The CROSS series B directional control valves provide good metering characteristics and long dependable service life. Optimum versatility is provided due to the many standard and optional features. Balanced spools are select-fit for minimum leakage and load holding checks prevent load drop when shifting. Parallel flow path permits spools to be operated independently or simultaneously.

GENERAL SPECIFICATIONS
Number of spools ........................................ one, two or three
Rated working pressure .................................. 3000 psi (206 bar)*
Maximum shock and surge pressure ...................... 4000 psi (276 bar)
Rated flow capacity ...................................... 30 gpm (114 l/min)
Maximum spool leakage (at 1000 psi w/100 SUS oil at 120° F) .......... 16 cc/min.
Mounting, any position .................................. Three mounting holes for \( \frac{3}{8}'' \) dia. bolts
Weight ........ 1 spool: 13 lbs. (6 Kg); 2 spool: 21 lbs. (9.5 Kg); 3 spool: 33 lbs. (15 Kg)
* SAE threads only, 2500 psi for NPTF

MATERIAL SPECIFICATIONS
Body ......................................................... High tensile strength cast iron
Spools ..................................................... Ground, plated and polished steel alloy
Seals ....................................................... Buna N

STANDARD FEATURES
- Integral load holding check valves (prevent reverse flow through valve when shifting)
- Integral differential poppet type relief valve, adjustable (set at 2000 psi, 10 gpm)
- Balanced, select-fit spools (provide minimum leakage, smooth operation)
- External spool seals (permit easy replacement, reduced maintenance cost)
- 3/4” NPTF inlet and outlet ports; 1/2” NPTF work ports
- Complete handle assembly • 1, 2, or 3 spools

OPTIONAL FEATURES AVAILABLE
- Open or closed center positions, 3-way or 4-way operation, 3-position or 4-position (float position), full open center (motoring spool) and other spool options
- Power beyond (permits use of neutral flow at system pressure); also permits field conversion from closed center to open center (tandem) operation
- Top, bottom or end location of outlet port
- Top or end location of inlet port
- Pressure release detent, in either or both work positions
- Integral pressure compensated flow control (Model BC), adjustable from 0 to 25 gpm, ± 5% flow regulation. Available in 1-spool version only. 21 lbs. (9.5 Kg)

NOTE: Refer to CROSS Valve Technical/Service Sheet for recommendations and limitations.
DIMENSIONAL DATA in inches and (millimeters)

SPOOL OPTIONS

ACTUATOR OPTIONS
**TYPICAL PERFORMANCE DATA**

**PRESSURE DROP** (with 100 SUS oil at 120° F, \(\frac{1}{4}\)" NPTF in & out, \(\frac{1}{2}\)" work ports)

<table>
<thead>
<tr>
<th>FLOW RATE</th>
<th>P to T</th>
<th>P to A or B</th>
<th>A₁ or B₁ to T</th>
<th>A₂ or B₂ to T</th>
<th>A₃ or B₃ to T</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPM</td>
<td>l/m</td>
<td>PSI bar</td>
<td>PSI bar</td>
<td>PSI bar</td>
<td>PSI bar</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>___</td>
<td>8 .6</td>
<td>2 .1</td>
<td>___</td>
</tr>
<tr>
<td>10</td>
<td>38</td>
<td>3 .2</td>
<td>20 1.4</td>
<td>6 .4</td>
<td>___</td>
</tr>
<tr>
<td>15</td>
<td>57</td>
<td>6 .4</td>
<td>36 2.5</td>
<td>13 .9</td>
<td>___</td>
</tr>
<tr>
<td>20</td>
<td>76</td>
<td>11 .8</td>
<td>55 3.8</td>
<td>23 1.6</td>
<td>___</td>
</tr>
<tr>
<td>25</td>
<td>95</td>
<td>17 1.2</td>
<td>83 5.7</td>
<td>35 2.4</td>
<td>___</td>
</tr>
<tr>
<td>30</td>
<td>114</td>
<td>25 1.7</td>
<td>120 6.3</td>
<td>48 3.3</td>
<td>___</td>
</tr>
<tr>
<td>35</td>
<td>132</td>
<td>33 2.3</td>
<td>159 11.0</td>
<td>64 4.4</td>
<td>___</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>___</td>
<td>10  .7</td>
<td>6 .4</td>
<td>___</td>
</tr>
<tr>
<td>10</td>
<td>38</td>
<td>5 .3</td>
<td>20 1.4</td>
<td>15 1.0</td>
<td>___</td>
</tr>
<tr>
<td>15</td>
<td>57</td>
<td>10 .7</td>
<td>38 2.6</td>
<td>33 2.3</td>
<td>___</td>
</tr>
<tr>
<td>20</td>
<td>76</td>
<td>18 1.2</td>
<td>60 4.1</td>
<td>58 4.0</td>
<td>___</td>
</tr>
<tr>
<td>25</td>
<td>95</td>
<td>29 2.0</td>
<td>90 6.2</td>
<td>92 6.3</td>
<td>___</td>
</tr>
<tr>
<td>30</td>
<td>114</td>
<td>41 2.8</td>
<td>127 8.8</td>
<td>133 9.2</td>
<td>___</td>
</tr>
<tr>
<td>35</td>
<td>132</td>
<td>54 3.7</td>
<td>174 12.0</td>
<td>184 12.7</td>
<td>___</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>___</td>
<td>8 .6</td>
<td>6 .4</td>
<td>2 1.1</td>
</tr>
<tr>
<td>10</td>
<td>38</td>
<td>12 .8</td>
<td>16 1.1</td>
<td>24 1.7</td>
<td>16 1.1</td>
</tr>
<tr>
<td>15</td>
<td>57</td>
<td>24 1.7</td>
<td>28 1.9</td>
<td>48 3.3</td>
<td>33 2.3</td>
</tr>
<tr>
<td>20</td>
<td>76</td>
<td>41 2.8</td>
<td>44 3.0</td>
<td>84 5.8</td>
<td>58 4.0</td>
</tr>
<tr>
<td>25</td>
<td>95</td>
<td>64 4.4</td>
<td>64 4.4</td>
<td>134 9.2</td>
<td>93 6.4</td>
</tr>
<tr>
<td>30</td>
<td>114</td>
<td>92 6.3</td>
<td>88 6.1</td>
<td>202 13.9</td>
<td>140 9.7</td>
</tr>
<tr>
<td>35</td>
<td>132</td>
<td>124 8.6</td>
<td>120 8.3</td>
<td>276 19.0</td>
<td>196 13.5</td>
</tr>
</tbody>
</table>

