Directional Control Valve VP170
Proportional, Load-Sensing, Pressure Compensated
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**Breadth of Line**

Parker Hannifin is a Fortune 300 company with sales of $8 billion and over 400,000 customers in 46 countries. Parker is the world’s leading supplier of motion control components and system solutions serving the mobile, industrial and aerospace markets.

Parker is your single source for any hydraulic valve requirement. We provide a wide selection of open-center and load-sense directional control valves for any construction, off-highway, or on-highway application. Many of our open-center valves can be adapted and used as closed-center, constant-pressure, and constant-pressure unloaded valves. Each of these technologies offers unique features for improved machine performance over traditional, open-center control valves.

When remote control is required, Parker provides a broad line of pilot controllers that are compact and pressure-matched with our control valves to provide consistent and optimized machine control. There are a variety of electric-switch handle options available for additional function control by the operator.

Parker’s premier IQAN electronics packages range from simple stand-alone controllers to large, multiple CAN bus systems with color displays. For example, IQAN interfaces with new electronic diesel engines over the SAE J1939 CAN bus.

Package components are designed and tested for mobile applications to help increase machine uptime. The IQAN valve drivers offer superior control of proportional hydraulic functions resulting in increased machine productivity.

Non-programmers find IQAN’s programming interface easy to use, reducing development time. Furthermore, excellent diagnostic tools and remote modem connection help cut field service time.

**Total Machine Motion Control**

You can turn to us for all your mobile motion control solutions. We offer stand-alone valves, as well as custom-designed manifolds with integrated directional control valves.

No matter what type of system you choose, Parker solutions provide top-notch performance and reliability. Our systems are optimized to reduce complexity, size, cost, and fluid leakage. Therefore, working with Parker can significantly cut your machine-build time.
State-of-the-Art Manufacturing

Parker is committed to using lean manufacturing to eliminate waste while streamlining processes. Lean technology helps us meet customer request dates quickly and cost-effectively. We also rely on state-of-the-art equipment and technology, such as computer-aided machining, to ensure product quality.

We regularly invest in our ISO 9001 certified manufacturing facilities because we are committed to meeting all international standards for safety and quality. The hydraulic valves we manufacture comply with relevant ISO, CSA, CE, and AMEX standards.

In addition, Parker hydraulic valves and valve manifolds are fully tested and certified before being released to the customer. You can expect Parker hydraulic valves to work the first time, every time.

Customer Service with a Global Reach

Parker’s worldwide network of field sales engineers and Mobile Systems Engineers (MSEs) are the best in the business. A field sales engineer works closely with you, acting as a single point of contact to evaluate applications and design solutions. MSEs support field sales efforts by managing difficult design problems and complex circuit design.

You also benefit from Parker Mobile Technology Centers (MTCs) that are staffed by specially trained distributors who provide only the highest levels of customer service. These one-stop shops offer complete hydraulic systems design for mobile applications, as well as technology services such as diagnostics, troubleshooting, computer design, testing, and integration of electronic controls.

Finally, our thousands of dependable distributors are strategically located in your markets. They carry inventory to meet specific, local market needs, and they ensure that products arrive when and where they are needed. You can count on Parker distributors to minimize downtime.

To locate your nearest distributor for the latest information on the VP170 Directional Control Valve, or our entire mobile valve line-up, visit us at www.parker.com.
General Description

The VP170 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 or engine rpms. The key technology integrated into the VP170 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.

The design of the VP170 is modular, allowing for content to be added or taken out of the valve to better match its value to varying machine requirements. For example, it is available as a load-sense pressure compensated, load-sense only, and with and without induced-load protection.

The valve can be operated manually, pneumatically, hydraulic remote or with solenoids. The same solenoid is used for on/off and proportional control. A bypass unloader is available for use with fixed-displacement pumps. Also, a new, low-pressure regeneration feature has been designed to overcome the damaging affects of cavitation – premature component wear and spongy operation.

The VP170 uses the same spool positioners and port accessories as its open-center counterpart – VA/VG20. The standard spool types are 3-way, 4-way and 4-position float. The standard flow limited spools are 8, 16, 24, 32 and 45 GPM based upon a margin pressure of 250 PSI. There is also a standard spool that is not flow limited.

Operation

The VP170 (PCLS) is an individually compensated load-sense directional control valve. For optimum horsepower utilization and heat generation, it is normally used with a piston pump. However, it does have the flexibility to be interfaced with a fixed (gear or vane) 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 section compensator will control the flow for the lighter loaded function.
Benefits

- **Excellent machine controllability** – individual pressure compensation in each work section delivers predictable metering with single and multi-function operation, regardless of changes in pressure or input flow. This enhances machine control, improves productivity and helps to make every operator an "expert" operator -- all of which saves money. Also, this valve type lends itself to closed-loop control.

