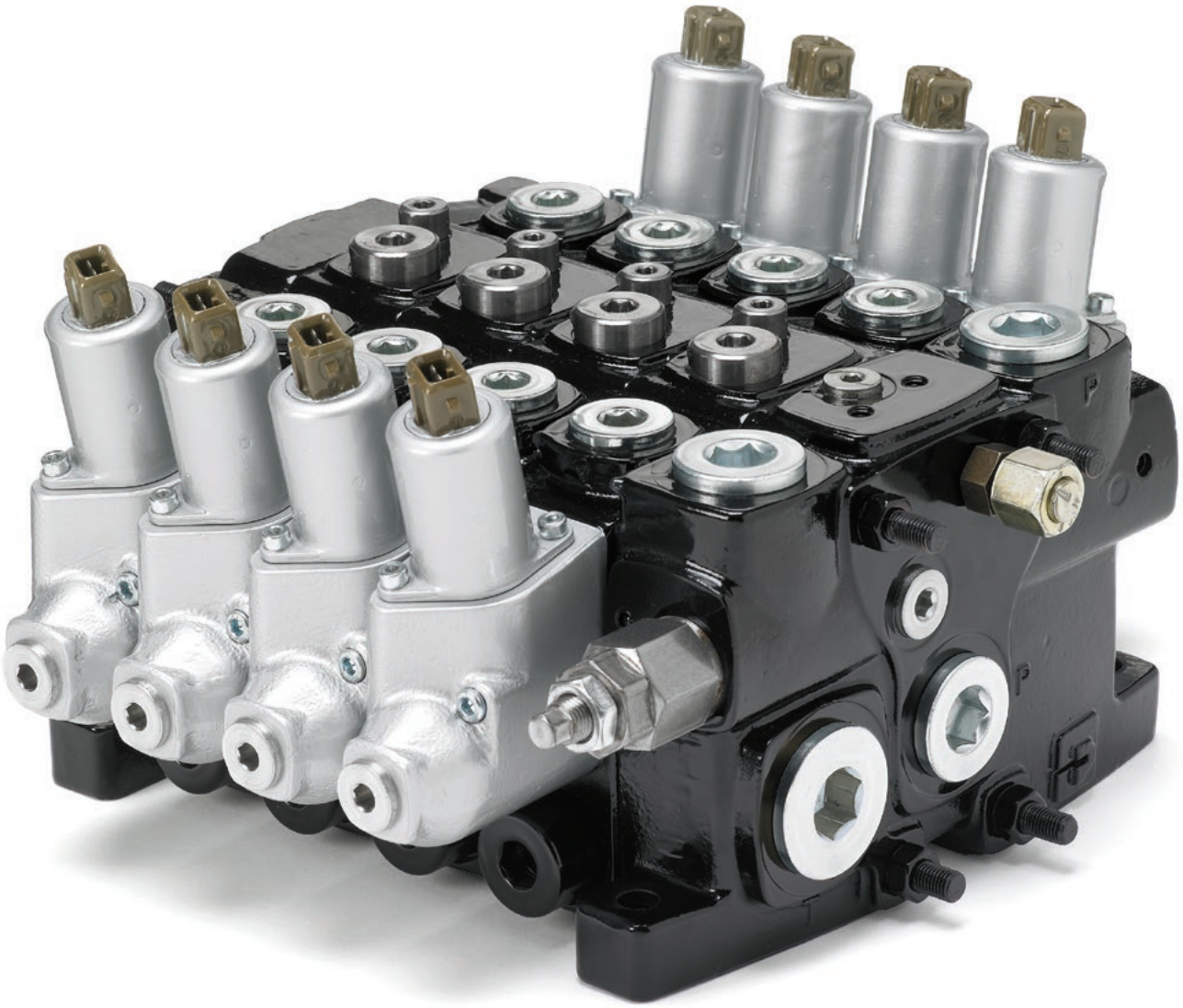

# VP120 Load-Sense Directional Control Valve

## Motion Hydraulic Valves

Catalog HY14-2008/US

aerospace
climate control
electromechanical
filtration
fluid & gas handling
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pneumatics
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## SAFETY GUIDE

For safety information, see Safety Guide SG HY14-1000 at www.parker.com/safety or call 1-800-CParker.



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**Parker Hannifin Corporation**
Hydraulic Valve Division
Elyria, Ohio, USA

## General Description

The VP120 can be configured either as pressure compensated load-sense (PCLS) or as load-sense (LS). Both have the flexibility of sectional construction. The PCLS work section has its own compensator, so that speed control of multiple functions is achieved, regardless of changes in pressure. The key technology inherent to the VP120 is flow-sharing. In pump over-demand conditions, flow-sharing benefits machine productivity by maintaining the speed relationship of the selected functions, but at a reduced speed. Thus, the operator can maintain the rhythm of the machine.

A new technology available in the VP120 is post compensation with pressure-limiting. This feature allows for selected functions to operate at pressures lower than the load-sense relief-valve setting. The advantage of using pressure limiters to accomplish this vs. port relief-valves is that less flow is lost – increased efficiency and productivity.

Another new technology developed for the VP120 is called margin control, which can be used to selectively boost or reduce the flow out of a work-section.

The standard inlet/outlet can be installed on both ends of the valve, facilitating the routing of pump/tank flow to both ends of the valve.

The valve can be operated manually, hydraulic-remote and with solenoids. The same solenoid is used for on/off and proportional control. A bypass compensator is available for use with fixed displacement pumps. Also, priority flow control is an option for steering requirements. In addition, low pressure regeneration is an option designed to overcome the damaging affects of cavitation – namely premature component wear and spongy operation.

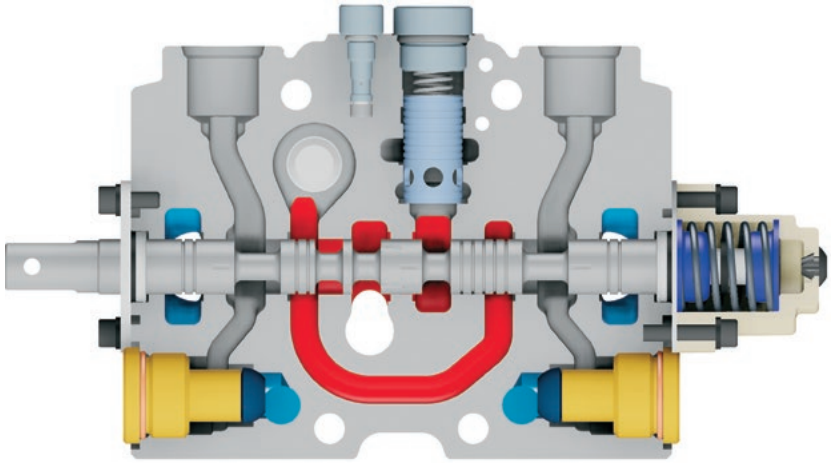
The VP120 uses the same port accessories, load-sense relief valve and pressure-reducing valve that are shared among multiple valve series. The standard spool types are 3-way, 4-way and 4-position float. A full range of flow limited spools are available.

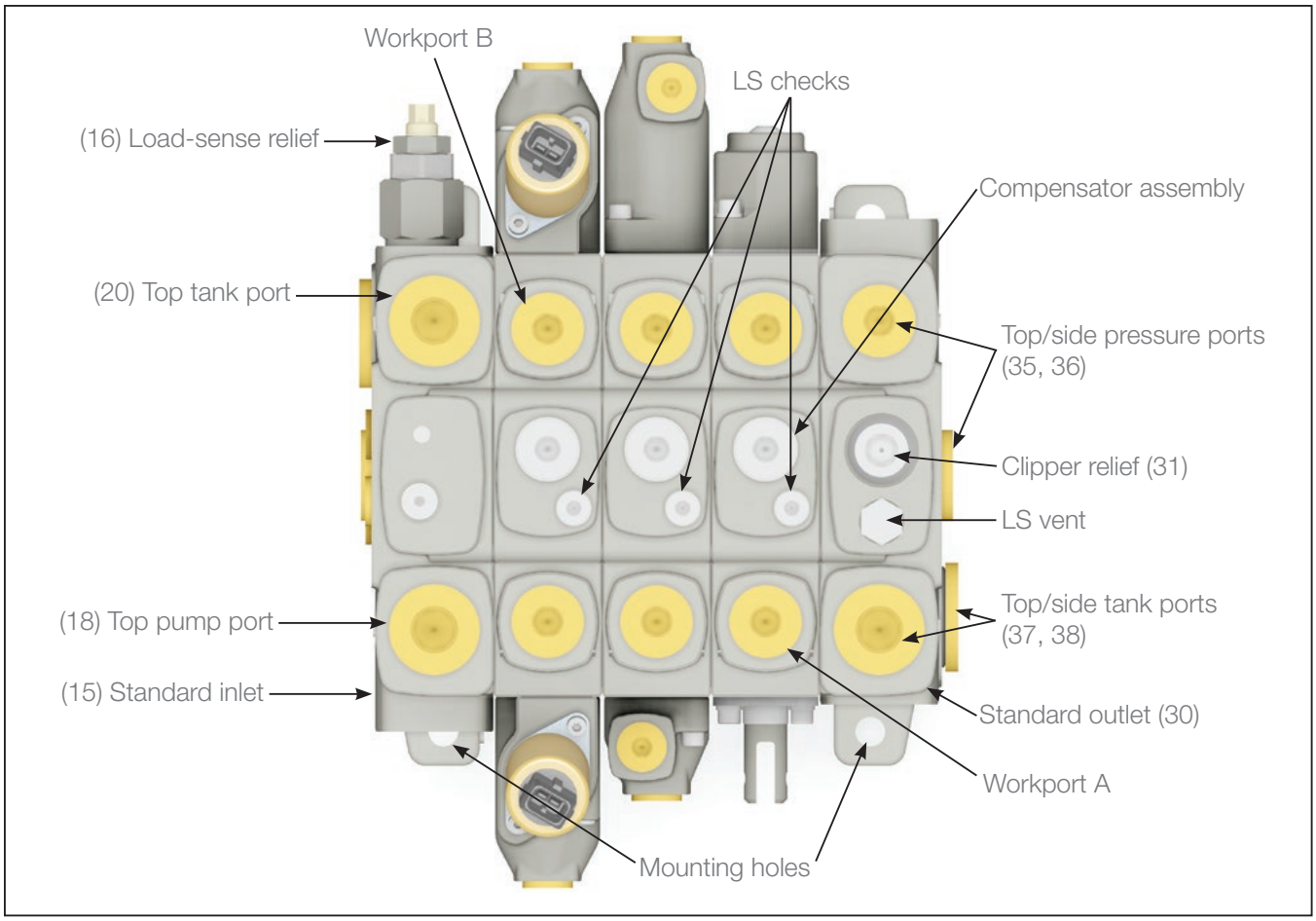
## Operation

The VP120 (PCLS) is an individually pressure compensated load-sense valve. For optimum horse-power utilization, it is normally used with a variable displacement pump. However, it does have the flexibility to be interfaced with a fixed displacement pump.

During single function use, the pump control will determine the flow to the valve, based upon the area opening of the spool notch and the load-sense signal being sent back to the pump.

During multi-function operation, the pump control will determine the flow for the highest loaded function, while the work-section compensator will control the flow for the lighter loaded function.






## Features

- **Excellent machine controllability** – Individual pressure compensation in each work section delivers predictable metering with single and multi-function operation; regardless of changes in pressure and input flow. This enhances machine control, improves productivity and helps to make every operator an “expert” operator – all of which saves money. This valve type also lends itself to closed-loop control.
- **Improved system efficiency** – Optimized horsepower utilization and heat management are features that are inherent with load-sense pressure compensated valves due to a closer match between horsepower consumption and horsepower demand. Fuel savings of up to 30% can be achieved vs. open-center type systems. Also, better horsepower utilization may enable the use of a smaller engine or elimination of a heat exchanger.
- **Enhanced machine productivity** – The VP120 incorporates flow-sharing technology. This means that during a pump over-demand condition the valve will automatically apportion the available flow to the selected functions, based upon the area openings of the spool notches. The selected functions will maintain their speed relationship, but at a lower overall speed. This automatic adjusting by the valve can improve machine productivity as much as 20% and reduce operator fatigue.
- **Enhanced speed control** – The optional margin control boosts or reduces flow of the selected work sections. This enables the hydraulic circuit designer to better utilize the available pump flow and possibly reduce the size of the engine.
- **Reduced heat generation** – Pressure limiting is a feature not common on valves with flow sharing technology. This feature allows for selected functions to operate at a pressure less than the setting of the load-sense relief-valve, while only passing a few liters of oil to tank. The alternative method for achieving this is with a port relief-valve.
- **Flexible design** – The VP120 is available as a pressure compensated load-sense valve (PCLS) or just as a load-sense (LS) valve. The combination inlet/out casting can be installed on both ends of the valve, which means that pump flows can be routed to both ends of the valve.
- **Ease of service** – The load-sense check and the compensator are located on the top of the work section, making them accessible for trouble-shooting without having to disassemble the valve bank.

## Definitions

**PCLS** = Pressure Compensated Load-Sense, or load-sensing with pressure compensation.

**LS** = Load-Sensing.

**LSRV/PLM** = Load-Sense Relief Valve – a small RV that sets maximum LS pressure.

**Clipper RV/PA** = "Clips" or reduces pressure spikes normally caused when flow demand decreases faster than the pump flow output can decrease.

**Margin$_{valve}$** = Pressure at valve pump – pressure at valve LS port = $M_v$.

**Margin$_{pump}$** = Pressure at pump outlet – pressure at pump LS port = $M_p$.

**Margin$_{neutral}$** = $M_v$ or $M_p$ when all valve spools are in neutral.

**Margin** = Mv or Mp when one valve function is deadheaded and the LSRV relieves.

**FLO** = Flow Limit Orifice, limits flow over LSRV.

**Over-demand** = When functions demand flow in excess of pump capacity.

**EC** = Solenoid controlled spool positioning.

**Induced load** = Occurs when an actuator tries to force fluid into a valve workport.

**Pressure Limiting** = Port pressure is limited to a value less than the normal operating pressure. Flow loss during pressure limiting is < 2 LPM (.53 GPM).

## Conversion Factors:

1 kg = 2.2 lbs.

1 N = 0.225 lbs. force

1 Bar = 14.5 PSI

1 liter = 0.22 UK gallon

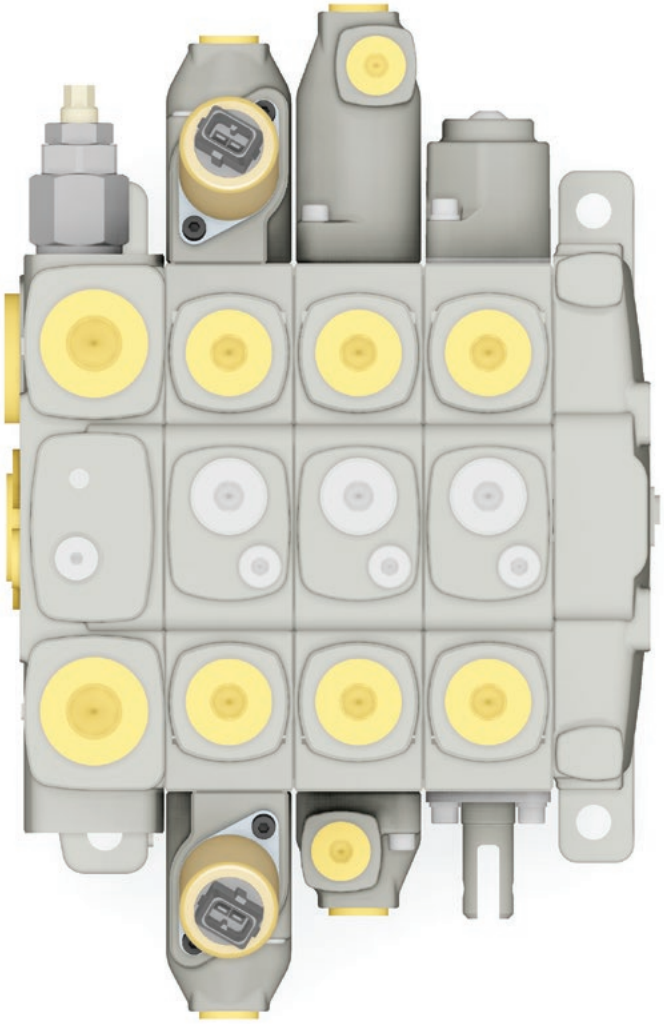
1 liter = 0.264 US gallon

1 $cm^3$ = 0.061 $in^3$

1 m = 3.28 feet

1 mm = 0.039 inches

9/5 °C + 32 = °F



## Specifications

| | |
|---|---|
| **Pressures** | Pump inlets: 280 Bar (4060 PSI)<br>Service Ports: 345 Bar (5000 PSI)<br>Pilot-EH (input or internal supply): 35 Bar (508 PSI)<br>Tank Return: 15 Bar (220 PSI)<br>Solenoid Drain: 20 Bar (300 PSI)<br>Pilot-Hydraulic Remote: 7-28 Bar (100-315 PSI) |
| **Flow Rates at 17 Bar (250 PSI) Margin** | Maximum Input: 160 LPM (42 US GPM)<br>Maximum Flow out of Service Ports: 120 LPM (32 US GPM) |
| **Leakage**<br>Performance with mineral oil, 20 cSt (100 SSU) @ 49°C (120°F) at 80 Bar (1100 PSI) differential | Workport w/Steel Plug or no Accessory: 20 cc/min max.<br>Thru reverse flow check only: 150 cc/min max.<br>Load-sense Leakage: 150 cc/min |
| **Hydraulic Fluid** | Mineral base oil.<br>For other fluids consult factory.<br>Viscosity, working range: 15-380mm²/s (15-380 cSt). |
| **Hydraulic Oil Temperature** | Recommended Operating Range without Solenoid Operation: -30° to 90°C (-22° to 194°F)<br>Recommended Operating Range with Solenoid Operation: -20° to 80°C (-4° to 176°F) |
| **Filtration (ISO 4406)** | 20/18/14 in Main Flow Paths<br>18/16/13 Pilot Supply |

## Weights

### Inlets/Outlets

| | |
|---|---|
| **Std. Combination Inlet/Outlet** | 4.58 kg (10.1 lb) |
| **EH Combination Inlet/Outlet** | 5.81 kg (12.8 lb) |
| **Combination Inlet/Outlet with priority flow divider** | 6.89 kg (15.2 lb) |
| **Combination Inlet/Outlet with bypass compensator** | 6.94 kg (15.3 lb) |
| **Combination Inlet/Outlet with low pressure regeneration** | 6.85 kg (15.1 lb) |
| **Simple turnaround cover** | 3.1 kg (6.8 lb) |
| **Work Sections**<br>**Manual with 2 port access.**<br>**Hydraulic Remote with 2 port access.**<br>**EH with 2 port access.** | <br>4.17 kg (9.2 lb)<br>4.58 kg (10.1 lb)<br>6.03 kg (13.3 lb) |

## Mounting Surface

There is no restriction on orientation.
Flatness should be at least 0.5 mm (0.020")
Surface must be stable and not put stress on valve.