**RELIEF VALVE CHARACTERISTICS** (100 SUS oil at 120° F.)

- Increasing Flow
- Decreasing Flow
### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th># OF SPOOLS</th>
<th>SPOOL TYPE</th>
<th>ACTUATOR OPTIONS</th>
<th>RELIEF VALVE(4)</th>
<th>POWER BEYOND</th>
<th>Outlet Port Location</th>
<th>SECONDARY FLOW OUTLET BC ONLY (OPTIONAL)</th>
<th>PORT SIZE &amp; TYPE</th>
<th>HANDLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>1</td>
<td>Manual</td>
<td>Single</td>
<td>A</td>
<td>O</td>
<td>End Outlet</td>
<td>0</td>
<td>A</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Single</td>
<td>2 (1)</td>
<td>B</td>
<td>1 (5)</td>
<td>Top Outlet</td>
<td>B</td>
<td>0</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Double</td>
<td>3-position, closed center</td>
<td>C</td>
<td>1500 psi</td>
<td>Bottom Outlet</td>
<td>E</td>
<td>2</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Triple</td>
<td>3-position, center</td>
<td>D</td>
<td>3 (6)</td>
<td>Other</td>
<td>G</td>
<td>4</td>
<td>1/2&quot; NPTF</td>
</tr>
<tr>
<td></td>
<td>4 (1)</td>
<td></td>
<td>3-position, open center</td>
<td>E</td>
<td>4 (5)</td>
<td>Other</td>
<td>H</td>
<td>5</td>
<td>3/4-16 (SAE #8)</td>
</tr>
<tr>
<td></td>
<td>4 (1)</td>
<td></td>
<td>3-position, center</td>
<td>F</td>
<td>5 (5)</td>
<td>Other</td>
<td>P</td>
<td>6</td>
<td>3/4&quot; NPTF</td>
</tr>
<tr>
<td></td>
<td>4 (1)</td>
<td></td>
<td>4-position, center</td>
<td>G</td>
<td>6 (5)</td>
<td>Other</td>
<td>N</td>
<td>7</td>
<td>1/16-12 (SAE #12)</td>
</tr>
<tr>
<td></td>
<td>4 (1)</td>
<td></td>
<td>4-position, center</td>
<td>H</td>
<td>7 (5)</td>
<td>Other</td>
<td>M</td>
<td>8</td>
<td>1/16-12 (SAE #12)</td>
</tr>
</tbody>
</table>

**Open Center Solenoid Valve must be externally drained.**

**Part number building example:**

**BA2A1XAB1EA0** is a manually operated double spool valve: the first spool being 4-way, 4-position, open center, spring centered with detent in float position; the second spool being 4-way, 3-position, open center spring centered. The non-adjustable relief is set at 1500 psi. 3/4" NPTF power beyond sleeve port, outlet port in end position. Inlet and outlet ports are 3/4" NPTF and the work ports are 1/2" NPTF. Complete handle assembly included.