- **Improved system efficiency** – optimized horsepower utilization and heat management are inherent with load-sense pressure compensated valves. This is because of a closer match between horsepower consumption and horsepower demand. Fuel savings between 30-50% can be achieved vs. open-center type systems. Also, better horsepower utilization may enable the use of a smaller, less costly engine.

- **Enhanced machine productivity** – the VP170 incorporates flow-sharing technology. This means that during a pump over-demand condition the valve will automatically apportion the available pump flow to the selected functions, based upon control spool area openings. 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.

- **Flexible design** – the modular design of the VP170 enables the machine designer to add or remove content to achieve a better "value match" with the machine requirements. For example, the VP170 is available as load-sense pressure compensated, load-sense only, and with or without induced-load protection. Also, a full line of spool positioners and port accessories is available.

- **Wide flow range** – offers application potential across a family of machines. The VP170 can handle a pump input of 230 LPM (60 GPM) and work sections flows from 30-190 LPM (8-50 GPM).

- **Induced-load protection** – is available for machines whose duty cycles might generate induced loads greater than the load-sense relief valve setting. This is an important option for valves with flow-sharing technology and has the benefit of maintaining machine productivity.

- **Addresses cavitation and maintains system responsiveness** – a unique, optional low-pressure regeneration feature combats cavitation and the damage it causes to hydraulic components -- reducing warranty costs as much as 15%. This device assures there is hydraulic oil in the loop at all times.

- **Ease of service** – the load-sense check, compensator and transition check are located on top of each work section making it a "service friendly" design.
Definitions

**PCLS** = Pressure Compensated Load-Sense, or load-sensing with individual pressure compensation. Individual pressure compensation means each circuit (work section) has a pressure compensator. These pressure compensators reduce pressure to individual circuit needs resulting in flows for each circuit being proportional to spool stroke.

**LS** = Load-Sensing (no individual pressure compensators). Flow is proportional to spool stroke in the highest loaded function only.

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

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

**Margin** = Pressure at valve inlet – pressure at valve LS port = $M_v$

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

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

**Margin** = $M_v$ or $M_p$ when one valve function is deadheaded and the LSRV relieves.

**FLO** = Flow Limit Orifice, limits flow over LSRV. Normally it is 0.045" diameter.

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

**EH** = Electrohydraulic or solenoid controlled spool positioning.

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

**PRRV** = Pressure Reducing and Relieving Valve.

**Q** = Flow or Flow rate.

**LS vent** = A small connection (0.014"/0.017" diameter) of the LS gallery to tank to “bleed down” the LS pressure to the tank level when LS pressure is not required.

**LS check** = Helps decide which circuit has the highest LS pressure.

**Flow sharing** = A valve arranged so available flow is shared between active circuits – also known as “post compensated”.

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
$9/5 \degree C + 32 = \degree F$
Specifications

Pressures
Pump inlets: 350 Bar (5000 PSI)
Service Ports: 350 Bar (5000 PSI)
Pilot (input or internal supply): 35 Bar (508 PSI)
Tank Return: 15 Bar (220 PSI)
Solenoil Drain: 2 Bar (29 PSI)

Flow Rates
Maximum Input: 227 LPM (60 US GPM)
Maximum Flow out of Service Ports: 190 LPM (50 US GPM)
Max. Return to Service Port: 280 LPM (75 US GPM)

Leakage Performance
With mineral oil, 100 SUS @ 120°F at 1100 PSI differential

Hydraulic Fluid
Mineral base oil.
Viscosity, working range: 15-380 mm²/s (15-380 cSt).

Hydraulic Oil Temperature
Recommended Operating Range without Solenoid Operation:
-30° to 90°C (-22° to 194°F)
Recommended Operating Range with Solenoid Operation:
-20° to 80°C (-4° to 176°F)

Filtration (ISO 4406)
20/18/14 in Main Flow Paths
18/16/13 Pilot Supply

Weights
Inlet w/o Bolt-on Block: 9.53 kg (21 lb)
Inlet with Bolt-on Block: 12.25 kg (27 lb)

Work Sections
Manual: 9.10 kg (20 lb)
Hydraulic Remote: 9.53 kg (21 lb)
EH: 9.98 kg (22 lb)

Outlets
Standard: 8.62 kg (19 lb)
LP Regen: 10.43 kg (23 lb)
LS Unloader: 10.43 kg (23 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
Pump gage port standard
o-ring boss 9/16"-18 UNF , BSPP ports 1/4"-19