## Connections

O-ring boss ports SAE-J1926-1

BSPP ports ISO 1179-1

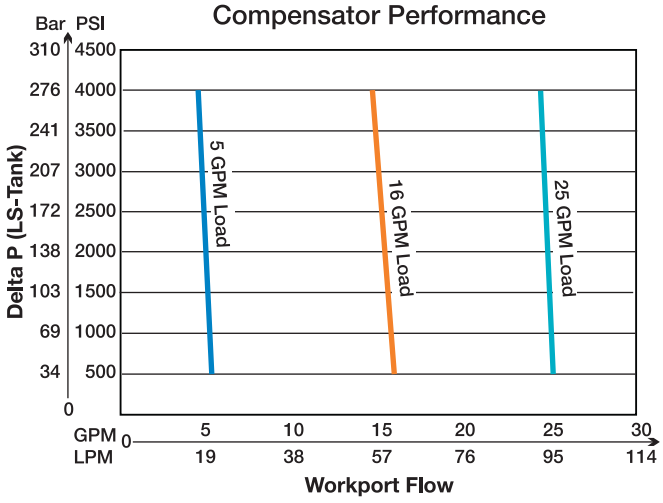
| | | Thread Size | |
|---|---|---|---|
| **Description** | **SAE #** | **O-ring Boss (UNF)** | **BSPP** |
| inlet, top | 12 | 1 1/16-12 | 3/4"-14 |
| inlet, side | 12 | 1 1/16-12 | 3/4"-14 |
| EH inlet, pilot | 6 | 9/16-18 | 1/4"-19 |
| outlet, top | 12 | 1 1/16-12 | 3/4"-14 |
| outlet, side | 16 | 1 5/16-12 | 1"-11 |
| work section | 8 | 3/4-12 | (none) |
| work section | 10 | 7/8-14 | 1/2"-14 |

## Solenoid Specifications

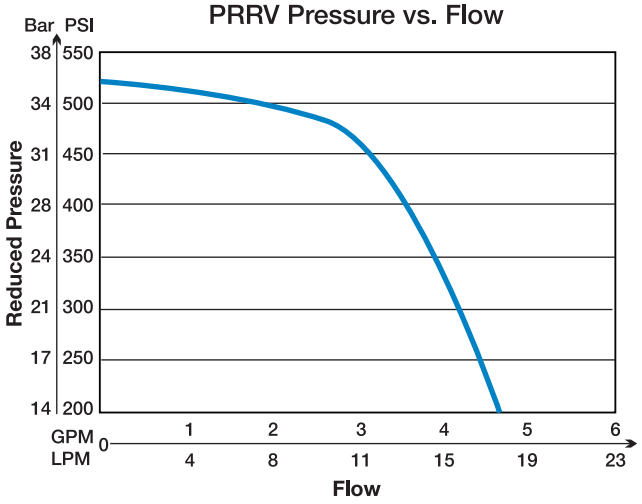
| | | | |
|---|---|---|---|
| **Voltage** | 12 or 24 VDC | | |
| **Pilot** | 35 Bar (508 PSI),<br>15-23 LPM (4-6 GPM) | | |
| **Current Input (I)** | 1.5A for 12 VDC<br>0.75A for 24 VDC | | |
| **Current (mA)** | | 12V | 24V |
| **for Spool Shift** | Start Shift | 500 | 250 |
| | Full Shift | 1250 | 625 |
| **Insulation Material** | Class H | | |
| **IP Rating** | Connector IP67, Coil IP69 | | |
| **Duty Cycle** | 100% | | |
| **R20 Ohm** | 5.3 (±5%) for 12 VDC<br>21.2 (±5%) for 24 VDC | | |
| **PWM Frequency** | 100hz ±10% | | |
| **Fluid Cleanliness (Pilot)** | 17/14 per ISO 4406 | | |
| **Ambient Temperature** | -30° to 80°C (-22° to 176°F) | | |
| **Fluid Temperature** | -20° to 80°C (-4° to 176°F) | | |

**VP120 Pre-Configured Module is Available in IQAN software package.**

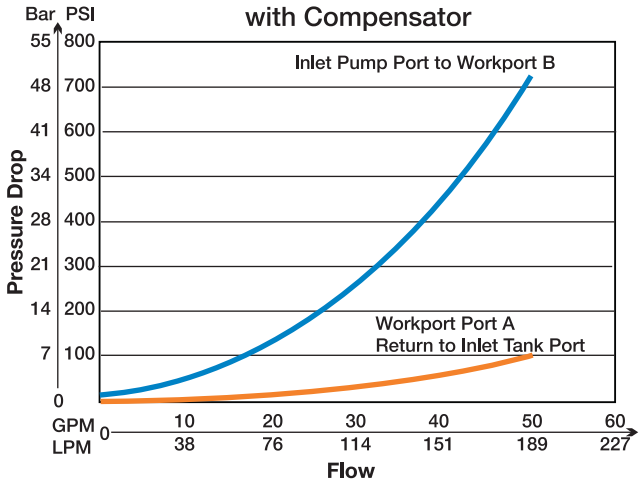
## Compensator Performance




## PRRV Pressure vs. Flow

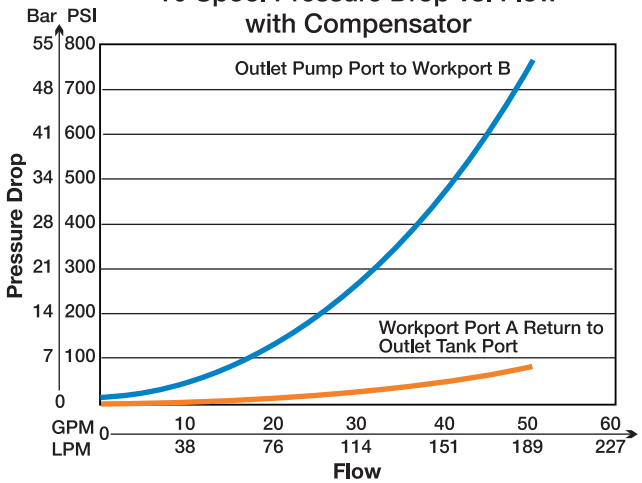



## 1 Spool Pressure Drop vs. Flow with Compensator



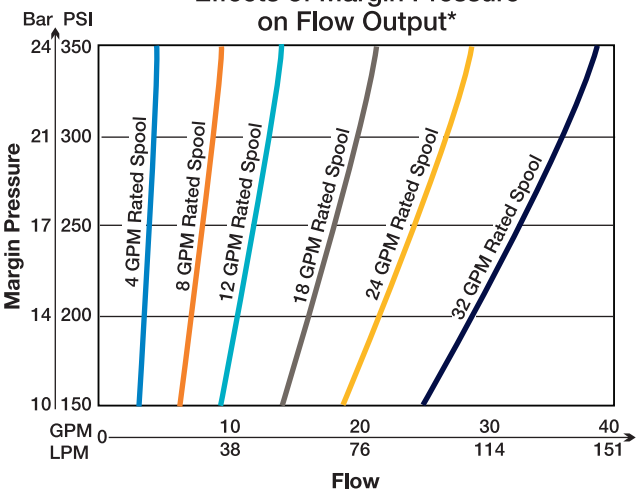

Roughly equivalent when plumbed to Outlet P and T Ports

## 10 Spool Pressure Drop vs. Flow with Compensator



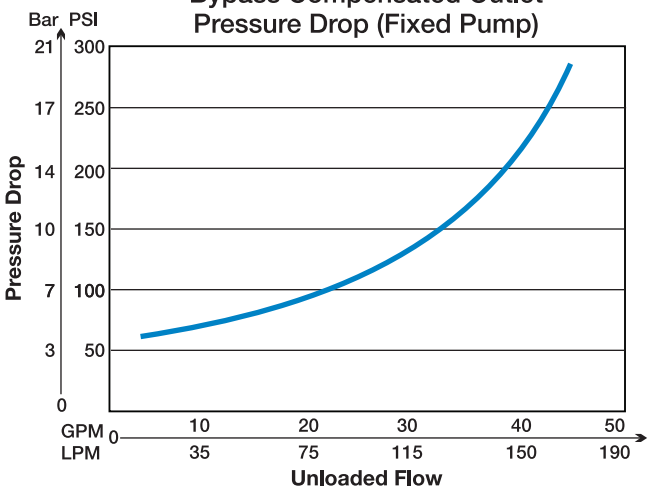

Roughly equivalent when plumbed to Inlet P and T Ports

## Effects of Margin Pressure on Flow Output*

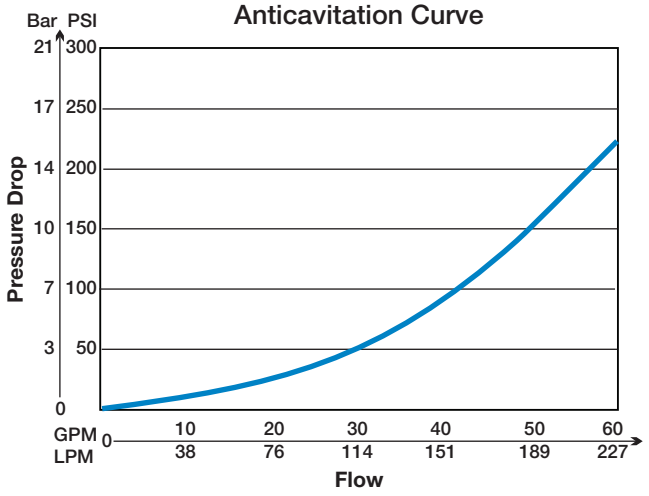



* Assumes no △p from pump to valve

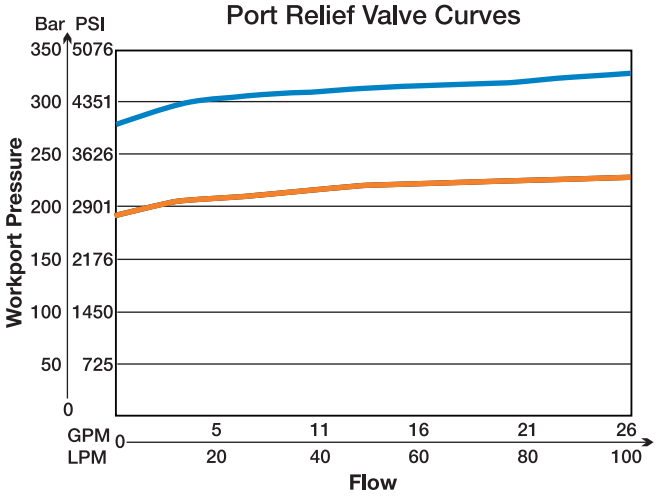
## Bypass Compensated Outlet Pressure Drop (Fixed Pump)



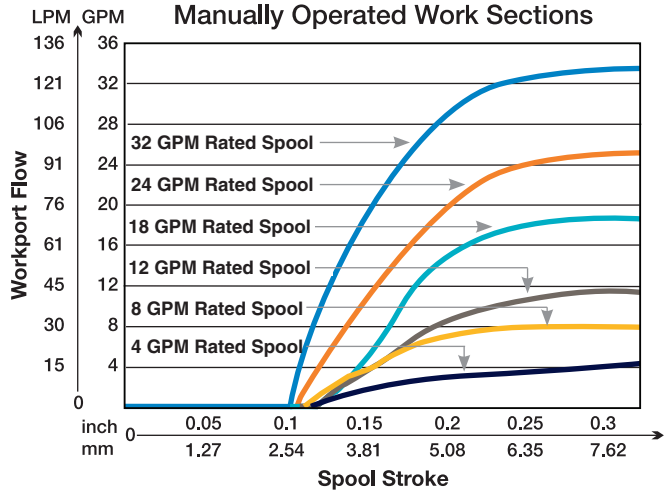
## Anticavitation Curve




## Port Relief Valve Curves

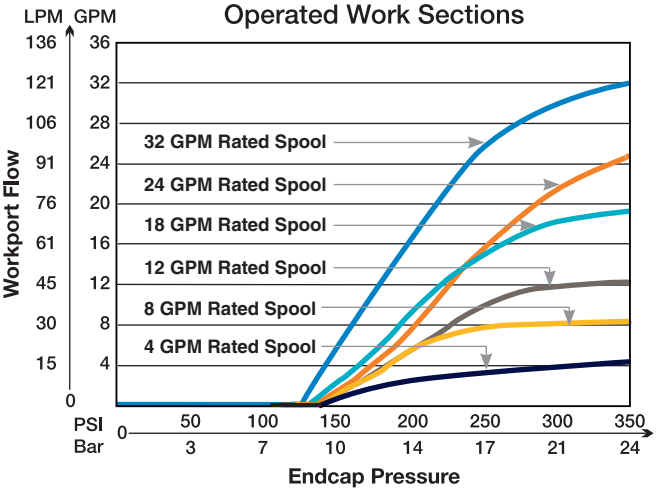



## Inlet to Workport for Manually Operated Work Sections




**Note:** Spool curves produced with nominal margin pressure of 17 Bar (250 PSI)

## Inlet to Workport for Hydraulic Remote Operated Work Sections




## Major Valve Options

### I. Circuits:

A) LS – when individual pressure compensation isn't needed.

B) PCLS with compensator. Also, both types of valves contain the load check which serves as a low leak transition check or when "induced loads"* are anticipated.

* Induced loads are actuators trying to force fluid back into valve.

### II. Inlets:

A) Combo – all spool operators. This also has the option for an external pilot supply in port if there is pilot supply available external to the valve for the solenoids.

B) "EC" – "external supply" to solenoids – port for connecting external supply to solenoids and drain port.

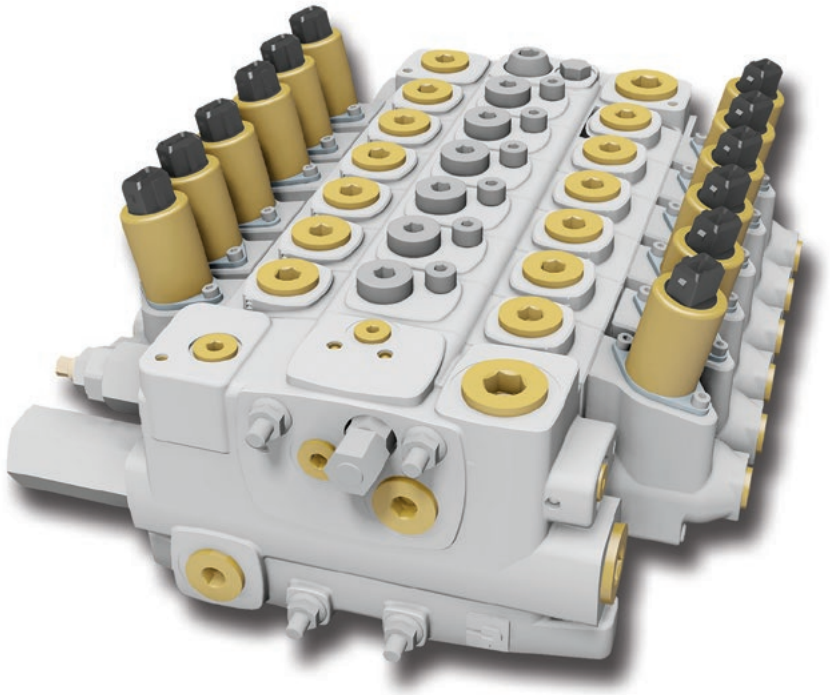
- Internal supply – reduced PSI to solenoids via internal pilot gallery.
  - Internal supply to solenoid operators.
- Joystick supply – reduced PSI to external port to supply joystick(s).
  - No internal pilot supply.
- Kidney loop – reduced PSI to an external pilot port. The pilot flow can then be routed to a filter and back into the valve. The signal is then routed to the solenoids via internal pilot gallery.

**All 3 options have:**

a) PRRV and screen upstream of it.

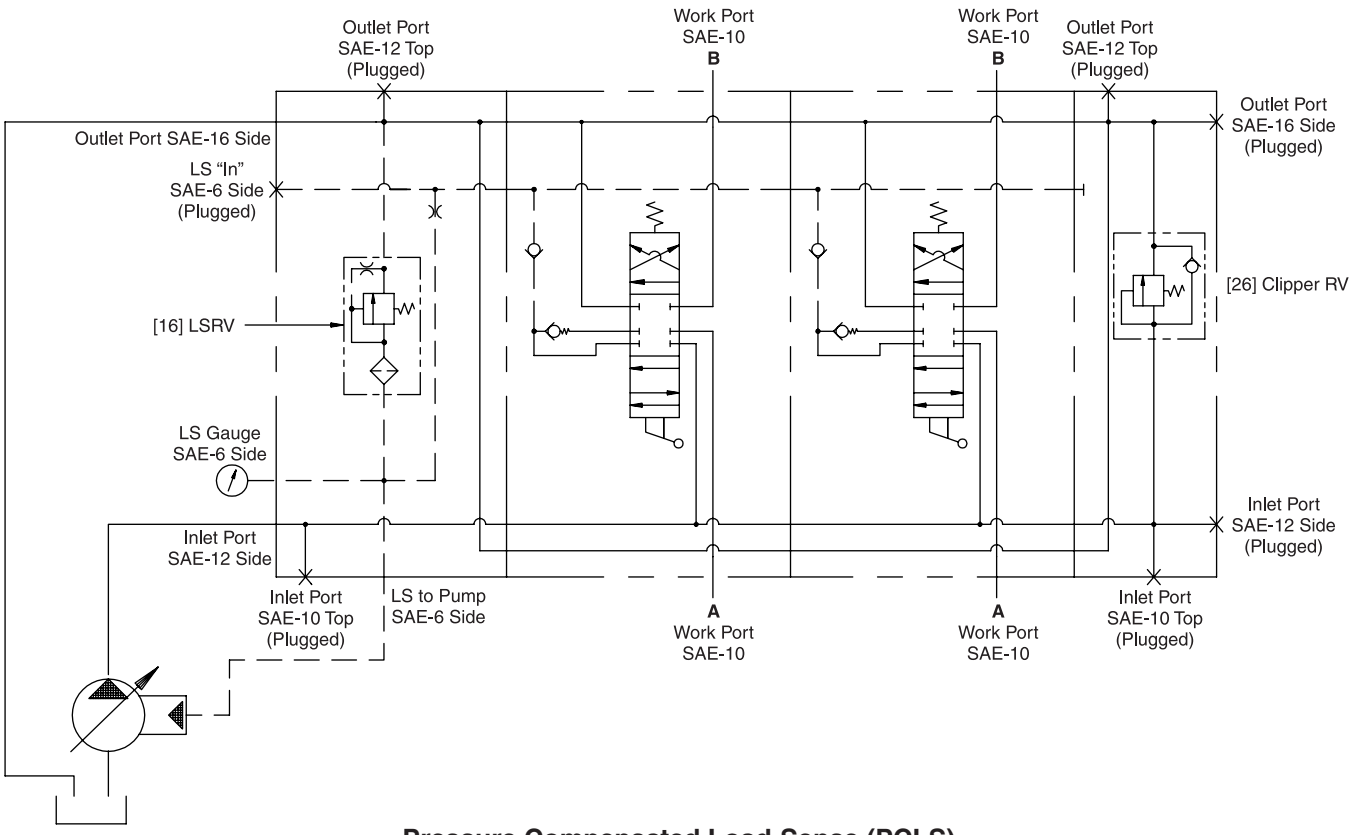
b) Accumulator port and check valve.

c) Drain port for connection of solenoid drains.

