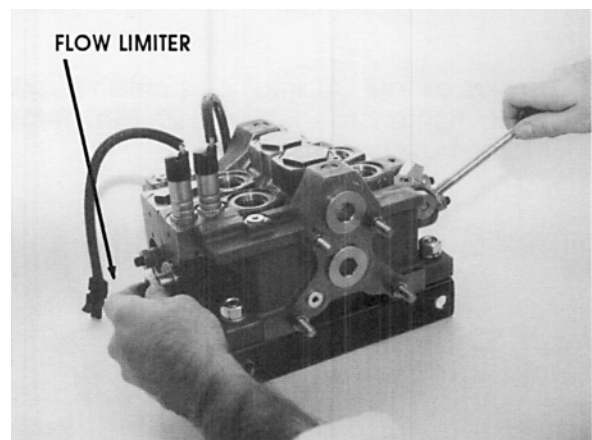
### VP/VPO Series Spool Replacement

#### General

In the VP/VPO Series valve, the main spool may be one of two types: proportional or "on/off." The main spool determines the segment type. Therefore, to change flow rates, or to change from proportional to "on/off" operation, it is the main spool which is exchanged. Also, please note that VP Series spools are of a different length than VPO spools and cannot be exchanged between segment bodies.

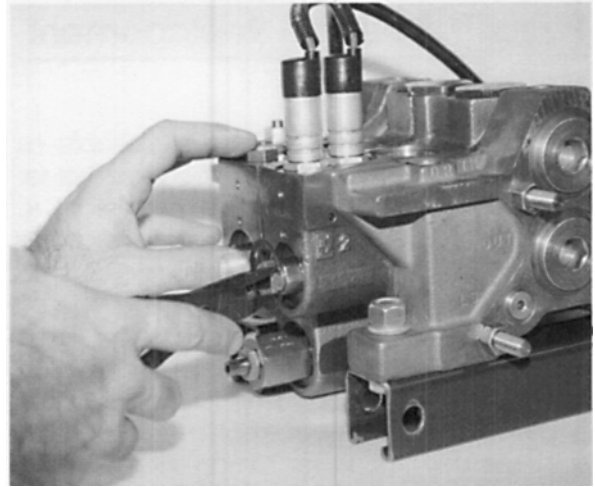
#### Spool Replacement Procedure

1. Install a manual override handle. Using a snap ring tool, remove the flow limiter assembly opposite the manual handle side. Rotate the override handle away from the valve until the assembly pops out. Insert a finger or hooked tool into the spring guide and pull the spool assembly out. Use care to pull the spool out as straight as possible, as side forces may damage the spool and/or bore.
2. Unpack the new spool assembly. Check that the spool is marked with the same number as shown on the packing. (Example: VP824K1 on the packing should show #824 on the spool.) Using a hard Arkansas stone, lightly "stone" the spool surface to remove minor nicks and burrs.
3. Make sure the new spool assembly is clean and free of any foreign material. Coat the spool with a thin layer of clean hydraulic oil. With the valve stack resting on the mounting pads, rotate the override handle fully downward, i.e., away from the valve. Carefully slide the spool straight into the bore with spool linkage groove facing upward. Again, exercise caution regarding placing a side load on the spool. Slide the spool in until it contacts the override linkage, then rotate the handle upward, thus pulling the spool the rest of the way into the bore. By slightly rotating the manual override back and forth, it is possible to check for proper installation.





4. Reinstall the flow limiter and push into position. Install the snap ring and check that it has seated completely. Use the manual override handle to fully shift the spool in both directions. Spool movement should be free of binding and capable of returning with spring force only. Check that flow limiters are securely seated.
5. With an "X" stamp, cross out the VP/VPO number that appears on the valve body above the pipe plug next to the override handle.
- 6a. For spool replacements involving flow rates less than 28 GPM (106 L/min), remove the stamped compensator plug and replace it with a new blank cap. Make sure no foreign material falls into the compensator. Stamp the new information on the cap, such as "10 GPM CC (38 L/min)" See **page 14 for compensator adjustment procedure.**
- 6b. Replacements that involve changing to spools of 28 GPM (106 L/min) or greater, also require changing to the high profile compensator design. See **page 17** for this procedure.



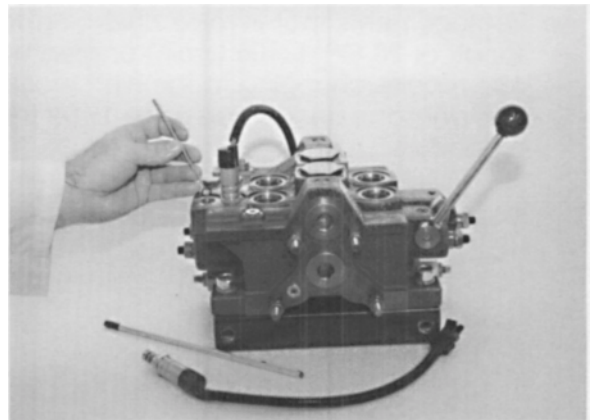
# Pulsar™ Solenoid Replacement

## General

All individual Pulsar™ solenoids available as service parts provide proportional control for the main spool. Should it be necessary to replace a solenoid, it will be necessary to identify which version(s) are involved. Prior to June 1992 all Pulsars™ were accompanied by their own separate orifice disk. After June 1992, the orifice is pressed in and integral to the lower body nozzle. As of November 1, 1996, a new filter design was implemented which also secures the lower O-ring to the lower body nozzle.

## Replacement Procedure

1. Remove the used solenoid (Item 23) and examine the nozzle end for the presence of a pressed in brass orifice plug.
- 2a. If the assembly includes the brass insert, without the O-ring secured to the lower body, simply remove the remaining O-ring from the segment cavity. Refer to Product Advisory 25 for further information.
- 2b. If the assembly includes the brass insert, with the lower O-ring secured to the lower body, simply remove complete solenoid. Refer to Product Update 046.
- 2c. If the assembly does not include the brass insert, remove the O-ring and, using a clean pencil magnet, also remove the orifice disk from the bottom of the Pulsar™ cavity.
3. With this removal now complete, install the new O-ring if applicable and check for proper seating.
4. Screw in the new solenoid with integral orifice and torque to 6.5 ft-lbs (9 Nm).
5. Any failed Pulsar™ solenoid should be returned to Parker for evaluation. Securely bag the cartridge assembly and orifice disk as required. If possible, allow the connector wires to remain outside the bag, as they may introduce contamination. Then contact your Parker representative for further return information.



# Pulsar™ Solenoid Removal and Plug

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## General

For applications using 2-position spools, only one Pulsar™ solenoid is needed. Unless otherwise specified, VP/VPO Series valves direct flow to the C<sub>1</sub> cylinder port. In these cases, the unused solenoid can either remain disconnected in the valve segment as a spare, or can be removed and plugged. Removed Pulsars must be replaced with the correct plug, as the cavity is not that of a standard fitting.

## Procedure

1. Remove the existing C<sub>2</sub> solenoid cartridge. For standard VP/VPO segments, this is the Pulsar™ closest to the manual override, but for high response segments, remove the other solenoid.
2. Inspect the nozzle end for the presence of a pressed in brass orifice plug.
- 3a. If the removed Pulsar™ includes the brass insert orifice plug, then simply remove the remaining O-ring from the segment cavity.
- 3b. If the Pulsar™ does not have the brass insert, then remove both the O-ring and, using a clean pencil magnet, also remove the orifice disk from the bottom of the valve cavity.
4. Unpack the solenoid plug kit, VNPK1, and verify the contents: two (2) solenoid plugs, four (4) O-rings.
5. Install the solenoid plug (Items 19, 20, 21) using 5-10 ft-lbs (7-14 Nm) torque.

## RECOMMENDED TEST STAND

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### Specifications

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**Hydraulic Oil** — Parker recommends petroleum-based hydraulic oil having 150 SUS (32 cST) viscosity at 100°F (38°C).

**Filtration Level** — 10 micron, high pressure, non-bypass.

**Temperature Range** — Test to be conducted from 100°F to 120°F (38°C - 49°C).

**Pressure Range & Measurement** — Test stand pump, controls and plumbing capable of producing and withstanding pressures from 100 psi to 3,500 psi (6.8 bar - 245 bar).

**Flow Range** — Test stand fixed displacement pump (with bypass inlet included), controls and plumbing to produce and accommodate flow up to the required flow rate.