<table>
<thead>
<tr>
<th>Description</th>
<th>SAE #</th>
<th>O-ring Boss (UNF)</th>
<th>BSPP</th>
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<tr>
<td>inlet, top</td>
<td>16</td>
<td>1(\frac{5}{16})-12</td>
<td>1&quot;-11</td>
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<tr>
<td>inlet, top</td>
<td>12</td>
<td>1(\frac{1}{16})-12</td>
<td>3/4&quot;-14</td>
</tr>
<tr>
<td>inlet, side</td>
<td>16</td>
<td>1(\frac{5}{16})-12</td>
<td>1&quot;-11</td>
</tr>
<tr>
<td>inlet, side</td>
<td>12</td>
<td>1(\frac{1}{16})-12</td>
<td>3/4&quot;-14</td>
</tr>
<tr>
<td>EH inlet, pilot</td>
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<td>9/16-18</td>
<td>1/4&quot;-19</td>
</tr>
<tr>
<td>All block ports</td>
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<td>9/16-18</td>
<td>1/4&quot;-19</td>
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<tr>
<td>outlet, top</td>
<td>16</td>
<td>1(\frac{5}{16})-12</td>
<td>1&quot;-11</td>
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<tr>
<td>outlet, top</td>
<td>12</td>
<td>1(\frac{1}{16})-12</td>
<td>3/4&quot;-14</td>
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<td>outlet, side</td>
<td>16</td>
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<tr>
<td>outlet, side</td>
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<td>1(\frac{1}{16})-12</td>
<td>3/4&quot;-14</td>
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<tr>
<td>work section</td>
<td>8</td>
<td>3/4-16</td>
<td>(none)</td>
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<tr>
<td>work section</td>
<td>10</td>
<td>7/8-14</td>
<td>1/2&quot;-14</td>
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<tr>
<td>work section</td>
<td>12</td>
<td>1(\frac{1}{16})-12</td>
<td>3/4&quot;-14</td>
</tr>
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</table>

Solenoid Specifications

<table>
<thead>
<tr>
<th>Voltage</th>
<th>12 or 24 VDC</th>
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<tr>
<td>Pilot</td>
<td>35 Bar (508 PSI), 15-23 LPM (4-6 GPM)</td>
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<tr>
<td>Current Input (I)</td>
<td>1.5A for 12 VDC 0.75A for 24 VDC</td>
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<tr>
<td>Current (mA) for Spool Shift</td>
<td>Start Shift Full Shift 12V 500 1250 24V 250 625</td>
</tr>
<tr>
<td>Insulation Material</td>
<td>Class H</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>100%</td>
</tr>
<tr>
<td>R20 Ohm</td>
<td>5.3 (±5%) for 12 VDC 21.2 (±5%) for 24 VDC</td>
</tr>
<tr>
<td>Fluid Cleanliness</td>
<td>17/14 per ISO 4406</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>-30° to 80°C (-22° to 176°F)</td>
</tr>
<tr>
<td>Fluid Temperature</td>
<td>-20° to 80°C (-4° to 176°F)</td>
</tr>
</tbody>
</table>
Performance Curves

Compensator Performance

PRRV Pressure vs. Flow

1 Spool Pressure Drop vs. Flow

7 Spool Pressure Drop vs. Flow

Effects of Margin Pressure on Flow Output*

* assumes no Delta P from pump to valve
Load-Sense Directional Control Valve
VP170

Performance Curves

A/C Curve 355 9001 164

Pressure Drop

Bar  PSI
0  3.5  7  10  15  20  25  30  35  40  50  60
0 21  25  29  33  37  41  45  49  53  57  61

Flow

GPM  LPM
0 10 20 30 40 50 60 70 80 90 100 110
0 38 76 113 151 189 227

A/C Curve 355 9001 278

Pressure IN-TK

Bar  PSI
0  7  10  14  20  25  30  35  40  50
0 21  28  35  42  50  57  65  72  80

Flow

LPM  GPM
0 10 20 30 40 50
0 38 76 113 151 189

Meter-In Flow to Workport
Manual Operated Work Sections

Workport Flow

GPM  LPM
0 19 38 57 76 95 114
0 0.125 0.213 0.30 0.383 0.409 0.406

Spool Travel

Inch  mm
0 0.125 0.213 0.30 0.383 0.409 0.406
0 3.175 5.41 7.92 8.64 10.31

45 GPM Spool
32 GPM Spool
24 GPM Spool
16 GPM Spool
8 GPM Spool

Note: Hydraulic remote controllers with a 95-400 PSI (7-28 Bar) controlled pressure range are required for optimum performance.