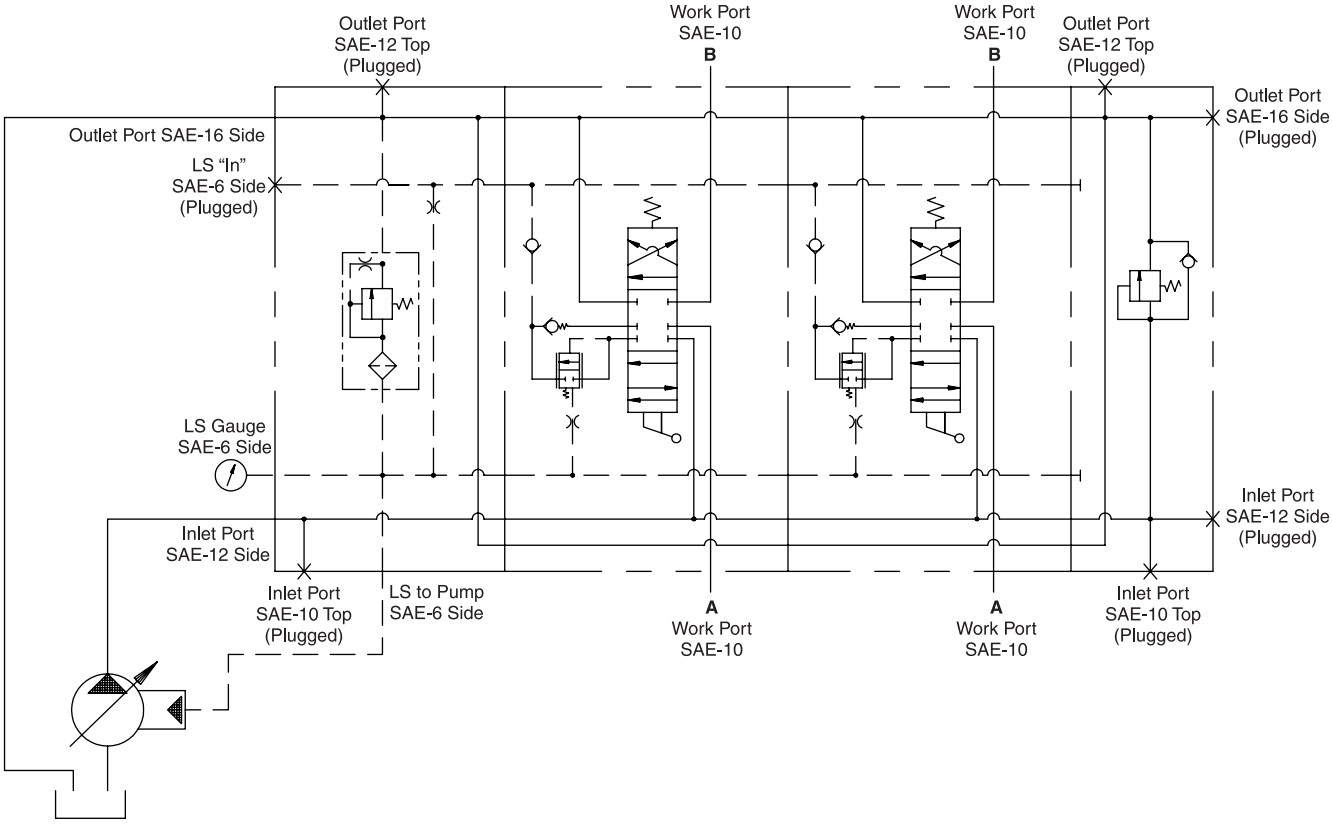


## How VP120 May Be Arranged

### Load-Sense Valve




### Pressure Compensated Load-Sense (PCLS)

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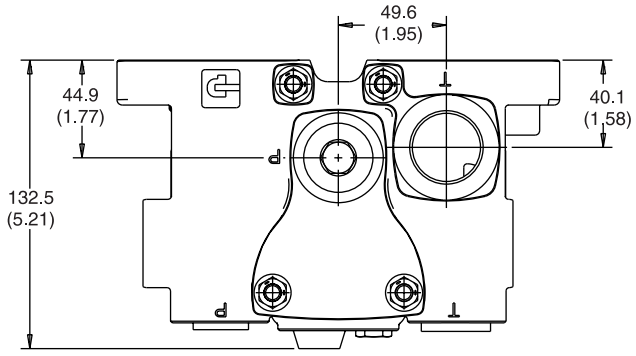
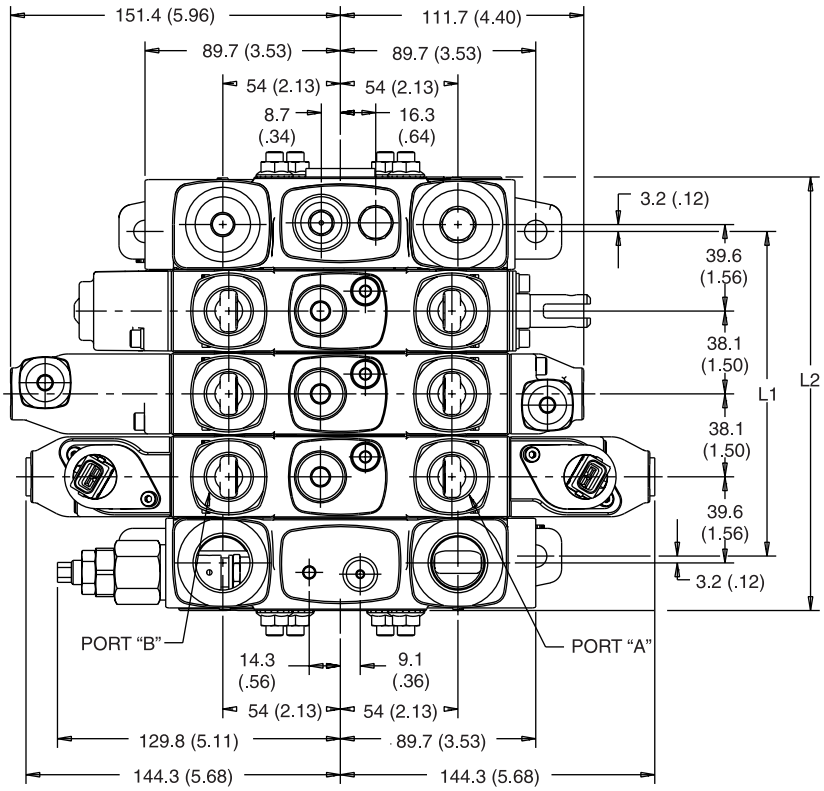
Elyria, Ohio, USA

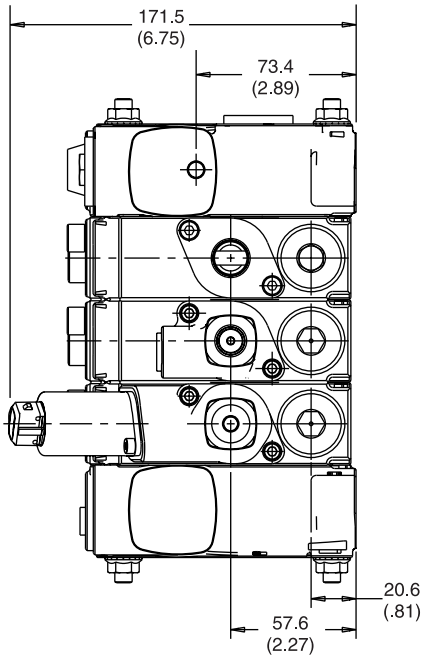
## VP120 with Combination Inlet / Combination Outlet

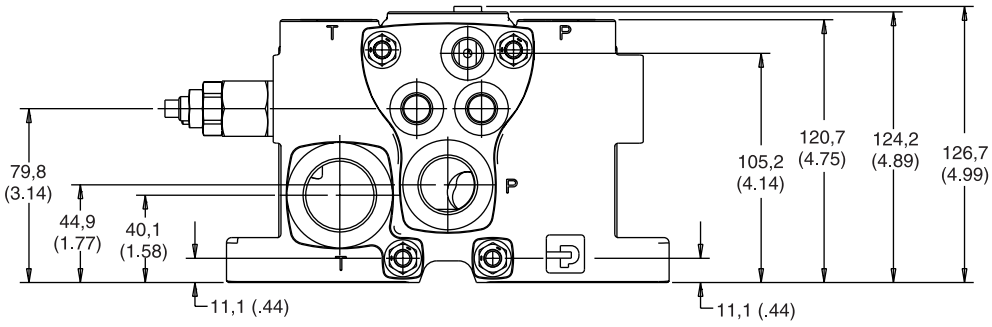
Inch equivalents for millimeter dimensions are shown in (**)




| No. of Sections | L1 mm (inch) | L2 mm (inch) |
|---|---|---|
| 1 | 72.8 (2.87) | 122.8 (4.83) |
| 2 | 110.9 (4.37) | 160.9 (6.33) |
| 3 | 149 (5.87) | 199.0 (7.83) |
| 4 | 187.1 (7.37) | 237.1 (9.33) |
| 5 | 225.2 (8.87) | 275.2 (10.83) |
| 6 | 263.3 (10.37) | 313.3 (12.33) |
| 7 | 301.4 (11.87) | 351.4 (13.83) |
| 8 | 339.5 (13.37) | 389.5 (15.33) |
| 9 | 377.6 (14.87) | 427.6 (16.83) |
| 10 | 415.3 (16.37) | 465.7 (18.33) |

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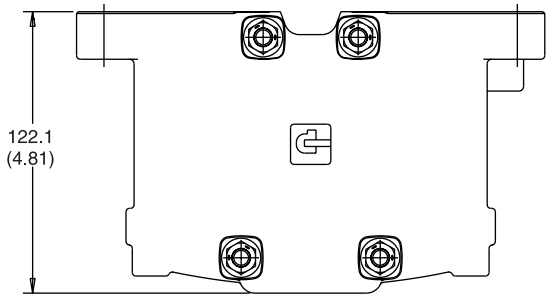
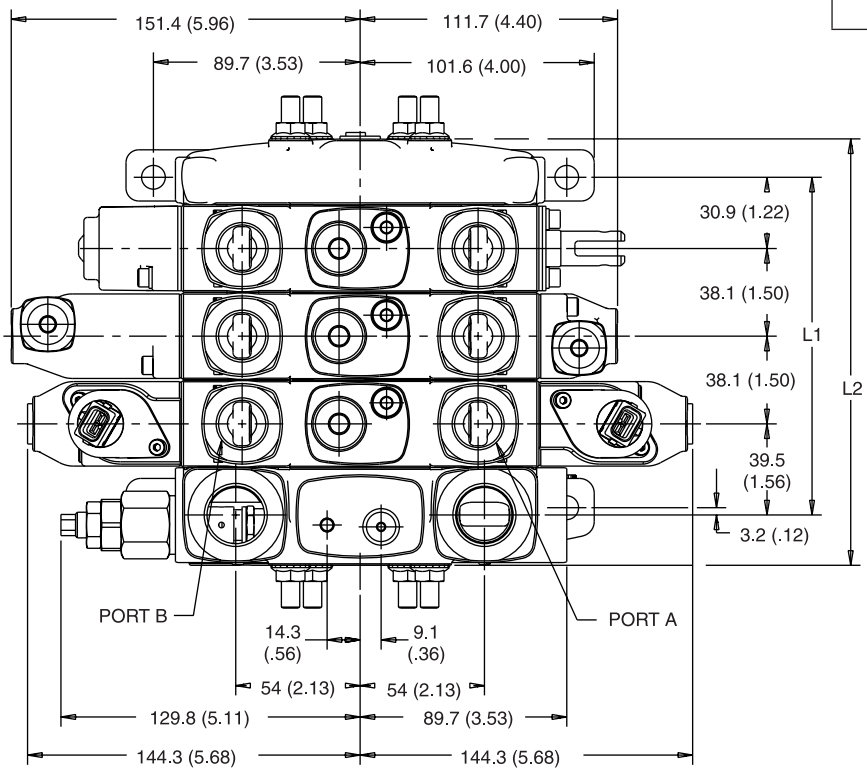
Hydraulic Valve Division
Elyria, Ohio, USA

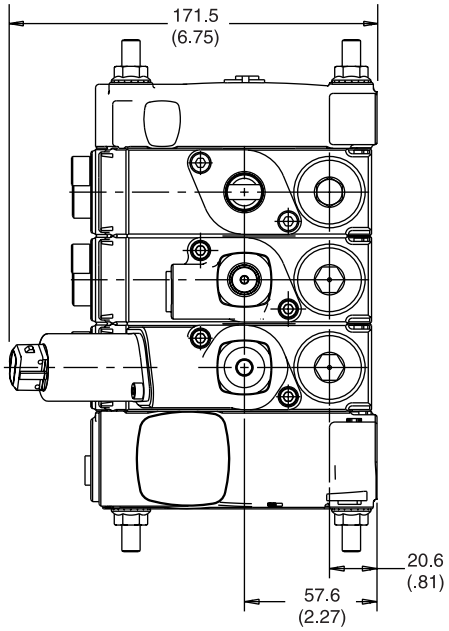
## VP120 with Combination Inlet / Simple Outlet

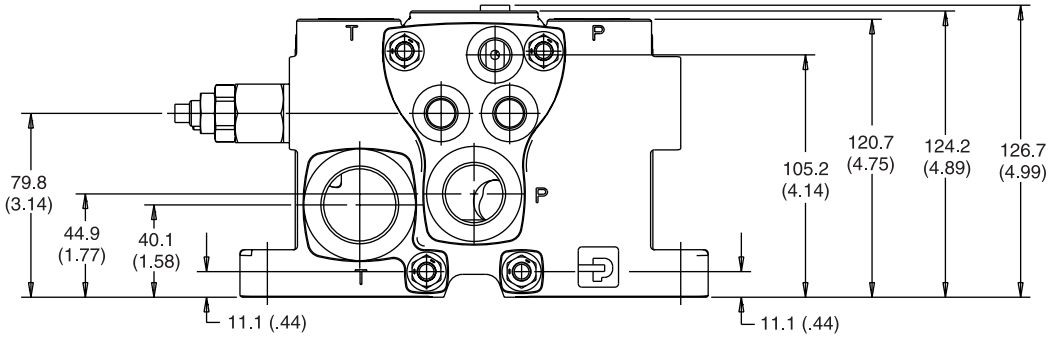
Inch equivalents for millimeter dimensions are shown in (**)

| No. of Sections | L1 mm (inch) | L2 mm (inch) |
|---|---|---|
| 1 | 70.4 (2.77) | 108.9 (4.29) |
| 2 | 108.5 (4.27) | 147.0 (5.79) |
| 3 | 146.6 (5.77) | 185.1 (7.29) |
| 4 | 184.7 (7.27) | 223.2 (8.79) |
| 5 | 222.8 (8.77) | 261.3 (10.29) |
| 6 | 260.9 (10.27) | 299.4 (11.79) |
| 7 | 299.0 (11.77) | 337.5 (13.29) |
| 8 | 337.1 (13.27) | 375.6 (14.79) |
| 9 | 375.2 (14.77) | 413.7 (16.29) |
| 10 | 413.3 (16.27) | 451.8 (17.79) |

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Hydraulic Valve Division
Elyria, Ohio, USA

## How to Configure a Valve Assembly

There are three choices available to configure a valve assembly: a hard copy specification sheet that is shown on page 32, an MS Excel spreadsheet version of this specification sheet and eSyber which is web based. Please contact your Parker representative or local distributor for additional information regarding these options.

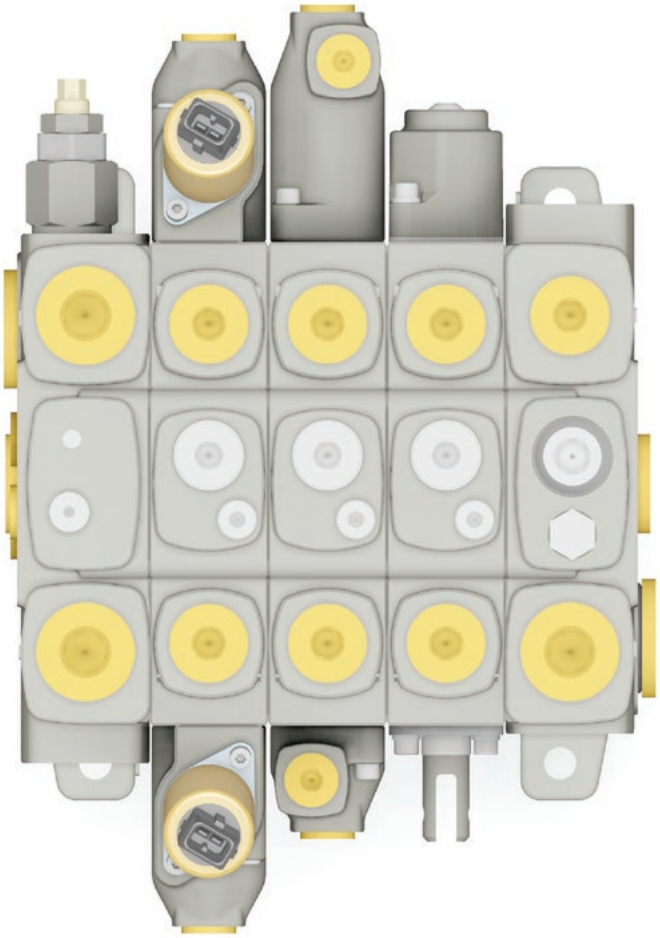
All of these choices involve selecting attributes or features for the system – inlet, work section and outlet. Each of the attributes is associated with a number or position that is shown in brackets [ ].

## Customer Information

| Position Code | Description |
|---|---|
| [D01] | Type of Market |
| [D02] | Market Segment |
| [D06] | Application |
| [D08] | Customer Product ID |
| [D19] | Customer Name |
| [D21] | Customer Contact |

## System Options

| Position Code | Description |
|---|---|
| [P01] | Valve Type |
| PCLS | Pressure compensated load-sense |
| LS | Load-sense |
| [P03] | Margin Pressure Setting (Bar) |
| [P04] | Port Type |
| U | SAE |
| G | BSPP |
| [P05] | System Voltage |
| 12 | 12 VDC |
| 24 | 24 VDC |
| \ | No solenoids |
| [P06] | Solenoid Connector Type |
| D | Deutsch |
| A1 | Amp Jr. |
| A2 | Amp Jr. with push pin override |
| \ | No solenoids |
| [P07] | Surface Finish |
| X | No paint |
| P | Painted black |
| [P08] | Pump Flow to Inlet (LPM) |
| [P09] | Pump Pressure to Inlet (Bar) |



### PSI to Bar Reference Table

| PSI | Bar |
|---|---|
| 145 | 10 |
| 290 | 20 |
| 435 | 30 |
| 580 | 40 |
| 725 | 50 |
| 870 | 60 |
| 1015 | 70 |
| 1160 | 80 |
| 1305 | 90 |
| 1450 | 100 |
| 1595 | 110 |
| 1740 | 120 |
| 1885 | 130 |
| 2030 | 140 |

| PSI | Bar |
|---|---|
| 2175 | 150 |
| 2320 | 160 |
| 2465 | 170 |
| 2610 | 180 |
| 2755 | 190 |
| 2900 | 200 |
| 3045 | 210 |
| 3190 | 220 |
| 3335 | 230 |
| 3480 | 240 |
| 3625 | 250 |
| 3770 | 260 |
| 3916 | 270 |
| 4060 | 280 |

| PSI | Bar |
|---|---|
| 4205 | 290 |
| 4350 | 300 |
| 4495 | 310 |
| 4640 | 320 |
| 4785 | 330 |
| 4930 | 340 |
| 5075 | 350 |
| 5220 | 360 |
| 5365 | 370 |
| 5510 | 380 |
| 5655 | 390 |
| 5800 | 400 |

## Inlet/Outlet Options

### Inlets

| [P15] | Inlet Section Type (ref. pages 15 – 17) |
|---|---|
| I | Standard Inlet |
| IEH | Pilot Generating Inlet |
| IPFD | Priority Flow Divider Inlet |
| **[P16]** | **Load-Sense Relief Valve (ref. page 22)** |
| LRSV1 | Load-Sense Relief Valve with LS Drain |
| LRSV2 | Load-Sense Relief Valve without LS Drain |
| LSRVY | Load-Sense Relief Valve Plug |
| **[P17]** | **Load-Sense Relief Valve Setting** |
| **[P18]** | **Top Pump Port** |
| P1B | Top Pump Port with a Steel Plug |
| P1 | Top Pump Port Open |
| \ | Top Pump Port Not Machined |
| **[P19]** | **Side Pump Port** |
| P2B | Side Pump Port with a Steel Plug |
| P2 | Side Pump Port Open |
| **[P20]** | **Top Tank Port** |
| T1B | Top Tank Port with a Steel Plug |
| T1 | Top Tank Port Open |
| PF | Priority Flow Port |
| **[P21]** | **Side Tank Port** |
| T2B | Side Tank Port with a Steel Plug |
| T2 | Side Tank Port Open |
| **[P22]** | **Load-Sense in Port (ref. page 22)** |
| ILSPB | Load-Sense in Port with a Steel Plug |
| ILSP | Load-Sense in Port Open |
| ILSPCK | Load-Sense in Port with an Integrated Shuttle Check |
| \ | Not Machined |
| **[P23]** | **Pilot Supply in Port** |
| IPSB | Pilot Supply in Port with a Steel Plug |
| IPS | Pilot Supply in Port Open |
| \ | Not Machined |
| **[P24F]** | **Priority Flow Setting in LPM** |
| **[P24]** | **Priority Flow Load-Sense Relief Valve** |
| PFLS | Priority Flow Load-Sense Relief Valve |
| \ | Not Machined |
| **[P24S]** | **Priority Flow Load-Sense Relief Setting in Bar** |
| **[P25]** | **Pilot Out Port** |
| IPOB | Pilot Out Port with a Steel Plug |
| IPO | Pilot Out Port Open |
| \ | Not Machined |
| **[P26]** | **Pilot Supply Accumulator Port** |
| IACB | Pilot Supply Accumulator Port Plugged |
| IAC | Pilot Supply Accumulator Port Open |
| \ | Not Machined |
| **[P27]** | **Inlet Pilot Drain** |
| ISDP | Inlet Pilot Drain Plugged |
| ISD | Inlet Pilot Drain Open |

### Outlets

| [P30] | Outlet Section Type (ref. pages 18 – 21) |
|---|---|
| O | Standard Outlet |
| OS | Simple Outlet |
| OEH | Pilot Generating Outlet |
| OBC | Bypass Outlet |
| **[P31]** | **Clipper Relief Valve** |
| CRVY | Clipper Relief Valve Plugged |
| CRV | Fixed Clipper Relief Valve |
| **[P31S]** | **Clipper Relief Setting (see chart on page 22)** |
| **[P33]** | **Solenoid Drain** |
| SDB | Solenoid Drain with a Steel Plug |
| SD | Solenoid Drain Open |
| \ | Not Machined |
| **[P35]** | **Top Pump Port** |
| P3B | Top Pump Port with a Steel Plug |
| P3 | Top Pump Port Open |
| \ | Not Machined |
| **[P36]** | **Side Pump Port** |
| P4B | Side Pump Port with a Steel Plug |
| P4 | Side Pump Port Open |
| \ | Not Machined |
| **[P37]** | **Top Tank Port** |
| T3B | Top Tank Port with a Steel Plug |
| T3 | Top Tank Port Open |
| \ | Not Machined |
| **[P38]** | **Side Tank Port** |
| T4B | Side Tank Port with a Steel Plug |
| T4 | Side Tank Port Open |
| \ | Not Machined |
| **[P39]** | **Load-Sense in Port** |
| OLSPB | Load-Sense in Port with a Steel Plug |
| OLSP | Load-Sense in Port Open |
| \ | Not Machined |
| **[P40]** | **Pilot Supply in Port** |
| OPSB | Pilot Supply in Port with a Steel Plug |
| OPS | Pilot Supply in Port Open |
| \ | Not Machined |
| **[P43]** | **Pilot Out Port** |
| OPOB | Pilot Out Port with a Steel Plug |
| OPO | Pilot Out Port Open |
| \ | Not Machined |
| **[P44]** | **Pilot Supply Accumulator Port** |
| OACB | Pilot Supply Accumulator Port Plugged |
| OAC | Pilot Supply Accumulator Port Open |
| \ | Not Machined |

**Note:** Porting availability for inlet/outlet may be referenced on the page corresponding to the specific cover type.

## Port Descriptions

**Top Pump Port:** The Top Pump Port is a direct pump to valve supply port and is a used to connect the pressurized oil supply to the valve.