**Flow Measurement** — Flow meter capable of measuring the required flow rate with acceptable accuracy.

**Electrical Solenoid Control** —

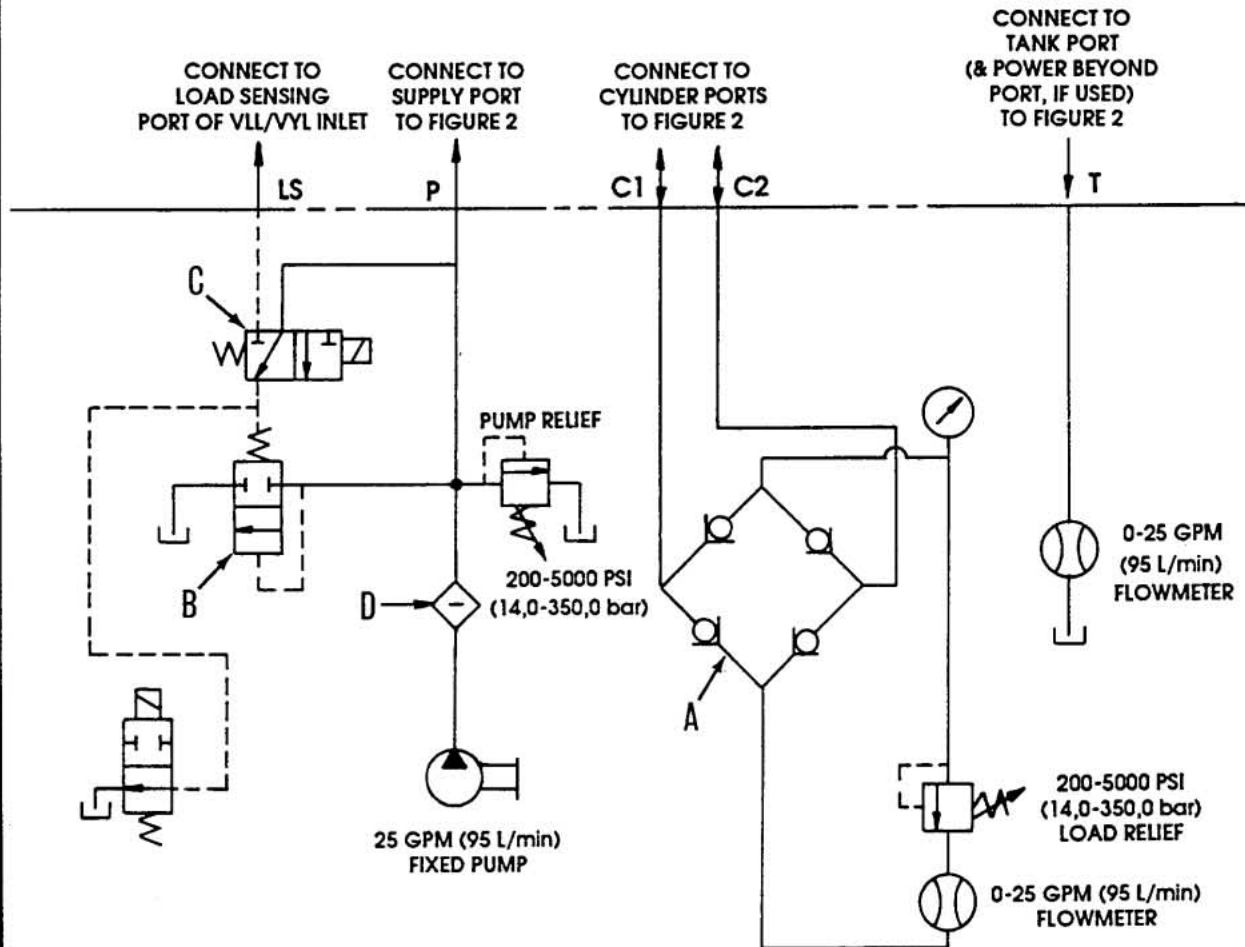
- Power supply of 12 VDC and 24 VDC, with negative voltage spike suppression from -10 to -20 VDC for 12 VDC. For 24 VDC (-20 to -36 VDC).
- Pulse-width modulated frequency output of 33 Hz.
- Recommend using Parker 12 VDC MC3100-0036 power module or 24 VDC MC3202-0111 power module.

### Configuration

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The test stand arrangement shown (FIGURE 1 and 2) is suggested. Parker recognizes the variety in test facilities of its distributorships. Consequently, it is expected each distributorship will configure a suitable test facility to satisfy requirements of both product qualification and individual needs.

# SUGGESTED TEST STAND CONFIGURATION



## NOTES

- A OPTION TO USE PRE-PACKAGE CIRCUIT SAVER FROM SUN HYDRAULICS, P/N CXHA XCN YSG.
- B VB-2211-5001 AND V0-0011-0001
- C USE LEFT CONFIGURATION FOR TESTING VB INLET STACK, USE RIGHT FOR VL INLET STACK.
- D 10 MICRON, NON-BYPASS FILTER.

FIGURE 1



SECTION VALVE SPOOL  
CONNECTIONS TO TEST STAND  
(SHOWN IN FIGURE 1)