Meter-In Flow to Workport
Hydraulic Remote Operated Work Sections

Workport Flow

GPM  LPM
0 19 38 57 76 95 114
0 0.125 0.213 0.30 0.383 0.409 0.406

Endcap Pressure

PSI  Bar
0 10 20 30 40 50
0 8 14 20 24 27

45 GPM Spool
32 GPM Spool
24 GPM Spool
16 GPM Spool
8 GPM Spool

Port Relief Valve Curves
Workport to Tank Flow

Workport Pressure

Bar  PSI
0 310 276 241 207 172 138 103 69 34 0
0 4500 4000 3500 3000 2500 2000 1500 1000 500 0

Flow

GPM  LPM
0 19 38 57 76 95 114 132 151 170
0 0.125 0.213 0.30 0.383 0.409 0.406 0.409 0.406 0.406

Pilot Operated RV+AC
Differential RV
Pilot Operated RV+AC
Differential RV

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA
Major Valve Options

I  Circuits:
   A) LS – when individual pressure compensation isn’t needed.
   B) PCLS without reverse flow check – when “induced loads”* are not anticipated. Also, the check may be eliminated when load drift is not required.
   C) PCLS with reverse flow check – when “induced loads”* are anticipated. Also, the check serves as a low leak transition check.
      * Induced loads are actuators trying to force fluid back into valve.

II  Inlets:
   A) Standard - all spool operators except solenoid
   B) “EH” - “external supply” to solenoids – port for connecting external supply to solenoids and drain port – 1.7 Bar (25 PSI) max
   C) Inlet + block 1, 2, 3
      Block 1: “Internal supply” – reduced PSI to solenoids via internal pilot gallery
               Internal supply to solenoid operators.
      Block 2: “Joystick supply” – reduced PSI to external port to supply joystick(s)
               No internal pilot supply.
      Block 3: “Kidney loop” – reduced PSI to an external pilot port. The signal 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 blocks have:
   a) PRRV and screen upstream of it
   b) Accumulator port and check valve
   c) Drain port for connection of solenoid drains and PRRV spring to tank – 1.7 Bar (25 PSI) max
How VP170 May Be Arranged

Pressure Compensated Load-Sense (PCLS) without Reverse Flow check

Pressure Compensated Load-Sense (PCLS) with Reverse Flow Check* (Protects against Induced Loads)
### Load-Sense Directional Control Valve

**VP170**

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

**Dimensions**

<table>
<thead>
<tr>
<th>No. of Sections</th>
<th>L1</th>
<th>L2</th>
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<tbody>
<tr>
<td>1</td>
<td>156 (6.14)</td>
<td>179.3 (7.06)</td>
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<tr>
<td>2</td>
<td>200.4 (7.89)</td>
<td>223.8 (8.81)</td>
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<td>3</td>
<td>244.9 (9.64)</td>
<td>269.2 (10.6)</td>
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<td>4</td>
<td>289.3 (11.39)</td>
<td>313.7 (12.35)</td>
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<tr>
<td>5</td>
<td>333.8 (13.14)</td>
<td>358.1 (14.1)</td>
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<tr>
<td>6</td>
<td>378.2 (14.89)</td>
<td>402.6 (15.85)</td>
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<tr>
<td>7</td>
<td>422.7 (16.64)</td>
<td>447.0 (17.6)</td>
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<tr>
<td>8</td>
<td>467.1 (18.39)</td>
<td>491.5 (19.35)</td>
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<tr>
<td>9</td>
<td>511.6 (20.14)</td>
<td>535.9 (21.1)</td>
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<tr>
<td>10</td>
<td>556 (21.89)</td>
<td>580.4 (22.85)</td>
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**Parts List**

<table>
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<tr>
<th>Serial No. Plate</th>
<th>Part No.</th>
<th>Closing Stem</th>
<th>LAST 5 DIGITS OF SECTION PART NO.</th>
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<tr>
<td></td>
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<td>202.9 (7.99)</td>
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<td>53.2 (2.09)</td>
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<td>76.2 (3.00)</td>
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<td>11.6 (0.46)</td>
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<td>47.8 (1.88)</td>
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</table>

**CLIPPER RV Setting**

**Port "B"**

- 83.1 (3.27)
- 175.9 (6.93)
- 202.2 (7.99)
- 154.7 (6.09)
- 29 (1.14)
- 10.7 (0.42)

**Port "A"**

- 154.7 (6.09)
- 87.8 (3.46)
- 23.1 (0.91)

**Blocks 1, 2, 3**

- 35.1 (1.38)
- 124 (4.88)
- 13.2 (0.52)
- 35.1 (1.38)
- 61.7 (2.43)

**Type 1 End**

- 9.50 - 9.67 (0.374 - 0.381)
- 26.2 (1.03)
- 9.7 (0.38)
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 25, an MS Excel spreadsheet version of this specification sheet and an eConfigurator that 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 [ ].