**Side Pump Port:** The Side Pump Port is a direct pump to valve supply port and is used to connect the pressurized oil supply to the valve.

**Top Tank Port:** The Top Tank Port is an oil exhaust port and is used to evacuate oil back to the system tank.

**Side Tank Port:** The Side Tank Port is an oil exhaust port and is used to evacuate oil back to the system tank.

**Load-Sense in Port:** The Load-Sense in Port is used when connecting two load-sensing valves together in the same system. This port can be configured to be open, plugged, or accept a shuttle check cartridge. The shuttle check cartridge will alleviate the need for an external shuttle check valve which is needed to communicate to the pump which valve assembly in the circuit is communicating the highest load-sense pressure.

**Pilot Supply Port:** The Pilot Supply Port can be configured to be open or plugged. Pilot flow and pressure is needed when using electrohydraulic solenoids to move the section spool. Often when pilot flow is needed the pilot generating inlet, which has an integrated pressure reducing valve to create the needed flow and pressure for the solenoids, is used and the pilot supply port is commonly used to return flow back to the the VP120 assembly once it has been diverted through a kidney loop filter. However, in some instances when pilot flow and pressure is available from another component in the hydraulic system the pilot flow and pressure can be supplied to the valve assembly through pilot supply port configured with a non-pilot generating inlet or outlet.

**Pilot Out Port:** The Pilot Out option is available on the pilot generating inlet and will provide up to 8 LPM (2 GPM) at 35 Bar (500 PSI) for kidney loop filtration or auxiliary functions needing pilot flow.

**Accumulator Supply Port:** The optional Accumulator Supply Port with check valve is meant for use with a standard accumulator for certain situations where standby flow and pressure may be needed.

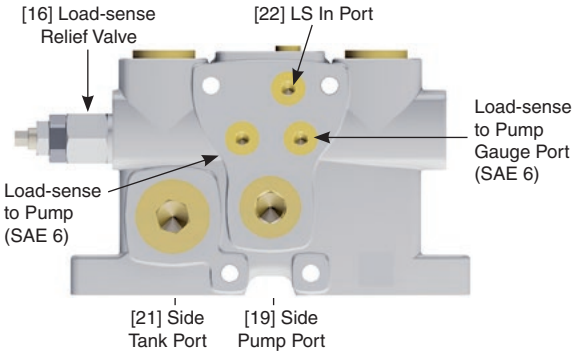
**Solenoid Drain Port:** The Solenoid Drain Port is needed when using electrohydraulic solenoids with the VP120 and comes unplugged when the assembly is configured for electrohydraulic actuation. This port allows low pressure oil which is being removed from the solenoid end cap opposite of the end cap being supplied with pilot flow and pressure to drain. If this port is not used, pilot drain flow will become trapped within the valve assembly and the spool will not continue to shift properly. The solenoid drain port should be routed directly back to the tank and should not go through any kind of a return fitler or other possible retriction as back pressure can cause damage to the VP120 solenoids.

## I – [P15] Inlet Section Type

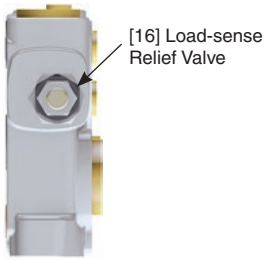
### Standard Inlet

The standard inlet can be used with manual, hydraulic pilot, and electrohydraulic configurations. The pilot in port allows for solenoid pilot generation flow to be brought into the VP120 valve assembly from an external source.

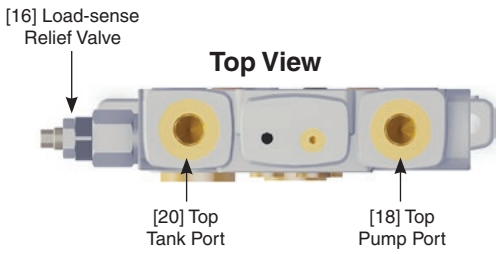
**Front View**

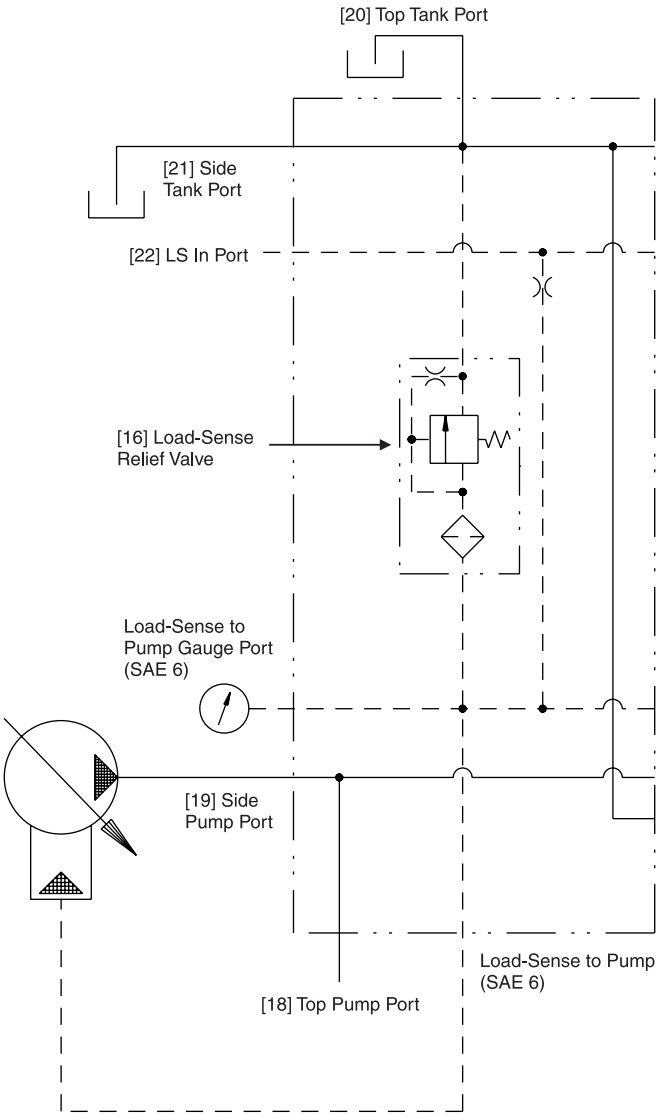



**Left View**




**Right View**




## Port Options Available

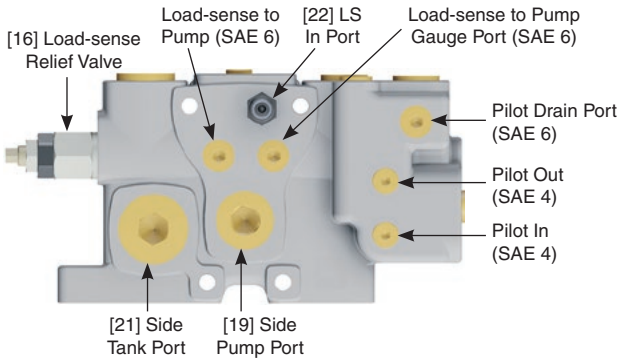
| | |
|---|---|
| **[P18]** | **Top Pump Port SAE 10** |
| P1B | Top Pump Port with a Steel Plug |
| P1 | Top Pump Port Open |
| **[P19]** | **Side Pump Port SAE 12** |
| P2B | Side Pump Port with a Steel Plug |
| P2 | Side Pump Port Open |
| **[P20]** | **Top Tank Port SAE 12** |
| T1B | Top Tank Port with a Steel Plug |
| T1 | Top Tank Port Open |
| **[P21]** | **Side Tank Port SAE 16** |
| T2B | Side Tank Port with a Steel Plug |
| T2 | Side Tank Port Open |
| **[P22]** | **Load-Sense in Port SAE 6** |
| ILSPB | Load-Sense in Port with a Steel Plug |
| ILSP | Load-Sense in Port Open |
| ILSPCK | Load-Sense in Port with an Integrated Shuttle Check |
| **[P23]** | **Pilot Supply in Port SAE 6** |
| IPSB | Pilot Supply in Port with a Steel Plug |
| IPS | Pilot Supply in Port Open |
| **[P25]** | **Pilot Out Port** |
| \ | Not Machined |
| **[P26]** | **Pilot Supply Accumulator Port** |
| \ | Not Machined |

## IEH – [P15] Inlet Section Type

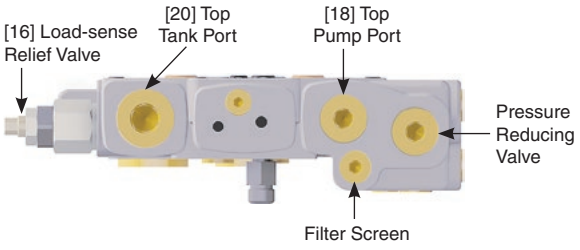
### Pilot Generating Inlet

The pilot generating inlet is mainly used when electrohydraulic sections are in use to provide pilot flow and pressure to the section solenoids. Other reasons for the inlet with internal pilot generation could be to generate pilot flow and pressure for external operations (i.e., hydraulic pilot controllers) or for kidney loop filtration. The inlet with internal pilot generation also contains an optional accumulator porting with check valve to provide a stand by flow and pressure for certain situations.

**Front View**

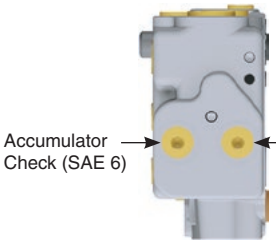


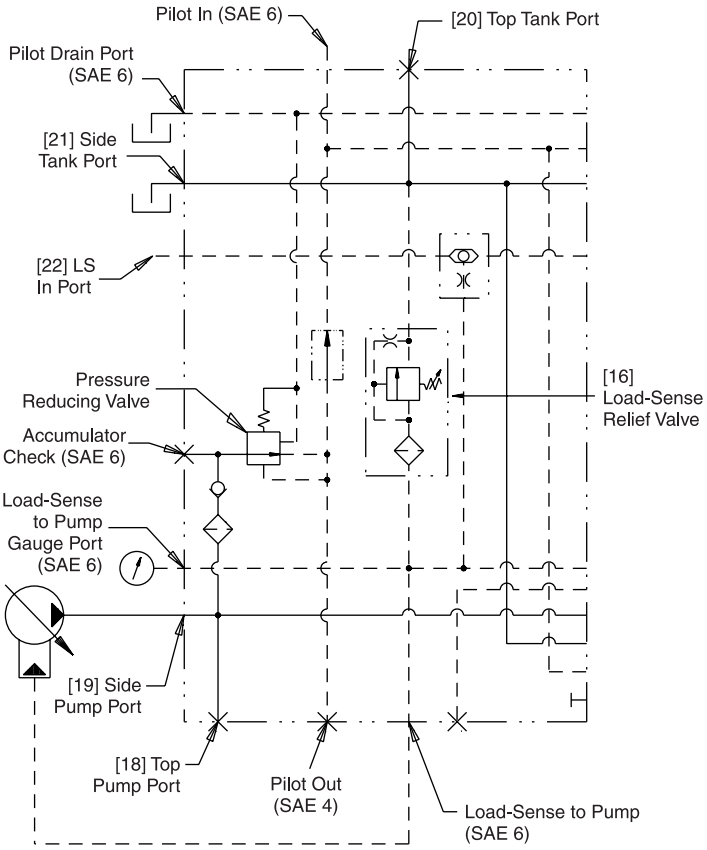

**Top View**




**Left View**


**Right View**




## Port Options Available

| | |
|---|---|
| **[P18]** | **Top Pump Port SAE 10** |
| P1B | Top Pump Port with a Steel Plug |
| P1 | Top Pump Port Open |
| **[P19]** | **Side Pump Port SAE 12** |
| P2B | Side Pump Port with a Steel Plug |
| P2 | Side Pump Port Open |
| **[P20]** | **Top Tank Port SAE 12** |
| T1B | Top Tank Port with a Steel Plug |
| T1 | Top Tank Port Open |
| **[P21]** | **Side Tank Port SAE 16** |
| T2B | Side Tank Port with a Steel Plug |
| T2 | Side Tank Port Open |
| **[P22]** | **Load-Sense in Port SAE 6** |
| ILSPB | Load-Sense in Port with a Steel Plug |
| ILSP | Load-Sense in Port Open |
| ILSPCK | Load-Sense in Port with an Integrated Shuttle Check |
| **[P23]** | **Pilot Supply in Port SAE 6** |
| IPSB | Pilot Supply in Port with a Steel Plug |
| IPS | Pilot Supply in Port Open |

Continued in next column

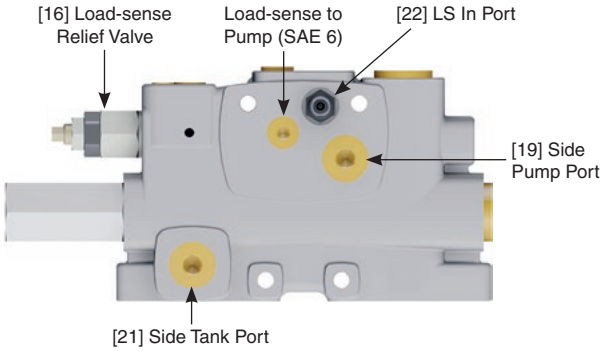
| | |
|---|---|
| **[P25]** | **Pilot Out Port SAE 6** |
| IPOB | Pilot Out Port with a Steel Plug |
| IPO | Pilot Out Port Open |
| **[P26]** | **Pilot Supply Accumulator Port SAE 6** |
| IACB | Pilot Supply Accumulator Port Plugged |
| IAC | Pilot Supply Accumulator Port Open |
| **[P27]** | **Inlet Pilot Drain** |
| ISDP | Inlet Pilot Drain Plugged |
| ISD | Inlet Pilot Drain Open |

## IPFD – [P15] Inlet Section Type

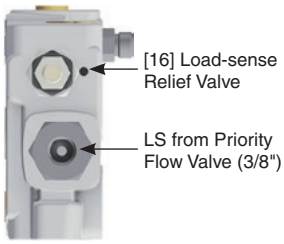
### Priority Flow Inlet (Steering / Braking)

The priority flow inlet is used when an auxilery function from the VP120 valve requires priority flow. The priority flow will always be used first and the remaining flow will be sent to the VP120 sections for use. The priority flow's pressure can be controlled either by an external relief valve or a built in load-sense relief valve which will limit the pressure for just the priority flow being diverted from the VP120 assembly. If choosing the priority flow inlet please use the notes section at the bottom of the specification sheet to note what priority flow rate is required and if a priority LS relief is required (pressure should be included).

**Front View**

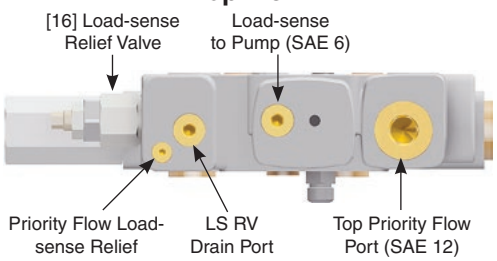


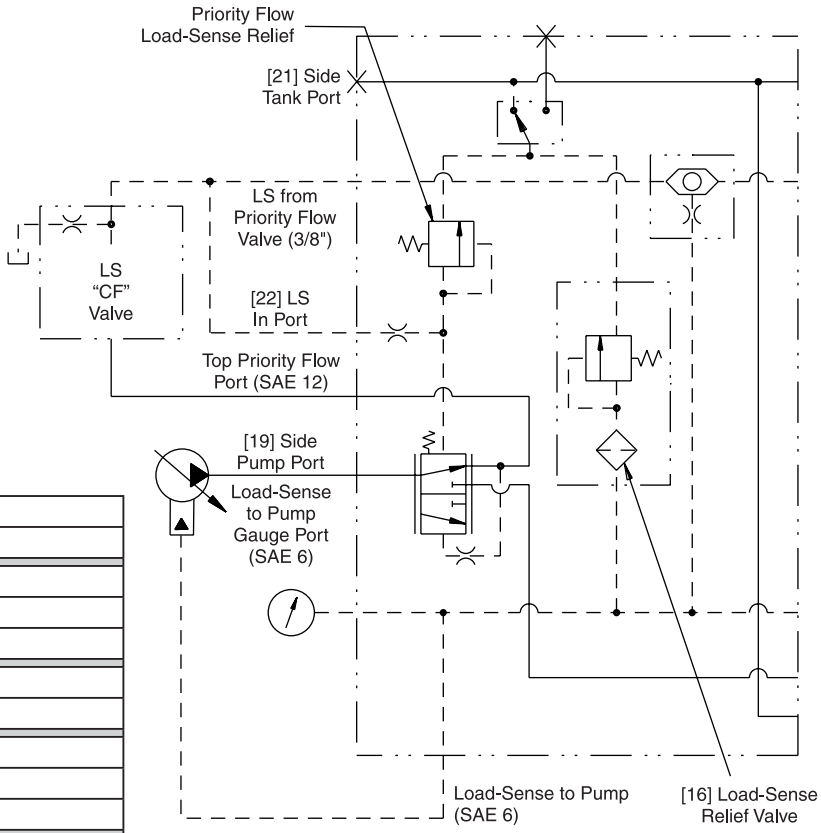

**Left View**




**Right View**


**Top View**




## Port Options Available

| | |
|---|---|
| **[P18]** | **Top Pump Port** |
| \ | Top Pump Port Not Machined |
| **[P19]** | **Side Pump Port SAE 12** |
| P2B | Side Pump Port with a Steel Plug |
| P2 | Side Pump Port Open |
| **[P20]** | **Top Tank Port SAE 12** |
| PF | Priority Flow Port |
| **[P21]** | **Side Tank Port SAE 12** |
| T2B | Side Tank Port with a Steel Plug |
| T2 | Side Tank Port Open |
| **[P22]** | **Load-Sense in Port SAE 6** |
| ILSPB | Load-Sense in Port with a Steel Plug |
| ILSP | Load-Sense in Port Open |
| ILSPCK | Load-Sense in Port with an Integrated Shuttle Check |
| **[P23]** | **Pilot Supply in Port SAE 6** |
| IPSB | Pilot Supply in Port with a Steel Plug |
| IPS | Pilot Supply in Port Open |
| **[P24F]** | **Priority Flow Setting in LPM** |

Continued in next column

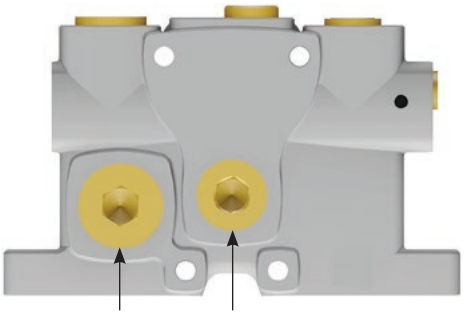
| | |
|---|---|
| **[P24]** | **Priority Flow Load-Sense Relief Valve** |
| **PFLS** | **Priority Flow Load-Sense Relief Valve** |
| \ | Not Machined |
| **[P24S]** | **Priority Flow Load-Sense Relief Setting in Bar** |
| **[P25]** | **Pilot Out Port** |
| \ | Not Machined |
| **[P26]** | **Pilot Supply Accumulator Port** |
| \ | Not Machined |

## O – [P30] Outlet Section Type

### Standard Outlet

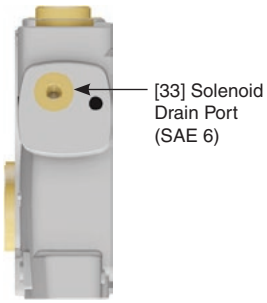
The standard outlet can be used with manual, hydraulic pilot, and electro-hydraulic actuation. All standard outlets contain a mandatory pilot drain port in the cover, which can be plugged if pilot flow will be drained from an inlet cover.