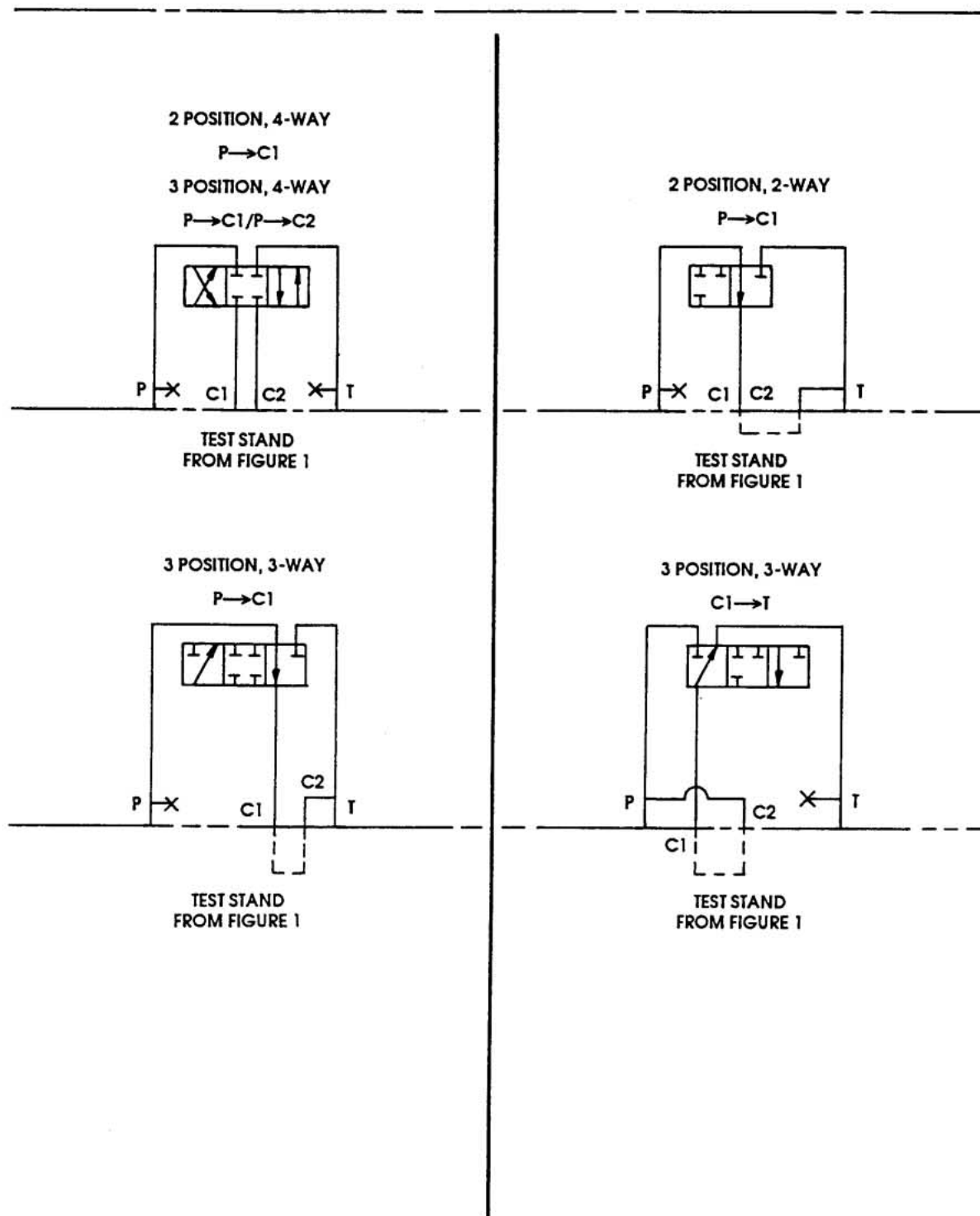


FIGURE 2

## FINAL STACK ADJUSTMENTS

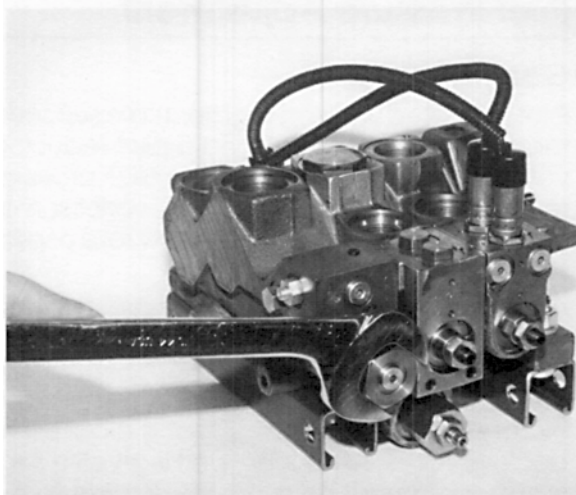
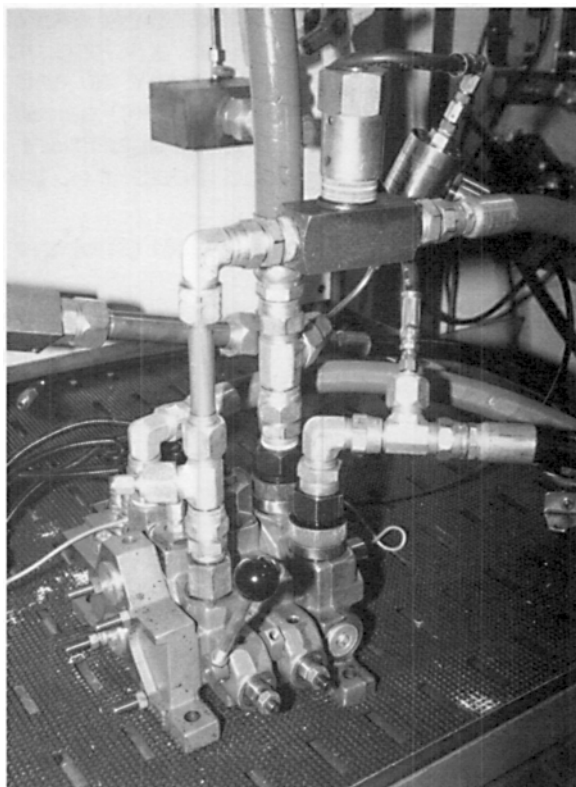
### Bypassing Inlet With Relief Inlet Adjustment

#### General

The pressure compensating bypass inlet (VB) requires two (2) adjustments. One adjustment establishes maximum working pressure and ensures the availability of a minimum pilot supply pressure of 200 psi (14 bar), the other sets the internal relief valve pressure.

#### Bypass Compensator Adjustment Procedure, VB2211-\*\*\*1

1. With the valve stack connected to supply pressure and tank return line, insert a pressure gauge in each line. Also, insert an in-line flow meter in the return line. Load circuit connection is not required for this adjustment.
2. Turn the test stand "on" and adjust the pump relief valve such that maximum bypass pressure is achieved, i.e., when no further increase in supply pressure occurs.
3. Adjust the pump flow setting to deliver the minimum/idle flow specified for this application, or use 10 GPM (38 L/min) if this number is unknown.
4. Turn out the bypass adjustment plug (Item 20) until the pressure difference between the gauges is 200-210 psi (13.8-14.5 bar). While holding this adjusted position, tighten the lock nut (Item 16) with a torque of 60-70 Ft-lbs. (81-95 Nm)

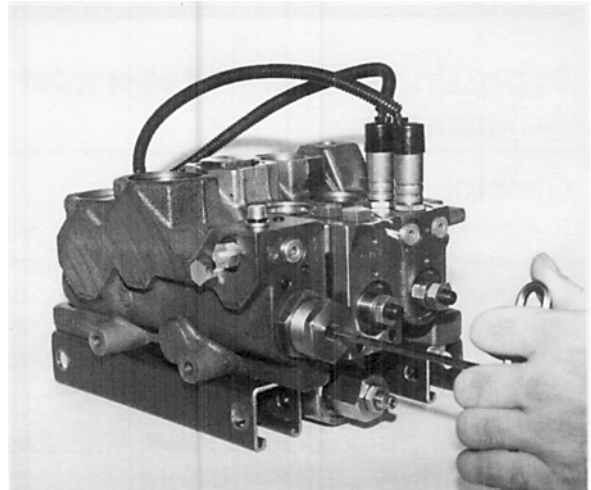


### Inlet Relief Valve Adjustment Procedure

5. With the test stand pump "on," be sure the pump or system relief setting exceeds the specified system relief setting by 200 psi (14 bar). Remove the SAE plug (Item 27) to adjust the socket set screw (Item 37) until the supply pressure does not exceed the specified relief pressure setting. The adjustment of this set screw is stiff and is equivalent to 1,000 psi (70 bar) per 360° turn. The maximum relief adjustment is 3,500 psi (241 bar) and should at no time be exceeded.

#### **Substitute the following items for (4) above if adjusting VB2213-\*\*\*1**

- 4a. Be sure the neutral loading set screw (Item 18) is fully backed out as to be unable to affect the  $P_s$  to  $P_r$  reading.
- 4b. With all main spools centered, adjust the bypass pressure adjustment plug (Item 17) to between 180-190 PSID (12-13 bar above tank pressure) While maintaining the adjusted position, tighten the lock nut (Item 16).
- 4c. Again with spools centered, adjust the neutral loading set screw (Item 18) to 205-210 PSID (14-14.5 bar above tank pressure) and tighten the associated lock nut (Item 19).



## Pilot Pressure Adjustment

### General

Pilot operated working segments are supplied the appropriate pressure via a pilot reducing valve located in the inlet. The pilot pressure required by a particular segment varies somewhat according to maximum flow rate or pilot type.

As of 6/92, Pulsar™ Series valves are outfitted with an externally adjustable pilot reducing valve, thereby eliminating the need for different thicknesses of shims. This permits the exact setting to be made that is required to achieve full stroke on the working valve segment. These new parts are retrofitable to existing castings and therefore may be used as a replacement on previous inventory.



### Pilot Reducing Adjustment

The accompanying photo shows the reducing valve assembly as it is installed in a VL Series inlet. With the locking nut loosened, pilot pressure can be adjusted according to the following guidelines:

#### Nominal Adjustment Limits

##### VP/VPO Series

215-225 psi < 20 GPM (15-16 bar < 75,7 L/min)

230-240 psi > 20 GPM (16-17 bar > 75,7 L/min)

##### VW Series

350-355 psi (24-25 bar)

#### Nominal Adjustment Sensitivity

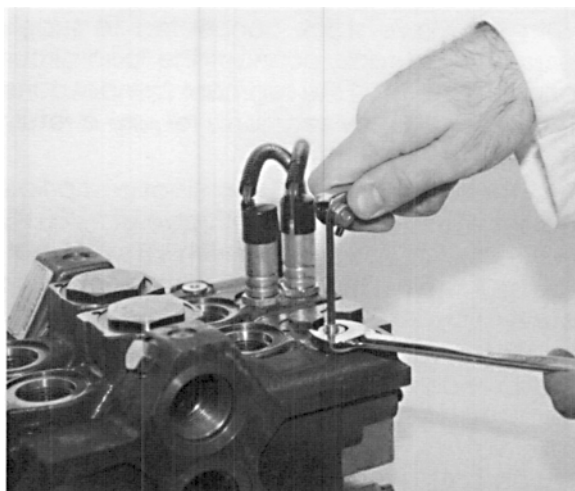
##### VP/VPO Series

40 psi per turn (2,8 bar)

##### VW Series

75 psi per turn (5,3 bar)

**CAUTION: WHEN ADJUSTING THE PILOT VALVE, THERE IS NOT A PHYSICAL STOP WHEN TURNING THE SCREW OUT. CAUTION MUST BE USED IN THIS PROCEDURE TO MAKE SURE THE PRESSURE LIMITS ARE NOT EXCEEDED.**



## Individual Segment Compensator Adjustment

**It is advisable to review this entire procedure prior to adjustment.**

### General

Proportional VP and VPO working segments include any of 9 spools with "rated flows" from 2.5 GPM (9,5 L/min) to 40 GPM (151 L/min). The individual segment compensators of packaged segments are factory set to provide those rated flows. However, for applications that require a flow rate between the available spool ratings, such as 25 GPM (95 L/min), the segment compensator may be adjusted to provide the required flow range.