### System Related Attributes

<table>
<thead>
<tr>
<th>Position Codes</th>
<th>Description</th>
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<tr>
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<td>Valve Type</td>
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<tr>
<td>PCLS</td>
<td>Pressure compensated load-sense</td>
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<tr>
<td>LS</td>
<td>Load-sense</td>
</tr>
<tr>
<td>[04]</td>
<td>Port Type</td>
</tr>
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<td>U</td>
<td>UNF</td>
</tr>
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<td>G</td>
<td>BSPP</td>
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<tr>
<td>[05]</td>
<td>System Voltage</td>
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<td>12 VDC</td>
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<td>24 VDC</td>
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<td>[06]</td>
<td>Connector Type</td>
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<td>A</td>
<td>Amp</td>
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<td>W</td>
<td>Weatherpack (see below)</td>
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<td>[07]</td>
<td>Surface Treatment</td>
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<td>[08]</td>
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<td>ID</td>
<td>Enter part number</td>
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</table>

**Note:** A jumper is available, Part 391 1823 417, that will connect a solenoid with an AMP connector to a Weatherpack connector on a machine.
## Inlet Attributes

The standard inlet has high pressure ports available on the top and side, and a gage port is also located on the side. An optional clipper relief valve is positioned on the top and set at 20 LPM (5.3 GPM).

- **Standard** – used with all spool operators, except solenoid.
- **EH** – this is the standard inlet and has machining for external pilot/drain. It also supplies internal pilot pressure to the work-sections.
- **Inlet + block 1, 2 or 3** - all three blocks have a screen upstream of the PRRV, an accumulator port and check valve, a PRRV and a dedicated solenoid drain port.

<table>
<thead>
<tr>
<th>[15]</th>
<th>Inlet Section Type (See next page)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Standard</td>
</tr>
<tr>
<td>IEH</td>
<td>EH</td>
</tr>
<tr>
<td>I1 (block 1)</td>
<td>Internal pilot supply to ports A&amp;B. It also has an optional port that provides a regulated signal out (with a steel plug).</td>
</tr>
<tr>
<td>I2 (block 2)</td>
<td>Supplies a regulated external signal to a hydraulic remote controller.</td>
</tr>
<tr>
<td>I3 (block 3)</td>
<td>Provides external pilot supply that can be routed thru an external filter and then back into the inlet, for internal supply to the work sections.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[16]</th>
<th>Clipper RV Cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Steel plug</td>
</tr>
<tr>
<td>PA</td>
<td>RV+AC (non-adjustable)</td>
</tr>
<tr>
<td>Z</td>
<td>Plastic closure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[17]</th>
<th>Clipper RV setting (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>80 Bar (1160 PSI)</td>
</tr>
<tr>
<td>100</td>
<td>100 Bar (1450 PSI)</td>
</tr>
<tr>
<td>125</td>
<td>125 Bar (1813 PSI)</td>
</tr>
<tr>
<td>140</td>
<td>140 Bar (2030 PSI)</td>
</tr>
<tr>
<td>160</td>
<td>160 Bar (2320 PSI)</td>
</tr>
<tr>
<td>175</td>
<td>175 Bar (2540 PSI)</td>
</tr>
<tr>
<td>190</td>
<td>190 Bar (2755 PSI)</td>
</tr>
<tr>
<td>210</td>
<td>210 Bar (3045 PSI)</td>
</tr>
<tr>
<td>230</td>
<td>230 Bar (3335 PSI)</td>
</tr>
<tr>
<td>250</td>
<td>250 Bar (3625 PSI)</td>
</tr>
<tr>
<td>280</td>
<td>280 Bar (4060 PSI)</td>
</tr>
<tr>
<td>300</td>
<td>300 Bar (4350 PSI)</td>
</tr>
<tr>
<td>330</td>
<td>330 Bar (4785 PSI)</td>
</tr>
<tr>
<td>350</td>
<td>350 Bar (5075 PSI)</td>
</tr>
<tr>
<td>380</td>
<td>380 Bar (5510 PSI)</td>
</tr>
<tr>
<td>400</td>
<td>400 Bar (5800 PSI)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[26]</th>
<th>Top Inlet HP Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1TOPB</td>
<td>SAE 16 or 1” BSPP with a steel plug</td>
</tr>
<tr>
<td>1TOP</td>
<td>SAE 16 or 1” BSPP open</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[27]</th>
<th>Side Inlet HP Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1SB</td>
<td>SAE 16 or 1” BSPP with a steel plug</td>
</tr>
<tr>
<td>1S</td>
<td>SAE 16 or 1” BSPP open</td>
</tr>
</tbody>
</table>
[15] Inlet Section Type

Standard Inlet

- Top Pump Connection
- Gage Port
- Pump Inlet (Standard)
- Side Pump Connection

Inlet with Bolt on Block

- Port P
- Reduced PSI
- Drain Port
- Non-Functional Port
- Bolt on Block
- Pilot Port
- Side Inlet Port
- Drain Port Option

EH Inlet

- Top Pump Connection
- Gage Port
- Pump Inlet (Standard)
- Side Pump Connection

Block Detail

- Inlet PSI, Screened, Feed to PRRV
- Port R (Reduced PSI)
- Spool
- Plug for Block 2, 3 (Block 1 – No Plug)
Outlet Attributes

The outlet is available with low pressure ports (top & side), a load-sense relief valve, load-sense and gage ports and an optional port to accept a load-sense signal from an external load-sense valve.