**NOTES:**

1. Model BC is a one spool combination adjustable priority flow divider and directional control valve, open centered, with conversion plug installed; available power beyond capability by adding kit. Not available as closed center.
2. Float position A or B is available on 1st spool only on 2 or 3 spool valves.
3. Specify detent kick-out pressure if other than 1,000 psi.
4. Pressure settings at 10 gpm.
5. If other setting desired, specify on order.
6. Top, end or bottom outlet (specify).
7. Specify T, B or E when ordering closed center spool, power beyond, or conversion plug.
8. Machined for unidirectional orifice plates.
9. Available for BA2 and BA3 models.

**CROSS MANUFACTURING**

100 James H. Cross Blvd.
Lewis, Kansas 67552
Phone 620/324-5525; FAX 620/324-5737
e-mail: info@crossmfg.com
SERIES B and C DIRECTIONAL CONTROL VALVE DETENT KIT
PART NO. 1V0294

With this option, the valve spool will remain in any of three positions in which it is placed manually. There is no spring return to neutral when this detent option is installed.

To convert from the standard 3-position spring-centered version to a 3-position detent, proceed as follows:

1. Remove the four socket head cap screws and end cap.
2. Remove the socket head cap screw from the spool end and take out the spring centering mechanism.
3. Position the retainer plate (1A0710) on end of valve body.
4. Install lockwasher (2A0736-104P) on threaded end of retainer (1V0272).
5. Screw the factory assembled detent mechanism into the end of the spool. Loctite #271, 9-11 ft. lbs. torque recommended.
6. Replace end cap and the four socket head cap screws.

Conversion is now complete. Save the spring centering mechanism in the event that reconversion should ever be desired.
SERIES B DIRECTIONAL CONTROL VALVE CONVERSION PLUG OPTIONS
(Refer to B series Directional Control Valve Specification Sheet, Form VBA1)

STANDARD OPEN CENTER VALVE WITH CONVERSION PLUG (option #3)
Plug Assembly 2A0354 - 121

This option allows conversion from standard open center function to either power beyond or to a closed center function.

CLOSED CENTER PLUG
Plug Assembly 1V0206

By replacing the conversion plug assembly (2A0354-121) with the closed center plug assembly (1V0206) the directional control valve is converted from open center to closed center function.

POWER BEYOND PLUG
Plug Assembly 1V0208, 3/4" NPTF port
1V0209, SAE #10
1V0249, SAE #12

By replacing plug assembly 2A0354-121 with the power beyond plug assembly, an additional valve may be connected downstream of the B series valve.

NOTE: Closed center or power beyond plugs CANNOT be installed in B series valves without the conversion plug option. Closed center version valves or valves with power beyond option may be converted using any of the above plug assemblies.
USE CROSS #1V0208 Power Beyond Sleeve

PWR BEYOND

High Pressure Oil Available for Downstream Function

INLET From Tractor Hydraulics or Pump

OUTLET Low Pressure Return Line to Reservoir
SERIES B DIRECTIONAL CONTROL VALVE OPTIONS

DETECT WITH SPRING CENTERING

This feature allows spring centering to neutral with a detent for the "in" "out" position, or both. The "in" and "out" positions. The one or two position detent with spring centering is desirable for the operation of hydraulic cylinders or motors. The one position detent provides a float position for a three-way spool in the "in" or "out" position. This detent feature is applicable where quick release and centering is needed or for good metering of flow before placing into detent.

SPECIAL PARTS

<table>
<thead>
<tr>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>QTY REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V0067 2-POSITION DETENT SLEEVE</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1V0070 1-POSITION DETENT SLEEVE, &quot;IN&quot; OPT.</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1V0071 1-POSITION DETENT SLEEVE, &quot;OUT&quot; OPT.</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1V0077 DETENT PLUG</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1V0081 DETENT HOUSING ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1A0010 DETENT SPRING</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1A0079-8 BALL (1/4 STEEL)</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1A0081-14 CAPSCREW</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>1A0079-416 CAPSCREW</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTE: ORDER BY KIT NUMBER

1V0067 DETENT SLEEVE
1V0070 DETENT SLEEVE, "IN" OPT.
1V0071 DETENT SLEEVE, "OUT" OPT.
1V0077 DETENT PLUG
1V0081 DETENT HOUSING ASSEMBLY
1A0010 DETENT SPRING
1A0079-8 BALL (1/4 STEEL)
1A0081-14 CAPSCREW
1A0079-416 CAPSCREW

PRESSURE DETENT KIT NO. 1V0642

"BA" values with three-position spools can be provided with this option on any or all spools. A pressure detent holds the spool in the "in" position, "out" position or both "in" and "out" positions. The detent is held until the cylinder or motor reaches a pre-set pressure, releasing the detent, allowing the spool to spring return to neutral. Field installation can be made only if valve already has this option.