**Right Cover**

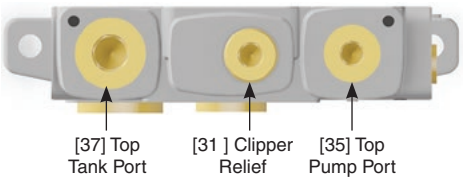


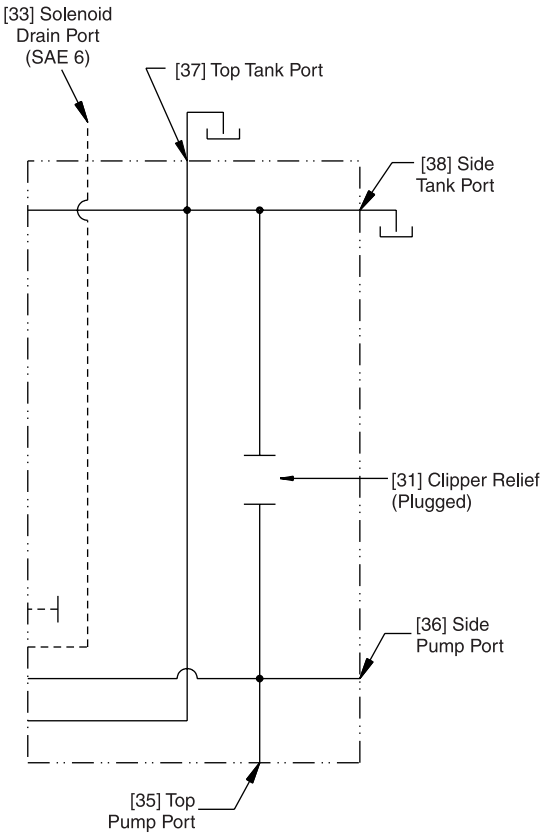

**Left View**

**Right View**




**Top View**




## Port Options Available

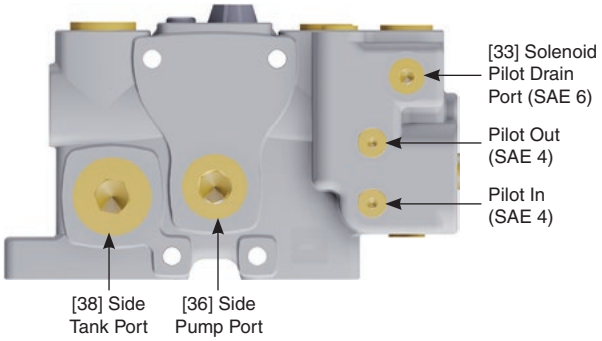
| | |
|---|---|
| **[P33]** | **Solenoid Drain SAE 6** |
| SDB | Solenoid Drain with a Steel Plug |
| SD | Solenoid Drain Open |
| **[P35]** | **Top Pump Port SAE 10** |
| P3B | Top Pump Port with a Steel Plug |
| P3 | Top Pump Port Open |
| **[P36]** | **Side Pump Port SAE 12** |
| P4B | Side Pump Port with a Steel Plug |
| P4 | Side Pump Port Open |
| **[P37]** | **Top Tank Port SAE 12** |
| T3B | Top Tank Port with a Steel Plug |
| T3 | Top Tank Port Open |
| **[P38]** | **Side Tank Port SAE 16** |
| T4B | Side Tank Port with a Steel Plug |
| T4 | Side Tank Port Open |
| **[P39]** | **Load-Sense in Port** |
| \ | Not Machined |
| **[P40]** | **Pilot Supply in Port** |
| \ | Not Machined |
| **[P43]** | **Pilot Out Port** |
| \ | Not Machined |
| **[P44]** | **Pilot Supply Accumulator Port** |
| \ | Not Machined |

## OEH – [P30] Outlet Section Type

### Pilot Generating Outlet

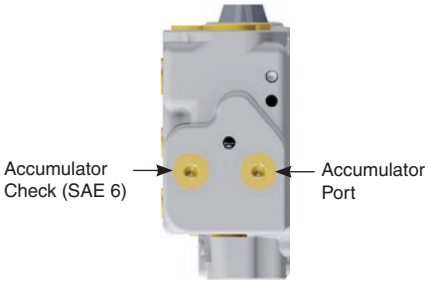
The pilot generating outlet is mainly used when electrohydraulic sections are in use to provide pilot flow and pressure to the section solenoids. Please note only one pilot generating outlet should be used, if already used as an inlet then the outlet option is not available. Other reasons the outlet with internal pilot generation could be to generate pilot flow and pressure for external operations (i.e., hydraulic pilot controllers) or for kidney loop filtration. All pilot generating outlets contain a mandatory pilot drain port in the cover which can be plugged if pilot flow will be drained from an inlet cover.

**Right Cover**

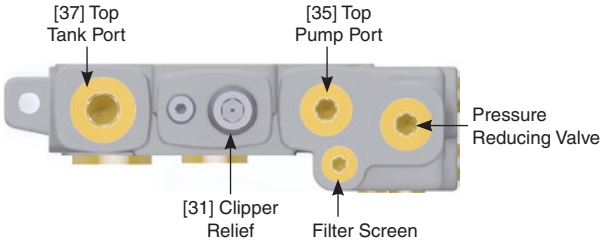


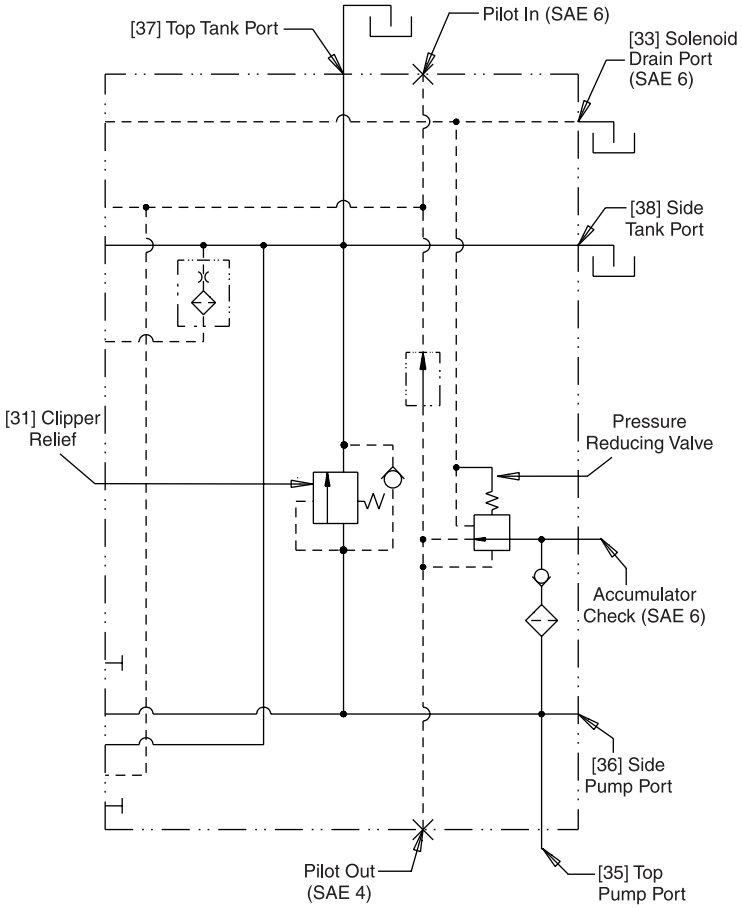

**Left View**

**Right View**




**Top View**




## Port Options Available

| [P33] | **Solenoid Drain SAE 6** |
|---|---|
| SDB | Solenoid Drain with a Steel Plug |
| SD | Solenoid Drain Open |
| **[P35]** | **Top Pump Port SAE 10** |
| P3B | Top Pump Port with a Steel Plug |
| P3 | Top Pump Port Open |
| **[P36]** | **Side Pump Port SAE 12** |
| P4B | Side Pump Port with a Steel Plug |
| P4 | Side Pump Port Open |
| **[P37]** | **Top Tank Port SAE 12** |
| T3B | Top Tank Port with a Steel Plug |
| T3 | Top Tank Port Open |
| **[P38]** | **Side Tank Port SAE 16** |
| T4B | Side Tank Port with a Steel Plug |
| T4 | Side Tank Port Open |
| **[P39]** | **Load-Sense in Port** |
| \ | Not Machined |
| **[P40]** | **Pilot Supply in Port SAE 6** |
| OPSB | Pilot Supply in Port with a Steel Plug |
| OPS | Pilot Supply in Port Open |

Continued in next column

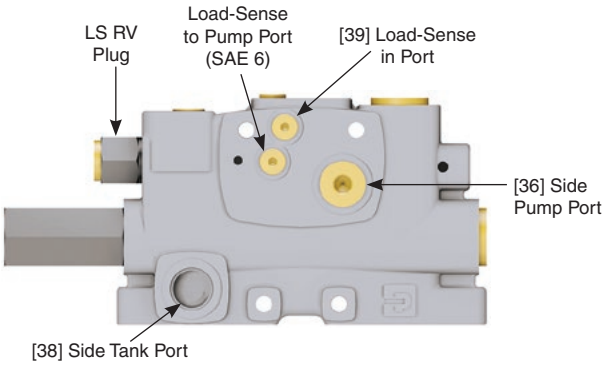
| [P43] | **Pilot Out Port SAE 6** |
|---|---|
| OPOB | Pilot Out Port with a Steel Plug |
| OPO | Pilot Out Port Open |
| **[P44]** | **Pilot Supply Accumulator Port SAE 6** |
| OACB | Pilot Supply Accumulator Port Plugged |
| OAC | Pilot Supply Accumulator Port Open |

## OBC – [P30] Outlet Section Type

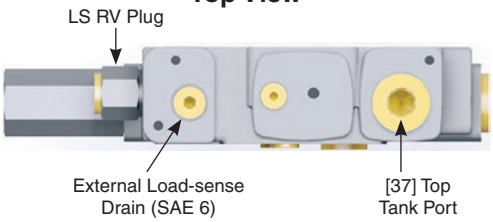
### Bypass Compensator Outlet

Bypass compensated outlets allow for the use of a fixed displacement pump with a closed center load sensing VP120 assembly. The spool type designed bypass compensator will proportionally unload the unneeded flow to the tank galley of the VP120 assembly when only a portion or no flow is required by the sections. All bypass compensated outlets contain a mandatory pilot drain port in the cover which can be plugged if pilot flow will be drained from an inlet cover.

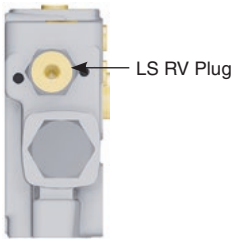
**Front View**



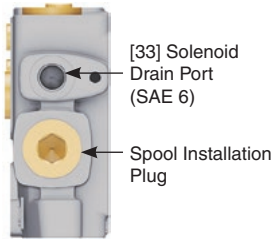

**Top View**

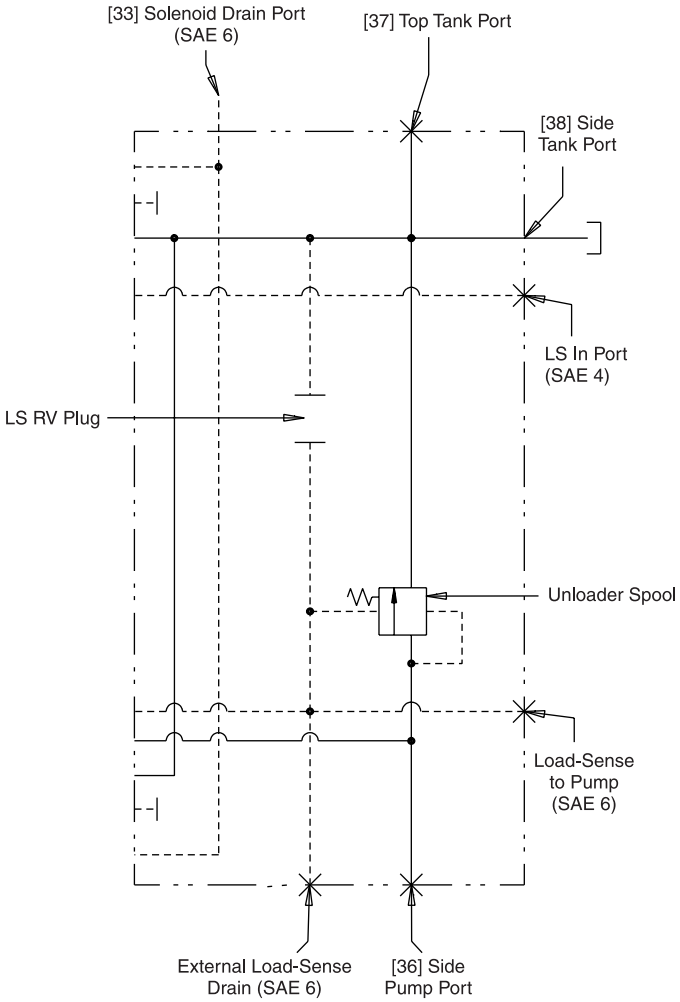



**Left View**




**Right View**




## Port Options Available

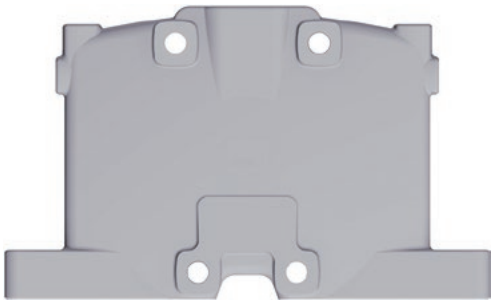
| | |
|---|---|
| **[P33]** | **Solenoid Drain SAE 6** |
| SDB | Solenoid Drain with a Steel Plug |
| SD | Solenoid Drain Open |
| **[P35]** | **Top Pump Port** |
| \ | Not Machined |
| **[P36]** | **Side Pump Port SAE 10** |
| P4B | Side Pump Port with a Steel Plug |
| P4 | Side Pump Port Open |
| **[P37]** | **Top Tank Port SAE 12** |
| T3B | Top Tank Port with a Steel Plug |
| T3 | Top Tank Port Open |
| **[P38]** | **Side Tank Port SAE 12** |
| T4B | Side Tank Port with a Steel Plug |
| T4 | Side Tank Port Open |
| **[P39]** | **Load-Sense in Port SAE 6** |
| OLSPB | Load-Sense in Port with a Steel Plug |
| OLSP | Load-Sense in Port Open |
| **[P40]** | **Pilot Supply in Port** |
| \ | Not Machined |
| **[P43]** | **Pilot Out Port** |
| \ | Not Machined |
| **[P44]** | **Pilot Supply Accumulator Port** |
| \ | Not Machined |

## OS – [P30] Outlet Section Type

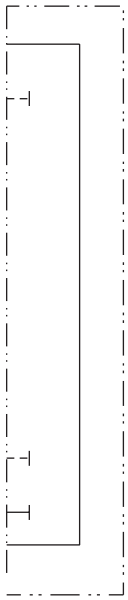
### Simple Outlet

Simple outlets blank off the outlet side of the valve and force the flow to enter and exit the valve in the inlet cover.

**Front View**



**Left View**



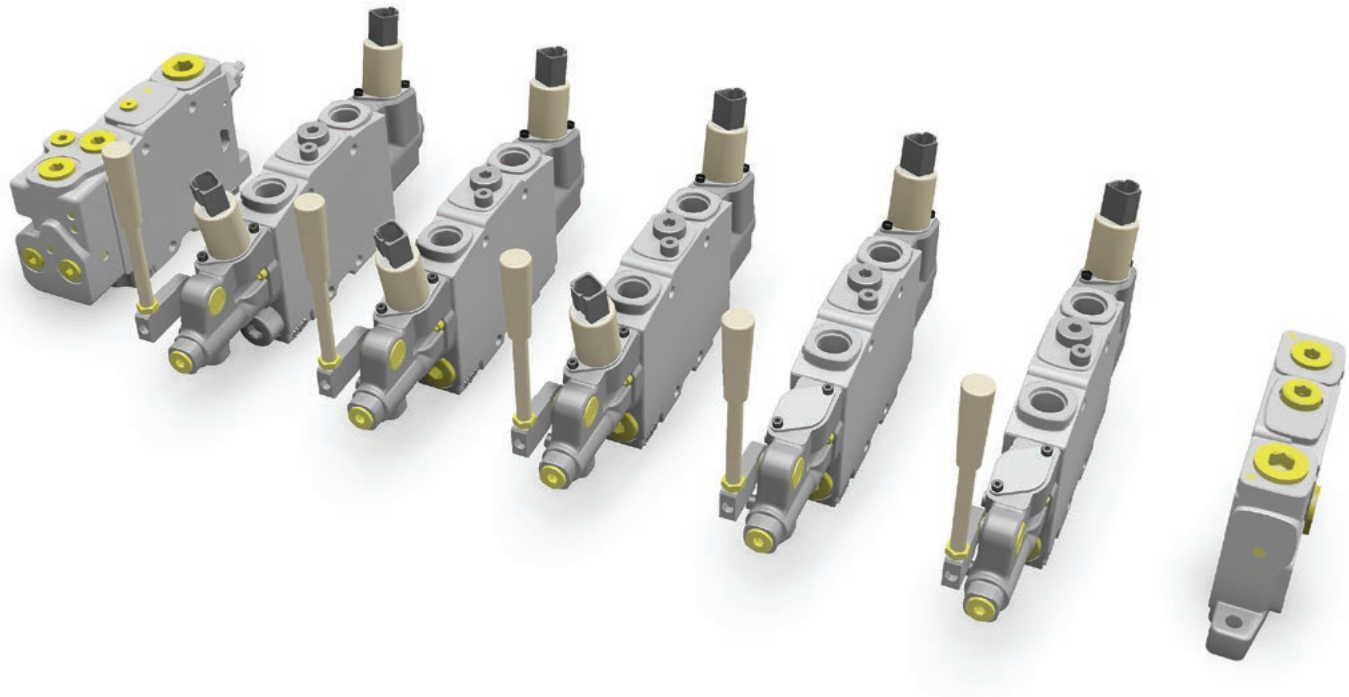
Standard simple outlet will include top solenoid pilot drain.

**Top View**


## [P35-P38] Pressure/ Porting Options

| Code | Description |
|---|---|
| / | No port options available |

**Pilot Drain Port** is standard on simple outlets and must be used in one location on the VP120 assembly to relieve pilot drain flow.