<table>
<thead>
<tr>
<th>[31]</th>
<th>Top load-sense IN port</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSP</td>
<td>Yes</td>
</tr>
<tr>
<td>LSPB</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[34]</th>
<th>Top tank return port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 TOPTB</td>
<td>SAE 16 or 1&quot; BSPP with a steel plug</td>
</tr>
<tr>
<td>1TOPT</td>
<td>SAE 16 or 1&quot; BSPP open</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[33]</th>
<th>Side tank return port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1STB</td>
<td>SAE 16 or 1&quot; BSPP with a steel plug</td>
</tr>
<tr>
<td>1ST</td>
<td>SAE 16 or 1&quot; BSPP open</td>
</tr>
<tr>
<td>2 STB</td>
<td>SAE 20 or 1 ¼&quot; BSPP with a steel plug</td>
</tr>
<tr>
<td>2 ST</td>
<td>SAE 20 or 1 ¼&quot; BSPP open</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[41]</th>
<th>LSRV Cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSRV</td>
<td>Load-sense relief valve</td>
</tr>
<tr>
<td>Y</td>
<td>Steel plug</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[43]</th>
<th>Load-sense RV setting (Bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar</td>
<td>Enter setting. If none, omit</td>
</tr>
</tbody>
</table>

![Outlet – Load Sense](image1)

![Outlet – PCLS](image2)
Work Section Attributes

Work sections are available in 3-way, 3-position (cylinder & motor), a 4-way, 3-position (cylinder & 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, pneumatic, hydraulic remote and solenoid.

Load-Sensing Work Section

PCLS Work Section with Reverse Flow Check

PCLS Work Section w/o Reverse Flow Check
### Work-Section Attributes

<table>
<thead>
<tr>
<th>[46]</th>
<th>Size of work ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP2001</td>
<td>SAE 10 or 1/2&quot; BSPP</td>
</tr>
<tr>
<td>WP2002</td>
<td>SAE 12 or 3/4&quot; BSPP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[50]</th>
<th>Spool Positioner (See below and next page)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Manual, 3-position</td>
</tr>
<tr>
<td>CB</td>
<td>Manual, 4-position, detent in 4th position float</td>
</tr>
<tr>
<td>B3</td>
<td>Manual, 3-position detent</td>
</tr>
<tr>
<td>3SD</td>
<td>Manual, 3-position, detent IN, spring-return OUT</td>
</tr>
<tr>
<td>ACP</td>
<td>Pneumatic, 3-position</td>
</tr>
<tr>
<td>PC</td>
<td>Hydraulic-remote, 3-position</td>
</tr>
<tr>
<td>PCA</td>
<td>Hydraulic-remote, 3-position, adjusted spool stroke</td>
</tr>
<tr>
<td>PCF</td>
<td>Hydraulic-remote, 4-position float</td>
</tr>
<tr>
<td>EC</td>
<td>Solenoid, 3-position</td>
</tr>
<tr>
<td>ECA</td>
<td>Solenoid, 3-position, adjusted spool stroke</td>
</tr>
<tr>
<td>ECF</td>
<td>Solenoid, 4-position float</td>
</tr>
</tbody>
</table>

### [50] Work Section Spool Positioner

**Code C1 = Spring Return**

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

**Code CB = Spring Return w/4th Position Detent**


**Code B3 = 3-Position Detent**

Basic Function: Hold spool in neutral position or in either work position. Manual handle operation.

**Code 3SD = Spring Return Out, Detent In**

Basic Function: Spool is detented when pushed IN. Spool is returned to neutral via spring when pulled OUT.

**Code ACP = Single Ended Pneumatic**

Basic Function: Proportional air pilot PSI, admitted at either port, balances against spring.

---

Continued on next page
[50] Work Section Spool Positioner (cont.)

**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 PCA = Hydraulic Remote, Adj. Spool Stroke**
Basic Function:
Reduce spool stroke thus reducing flow to service ports. Can reduce spool stroke from 0.406 to 0.094. Flow (Q) set at "A", "B" [61]

**Code PCF = Hydraulic Remote, 4-Position Float**
Basic Function:
Proportional hydraulic pilot PSI admitted to ports from PCL4 moves spool proportionally to HP @ A, B or 4th position float.