VQ or VQO ON/OFF segments use a square-shouldered spool. Standardly these segments are factory set using the individual compensator and flow limiters to deliver between 22 and 26 GPM (83-99 L/min). As this arrangement is substantially different from proportional VN(O), VW(O) AND VP(O) segments, they will be discussed separately.

### Test Stand Preparation

With the valve stack connected to supply pressure and tank, connect the load circuit and flow meter to the segment cylinder ports. Two-way or 3-way segments require a return line back to tank.

Turn the test stand "On" such that pump flow passes over the pump relief valve at 1,700 PSI (117 bar). For valve stacks with VB inlets, bottom out the full flow adjustment (Item 20) to prevent bypassing.

Energize the solenoid with 100 percent modulation ratio (M.R.) to produce load flow through the cylinder port. Set the load circuit relief valve to 1,500 PSI (103 bar). Recheck the supply pressure and "tune" both relief valves until the supply pressure is approximately 1,700 PSI (117 bar) and load pressure about 1,500 PSI (103 bar).

**Note: Refer to Product Advisory No. 013 for descriptions of the various compensator configurations. Options B,C,D, and E are no longer available on new segments.**

### Compensator Adjustment, Spools 1-7

Each of these spools use the standard low profile compensator and are shim adjustable. Available shim thicknesses (Kit No. VPCSK1) are as follows:

P/N DB1044.248 = 0.025 inches (0,635mm)

P/N DB1045.248 = 0.008 inches (0,203mm)

P/N DB1046.248 = 0.003 inches (0,076mm)

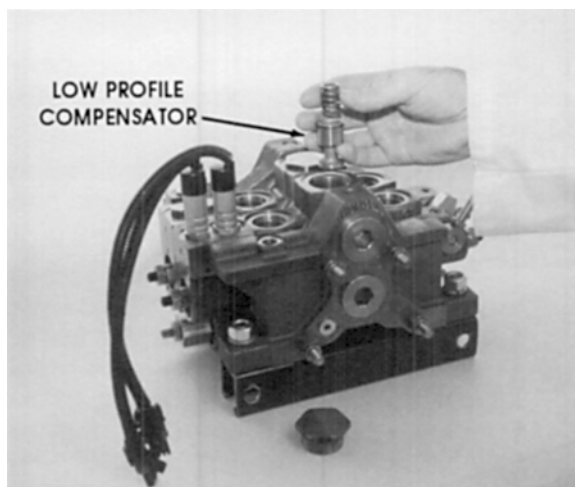
There should never be more than two (2) pieces of either 0.008" (0,203 mm) or 0.003" (0,076 mm) stock for any setting. Also, the thinnest shims 0.003" (0,076 mm) should be placed at the bottom of the shim stack.

### About the Compensator Shim Adjustment Graph

- Figure 3 shows the relationship between "DELIVERED FLOW" through a segment compared to the "ADDED SHIM THICKNESS" required to increase the flow above its rating. These curves provide only approximate thickness adjustments and require testing to confirm the flow.
- As previously noted, each segment is factory set. Therefore, the existing shim condition in a proportional segment is that which provides rated flow.



- The spool number, 1 through 9, is found in the first numerical position of the VP or VPO Series model number, i.e., VP5\*\*\*-\*\*\*\* is Spool 5 whose rated flow is 10 GPM (38 L/min). In the graph, nine proportional spools are shown with ratings from 2.5 to 40 GPM (10 to 152 L/min). Rated flow for each is found where the spool curve meets the left vertical axis. (See arrows.)
- Each spool should **ONLY** be used within its designed metering range. Spool 3 is for 5 GPM (19 L/min) to 7.0 GPM (26 L/min). Therefore:
  - a. To increase the flow of a single spool within its eligible range, simply add the appropriate amount of shim material to the compensator. This moves the maximum available flow from left to right along the shim curve.
  - b. To substantially change the flow from a segment, as required when changing from one spool to another, first exchange the spool, then adjust the segment compensator as necessary. For example, when changing a 7 GPM (27 L/min) segment to provide 18 GPM (68 L/min), first exchange the No. 4 spool to a No. 6, then adjust the compensator shimming accordingly.



**TABLE 1**  
**FLOW RANGE OF MAIN SPOOLS**

Spool I.D. No.	Rated Flow GPM (L/min)	Flow Range GPM (L/min.)
9 *	40 (152)	40-55 (152-208)
8 *	28 (106)	28-40 (106-152)
7	20 (76)	20-28 (76-106)
6	14 (53)	14.0-20 (53-76)
5	10 (38)	10.0-14.0 (38-53)
4	7 (26)	7.0-10.0 (27-38)
3	5 (19)	5.0-7.0 (19-27)
2	3.5 (13)	3.5-5.0 (13-19)
1	2.5 (9.5)	2.5-3.5 (9-13)

\* Requires high profile individual compensator.

### Adjustable Compensator Option

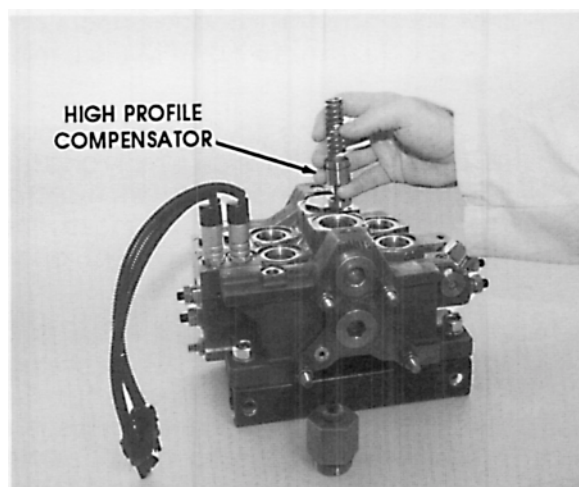
This option uses the high profile design which includes a longer spring and taller compensator cap. This version is externally adjustable within the designed metering range for each spool but up to 60 GPM (227 L/min) with No. 9 spool.

When changing from a low profile to a high profile, the compensator cap (Item 26) requires 80 to 85 ft-lbs (108-115 Nm) of torque, while the adjustment lock nut is tightened to 5-10 ft-lbs (7-14 Nm).

### Compensator Adjustment, VQ and VQO Spools

Unless otherwise specified, these spool segments are factory set to provide 22 to 26 GPM (83 to 99 L/min). Therefore:

1. To achieve flow rates below the factory setting, turn in the appropriate flow limiter(s) to desired flow rate.
2. For flow rates above the factory setting, back out the flow limiters until the desired flow is achieved. Or, if flow limiters are no longer positioned to short-stroke the spool, then add shim stock according to the Flow Setting Graph (Figure 3) to increase flow through the segment up to 40 GPM (152 L/min) max., and adjust flow limiters as needed.