## Load-Sense Relief Valve

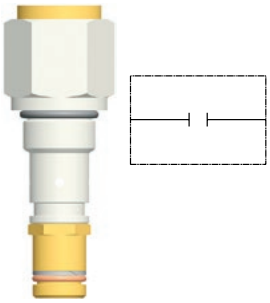
The Load-Sense Relief Valve limits the load-sense pressure which will limit the pressure the valve assembly is able to achieve. The load-sense relief pressure should be set to the pressure desired at the workport.

The load-sense relief valve comes in three standard configurations, as shown below.

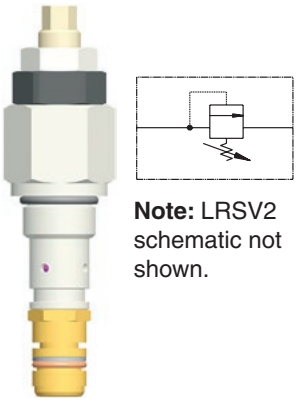
| Code | Description |
|---|---|
| **LSRV1** | Pressure adjustable and includes an integrated load-sense bleed or drain. |
| **LSRV2** | Pressure adjustable but does not include an integrated load-sense bleed or drain. |
| **LSRVY** | A load-sense defeat plug and should be combined with another load-sense relief somewhere in the hydraulic system. |

## [P16] Load-Sense Relief Valve

**Code Y**



**Codes LSRV and LSRV2**



**Note:** LRSV2 schematic not shown.

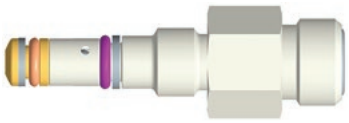
**Adjustable Pressure Setting Range Reference (Use Bar for coding)**

| Bar | (PSI) | Bar | (PSI) |
|---|---|---|---|
| 180 | (2600) | 220 | (3200) |
| 185 | (2700) | 230 | (3300) |
| 195 | (2800) | 235 | (3400) |
| 200 | (2900) | 240 | (3500) |
| 205 | (3000) | 250 | (3600) |
| 215 | (3100) | 255 | (3700) |
| | | 260 | (3800) |

**Example:** If the LSRV is set at 260 Bar (3800 PSI) plus 17 Bar (250 PSI) (pump margin) then the pump is at 277 Bar (4017PSI).

## [P22] Load-Sense in Port

The External LS in cavity can be configured to be open, plugged, or accept a shuttle check cartridge. The shuttle check cartridge can be used when connecting two LS valves and will alleviate the need for an external shuttle check valve in the circuit. (Available on Standard, EH, and PBL Inlet Covers)



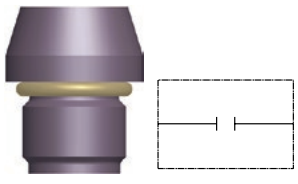
| Code | Description | |
|---|---|---|
| LSP | SAE 6 | LS In Open |
| LSPCK | SAE 6 | LS In with Shuttle Cartridge |
| LSPB | SAE 6 | LS In Port Steel Plug |

## Clipper Relief Valve

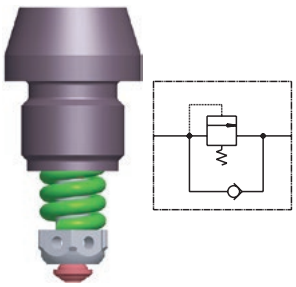
The clipper relief valve is used for additional protection against pressure spikes in the pump supply line.

## [P31] Clipper Relief Valve

**Code Y**



**Code PA**



**Pressure Setting (Use Bar for coding)**

| Bar | (PSI) | Bar | (PSI) | Bar | (PSI) |
|---|---|---|---|---|---|
| 25 | (363) | 140 | (2030) | 260 | (3770) |
| 32 | (464) | 160 | (2320) | 270 | (3915) |
| 40 | (580) | 175 | (2538) | 280 | (4060) |
| 50 | (725) | 190 | (2755) | 300 | (4350) |
| 63 | (914) | 210 | (3045) | 330 | (4785) |
| 80 | (1160) | 225 | (3263) | | |
| 100 | (1450) | 230 | (3335) | | |
| 125 | (1813) | 250 | (3625) | | |

**Note:** Not available on simple or OBC outlets.

## Work Section Attributes

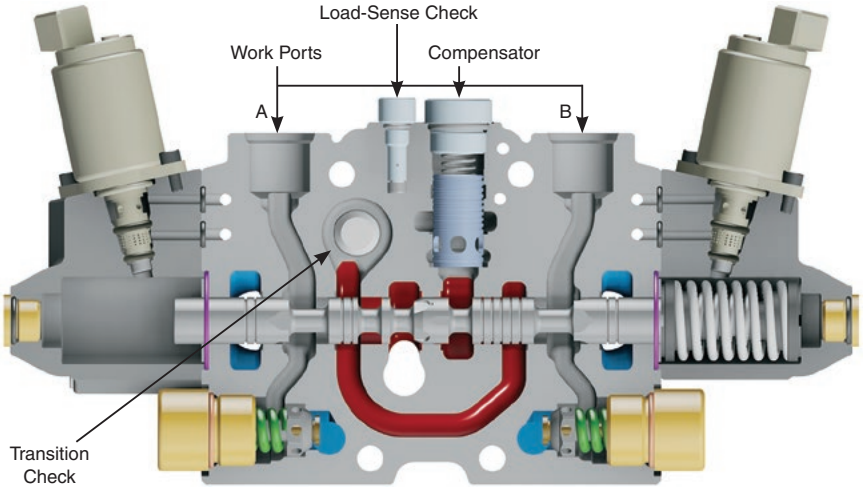
| [P47] | Size of Work Ports (ref. page 24) |
|---|---|
| WP2001 | SAE 10 Work Ports |
| WP2002 | 1/2" BSPP Porting |
| **[P50]** | **Spool Positioner (ref. pages 24 – 25)** |
| C1 | Manual 3-Position Spring Centered |
| C2 | Manual 3-Position Detent |
| C3 | Manual Detent Port A |
| C4 | Manual Detent Port B |
| C5 | Manual 4th Position Float Port A |
| PC | Hydraulic Remote 3-Position |
| PCF | Hydraulic Remote 4th Position Float A Port |
| PCH | Hydraulic Remote 3-Position with Handle |
| EC | Electrohydraulic 3-Position |
| ECF | Electrohydraulic 4th Position Float |
| ECH | Electrohydraulic 3-Position with Handle |
| **[P51]** | **Manual Operator (ref. page 25)** |
| L1 | Lug End Only |
| L3 | Bonnet Style Manual Handle |
| L4 | ECH / PCH Handle |
| L5 | ECH / PCH No Handle |
| \ | Not Applicable |
| **[P55A]/ [P55B]** | **Solenoid Orifice (ref. page 26)** |
| 0.6 | Solenoid Pilot Orifice 0.6 mm |
| 0.7 | Solenoid Pilot Orifice 0.7 mm |
| 0.8 | Solenoid Pilot Orifice 0.8 mm |
| 0.9 | Solenoid Pilot Orifice 0.9 mm |
| 1.0 | (Std) Solenoid Pilot Orifice 1.0 mm |
| 1.1 | Solenoid Pilot Orifice 1.1 mm |
| 1.2 | Solenoid Pilot Orifice 1.2 mm |
| 1.3 | Solenoid Pilot Orifice 1.3 mm |
| 2.0 | Solenoid Pilot Orifice 2.0 mm (No Restriction) |
| \ | Not Applicable |
| **[P60]** | **Spool Function (ref. page 27)** |
| D | Double-Acting 3-Position, 4-Way Cylinder Spool |
| M | Double-Acting 3-Position, 4-Way Motor Spool |
| DEB | Double-Acting 3-Position, 4-Way Cylinder Spool |
| MEB | Double-Acting 3-Position, 4-Way Motor Spool |
| MA | Single-Acting 2-Position, 3-Way Motor Spool (Port A) |

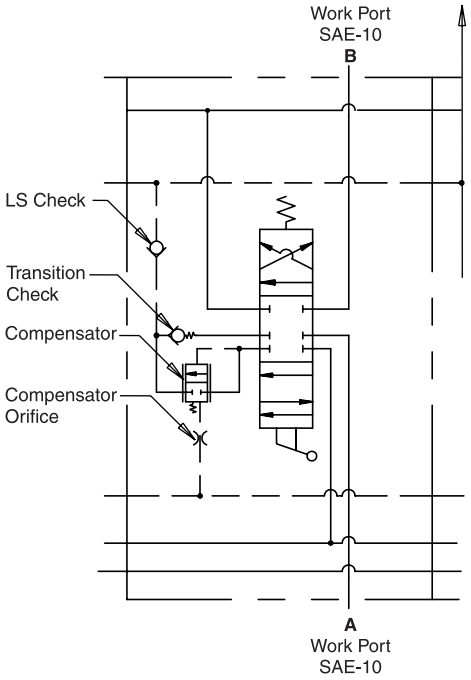
Continued in next column

| [P60] | Spool Function (ref. page 27) [Continued] |
|---|---|
| MB | Single-Acting 2-Position, 3-Way Motor Spool (Port B) |
| F | Double-Acting 4th Position Float Spool (Port B) |
| R | Double-Acting 3-Position Regeneration Spool |
| B | Double-Acting 3-Position, 4-Way Bleeder Spool Ports A and B |
| BA | Double-Acting 3-Position, 4-Way Bleeder Spool Port A |
| BB | Double-Acting 3-Position, 4-Way Bleeder Spool Port B |
| **[P64]** | **Spool Force Feedback (ref. page 27) (Available in Custom Spool List)** |
| **[P69]** | **Spool Flow Rate at Full Stroke** |
| 15/4 | 15 LPM (4 GPM) |
| 30/8 | 30 LPM (8 GPM) |
| 45/12 | 45 LPM (12 GPM) |
| 68/18 | 68 LPM (18 GPM) |
| 90/24 | 90 LPM (24 GPM) |
| 120/32 | 120 LPM (32 GPM) |
| Full | Full Flow |
| (Code) | Spool code from spool list |
| **[P70]** | **Custom Spool Code (Please see Custom Spool List)** |
| **[P72A]/ [P72B]** | **Stroke Limiters (ref. page 27)** |
| Qset | Stroke Limiter A and B Side |
| QsetA | Stroke Limiter on A Side |
| QsetB | Stroke Limiter on B Side |
| Y | No Stroke Limiters |
| **[P76A]/ [P76B]** | **Port Accessory (ref. page 28)** |
| PA | Port Relief Valve with Anti-Cavitation Check |
| N2 | Anti-Cavitation Check |
| Y2 | Relief Cavity Plug (Closed to Tank) |
| X2 | Relief Cavity Plug (Open to Tank) |
| **[P76AS]/ [P76BS)** | **Port Relief Valve Setting (Please See Port RV Setting Options on page 28)** |
| **[P77]** | **Pressure Limited Flow (ref. pages 28 – 29)** |
| PLQ | Pressure Limited Flow |
| PLQN | No PLQ |
| **[P77S]** | **PLQ Setting (Please see PLQ Setting Options on page 29)** |

## Work Section Attributes

Work sections are available in 3-way, 3-position (cylinder and motor), a 4-way, 3-position (cylinder and motor), and a 4-position float. There are six flow ranges available for each spool type. These spools are based upon a valve margin pressure of 17 Bar (250 PSI). Spool positioners are manual, hydraulic remote and solenoid.




## [P47] Size of Work Ports

Standard spool sections come in either SAE or BSPP porting and come with LS and transition checks.

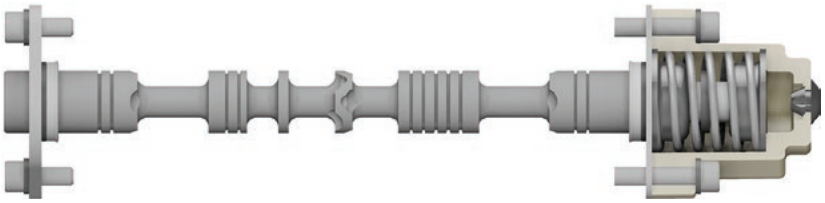
### PCLS Work Section with Transition Check

## [P50] Spool Positioner

The section positioner refers to the section bonnet options and what options are available in the bonnet. All sections come with a spring pack to create a default to neutral setting if no actuation is occuring and the spool is not being influenced by the bonnet (example, detented positioners).

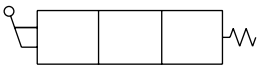
### Code C*

Basic Function: Return spool to neutral position from either work position when handle is released. Manual handle operation.



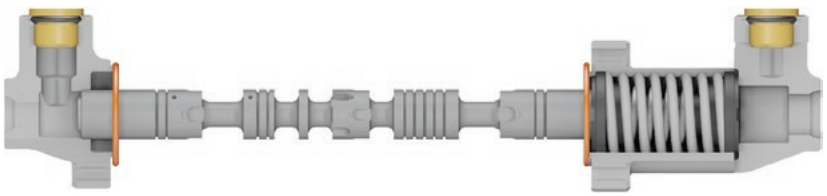
**Code C* Options**

| Code | Description |
|---|---|
| C1 | Manual 3-Position Spring Return |
| C2 | Manual 3-Position Detent |
| C3 | Manual 3-Position Detent In (Port A Flow) |
| C4 | Manual 3-Position Detent Out (Port B Flow) |
| C5 | Manual 4-Position Float with Detent (Port A Flow) |



### Code PC = Hydraulic Remote (Proportional)

Basic Function: Proportional hydraulic pilot PSI is admitted to port (PCL4) and balances against metering/return springs. Use metering band of PCL4 for best match.



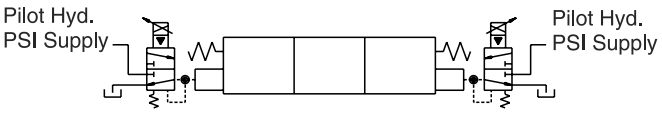
**Code PC* Options**

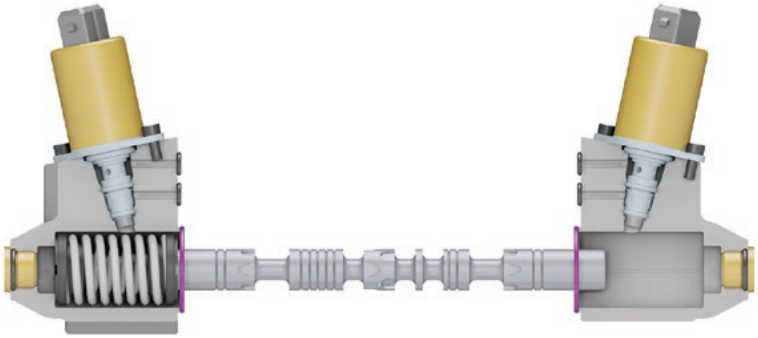
| Code | Description |
|---|---|
| PC | Hydraulic Remote |
| PCF | Hydraulic Remote with 4th Position Float |
| PCH | Hydraulic Remote with Manual Handle |

## [P50] Spool Positioner (Continued)

### Code EC = Proportional Solenoid, 3-Position

Basic Function: Proportional spool movement via proportional current to solenoid (ref. IQAN).



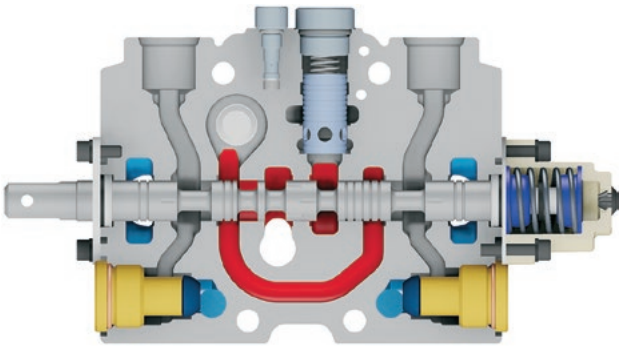



**Code EC* Options**

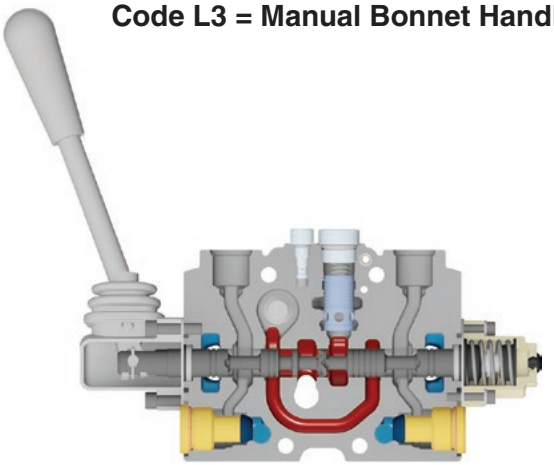
| Code | Description |
|---|---|
| EC | Proportional Solenoid, 3-Position |
| ECF | Electrohydraulic witih 4th Position Float |
| ECH | Electrohydraulic with Manual Handle |

## [P51] Manual Operator

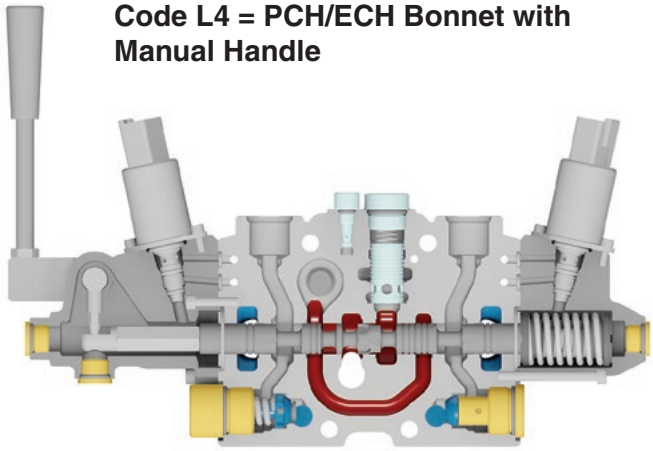
### Code L1 = Lug End



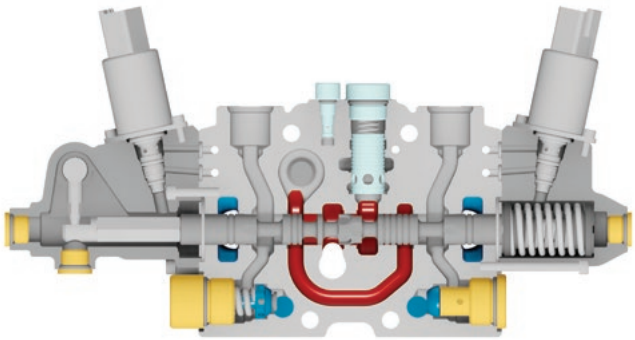
### Code L3 = Manual Bonnet Handle



### Code L4 = PCH/ECH Bonnet with Manual Handle

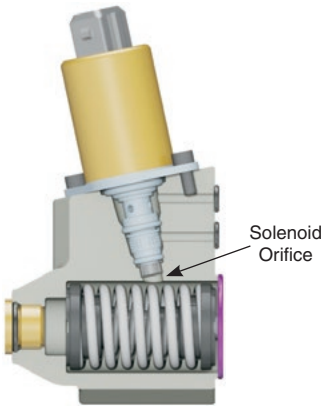


### Code L5 = PCH/ECH No Handle



## [P55A/P55B] Solenoid Orifice

Solenoid driven sections may require pilot flow orifices to meter flow at different rates into the solenoid bonnet to help with functional performance. The standard size is 1.0mm.




| Code | Description |
|---|---|
| 0.6 | 0.6 mm |
| 0.7 | 0.7 mm |
| 0.8 | 0.8 mm |
| 0.9 | 0.9 mm |
| 1.0 | 1.0 mm (Standard) |
| 1.1 | 1.1 mm |
| 1.2 | 1.2 mm |
| 1.3 | 1.3 mm |
| 2.0 | 2.0 mm (No Dampening) |