**Code EC = Proportional Solenoid, 3-Position**
Basic Function:
Proportional spool movement via proportional current to solenoid (ref. IQAN).

**Code ECA = Proportional Solenoid, Adj. Spool Stroke**
Basic Function:
Reduce spool stroke thus reducing flow to service ports. Can reduce spool stroke from 0.406 to 0.094. Flow (Q) set at "A", "B" [61]

**Code ECF = Proportional Solenoid, 4-Position Float**
Basic Function:
Solenoids use current proportioning to proportion hydraulic pilot PSI and balance it against metering/return springs for proportional spool movement.
### [51] Manual Operator (See next page)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Type 1 Handle</td>
</tr>
<tr>
<td>L2</td>
<td>Type 2 Lug End</td>
</tr>
</tbody>
</table>

### [55A] Pilot orifice diameter for hydraulic remote. Controls shift to ‘A’ port – mm. This option is utilized, when dampening is needed.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 mm (0.039&quot;)</td>
</tr>
<tr>
<td>0</td>
<td>None</td>
</tr>
</tbody>
</table>

### [55B] Pilot orifice diameter. Controls shift to ‘B’ port – mm. This option is utilized, when dampening is needed.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 mm (0.039&quot;)</td>
</tr>
<tr>
<td>0</td>
<td>None</td>
</tr>
</tbody>
</table>

### [56A] Solenoid pilot orifice. Controls shift to ‘A’ port – mm. This option is utilized, when dampening is needed. The standard size is 3mm.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>.45</td>
<td>.45</td>
</tr>
<tr>
<td>.6</td>
<td>.6</td>
</tr>
<tr>
<td>.7</td>
<td>.7</td>
</tr>
<tr>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### [56B] Solenoid pilot orifice. Controls shift to ‘B’ port - mm. This option is utilized, when dampening is needed. The standard size is 3mm.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>.45</td>
<td>.45</td>
</tr>
<tr>
<td>.6</td>
<td>.6</td>
</tr>
<tr>
<td>.7</td>
<td>.7</td>
</tr>
<tr>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Type 1 Handle End

Spool Direction

PULL HANDLE
Spool OUT
High Pressure @ Port B
Port A to Tank

PUSH HANDLE
Spool IN
High Pressure @ Port A
Port B to Tank

Handle Assembly
Kit 396 1823 233
(includes handle, knob and jam nut)

Type 2 Lug End
### Ordering Information – Work Sections

**VP170**

<table>
<thead>
<tr>
<th>[57]</th>
<th>Diode (ports A and B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Yes</td>
</tr>
<tr>
<td>/</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[60]</th>
<th>Spool Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Double-Acting Cylinder</td>
</tr>
<tr>
<td>M</td>
<td>Double-Acting Motor</td>
</tr>
<tr>
<td>DEB</td>
<td>Single-Acting Cylinder @ port B</td>
</tr>
<tr>
<td>MEB</td>
<td>Single-Acting Motor @ port B</td>
</tr>
<tr>
<td>F</td>
<td>4th Position Float</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[61A]</th>
<th>Flow setting out of port ‘A’ with stroke limiter. For hydraulic remote or solenoid operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPM</td>
<td>Enter setting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[61B]</th>
<th>Flow setting out of port ‘B’ with stroke limiter. For hydraulic remote or solenoid operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPM</td>
<td>Enter setting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[68]</th>
<th>Reverse Flow Check (applies to VP170 (PCLS) only. This feature addresses induced loads and also serves as a transition check. It is not needed if induced loads are not applicable OR the function has pilot-operated checks or counterbalance valves.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>Yes</td>
</tr>
<tr>
<td>Y2</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[70]</th>
<th>Spool Flow at Full Stroke – Ports ‘A &amp; B’. This is based upon a margin pressure of 17 Bar (250 PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/8</td>
<td>30 LPM/8 GPM</td>
</tr>
<tr>
<td>61/16</td>
<td>61 LPM/16 GPM</td>
</tr>
<tr>
<td>91/24</td>
<td>91 LPM/24 GPM</td>
</tr>
<tr>
<td>121/32</td>
<td>121 LPM/32 GPM</td>
</tr>
<tr>
<td>170/45</td>
<td>170 LPM/45 GPM</td>
</tr>
<tr>
<td>Full</td>
<td>This spool will meter to approximately 75% of stroke. With further spool movement, the spool will come off the notch.</td>
</tr>
</tbody>
</table>