# DUAL SPRING INDIVIDUAL COMPENSATOR SHIM ADJUSTMENT

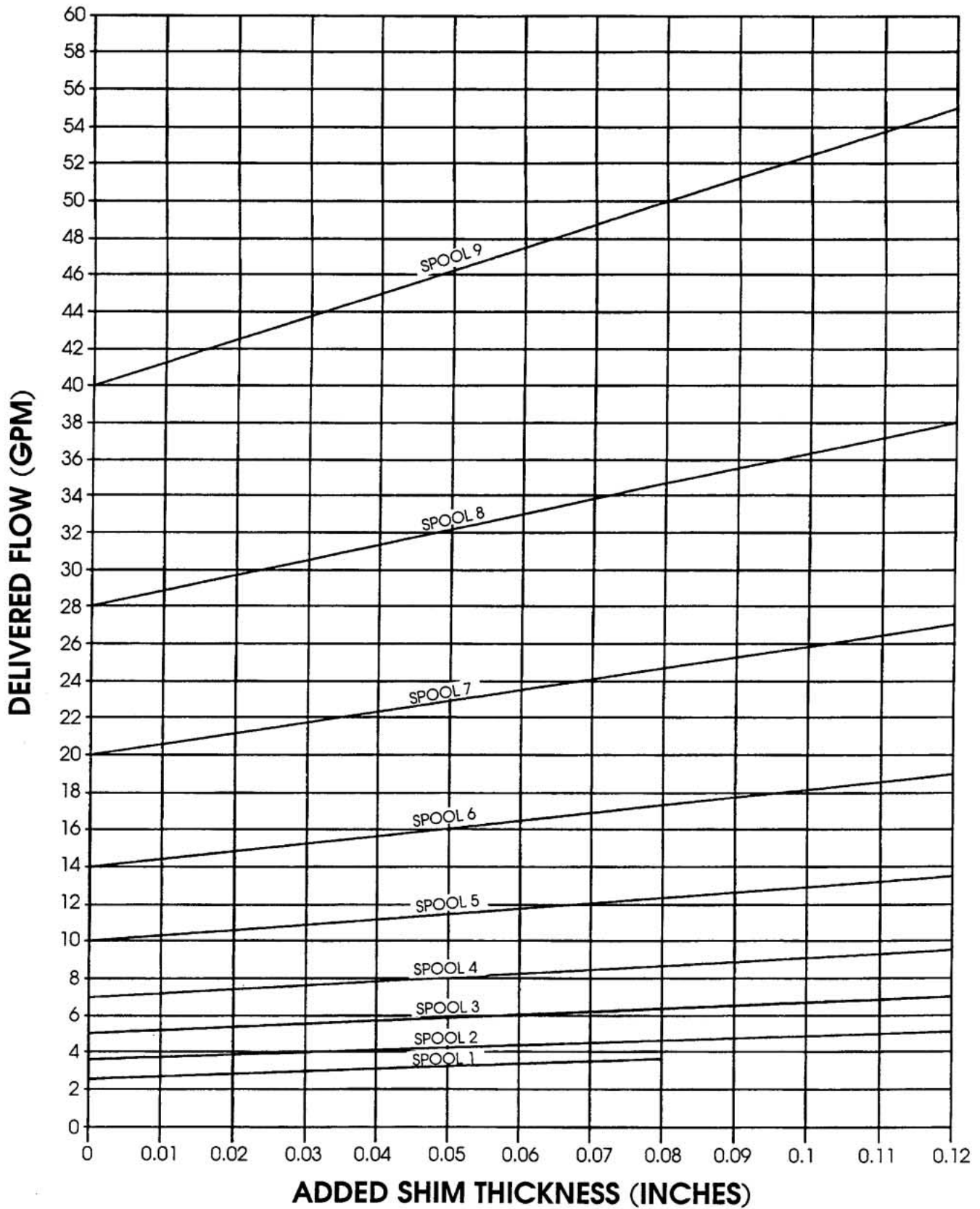


FIGURE 3



## Flow Limiter Adjustment

### General

Adjustment of the spool flow limiter is appropriate:

1. In all on/off (VQ) segments.
2. In 4-way VP proportional segments if a lower flow rate is specified for one of the cylinder ports.
3. In 3-way VP segments if lower return flow (C<sub>1</sub> to T) is specified.

### Adjustment Procedure

1. With the valve stack connected to supply pressure and tank, check that the flow limiting adjustment screws are backed out sufficiently as not to interfere with main spool movement.

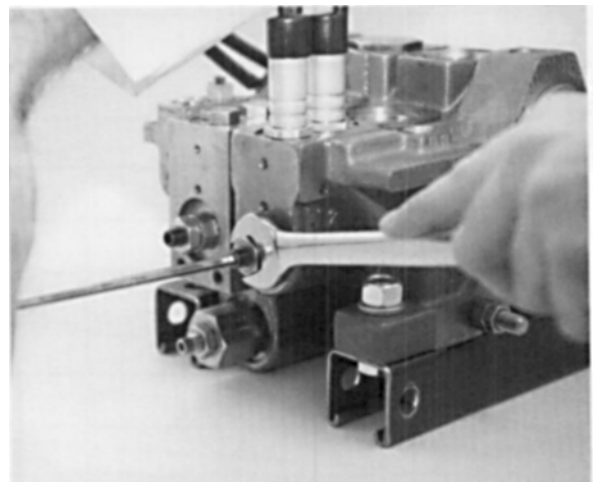
2. Four-way VP or VQ adjustment:

With the load circuit and flow meter connected to the segment cylinder ports and the test stand "on," energize the Pulsar™ solenoid with 100 percent modulation ratio (M.R.) to produce load flow through the cylinder port to be adjusted. Check that pump relief valve is set high enough to saturate the cylinder port flow.

While holding the adjustment plug (Item 15 or 44) by the wrench flats, turn the adjustment screw (Item 17) until output flow equals the specified flow setting. After adjustment, hold the adjustment screw and adjustment plug, then tighten the lock nut with a torque of 5-10 ft-lbs. (7-14 Nm). To adjust flow through the other cylinder port, repeat this process with other solenoid and flow limiter.

3. Three-way (one cylinder port plugged) VP or VQ adjustment:

For three-way segments, it is necessary to furnish the singular cylinder port with access to a supply pressure line and flow meter to verify return flow. This access may be accomplished by (a) using a flow rectifier circuit, (b) by connecting a parallel pressure supply line to the cylinder port. Set supply pressure equal to load pressure on the application. Energize for 100% modulation ratio at the C<sub>2</sub> solenoid. While holding adjustment plug (Item 44), turn the adjustment screw (Item 17) until the output flow is equal to specified setting.



4. For flow limiters which do not require adjustment:

Back out the set screw (Item 17) until the internal upset screw thread contacts the adjustment plug. While holding the adjustment screw and plug, tighten the lock nut with a torque of 5-10 ft-lbs (7-14 Nm).

**NOTE: All flow limiters are assembled in a retracted position, unless otherwise specified.**

## Pressure Limiter Adjustment

The pressure limiting feature is used to establish the maximum operating pressure available within the given segment. In the VP/VPO Series this is a "common" pressure limiter, where both C<sub>1</sub> and C<sub>2</sub> cylinder ports are controlled by the same setting.

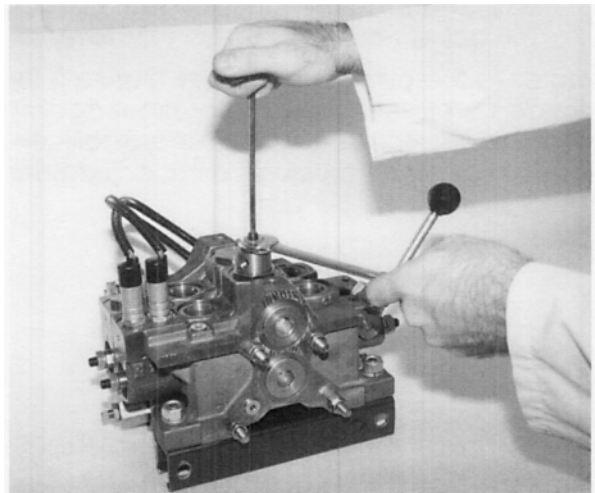
Have on Hand:

- 3/16" allen wrench
- 11/16" wrench

### Adjustment Procedure

1. Flow through the segment is not required when setting the pressure limiter. However, a gauge must be connected to read the load on the dead headed cylinder port. Energize either C<sub>1</sub> or C<sub>2</sub> Pulsar with 100% M.R. to pressurize this cylinder port.
2. Turn the adjustment screw (Item 73) until the pressure is equal to the specified setting. Retighten the locking nut (Item 16) with a torque of 5-10 ft-lbs (7-14 Nm).

**CAUTION: THESE ADJUSTMENT SCREWS ARE NOT SELF-CONTAINED. DO NOT ADJUST THE SCREW ALL THE WAY IN OR OUT.**





## Work Port Relief Adjustment

### General

The taller VPO Series segments include the ability to relieve either cylinder port directly to tank at a predetermined pressure, thereby protecting the actuator circuit from shock loads. This feature can also be furnished with an anti-cavitation check.

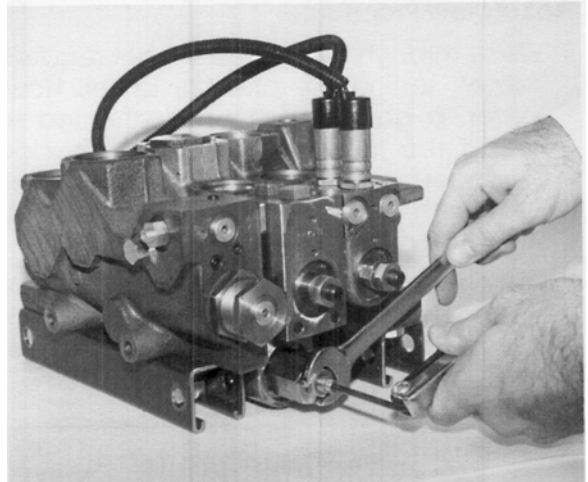
Have on hand:

- 17mm open end wrench
- 4mm allen wrench

### Adjustment Procedure

1. Flow through the segment is not required for this adjustment. However, with the cylinder port blocked, a gauge must be connected to the cylinder port to read the relief setting. With the lock nut loosened, energize the Pulsar™ with 100% M.R. to pressurize the appropriate cylinder port.
2. Turn the adjustment screw until the pressure is equal to the specified setting. Lock the adjustment to 100 ft-lbs. (136 Nm).