SPECIAL PARTS

<table>
<thead>
<tr>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>QTY REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V0067 2-POSITION DETENT SLEEVE</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1V0086 PRESSURE DETENT PISTON</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1V0086 ADJUSTMENT SCREW</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1V0071 DETENT HOUSING ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1V0071 1-POSITION DETENT SLEEVE &quot;OUT&quot; OPT.</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1V0072 PISTON STOP</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1V0072 DETENT HOUSING ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>11A0669 NUT</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>1A0070 ACORN NUT</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1A0070 DETENT SPRING</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>11A0072-208 UPPER O-RING BACK-UP</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>11A0072-207 LOWER O-RING BACK-UP</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>11A0072-8 BALL (1/4 STEEL)</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>11A0072-14 CAPSCREW</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>11A0072-418 CAPSCREW</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>11A0072-507 LOWER PISTON O-RING</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>11A0072-708 UPPER PISTON O-RING</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>11A0072-607 HOUSING O-RING</td>
<td>1</td>
</tr>
</tbody>
</table>

* CONTAINED IN KIT NO. 1V0642. DETENT SLEEVE (3 or 4) OR CAPSCREWS 16 must be ordered separately.
HYDRAULIC VALVES

SERIES B DIRECTIONAL CONTROL VALVE OPTIONS

4-POSITION FLOAT

LOCTITE #271
TORQUE 9-11 FT/LBS.

KIT NO. 1V1600
(SPOOL NOT INCLUDED)

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V0094 FLOAT SPOOL</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1V0209 FLOAT DETENT SLEEVE</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1V0280 FLOAT DETENT RETAINER</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1A0294P END CAP</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1A0710 RETAINER PLATE</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1A0737 FLOAT STOP WASHER</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1A0739 FLOAT STOP COLLAR</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1A0738 DETENT SPRING</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>1A0764 FLOAT SPACER</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1A09231 FLOAT CENTERING SPRING</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>2A0078-8 BALL (1/4 STEEL)</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>2A0079-416 CAPSCREW</td>
<td>4</td>
</tr>
</tbody>
</table>

SPECIAL PARTS

THIS FEATURE PROVIDES FOUR HANDLE POSITIONS, OF WHICH THREE ARE STANDARD DOUBLE-ACTING WITH SPRING CENTERING TO NEUTRAL. THE FOURTH POSITION HAS A DETENT TO HOLD IN "FLOAT" POSITION ALLOWING THE CYLINDER OR MOTOR TO TRAVEL BACK AND FORTH AT WILL. WHEN THE SPOOL IS IN THIS "FLOAT" POSITION, BOTH CYLINDER PORTS AND PUMP PORTS ARE OPEN TO TANK.

3-POSITION DETENT

LOCTITE #271
TORQUE 9-11 FT/LBS.

THIS FEATURE PROVIDES THREE HANDLE POSITIONS, ALL OF WHICH ARE HELD WITH A DETENT, AND HAS NO SPRING CENTERING TO NEUTRAL. THIS OPTION ALLOWS CONTROL AND DIRECTING OF FLOW TO STOP, START OR REVERSE HYDRAULIC MOTORS. IT CAN BE USED TO DIVERT FLOW TO ONE OR MORE SEPARATE CIRCUITS.

SPECIAL PARTS

TO CONVERT FROM SPRING CENTERING TO 3-POSITION DETENT:

1V0284 - DETENT CONVERSION KIT

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V0269 DETENT SLEEVE</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1V0272 DETENT RETAINER</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1A0710 RETAINER PLATE</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1A0738 DETENT SPRING</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2A0017-8 BALL (1/4 STEEL)</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>2A0738-104 LOCK WASHER</td>
<td>1</td>
</tr>
</tbody>
</table>

SPRING EXTENDED SPOOL

SPECIAL PARTS

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V0082 STOP COLLAR</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1A0008 SPRING</td>
<td>1</td>
</tr>
</tbody>
</table>

SPRING RETRACTED SPOOL

SPECIAL PARTS

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1V0200 SPOOL SPACER</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1V0211 SPECIAL END CAP</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2A0079-410 CAPSCREW</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1A0008 SPRING</td>
<td>1</td>
</tr>
</tbody>
</table>
FUNCTION
To restrict the fluid flow in or out of valve ports.