---

![Diagram](image-url)
## Workport Accessories – Select one for each port

<table>
<thead>
<tr>
<th>Port A</th>
<th>Accessory (See below for details)</th>
<th>Port B</th>
</tr>
</thead>
<tbody>
<tr>
<td>[76A]</td>
<td>Y2 Steel Plug</td>
<td>Y2</td>
</tr>
<tr>
<td></td>
<td>C Plastic Closure</td>
<td>C</td>
</tr>
<tr>
<td>PS</td>
<td>RV/AC, screw adjustable, 35-345 Bar (500-5000 PSI)</td>
<td>PS</td>
</tr>
<tr>
<td>RV1</td>
<td>RV, screw adjustable, 35-86 Bar (500-1250 PSI)</td>
<td>RV1</td>
</tr>
<tr>
<td>RV2</td>
<td>RV, screw adjustable, 86-183 Bar (1251-2650 PSI)</td>
<td>RV2</td>
</tr>
<tr>
<td>RV3</td>
<td>RV, screw adjustable, 183-269 Bar (2651-3900 PSI)</td>
<td>RV3</td>
</tr>
<tr>
<td>RV4</td>
<td>RV, shim adjustable, 35-69 Bar (500-1000 PSI)</td>
<td>RV5</td>
</tr>
<tr>
<td>RV5</td>
<td>RV, shim adjustable, 69-172 Bar (1001-2500 PSI)</td>
<td>RV6</td>
</tr>
<tr>
<td>RV6</td>
<td>RV, shim adjustable, 172-241 Bar (2501-3500 PSI)</td>
<td>RV7</td>
</tr>
<tr>
<td>N2</td>
<td>Anti-Cav</td>
<td>N2</td>
</tr>
<tr>
<td>Bars</td>
<td>R/V Setting – enter in Bars</td>
<td>Bars</td>
</tr>
</tbody>
</table>

### [76A] and [76B] – Workport Accessories

- **Code Y2**
  - ![Code Y2 Diagram](image)

- **Code PS**
  - ![Code PS Diagram](image)

- **Code N2**
  - ![Code N2 Diagram](image)

- **Code RV1, RV2, RV3**
  - ![Code RV1, RV2, RV3 Diagram](image)

- **Code RV4, RV5, RV6**
  - ![Code RV4, RV5, RV6 Diagram](image)
Low Pressure Regeneration

For combating cavitation

To combat cavitation, this outlet is designed to always keep oil in the loop between the valve and the actuator. When a function is cavitating, it will force oil across any anti-cavitation checks in the valve. If there is still a void in the hydraulic loop (valve to actuator) after the spools are returned to neutral, it will keep the piston pump on stroke until that void is eliminated.

LS Unloader

Operates with fixed displacement pumps
## Stud Assemblies

<table>
<thead>
<tr>
<th># Sections</th>
<th>Stud assembly</th>
<th>Stud</th>
<th>Length (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>391 9425 108</td>
<td>391 1425 378</td>
<td>6.75</td>
</tr>
<tr>
<td>2</td>
<td>391 9425 107</td>
<td>391 1425 377</td>
<td>8.50</td>
</tr>
<tr>
<td>3</td>
<td>391 9425 085</td>
<td>391 1425 425</td>
<td>10.25</td>
</tr>
<tr>
<td>4</td>
<td>391 9425 109</td>
<td>391 1425 382</td>
<td>12.00</td>
</tr>
<tr>
<td>5</td>
<td>391 9425 111</td>
<td>391 1425 388</td>
<td>13.75</td>
</tr>
<tr>
<td>6</td>
<td>391 9425 121</td>
<td>391 1425 404</td>
<td>15.50</td>
</tr>
<tr>
<td>7</td>
<td>391 9425 122</td>
<td>391 1425 405</td>
<td>17.25</td>
</tr>
<tr>
<td>8</td>
<td>391 9425 123</td>
<td>391 1425 406</td>
<td>19.00</td>
</tr>
<tr>
<td>9</td>
<td>391 9425 124</td>
<td>391 1425 407</td>
<td>20.75</td>
</tr>
</tbody>
</table>
### System Attributes
<table>
<thead>
<tr>
<th>POS</th>
<th>DESCRIPTION</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Valve Type</td>
<td>NCLS, L5</td>
</tr>
<tr>
<td>04</td>
<td>Port Type</td>
<td>G (UNF), G (BSPP)</td>
</tr>
<tr>
<td>05</td>
<td>System Voltage</td>
<td>12V, 24V</td>
</tr>
<tr>
<td>06</td>
<td>Connector Type</td>
<td>Weatherpack, AMP Deutsch</td>
</tr>
<tr>
<td>07</td>
<td>Surface Treatment</td>
<td>No paint, black</td>
</tr>
</tbody>
</table>

### Stack POS

#### Work Section

<table>
<thead>
<tr>
<th>POS</th>
<th>DESCRIPTION</th>
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#### Pin MCH Cast

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Directional Control Valve VP170
Proportional, Load-Sensing, Pressure Compensated

Catalog HY14-2006/US