Note: As the cylinder port relief feature is intended to protect the actuator circuit against shock loads, the setting should typically exceed a segment pressure limiter adjustment by at least 250 PSI (17 bar).

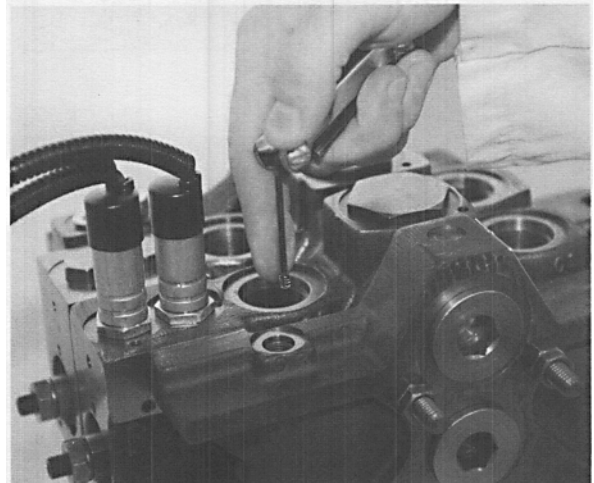
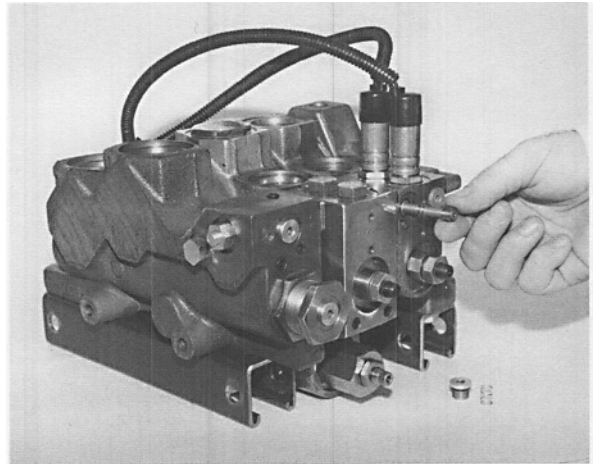


## High Response Segment

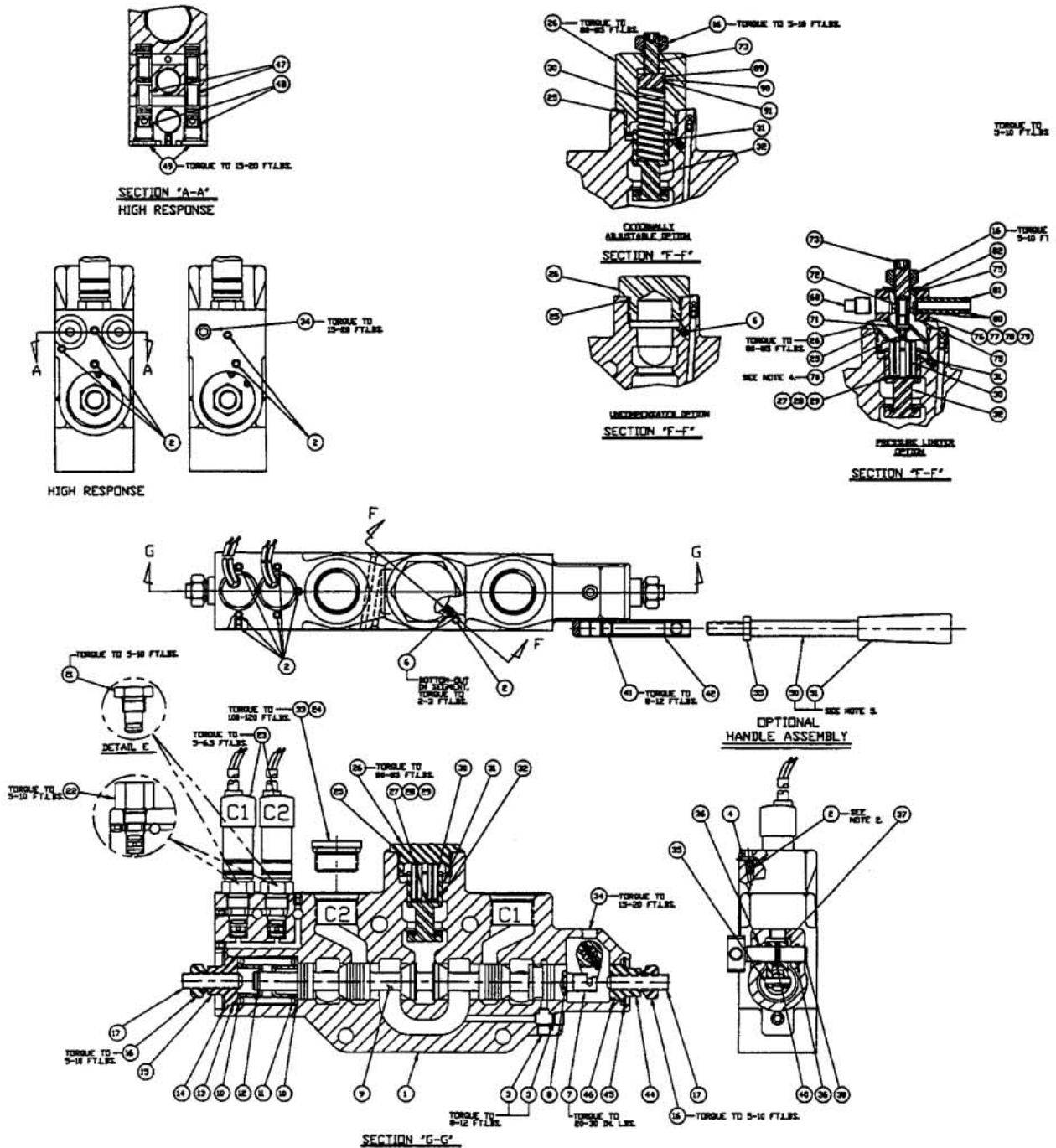
### General

VP/VPO Series Segments may be equipped with high response capability. This feature reduces the time required for the main spool to shift from neutral to full displacement from 600 msec to 80 msec on a proportional spool. The accompanying photograph shows the location and access to the high response spool cavity. Adjustment of this feature typically takes place at Parker, therefore please consult the factory before making any adjustments in this area.

Additionally any stack that includes a high response segment requires the pilot drain be isolated and externally drained. As shown, this is accomplished by inserting a set screw in the drain port on the stacking plate and providing a separate line to tank.