APPLICATION

**"IN-FLOW" POSITION**
Orifice plates installed in this position restrict flow entering the valve port from a cylinder or motor, offering these advantages:
1. Prevents cavitation of cylinder or motor having an inertia load.
2. Improves control of operation for double or single acting cylinders when lowering.
3. Improves control of rotary cylinders which have inertia loads in both directions. (use an orifice plate in both cylinder ports)

**"OUT-FLOW" POSITION**
Orifice plates installed in this position restrict flow of pressurized oil flowing out of the valve port to a cylinder or motor, offering the advantage of:
Improved control for extending single or double acting cylinders or speed of a hydraulic motor.

**ORIFICE SIZING:**
CROSS Engineering will calculate the proper orifice size for each application if flow rate, system pressure, and pressure drop requirements are supplied.

**ORIFICE SIZES AVAILABLE**

<table>
<thead>
<tr>
<th>Size (inches)</th>
<th>.031</th>
<th>.081</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.040</td>
<td>.094</td>
</tr>
<tr>
<td></td>
<td>.047</td>
<td>.109</td>
</tr>
<tr>
<td></td>
<td>.052</td>
<td>.125</td>
</tr>
<tr>
<td></td>
<td>.055</td>
<td>.140</td>
</tr>
<tr>
<td></td>
<td>.060</td>
<td>.156</td>
</tr>
<tr>
<td></td>
<td>.063</td>
<td>.204</td>
</tr>
<tr>
<td></td>
<td>.078</td>
<td>.250</td>
</tr>
</tbody>
</table>

**INSTALLATION INSTRUCTIONS**
Insert orifice plate into port in proper position to obtain desired direction of flow restriction. Lips of plate always point toward the pressure source to assure proper seating. (For "IN-FLOW" restriction, plate lips point "OUT". For "OUT-FLOW" restriction, plate lips point "IN").

**3/4 - 16 (SAE #8) Ports**

**IN-FLOW RESTRICTION**
The lower face of the fitting inserted into the port will limit the upward travel of the orifice plate.

**1/2” NPTF Ports**

**IN-FLOW RESTRICTION**
It is necessary to use the retainer (#1A0741) screwed into the port until it bottoms on the port thread, to limit the upward travel of the orifice plate. CAUTION: After installation of retainer, check to see that orifice plate is free to move at least 1/32 inch.
ORDERING INFORMATION

SAE PORT

Fitting serves as retainer, limiting upward travel of plate.

ORIFICE PLATE

ORIFICE PLATE ONLY
Available for 7/16 - 16 (SAE #8) ports only.

NPTF PORT

ORIFICE PLATE and RETAINER
Available for 1/2" ports only.

ORIFICE PLATE Part No. 1A0742

RETAINER Part No. 1A0741

<table>
<thead>
<tr>
<th>SAE #8 (7/16 - 16)</th>
<th>ORIFICE PLATE - 1A0742</th>
<th>HOLE DIA. use 3 digit decimal to identify diameter of hole in orifice plate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPTF (1/2&quot;)</td>
<td>RETAINER - 1A0741</td>
<td>ORIFICE PLATE - 1A0742</td>
</tr>
</tbody>
</table>

EXAMPLE: 1A0742-125 describes an orifice plate with 1/4" hole. If the hole diameter is not specified, plates without hole will be shipped and customer must drill.

CROSS MANUFACTURING, INC.
100 Factory Street
Lewis, Kansas 67552
Phone 620/324-5525; FAX 620/324-5737; e-mail: info@crossmfg.com
CROSS is pleased to announce the addition of a solenoid option for the 30 Gallon 3000 psi Series BA valve. Available in 12 or 24 volts DC, or 120 or 240 volts AC, this feature offers the convenience and remote control capabilities of electrical operation with the load check advantages of the BA Valve for lifting applications. External drains are required on all open center models. The versatile BA valve is available in a single, double, or triple spool model with power beyond option as well as a variety of spool and actuator choices.

Standard Valves — 4 way, 3 position open center (tandem), 12 volt solenoid, 2000 psi adjustable relief, with end outlet and 1V3636 check plug in power beyond, SAE ports — 1 1/16-12 in and out & 3/4-16 work

<table>
<thead>
<tr>
<th>Spool Type</th>
<th>Code</th>
<th>Part Number</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single spool</td>
<td>SBS2</td>
<td>132040</td>
<td>BA11HG6EC4</td>
</tr>
<tr>
<td>Double spool</td>
<td>SBS22</td>
<td>137020</td>
<td>BA211HHG6EC4</td>
</tr>
<tr>
<td>Triple spool</td>
<td>SBS222</td>
<td>146505</td>
<td>BA3111HHHG6EC4</td>
</tr>
</tbody>
</table>

*These standard valves are included in our Full Line catalog.*

**Ordering Notes:** Nomenclature will be similar to the BA valve.
- For actuator options use "H" for 12 volt, "J" for 24 volt, "K" for 120 volt, and "L" for 240 volt.
- Specify #6 for the 1V3636 check valve in the power beyond machining (unless you are specifying a power beyond sleeve or closed center plug).
- A #4 designation for the handle option will indicate "no handle" for those spools where a solenoid option has been specified.