## [P60] Spool Function

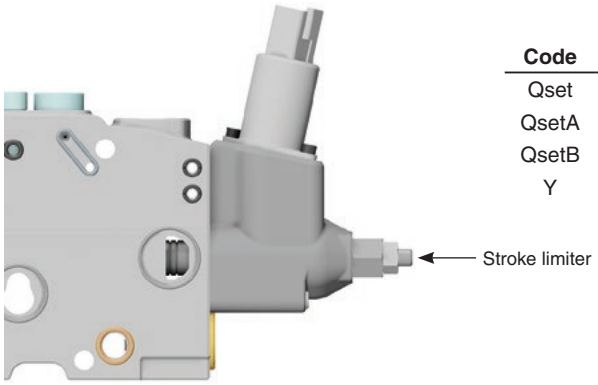
| | | |
|---|---|---|
| **D** | Double-Acting 3-Position, 4-Way Cylinder Spool | Double-acting cylinder spools are generally used when a cylinder is being operated with power extend and retract. |
| **M** | Double-Acting 3-Position, 4-Way Motor Spool | Double-acting motor spools are generally used when a motor is being operated in a bi-directional manner. |
| **DEB** | Double-Acting 3-Position, 4-Way Cylinder Spool | Double-acting cylinder spools are generally used when a cylinder is being operated with an outside force to either retract or extend the non-power port. |
| **MEB** | Double-Acting 3-Position, 4-Way Motor Spool | Double-acting motor spool generally used when power in one position is needed and free spin in the opposite direction. |
| **MA** | Single-Acting 2-Position, 3-Way Motor Spool (Port A) | Single-acting 3-way motor spool generally used when a motor is single direction with return flow going directly to tank. Flow is generated from Port A. |
| **MB** | Single-Acting 2-Position, 3-Way Motor Spool (Port B) | Single-acting 3-way motor spool generally used when a motor is single direction with return flow going directly to tank. Flow is generated from Port B. |
| **F** | Double-Acting 4th Position Float Spool (Port B) | 4th position float spools are used when an application requires flow and pressure to extend and retract a cylinder function, but in addition needs to have a floating position where A and B ports are open to tank, creating no resistance against the load causing it to move when influenced by outside forces. |
| **R** | Double-Acting 3-Position Regeneration Spool | Regeneration spools use the return flow from port B to add flow to port A for increased speed for the implement connected to port A. |
| **B** | Double-Acting 3-Position, 4-Way Bleeder Spool Ports A and B | Bleeder spools use an orificed spool notch to control the flow in and out of A and B ports, as opposed to a cylinder spool which blocks flow from work ports to tank or motor spools which are completely open from work ports to tank. |
| **BA** | Double-Acting 3-Position, 4-Way Bleeder Spool Port A | Port A bleeder spools use an orificed spool notch to control the flow in and out of A and B port is connected to tank as opposed to a cylinder spool which blocks flow from both work ports to tank or motor spools which are completely open from both work ports to tank. |
| **BB** | Double-Acting 3-Position, 4-Way Bleeder Spool Port B | Port B bleeder spools use an orificed spool notch to control the flow in and out of B and A port is connected to tank as opposed to a cylinder spool which blocks flow from both work ports to tank or motor spools which are completely open from both work ports to tank. |

## [P64] Spool Force Feedback

With force feedback, the operator is better able to sense the increase in machine load, for example when a hard obstacle is met, and thereby avoid damage. Force feedback also gives a kind of ramp function, which results in more gentle transitions during speed changes. This in turn has a stabilizing effect on the hydraulic system, and the machine operating characteristics become smoother. Both of these characteristics are important, especially for slewing functions and similar movements. With force feedback, machine wear is reduced and efficiency increases. The section can be equipped with force feedback for workports A and B, individually. The higher level of force feedback, the greated the reduction in the function's speed upon increasing resistance for the same lever stroke. It follows from this that the lever must be moved further in order for the speed to remain the same. If force feedback is desired please use FF as the option code; otherwise use \ or leave blank.

## [P72A/P72B] Stroke Limiters

Stroke Limiters are used to manually limit the full flow capability of the spool. It is an adjustable bonnet option which can be adjusted to prevent full spool movement in either direction. Stroke limiters are available on Hydraulic Pilot and EH Sections.




| Code | Description |
|---|---|
| Qset | Stroke Limiter A and B Side |
| QsetA | Stroke Limiter on A Side |
| QsetB | Stroke Limiter on B Side |
| Y | No Stroke Limiters |

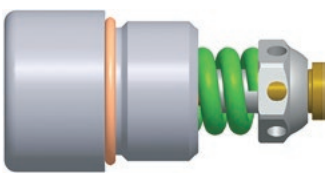
## [P76] and [P77] Accessory Options

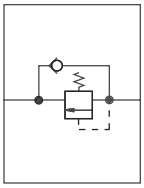
| | | |
|---|---|---|
| **PA** | Relief Valve with Anti-Cavitation Check | Port relief valves are pre-set to the designated pressure setting selected and come with anti-cavitation protection which will use flow from the the tank galley to supply extra oil to the work port should cavitation of the function begin to occur. |
| **N2** | Anti-Cavitation Check | Anti-cavitation protection only will use flow from the the tank galley to supply extra oil to the work port should cavitation of the function begin to occur. |
| **Y2** | Relief Cavity Plug Closed to Tank | The relief cavity plug is a port defeat plug and will block flow from returning to the tank galley through the port accessory flow path and force the oil to go to the tank galley from the work port. |
| **X2** | Relief Cavity Open to Tank | Relief valve cavity machined and filled with a short plug which leaves a passage open to the tank. |

## [P76A] and [P76B]

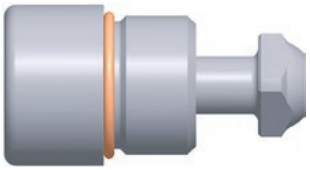
| Code | Description |
|---|---|
| N2 | Anticavitation check |
| Y2 | Relief Cavity Plug (Closed to Tank) |
| X2 | Blanking Plug (Open to Tank) |
| 25 | 25 Bar (363 PSI) |
| 32 | 32 Bar (464 PSI) |
| 40 | 40 Bar (580 PSI) |
| 50 | 50 Bar (725 PSI) |
| 63 | 63 Bar (914 PSI) |
| 80 | 80 Bar (1160 PSI) |
| 100 | 100 Bar (1450 PSI) |
| 125 | 125 Bar (1813 PSI) |
| 140 | 140 Bar (2030 PSI) |
| 160 | 160 Bar (2320 PSI) |
| 175 | 175 Bar (2538 PSI) |
| 190 | 190 Bar (2755 PSI) |
| 210 | 210 Bar (3045 PSI) |
| 225 | 225 Bar (3263 PSI) |
| 230 | 230 Bar (3335 PSI) |
| 250 | 250 Bar (3625 PSI) |
| 265 | 265 Bar (3843 PSI) |
| 270 | 270 Bar (3915 PSI) |
| 280 | 280 Bar (4060 PSI) |
| 300 | 300 Bar (4350 PSI) |
| 330 | 330 Bar (4785 PSI) |
| 350 | 350 Bar (5075 PSI) |

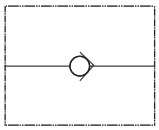
### Code PA – Relief with Anticavitation Check



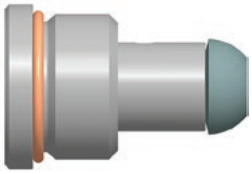


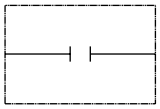
### Code N2 – Anticavitation Check



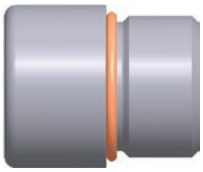


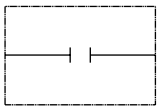
### Code Y2 – Relief Cavity Plug Closed to Tank





### Code X2 – Relief Cavity Plug Open to Tank



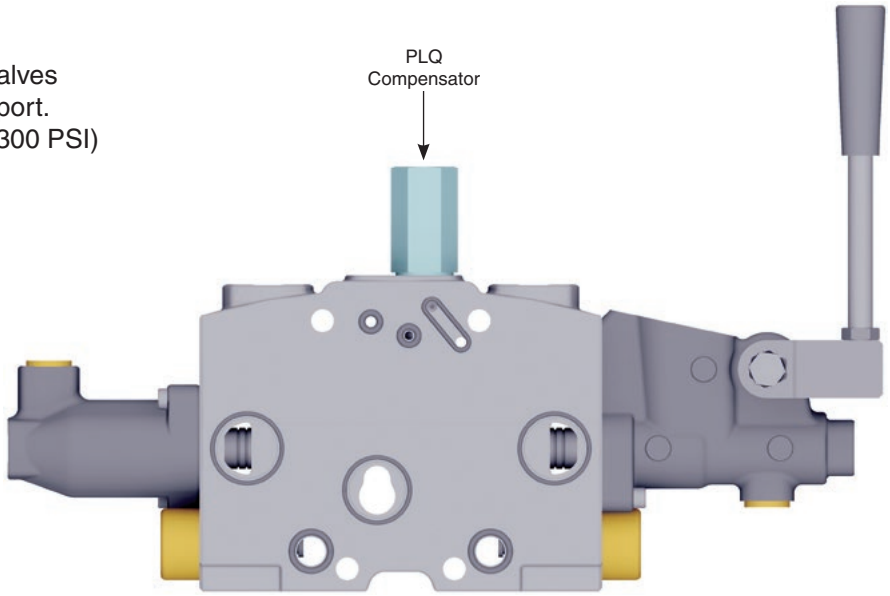


## [P77] PLQ

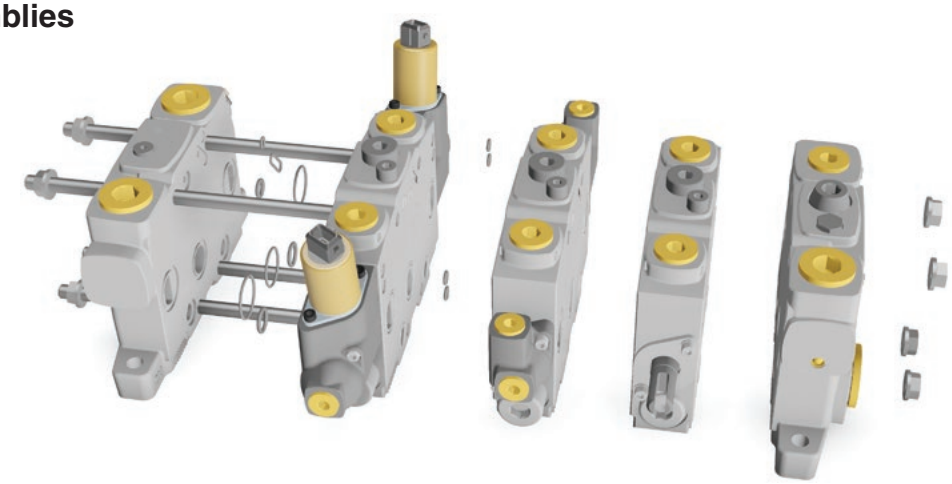
### General Application Concept

**Constant Force or Torque:** Any application that requires a constant force or torque via deadheading a workport can use PLQ. This assumes the PLQ regulated workport pressure is less than maximum system pressure. The PLQ work section consumes a very insignificant flow of less than 2.8 LPM (0.75 GPM). Working at only the essential pressure and minimum flow maximizes energy efficiency. Pressure range available: 17 Bar (250 PSI) to 240 Bar (3500 PSI).

**Note:** When using PLQ, port relief valves must be selected for corresponding port. Recommended selection is 25 Bar (300 PSI) above PLQ setting.




### Stud Assemblies



**For use with Combo-In + Combo-Out OR Combo-In + Simple-Out OR PBL-In + Simple-Out**

| Number of Work Sections | Length "L" (±.030) | Number of Work Sections | Length "L" (±.030) |
|---|---|---|---|
| 1 | 5.75 | 7 | 14.75 |
| 2 | 7.25 | 8 | 16.25 |
| 3 | 8.75 | 9 | 17.75 |
| 4 | 10.25 | 10 | 19.25 |
| 5 | 11.75 | | |
| 6 | 13.28 | | |

**For use with PBL-In + PBL-Out OR PBL-In + Combo-Out OR Combo-In + PBL-Out**

| Number of Work Sections | Length "L" (±.030) | Number of Work Sections | Length "L" (±.030) |
|---|---|---|---|
| 1 | 6.50 | 7 | 15.50 |
| 2 | 8.00 | 8 | 17.00 |
| 3 | 9.50 | 9 | 18.50 |
| 4 | 11.00 | 10 | 20.00 |
| 5 | 12.50 | | |
| 6 | 14.00 | | |

# Optimize System Performance and Avoid Downtime

## SensoControl® Diagnostic

Optimize or troubleshoot hydraulic and pneumatic systems with SensoControl diagnostic meters.

- Detect intermittent problems
- Innovative recording capabilities
- In-depth analysis
- Pressure, flow, RPM, and temperature measurements

## SensoControl® Mobile Products

Continuously monitor or control a system's pressure and temperature with SensoControl sensors.

- Reliable performance
- Resistance to shock and vibration
- E1 road approved
- Rugged stainless steel construction

**Learn more:**
*www.parker.com/sensocontrol*

**Contact:**
Parker's Quick Coupling Division
763-544-7781
QCD_sales@parker.com

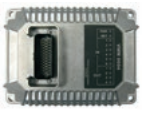
## Parker Electronic Controls

The VP120 valve can achieve fine proportional control when paired with electronic control systems from Parker. Several types of systems from basic to complex can be utilized depending on the desired functionality of your equipment.

## Basic Valve Driver module

Controls up to 2 valve sections.

| Valve Driver Module | Inputs | Outputs |
|---|---|---|
| IQAN-TOC2 | 4 | 2 (dual) |



## Programmable Multiplexing modules

Controls valve sections and other machine functions. More than 1 module can be combined into a multiplexed system. Programmed with Ladder Logic software.

| Multiplexing Module | Inputs | Outputs |
|---|---|---|
| VMM0604 | 6 | 4 |
| VMM2404 | 24 | 4 |
| VMM3120 | 31 | 20 |



## Programmable Controller modules

Controls valve sections and other machine functions. Can be combined with other controller modules or multiplexing modules to create a complex control system. Programmed with C or Matlab software.

| Controller Module | Inputs | Outputs |
|---|---|---|
| CM0711 | 7 | 11 |
| CM3620 | 36 | 20 |
| CM3626 | 36 | 26 |

Contact the Electronic Controls Division:


Parker Hannifin Corporation
**Electronic Controls Division**
850 Arthur Avenue
Elk Grove Village, IL 60007 USA
phone 800 221 9257


**VP120 Pre-Configured Module is Available in IQAN software package.**

## Levers and Joysticks for Electronic Control

Single axis input devices like the IQAN-LST paddle and IQAN-LSL lever can each control a valve section when paired with any valve driver or controller module. More functions are controlled from a multi-axis joystick like the IQAN-LC5 or -LC6.

| Master Display Module | Prop Axis | Buttons |
|---|---|---|
| IQAN-LST paddle | 1 | — |
| IQAN-LSL lever | 1 | up to 1 |
| IQAN-LC5 large joystick | up to 4 | up to 8 |
| IQAN-LC6 small joystick | up to 4 | — |


## Programmable Master Controllers

Controls valve sections and other machine functions. More than 1 master module can be combined or expansion modules added to create a complex control system. Programmed with IQAN software.

| Master Controller Module | Inputs | Outputs |
|---|---|---|
| IQAN-MC2 | 5 | 8 dual |
| IQAN-MC31 | 16 | 4 dual |


## Programmable Master Displays

Displays and monitors machine status and provides HMI. Commands outputs on master controllers or expansion modules to control valve sections and other machine functions in a complex control system. Programmed with IQAN software.

| Master Display Module | Inputs | Outputs |
|---|---|---|
| IQAN-MD3 3.5" Color TFT | 7 | — |
| IQAN-MD4-7 7" Color touchscreen | 7 | — |
| IQAN-MD4-5 5.7" Color touchscreen | 7 | — |

# VP120 Data Sheet

| Customer Info | | |
|---|---|---|
| [D01] | Type of Market | |
| [D02] | Market Segment | |
| [D06] | Application | |
| [D08] | Customer Product ID | |
| [D19] | Customer Name | |
| [D21] | Customer Contact | |

**Customer Notes**

| System Options | | |
|---|---|---|
| [P01] | Valve Type | |
| [P03] | Margin Pressure Setting (Bar) | |
| [P04] | Port Type | |
| [P05] | System Voltage | |
| [P06] | Solenoid Connector Type | |
| [P07] | Surface Finish | |
| [P08] | Pump Flow to Inlet (LPM) | |
| [P09] | Pump Pressure to Inlet (Bar) | |

**System Notes**

| Inlet Options | | |
|---|---|---|
| [P15] | Inlet Section Type | |
| [P16] | Load-Sense Relief Valve | |
| [P17] | Load-Sense Relief Valve Setting | |
| [P18] | Top Pump Port | |
| [P19] | Side Pump Port | |
| [P20] | Top Tank Port | |
| [P21] | Side Tank Port | |
| [P22] | Load-Sense in Port | |
| [P23] | Pilot Supply in Port | |
| [P24F] | Priority Flow Setting (LPM) | |
| [P24] | Priority Flow LS Relief Valve | |
| [P24S] | Priority Flow LS Relief Setting (Bar) | |
| [P25] | Pilot Out Port | |
| [P26] | Pilot Supply Accum Port | |
| [P27] | Inlet Pilot Drain | |

| Outlet Options | | |
|---|---|---|
| [P30] | Outlet Section Type | |
| [P31] | Clipper Relief Valve | |
| [P31S] | Clipper Relief Setting | |
| [P33] | Solenoid Drain | |
| [P35] | Top Pump Port | |
| [P36] | Side Pump Port | |
| [P37] | Top Tank Port | |
| [P38] | Side Tank Port | |
| [P39] | Load-Sense in Port | |
| [P40] | Pilot Supply in Port | |
| [P43] | Pilot Out Port | |
| [P44] | Pilot Supply Accum Port | |

| | | Work Sections | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 |
| [P47] | Size of Work Ports | | | | | | | | | | |
| [P50] | Spool Positioner | | | | | | | | | | |
| [P51] | Manual Operator | | | | | | | | | | |
| [P55A] | Solenoid Orifice A Side | | | | | | | | | | |
| [P55B] | Solenoid Orifice B Side | | | | | | | | | | |
| [P60] | Spool Function | | | | | | | | | | |
| [P64] | Spool Force Feedback | | | | | | | | | | |
| [P69] | Spool Flow Rate at Full Stroke | | | | | | | | | | |
| [P70] | Custom Spool Code | | | | | | | | | | |
| [P72A] | Stroke Limiters A Side | | | | | | | | | | |
| [P72B] | Stroke Limiters B Side | | | | | | | | | | |
| [P76A] | Port Accessory A | | | | | | | | | | |
| [P76AS] | Port Relief Valve A Setting | | | | | | | | | | |
| [P76B] | Port Accessory B | | | | | | | | | | |
| [P76BS] | Port Relief Valve B Setting | | | | | | | | | | |
| [P77] | Pressure Limited Flow | | | | | | | | | | |
| [P77S] | PLQ Setting | | | | | | | | | | |

**Assembly Notes**

# Offer of Sale

The goods, services or work (referred to as the "Products") offered by Parker-Hannifin Corporation, its subsidiaries, groups, divisions, and authorized distributors ("Seller") are offered for sale at prices indicated in the offer, or as may be established by Seller. The offer to sell the Products and acceptance of Seller's offer by any customer ("Buyer") is contingent upon, and will be governed by all of the terms and conditions contained in this Offer of Sale. Buyer's order for any Products specified in Buyer's purchase document or Seller's offer, proposal or quote ("Quote") attached to the purchase order, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as "Products".

**1. Terms and Conditions.** Seller's willingness to offer Products for sale or accept an order for Products is subject to the terms and conditions contained in this Offer of Sale or any newer version of the same, published by Seller electronically at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document or other communication issued by Buyer.

**2. Price; Payment.** Prices stated on Seller's Quote are valid for thirty (30) days, except as explicitly otherwise stated therein, and do not include any sales, use, or other taxes or duties unless specifically stated. Seller reserves the right to modify prices to adjust for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified by Seller's Credit Department). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

**3. Shipment; Delivery; Title and Risk of Loss.** All delivery dates are approximate. Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

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**5. Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to the Seller within ten (10) days of delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the defect is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

**6. LIMITATION OF LIABILITY.** IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

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**8. Loss to 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, will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the items 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. Special Tooling.** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. 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 Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

**10. Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller retains a security interest in all Products delivered to Buyer and this agreement is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

**11. Improper Use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, application, design, specification or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Products; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

**12. Cancellations and Changes.** Buyer may not cancel or modify or cancel any order for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change Product features, specifications, designs and availability.