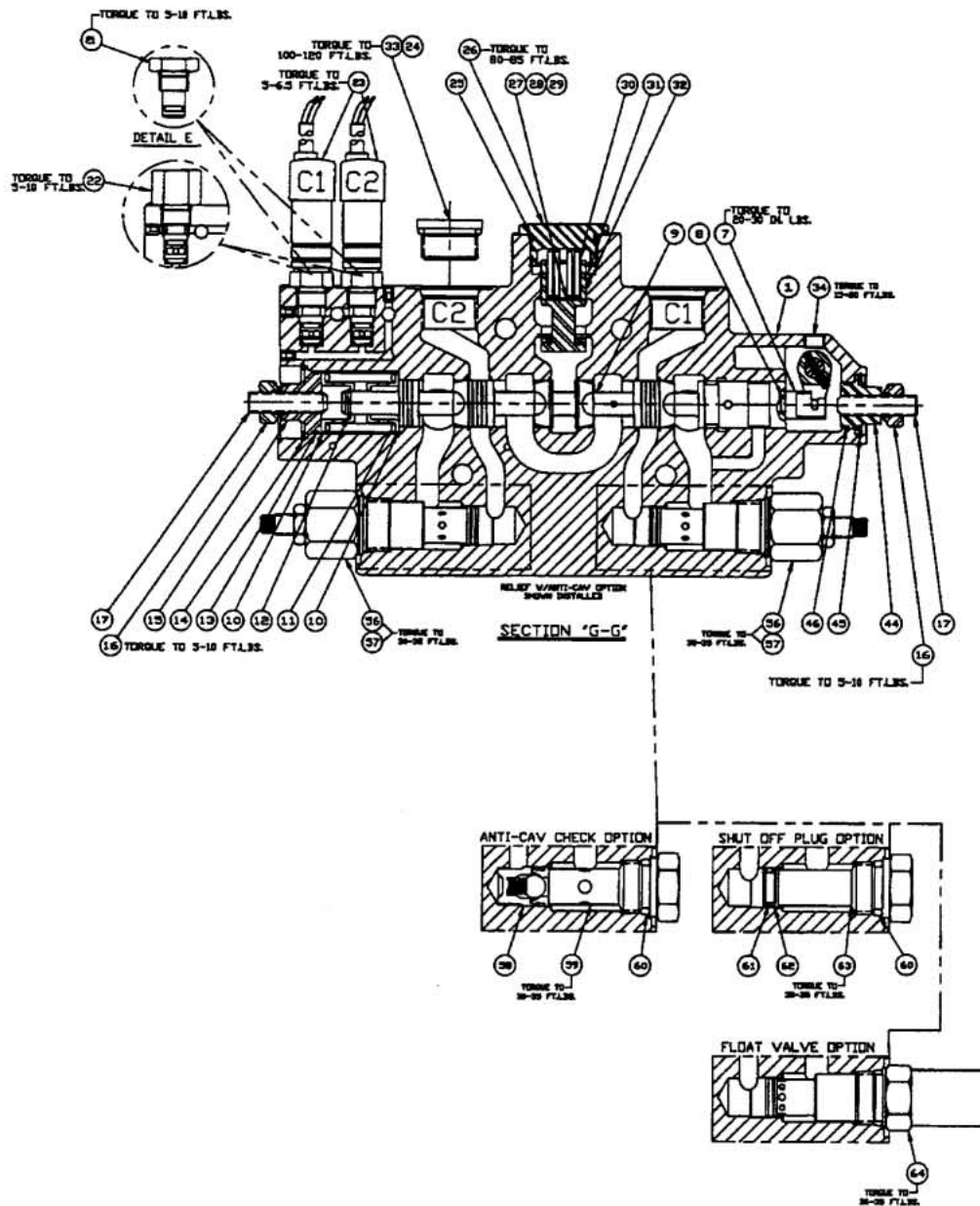


# VP WORKING SEGMENT PARTS LIST



1 Valve Body	21 Solenoid Plug S/A	37 Clevis	71 Poppet Cone
2 Construction Plug	22 Adaptor Fitting	38 Shaft	72 Compression Spring
3 Plug	23 Solenoid S/A	40 Straight Pin	73 Set Screw
4 Spring Pin	24 Shipping Plug	41 Set Screw	75 O-Ring
6 Orifice Screw	25 O-Ring	42 Handle Adaptor	76 Manifold
7 Override Hook	26 Plug or Housing	44 Adjustment Plug	77 Manifold
8 O-Ring	27 Regulator Shim	45 Retaining Ring	78 Manifold
9 Main Spool	28 Regulator Shim	46 O-Ring	79 Manifold
10 Spring Guide	29 Regulator Shim	47 High Response Spool	80 O-Ring
11 Compression Spring	30 Compression Spring	48 Compression Spring	81 Tube
12 Retaining Ring	31 Retaining Ring	49 Steel Plug	82 Plate
13 O-Ring	32 Compensator Spool	50 Handle Rod	89 Piston
14 Retaining Ring	33 Steel Plug	51 Handle Knob	90 Back-Up Ring
15 Adjustment Plug	34 Pipe Plug	55 Lock Nut	91 O-Ring
16 Seal Nut	35 Dowel Pin	68 Shipping Plug	
17 Set Screw	36 O-Ring	70 Seat	

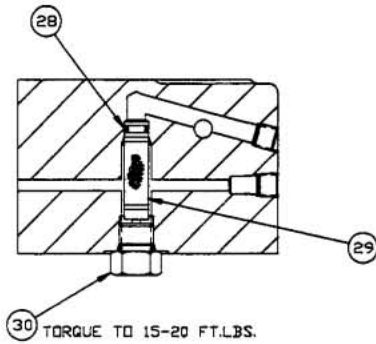
# VPO WORKING SEGMENT PARTS LIST



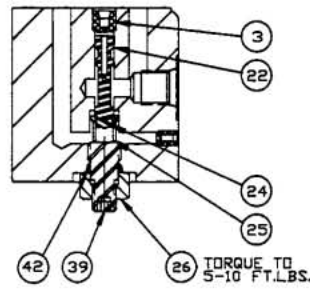
1 Valve Body	24 Shipping Plug	44 Adjustment Plug	68 Shipping Plug
2 Construction Plug	25 O-Ring	45 Retaining Ring	70 Seat
4 Spring Pin	26 Plug or Housing	46 O-Ring	71 Poppet Cone
6 Orifice Screw	27 Regulator Shim	47 High Response Spool	72 Compression Spring
7 Override Hook	28 Regulator Shim	48 Compression Spring	73 Set Screw
8 O-Ring	29 Regulator Shim	49 Steel Plug	75 O-Ring
9 Main Spool	30 Compression Spring	50 Handle Rod	76 Manifold
10 Spring Guide	31 Retaining Ring	51 Handle Knob	77 Manifold
11 Compression Spring	32 Compensator Spool	55 Lock Nut	78 Manifold
12 Retaining Ring	33 Steel Plug	56 Relief w/Anti-Cav	79 Manifold
13 O-Ring	34 Pipe Plug	57 Relief Valve	80 O-Ring
14 Retaining Ring	35 Dowel Pin	58 Check Valve	81 Tube
15 Adjustment Plug	36 O-Ring	59 Check Plug	82 Plate
16 Seal Nut	37 Clevis	60 O-Ring	89 Piston
17 Set Screw	38 Shaft	61 O-Ring	90 Back-Up Ring
21 Solenoid Plug	40 Straight Pin	62 Back-Up Ring	91 O-Ring
22 Adaptor Fitting	41 Set Screw	63 Shut Off Plug	
23 Solenoid S/A	42 Handle Adaptor	64 Float Valve	

# VB BYPASS PRESSURE COMPENSATING INLET PARTS LIST

- 1 INLET PLATE
- 2 CONSTRUCTION PLUG
- 3 CONSTRUCTION PLUG
- 4 SOCKET HEX PLUG
- 5 SPOOL
- 6 SAE #12 HEX SOCKET
- 7 SPRING WASHER
- 8 COMPRESSION SPRING
- 9 RELIEF VALVE
- 10 LOADER HOUSING
- 11 O-RING
- 12 BACK-UP RING
- 13 O-RING
- 14 SPRING GUIDE
- 15 LOADER COMPRESSION SPRING
- 16 LOCK NUT
- 17 ADJUSTABLE PLUG
- 18 SET SCREW
- 19 SEAT NUT
- 20 ADJUSTABLE PLUG
- 21 ORIFICE SCREW
- 22 PILOT REDUCING SPOOL
- 24 SPRING GUIDE
- 25 PILOT REDUCING SPRING
- 26 PILOT VALVE LOCK NUT
- 27 SAE #4 HEX SOCKET
- 28 O-RING
- 29 FILTER
- 30 SAE #4 SOCKET HEX
- 32 SHIPPING PLUG
- 33 STEEL PLUG
- 34 RELIEF SEAT
- 35 POPPET CONE
- 36 COMPRESSION SPRING
- 37 SET SCREW
- 38 SHIPPING PLUG
- 39 PILOT VALVE ADJ. SCREW
- 42 O-RING
- 47 SAE #2 SOCKET HEX
- 48 POWER BEYOND PLUG KIT