**External Drain Kits:**

| BA1 - #12 SAE - #1V2171 | BA2 - #12 SAE - #1V2173 | BA3 - #12 SAE - #1V2175 |
| BA1 - 3/4" NPTF - #1V2172 | BA2 - 3/4" NPTF - #1V2174 | BA3 - 3/4" NPTF - #1V2176 |
The Cross series AD directional control valves provide good metering characteristics and long dependable service life. Optimum versatility is provided due to the many standard and optional features. Balanced spools are select-fit for minimum leakage and load holding checks prevent load drop when shifting. Parallel flow path permits spools to be operated independently or simultaneously.

**GENERAL SPECIFICATIONS**
- Number of spools: One, two
- Maximum working pressure: 3000 psi (206 bar)
- Maximum shock and surge pressure: 4000 psi (276 bar)
- Maximum flow capacity: 15 gpm (57 l/m)
- Maximum spool leakage (at 1000 psi w/100 SUS oil at 120° F): 16 cc/min.
- Mounting, any position: Two mounting holes for 1/4" dia. bolts
- Weight: 1 spool: 8 lbs. (3.6 Kg.) 2 spool: 10 lbs. (4.5 Kg)

**MATERIAL SPECIFICATIONS**
- Body: High tensile strength cast iron
- Spools: Ground, plated and polished steel alloy
- Seals: Buna N

**STANDARD FEATURES**
- Integral load holding check valves (prevent reverse flow through valve when shifting)
- Integral differential poppet type relief valve, adjustable (set at 2000 psi, 10 gpm)
- Balanced, select-fit spools (provide minimum leakage, smooth operation)
- External spool seals (permit easy replacement, reduced maintenance cost)
- SAE#10 (5/16") 7/8 - 14 inlet and outlet ports: SAE#8 (1/2") 5/4 - 16 work ports
- Complete handle assembly

**OPTIONAL FEATURES AVAILABLE**
- Open or closed center positions, 3-way or 4-way operation, 3-position or 4-position (float position), full open center (motoring spool) and other spool options
- Power beyond (permits use of neutral flow at system pressure); also permits field conversion from closed center to open center (tandem) operation

**NOTE:** Refer to CROSS Valve Technical/Service Sheet for recommendations and limitations.
DIMENSIONAL DATA in inches

SPOOL OPTIONS

ACTUATOR OPTIONS

lever spring centered
lever no centering
lever 2-pos. detent spring centered
lever 1-pos. detent-in spring centered
lever 1-pos. detent-out spring centered
lever 4-pos. detent-in float position spring centered
TYPICAL PERFORMANCE DATA
PRESSURE DROP (with 100 SUS oil at 120° F, SAE #10 in and out, #8 work ports)

<table>
<thead>
<tr>
<th>FLOW GPM</th>
<th>P-A</th>
<th>P-B</th>
<th>PSI</th>
<th>A-T</th>
<th>B-T</th>
<th>P-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>21</td>
<td>20</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>42</td>
<td>40</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>65</td>
<td>63</td>
<td>21</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>90</td>
<td>87</td>
<td>34</td>
<td>32</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FLOW GPM</th>
<th>FLOAT</th>
<th>PSI</th>
<th>P-A-B-T</th>
<th>P-A-B-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>23</td>
<td>27</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>43</td>
<td>53</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>65</td>
<td>88</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>90</td>
<td>125</td>
<td>140</td>
<td></td>
</tr>
</tbody>
</table>

TO CONVERT GALLONS INTO LITERS MULTIPLY BY 3.7853
PSI BAR 0.0690

<table>
<thead>
<tr>
<th>FLOW GPM</th>
<th>PABT</th>
<th>PBAT</th>
<th>PSI</th>
<th>PCDT</th>
<th>PDCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>52</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>94</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>146</td>
<td>158</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>212</td>
<td>228</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RELIEF VALVE CHARACTERISTICS