**13. Limitation on Assignment.** Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and is not liable for delay or failure to perform any of Seller's obligations by reason of events or circumstances beyond its reasonable control (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

**15. Waiver and Severability.** Failure to enforce any provision of this agreement will not invalidate that provision; nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

**16. Termination.** Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate this agreement, in writing, if Buyer: (a) breaches any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or one if filed by a third party (d) makes an assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

**17. Governing Law.** This agreement and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

**18. Indemnity for Infringement of Intellectual Property Rights.** Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("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 a Product sold pursuant to this agreement 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 a Product 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 the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and refund the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller is not liable for claims of infringement based on information provided by Buyer, or directed to Products 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 Product sold hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

**19. Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged. The terms contained herein may not be modified unless in writing and signed by an authorized representative of Seller.

**20. Compliance with Laws.** Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards of care, including those of the United Kingdom, the United States of America, and the country or countries in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act") and the U.S. Food Drug and Cosmetic Act ("FDCA"),each as currently amended, and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that it is familiar with the provisions of the U. K. Bribery Act, the FCPA, the FDA, and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.

5/14

# Parker Safety Guide for Selecting and Using Hydraulic Valves and Related Accessories

**WARNING**: Failure or improper selection or improper use of Parker Hydraulic Valve Division (HVD) Valves or related accessories ("Products") can cause death, personal injury and property damage. Possible consequences of failure or improper use of these Products include but are not limited to:

- Valves or parts thereof thrown off at high speed
- High velocity fluid discharge
- Explosion or burning of the conveyed fluid
- Contact with suddenly moving or falling objects controlled by the Valve
- Injections by high-pressure fluid discharge
- Contact with fluid that may be hot, cold, toxic or otherwise injurious
- Injuries resulting from injection, inhalation or exposure to fluids
- Injury from handling a heavy item (dropped, awkward lift)
- Electric shock from improper handling of solenoid connections
- Injury from slip or fall on spilled or leaked fluid

Before selecting or using any of these Products, it is important that you read and follow the instructions below. In general, the Products are not approved for in-flight aerospace applications. Consult the factory for the few that are FAA approved.

## 1.0 GENERAL INSTRUCTIONS

1.1 **Scope**: This safety guide provides instructions for selecting and using (including assembling, installing and maintaining) these Products. For convenience all items in this guide are called "Valves". This safety guide is a supplement to and is to be used in conjunction with the specific Parker catalogs for the specific Valves and/or accessories being considered for use. See item 1.6 below for obtaining those catalogs.

1.2 **Fail-Safe:** Valves can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Valve or Valve Assembly will not endanger persons or property.

1.3 **Safety Devices:** Never disconnect, override, circumvent or otherwise disable any safety lockout on any system whether powered by HVD Valves or any motion control system of any manufacturer. (e.g. Automatic shut-off on a riding lawn mower should the operator get out of the seat).

1.4 **Distribution:** Provide a copy of this safety guide to each person that is responsible for selecting or using HVD Valve Products. Do not select HVD Valves without thoroughly reading and understanding this safety guide as well as the specific Parker catalogs for the Products considered or selected.

1.5 **User Responsibility:** Due the wide variety of operating conditions and applications for Valves, HVD and its distributors do not represent or warrant that any particular Valve is suitable for any specific system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing is solely responsible for:

- Making the final selection of the Valve
- Assuring that the user's requirements are met and that the application presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the Valves are used.
- Assuring compliance with all applicable government and industry standards.

1.6 **Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com , for the telephone numbers of the appropriate technical service department. For additional copies of this or any other Parker Safety Guide go to www.parker.com and click on the safety button on the opening page. Catalogs and/or catalog numbers for the various HVD Valve Products can be obtained by calling HVD at 440-366-5100. Phone numbers and catalog information is also available on the Parker website, www.parker.com .

## 2.0 VALVE SELECTION INSTRUCTIONS

2.1 Pressure: Valve selection must be made so that the maximum working pressure of the Valve is equal to or greater than the maximum system pressure. Surge, impulse or peak transient pressures in the system must be below the maximum working pressure of the Valve. Surge, impulse and peak pressures can usually be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressure and cannot be used to determine surge, impulse or peak transient pressures. Burst pressure ratings if given or known are for manufacturing purposes only and are not an indication that the Product can be used in applications at the burst pressure or otherwise above the maximum working pressure.

2.2 **Temperature:** The fluid temperature must be regulated or controlled so that the operating viscosity of the fluid is maintained at a level specified for the particular Valve product. Such ranges are given in the product catalogs or can be obtained from the appropriate customer service department for the particular Valve product.

2.3 **Fluid Compatibility:** The fluid conveyed in Valves has direct implications on the Valve selection. The fluid must be chemically compatible with the Valve component materials. Elastomer seals, brass, cast iron, aluminum for example all are potentially affected by certain fluids. Additionally, fluid selection affects the performance of various Valves. Considerations relative to fluid selection are outlined in the specific HVD Valve product catalog. Of particular importance is that the fluid be for hydraulic use, contain the proper additives and wear inhibitors. See 1.6 "Additional Questions" above for information to obtain such HVD catalogs.

2.4 **Changing Fluids:** If a system requires a different fluid, it should be done with the guidance in number 2.3 above. Additionally, it may be necessary to flush the system (including the Valves) to remove any of the previous fluid. Consult the Parker Valve Division for guidance.

2.5 **Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.

2.6 **Placement:** Installation of Valves must take into account the orientation of the Valve and the proximity of the Valve to other parts of the system. This includes but is not limited to closeness to hot and cold areas, access for servicing and operation as well as orientation for proper connectors.

2.7 **Ports:** Connection of Valves in systems can be by threaded ports, sub-base surfaces, flanges and manifolds. In all cases, the proper fitting, surface or mounting hardware must be selected to properly seal and contain the system fluid so as to avoid the adverse conditions listed in the initial warning box above. Specifically, if using threaded ports, the designer must make sure that the mating fitting is of the compatible thread. Also, the instructions provided by the connector hardware supplier must be read and understood so as to properly assemble the connector. The Parker Safety Guide for using Hose, Tubing and Fittings and Related Accessories is but one reference to this end.

2.8 **Environment:** Care must be taken to insure that the Valve and Valve Assemblies are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.

2.9 **Electric Power:** For Valves requiring electric power for control, it is imperative that the electricity be delivered at the proper voltage, current and wattage requirements. To obtain the proper control requirements please refer to the respective Parker product catalog for the specific Valve that is intended for use. If further guidance is required, call the appropriate technical service department identified in the respective Parker product catalog.

2.10 **Specifications and Standards:** When selecting Valves, government, industry and Parker specifications and recommendations must be reviewed and followed as applicable.

2.11 **Accessories:** All accessories used in conjunction with any Parker Valve product must be rated to the same requirements of the Valve including but not limited to pressure, flow, material compatibility, power requirements. All of these items must be examined as stated in the "VALVE INSTALLATION INSTRUCTIONS" paragraph 3.0.

**(continued on next page)**

## 3.0 VALVE INSTALLATION INSTRUCTIONS

3.1 **Component Inspection:** Prior to use, a careful examination of the Valve(s) must be performed. The Valve intended for use must be checked for correct style, size, catalog number and external condition. The Valve must be examined for cleanliness, absence of external defects or gouges, cracked or otherwise deformed parts or missing items. The mounting surface or port connections must be protected and free of burrs, scratches, corrosion or other imperfections. Do NOT use any item that displays any signs of nonconformance. In addition, any accessory including but not limited to fittings, bolt kits, hoses, sub bases, manifolds, and electrical connectors must be subjected to the same examination.

3.2 **Handling Valves:** Many Valves whether HVD Valves or of another manufacturer can be large, bulky or otherwise difficult to handle. Care must be taken to use proper lifting techniques, tools, braces, lifting belts or other aids so as not to cause injury to the user, any other person or to property.

3.3 **Filtration:** Fluid cleanliness is a necessity in any hydraulic system. Fluid filters must be installed and maintained in the system to provide the required level of fluid cleanliness. Filters can be placed in the inlets, pressure lines and return lines. The level of cleanliness required is specified in the HVD product catalog for the specific Valve(s) selected or intended for use. For additional information on Filter selection contact Parker Filter Division at 800-253-1258 or 419-644-4311.

3.4 **Servo Valves:** Application of Servo Valves in general requires knowledge and awareness of "closed loop control theory" and the use of electronic controls for successful and safe operation. Individuals who do not have such experience or knowledge must gain training before use of such Products. Parker offers both classroom training as well as manuals to assist in gaining this knowledge. These aids can be obtained by contacting Hydraulic Valve Division at 440-366-5100, calling the general Parker help line 800-CPARKER or going to the Parker web site at www.parker.com.

3.5 **Accessory Ratings:** All accessories used in combination with the selected or intended Valve product must be rated and compatible with the selected Valve. Specifically, the items must be of equal or greater rating including but not limited to pressure, flow, power, size, port style, thread connectors and material.

3.6 **Connection Styles:** It is the responsibility of the user of the Parker product to properly select connectors and accessories that match the connections on the sub plate, Valve, flange or threaded connection or manifold. It is also the responsibility of the installer to possess adequate skill and knowledge including but not limited to thread preparation, torque technique, hose assembly and inspection, tube preparation and assembly, and fitting installation. Parker Tube Fitting Division (www.parker.com/tfd) catalog 4300 and Parker Hose Products (www.parkerhose.com) catalog 4400 describe some basic technical information relative to proper fitting assembly.

3.7 **Electrical Connections:** All electrical connections must be made to the applicable codes and local safety requirements.

3.8 **Gauges and Sensors:** The user must install sufficient gauges and sensors in the system so as to be able to determine the condition of the system. This includes but is not limited to pressure gauges, flow meters, temperature sensors and site gauges. These are of utmost importance should removal or disassembly of a Valve, portion of a Valve or portion of the system become necessary. Refer to "VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS" for details and especially item 4.8.

3.9 **System Checkout:** Once installed, the Valve installation must be tested to insure proper operation and that no external leakage exists. All safety equipment must be in place including but not limited to safety glasses, helmets, ear protection, splash guards, gloves, coveralls and any shields on the equipment. All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Valve maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potentially hazardous areas while testing and using.

## 4.0 VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS

4.1 **Maintenance Program:** Even with proper installation, Valves and Valve System life may be significantly reduced without a continuing maintenance program. The severity of the application and risk potential must determine the frequency of the inspection and the replacement of the Products so that Products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at a minimum, must include instructions 4.2 through 4.10. An FMEA (Failure Mode and Effects Analysis) is recommended in determining maintenance requirements.

4.2 **Visual Inspection-Valves:** Any of the following conditions require immediate shut down and replacement of the Valve.

- Evidence that the Valve is in partial dis-assembly.
- Visible crack or suspicion of a crack in the Valve housing or bent, cracked or otherwise damaged solenoid.
- Missing or partially extending drive pin on a flow control knob.
- Missing, loose components, obstructions or other condition impeding the motion or function of the manual knob, lever, foot pedal or other mechanical operator of a hydraulic Valve.
- Any evidence of burning or heat induced discoloration.
- Blistered, soft, degraded or loose cover of any kind.
- Loose wire or electrical connector.

4.3 **Visual Inspection-Other:** The following conditions must be tightened, repaired, corrected or replaced as required.

1. Fluid on the ground must be cleaned immediately. Also, the source of the fluid must be determined prior to running the equipment again.
2. Leaking port or excessive external dirt build-up.
3. System fluid level is too low or air is entrapped or visible in the reservoir.
4. Equipment controlled by the Valve or Valve assembly has been losing power, speed, efficiency

4.4 **Filter Maintenance:** System filters must be maintained and kept in proper working order. The main service requirement is periodic replacement of the filter element or screen. Contact Parker Filter Division at 800-253-1258 or 419-644-4311 for further filter maintenance details.

4.5 **Functional Test:** See "System Checkout" number 3.9 above in "VALVE INSTALLATION INSTRUCTIONS".

4.6 **Replacement Intervals:** Valves and Valve Systems will eventually age and require replacement. Seals especially should be inspected and replaced at specific replacement intervals based on previous experience, government or industry recommendations, or when failures could result in unacceptable downtime, damage or injury risk. At a minimum seals must be replaced whenever service is rendered to a Valve product.

4.7 **Adjustments, Control Knobs, and Other Manual Controls:** System Pressure and Flow are typically adjusted by knobs and/or handles. A set-screw or lock-nut secures the adjustment device so as to maintain the desired setting. This set-screw or lock-nut must first be loosened prior to making any adjustments and re-tightened after adjustment on the HVD Valve. All adjustments must be made in conjunction with pressure gauges and/or flow meters (or by watching the speed of the actuator in the case of setting flow only). See paragraph "Gauges and Sensors" above in the section "VALVE INSTALLATION INSTRUCTIONS'. Under no circumstances should any control knob, adjustment stem, handle, foot pedal or other actuating device be forced beyond the mechanical stop(s) on the Valve. For example, the Parker Safety Notice Bulletin **HY14-3310-B1/US** for HVD Colorflow Valves specifically restricts the adjustment torque to "hand adjust" or "less than 10 ft/lbs" if it cannot be adjusted by hand. Failure to adhere to this may force the knob beyond the stop point allowing it to be ejected at high speed resulting in death, personal injury and property damage. For complete safety instructions on HVD Colorflow Valves, copies of Safety Notice **Bulletin HY14-3310-B1/US** can be obtained directly from the Hydraulic Valve Division at 440-366-5100 or from the Parker web site at www.parker.com by selecting the "Safety" button. Parker help line 800-CPARKER is on call 24/7 as well should there be any question about the use of a HVD Valve. Additionally, when making adjustments, always adjust the Valve with all parts of your body to the side of the Valve (that is, the knob is not pointing toward you or anyone else).

4.8 **High pressure Warning:** Hydraulic power is transmitted by high-pressure fluids through hoses, fittings and valves, pumps and actuators. This condition can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure. From time to time, hoses, Valves, tubes or fittings fail if they are not replaced at proper time intervals. Typically these failures are the result of some form of misapplication, abuse, wear, or failure to perform proper maintenance. When such failure occurs, generally the high pressure fluid inside escapes in a stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by "feeling" with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possible loss of limb or life. Even seemingly minor hydraulic fluid injection injuries must be treated immediately by a physician with knowledge of the tissue damaging properties of hydraulic fluid.

If a hose, tube, fitting or Valve failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the system. Simply shutting down the pump may or may not eliminate the pressure in the system. It may take several minutes or even hours for the pressure to be relieved so that the leak area can be examined safely. Once the pressure has been reduced to zero, the suspected leaking item can be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a connector (especially a hose) or Valve that has failed. Consult the nearest Parker distributor or the appropriate Parker division for component replacement information. Never touch or examine a failed hydraulic component unless it is obvious that the item no longer contains fluid under pressure.

## Notes

# Parker's Motion & Control Technologies

**At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 1 800 C-Parker (1 800 272 7537)**

## Aerospace

### Key Markets
Aftermarket services
Commercial transports
Engines
General & business aviation
Helicopters
Launch vehicles
Military aircraft
Missiles
Power generation
Regional transports
Unmanned aerial vehicles

### Key Products
Control systems & actuation products
Engine systems & components
Fluid conveyance systems & components
Fluid metering, delivery & atomization devices
Fuel systems & components
Fuel tank inerting systems
Hydraulic systems & components
Thermal management
Wheels & brakes

## Climate Control

### Key Markets
Agriculture
Air conditioning
Construction Machinery
Food & beverage
Industrial machinery
Life sciences
Oil & gas
Precision cooling
Process
Refrigeration
Transportation

### Key Products
Accumulators
Advanced actuators
$CO_2$ controls
Electronic controllers
Filter driers
Hand shut-off valves
Heat exchangers
Hose & fittings
Pressure regulating valves
Refrigerant distributors
Safety relief valves
Smart pumps
Solenoid valves
Thermostatic expansion valves

## Electromechanical

### Key Markets
Aerospace
Factory automation
Life science & medical
Machine tools
Packaging machinery
Paper machinery
Plastics machinery & converting
Primary metals
Semiconductor & electronics
Textile
Wire & cable

### Key Products
AC/DC drives & systems
Electric actuators, gantry robots & slides
Electrohydrostatic actuation systems
Electromechanical actuation systems
Human machine interface
Linear motors
Stepper motors, servo motors, drives & controls
Structural extrusions

## Filtration

### Key Markets
Aerospace
Food & beverage
Industrial plant & equipment
Life sciences
Marine
Mobile equipment
Oil & gas
Power generation & renewable energy
Process
Transportation
Water Purification

### Key Products
Analytical gas generators
Compressed air filters & dryers
Engine air, coolant, fuel & oil filtration systems
Fluid condition monitoring systems
Hydraulic & lubrication filters
Hydrogen, nitrogen & zero air generators
Instrumentation filters
Membrane & fiber filters
Microfiltration
Sterile air filtration
Water desalination & purification filters & systems

## Fluid & Gas Handling

### Key Markets
Aerial lift
Agriculture
Bulk chemical handling
Construction machinery
Food & beverage
Fuel & gas delivery
Industrial machinery
Life sciences
Marine
Mining
Mobile
Oil & gas
Renewable energy
Transportation

### Key Products
Check valves
Connectors for low pressure fluid conveyance
Deep sea umbilicals
Diagnostic equipment
Hose couplings
Industrial hose
Mooring systems & power cables
PTFE hose & tubing
Quick couplings
Rubber & thermoplastic hose
Tube fittings & adapters
Tubing & plastic fittings

## Hydraulics

### Key Markets
Aerial lift
Agriculture
Alternative energy
Construction machinery
Forestry
Industrial machinery
Machine tools
Marine
Material handling
Mining
Oil & gas
Power generation
Refuse vehicles
Renewable energy
Truck hydraulics
Turf equipment

### Key Products
Accumulators
Cartridge valves
Electrohydraulic actuators
Human machine interfaces
Hybrid drives
Hydraulic cylinders
Hydraulic motors & pumps
Hydraulic systems
Hydraulic valves & controls
Hydrostatic steering
Integrated hydraulic circuits
Power take-offs
Power units
Rotary actuators
Sensors

## Pneumatics

### Key Markets
Aerospace
Conveyor & material handling
Factory automation
Life science & medical
Machine tools
Packaging machinery
Transportation & automotive

### Key Products
Air preparation
Brass fittings & valves
Manifolds
Pneumatic accessories
Pneumatic actuators & grippers
Pneumatic valves & controls
Quick disconnects
Rotary actuators
Rubber & thermoplastic hose & couplings
Structural extrusions
Thermoplastic tubing & fittings
Vacuum generators, cups & sensors

## Process Control

### Key Markets
Alternative fuels
Biopharmaceuticals
Chemical & refining
Food & beverage
Marine & shipbuilding
Medical & dental
Microelectronics
Nuclear Power
Offshore oil exploration
Oil & gas
Pharmaceuticals
Power generation
Pulp & paper
Steel
Water/wastewater

### Key Products
Analytical Instruments
Analytical sample conditioning products & systems
Chemical injection fittings & valves
Fluoropolymer chemical delivery fittings, valves & pumps
High purity gas delivery fittings, valves, regulators & digital flow controllers
Industrial mass flow meters/ controllers
Permanent no-weld tube fittings
Precision industrial regulators & flow controllers
Process control double block & bleeds
Process control fittings, valves, regulators & manifold valves

## Sealing & Shielding

### Key Markets
Aerospace
Chemical processing
Consumer
Fluid power
General industrial
Information technology
Life sciences
Microelectronics
Military
Oil & gas
Power generation
Renewable energy
Telecommunications
Transportation

### Key Products
Dynamic seals
Elastomeric o-rings
Electro-medical instrument design & assembly
EMI shielding
Extruded & precision-cut, fabricated elastomeric seals
High temperature metal seals
Homogeneous & inserted elastomeric shapes
Medical device fabrication & assembly
Metal & plastic retained composite seals
Shielded optical windows
Silicone tubing & extrusions
Thermal management
Vibration dampening

ENGINEERING YOUR SUCCESS.

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