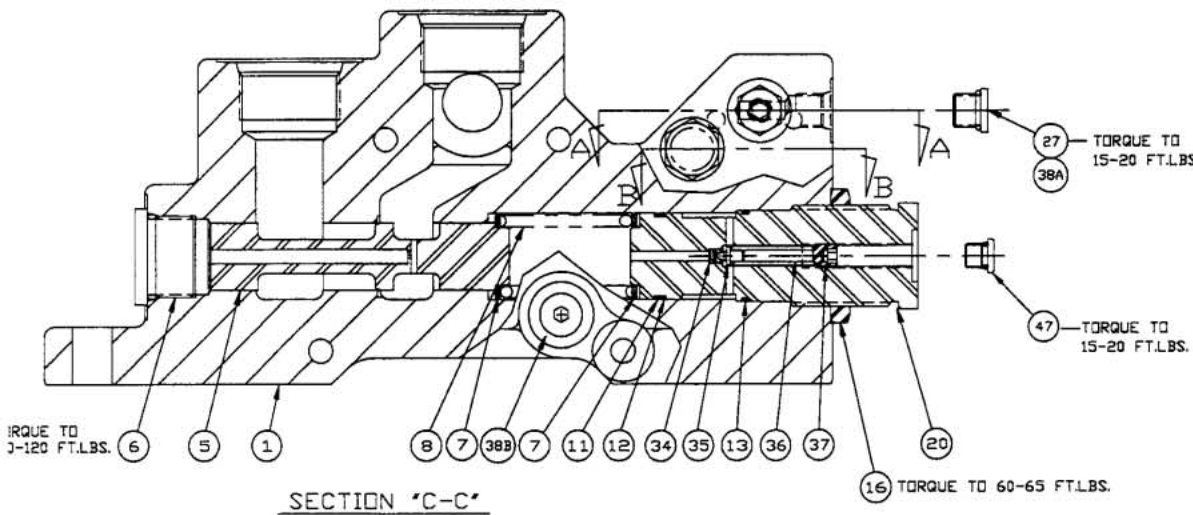


SECTION "B-B"

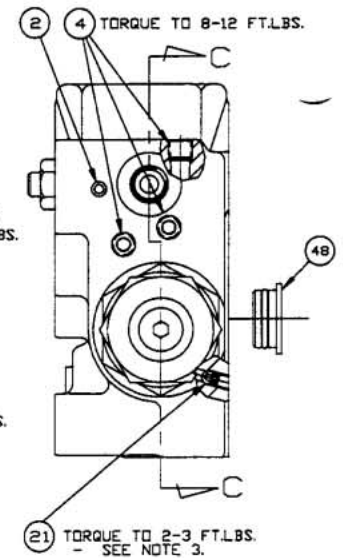


SECTION "A-A"

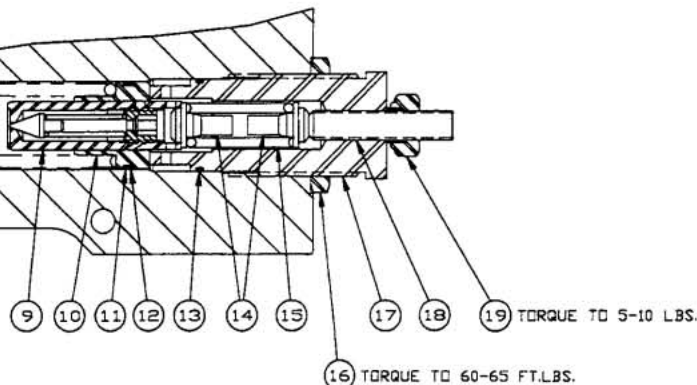
VB2211- OR VB2411-



SECTION "C-C"



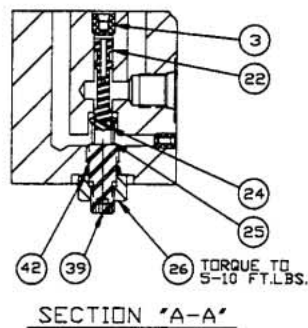
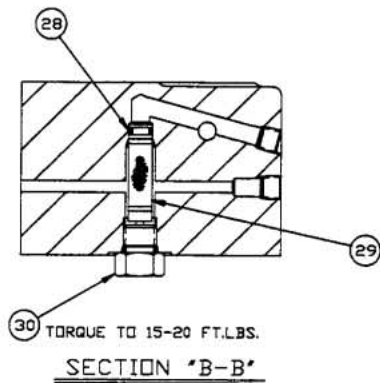
WITH NEUTRAL UNLOADER



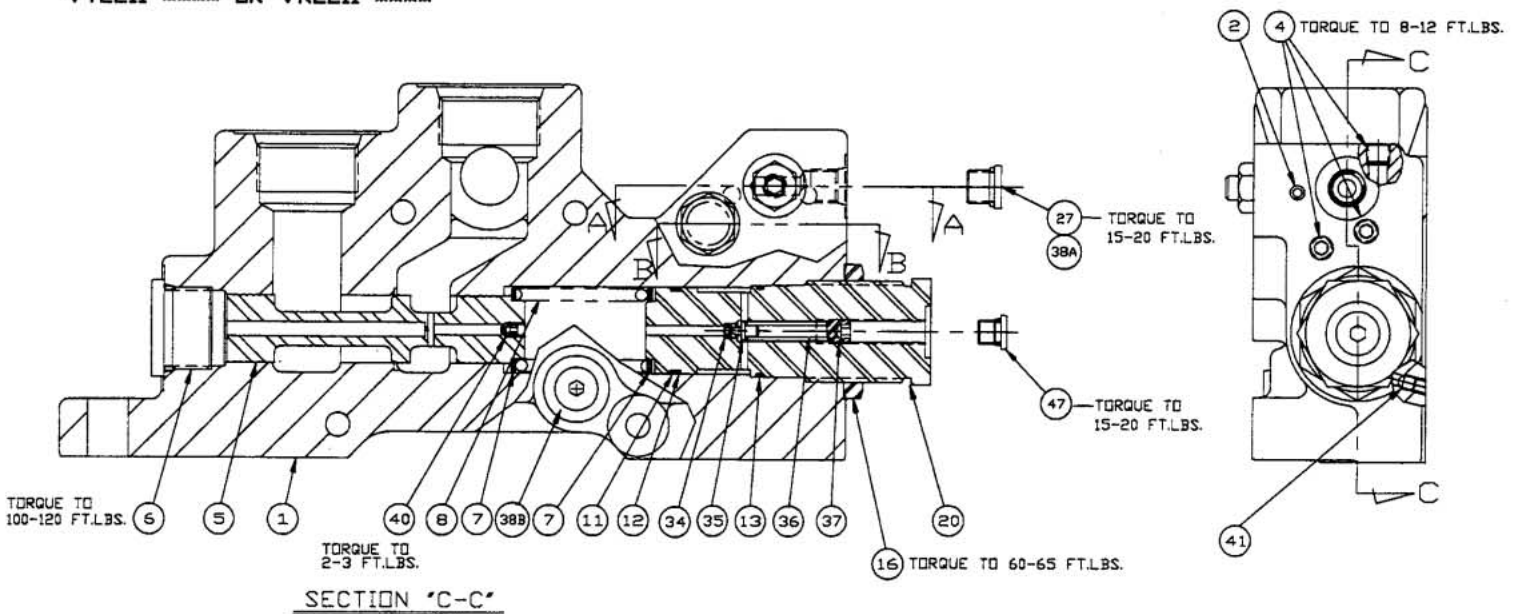


# VY & VR PRESSURE COMPENSATING LIST PARTS LIST

- 1 INLET PLATE
- 2 CONSTRUCTION PLUG
- 3 CONSTRUCTION PLUG
- 4 SOCKET HEX PLUG
- 5 SPOOL
- 6 SAE #12 HEX SOCKET
- 7 SPRING WASHER
- 8 COMPRESSION SPRING
- 11 O-RING
- 12 BACK-UP RING
- 13 O-RING
- 16 LOCK NUT
- 20 ADJUSTABLE PLUG
- 22 PILOT REDUCING SPOOL
- 24 SPRING GUIDE
- 25 PILOT REDUCING SPRING
- 26 PILOT VALVE LOCK NUT
- 27 SAE #4 HEX SOCKET
- 28 O-RING
- 29 FILTER
- 30 SAE #4 SOCKET HEX
- 32 SHIPPING PLUG
- 33 STEEL PLUG
- 34 RELIEF SEAT
- 35 POPPET CONE
- 36 COMPRESSION SPRING
- 37 SET SCREW
- 38 SHIPPING PLUG
- 39 PILOT VALVE ADJ. SCREW
- 40 ORIFICE SCREW
- 41 SET SCREW
- 42 O-RING
- 47 SAE #2 SOCKET HEX



VY2211-~~XXXXXX~~ OR VR2211-~~XXXXXX~~



## Offer of Sale

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**2. Payment:** Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

**3. Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

**4. Warranty:** Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.**

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**6. Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

**7. Special Tooling:** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges

paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

**8. Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

**9. Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

**10. Indemnity For Infringement of Intellectual Property Rights:** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights. If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

**11. Force Majeure:** Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

**12. Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

9/91-P



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2C, 9/02, PHD