100 SSU oil at 120° F
Opening Closing
## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>NUMBER OF SPOOLS</th>
<th>SPOOL TYPE</th>
<th>ACTUATOR OPTIONS</th>
<th>RELIEF VALVE</th>
<th>POWER BEYOND</th>
<th>OUTLET PORT LOCATION</th>
<th>PORT SIZE &amp; TYPE</th>
<th>HANDLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>1 Single</td>
<td>4-way, 3-position, open center</td>
<td>A 3 position Spring centered</td>
<td>A 1000 psi</td>
<td>0 End Outlet</td>
<td>SAE #10, 7/8-14 In &amp; Out</td>
<td>0 Complete handle assembly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Double</td>
<td>4-way, 3-position, closed center</td>
<td>B 3 position manual detent - no spr. cltg.</td>
<td>A 1500 psi</td>
<td>B Top Inlet &amp; Outlet</td>
<td>SAE #8, 3/4-16 Work Ports</td>
<td>1 Less Complete handle assembly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-way, 3-position, open center</td>
<td>C manual - no detent - no centering spring</td>
<td>C 2000 psi</td>
<td>D Conversion plug</td>
<td>Top Inlet</td>
<td>2 Less Handle only (lock, pis &amp; bracket included)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-way, 3-position, closed center</td>
<td>D 2 position detent, &quot;n&amp; out&quot; spring centering</td>
<td>E None</td>
<td>4 R Rear 3/8 NPTF</td>
<td>SAE #6, 9-16 In &amp; Out &amp; Work Ports</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-way, 3-position, open center w/moving spool</td>
<td>N 1 position detent, in only, spring centering</td>
<td>F Adjustable 500-1500 psi (set at 1000)</td>
<td>5 Adjustable 1500-1500 psi (set at 1000)</td>
<td>3 Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-way, 4-position, open center, detent float position</td>
<td>X 4-pos. spring centered to neutral Detent in float</td>
<td>4 Y 4-pos. spring centered with regen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-way, 4-position, closed center, detent float position</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-way, 4-position, open center w/regen float position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXAMPLE:** AD2A1XAG4000 is a manually operated double spool valve, the first spool being 4-way, 4 position, open center, spring centered with detent in float position; the second spool being 4-way, 3-position, open centered spring centered. The adjustable relief valve is set at 2000 psi. Power beyond sleeve with 7/8-14 SAE thread. Inlet and outlet ports SAE #10, 7/8-14. Work ports SAE#8, 3/4-16. Complete handle assembly.

**Standard Full Line Valves:** (See page 6 in Full Line Catalog for additional information.)
- SA2 - AD11AG3000 - Single spool 3-position, 4-way
- SA22 - AD21AAG3000 - Double spool 3-position, 4-way
- SAF2 - AD2A1XAG3000 - Double spool 1st spool 4-position float, 2nd spool 3-position, 4-way
The CROSS series SS directional control valve offers extremely low leakage with exceptional load holding ability in a small, yet rugged, sectional valve. A single section may be utilized by itself or stacked in series to perform multiple functions giving this valve a unique versatility. Solenoid as well as manual actuators are available. It is compact, yet large enough to accommodate quick disconnect fittings.

GENERAL SPECIFICATIONS

- Number of spools: one or multiple
- Rated working pressure: 3500 psi (241 bar)
- Maximum shock and surge pressure: 4500 psi (309 bar)
- Rated flow capacity: 7 gpm (26.5 l/m)
- Maximum spool leakage (at 1000 psi w/120 SUS oil at 120°F): 5 cc/min
- Mounting, any position: 1/4"-20 mtg. holes - 2 per section
- Weight, 1 spool: 7 lbs.

MATERIAL SPECIFICATIONS

- Body: Ductile iron
- Inlet relief plate: Aluminum
- Spools: Ground, plated and polished steel alloy
- Seals: Buna N

STANDARD FEATURES

- Series operation
- Excellent spool metering characteristics
- Open center, 4 way 3 position or 4 way, 4 position (float)
- Integral load holding check valves to prevent reverse flow through valve when shifting
- Balanced, select-fit spools to provide minimum leakage, smooth operation
- 9/16-18 (SAE #6) inlet and outlet ports, 9/16-18 (SAE #6) work ports
- May stand alone or be stacked in series
- Built-in power beyond capability • Complete handle assembly

OPTIONAL FEATURES

- Optional add-on inlet section with differential poppet type relief valve
- High flow spool available for up to 10 gpm
- Single handle actuator with rubber boot
- 3/4-16 (SAE #8) inlet and outlet ports, 3/4-16 (SAE #8) work ports
- Solenoid actuators (12 and 24 volt DC, 120 and 240 volt AC) - complete internal plumbing - no external drains required
DIMENSIONAL DATA in inches

WORK PORTS

SPOOL TRAVEL
.22 IN or OUT
.42 into Float
.42 into Regen

(Inlet Relief shown for reference)

SPOOL OPTIONS

ACTUATOR OPTIONS

LEVER, SPRING CENTERED

LEVER, NO SPR. CNTR

(also J, K or L)

SOLENOID, DC OR AC SPR. CNTR

1-POS. DETENT IN, FLOAT POSITION

LEVER, SPR. CTR. W/ REGEN FEEL POS.
TYPICAL PERFORMANCE DATA
PRESSURE DROP (with 120 SUS oil at 120°F, 9/16-18 ports)

<table>
<thead>
<tr>
<th>FLOW RATE in GPM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SINGLE SPOOL VALVE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P to A or B</td>
<td>9</td>
<td>14</td>
<td>24</td>
<td>36</td>
<td>50</td>
<td>66</td>
<td>90</td>
<td>113</td>
</tr>
<tr>
<td>A or B to T</td>
<td>10</td>
<td>18</td>
<td>28</td>
<td>45</td>
<td>66</td>
<td>87</td>
<td>116</td>
<td>146</td>
</tr>
<tr>
<td>P to T</td>
<td>8</td>
<td>10</td>
<td>14</td>
<td>24</td>
<td>31</td>
<td>40</td>
<td>51</td>
<td>64</td>
</tr>
</tbody>
</table>

| **TWO SPOOL VALVE** |   |   |   |   |   |   |   |   |
| P to T            | 14| 17| 24| 40| 55| 72| 93| 116|
| A1 or B1 to T     | 16| 24| 37| 61| 90| 119|158|199|
| P to A2 or B2     | 14| 20| 32| 52| 74| 98|132|166|

P to A1 or B1 same as single spool data;
A2 or B2 to tank same as A1 or B1 to tank data of single spool.

| **THREE SPOOL VALVE** |   |   |   |   |   |   |   |   |
| P to T              | 19| 24| 32| 56| 79|104|135|170|
| A1 or B1 to T       | 22| 30| 46| 77|114|151|200|252|
| P to A3 or B3       | 20| 27| 42| 68| 98|130|174|219|

P to A1 or B1 same as single spool data;
P to A2 or B2 same as 2 spool data;
A2 or B2 to tank same as A1 or B1 to tank data of two spool;
A3 or B3 to tank same as A1 or B1 to tank data of single spool.

| Adder per spool | 6 | 6 | 9 | 16 | 24 | 32 | 42 | 53 |

(Use adder figure for all ports except last ports to tank or first ports from pump)

RELIEF VALVE CHARACTERISTICS (120 SUS OIL AT 120°F.)

[Graph showing RELIEF VALVE CHARACTERISTICS]
# HYDRAULIC VALVES

## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>SPOOL TYPE</th>
<th>SPOOL ACTION</th>
<th>PORT SIZE &amp; TYPE</th>
<th>HANDLE</th>
<th>HIGH FLOW SPOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>1</td>
<td>A</td>
<td>A 9/16-18, SAE #6, all ports</td>
<td>0</td>
<td>High flow spool (above 7 gpm)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>H</td>
<td>B 3/4-16, SAE #8, all ports</td>
<td>1</td>
<td>Complete handle ass'y. &quot;A&quot; port end.</td>
</tr>
<tr>
<td>(use with optional inlet relief plate)</td>
<td>4</td>
<td>K</td>
<td></td>
<td>3</td>
<td>Less handle ass'y. &quot;B&quot; port.</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXAMPLE:** SS1AA0 is a manually operated single section with 4 way, 3 position, spring centered open center spool, with 9/16-18 SAE ports and handle assembly "A" port end.

* Must be last section in stack.

Optional inlet plate may be ordered by specifying port size and pressure relief setting.

Single handle actuator with rubber boot is available on multi-stack units.

Contact CROSS ENGINEERING for specifications.
The CROSS series C monoblock type directional control valves provide good metering characteristics and long dependable service life. Select-fit spools give minimum leakage for maximum load holding ability. Many options are available including pressure release detents and solenoid actuators. Basically a series type valve, the first spool has priority in the 2-spool version. These valves are recommended for all general purpose applications except for metering-up with heavy vertical loads. See Hydraulic Safety Sheet.

GENERAL SPECIFICATIONS
Number of spools ................................................................. 1 or 2
Rated working pressure .................................................. 2500 psi (172 bar)*
Maximum shock and surge pressure ................................. 4000 psi (276 bar)
Rated flow capacity ......................................................... 30 gpm (114 l/min)
Maximum spool leakage (@ 1000 psi w/100 SUS oil @ 120°F) .... 32 cc/min.
Mounting, any position ................................................ Three mounting holes for 3/8” dia. bolts
Weight 1 spool: Standard, 9 lbs. (4Kg); w/detents, 10 lbs. (4.5 Kg), w/sol., 12 lbs. (5 Kg)
2 spool: Standard, 17 lbs. (7.7 Kg), w/detents, 18 lbs. (8 Kg), w/sol., 23 lbs. (10 Kg)

MATERIAL SPECIFICATIONS
Body ............................................................ High tensile strength cast iron
Spool ............................................................. Ground, plated and polished steel alloy
Seals .............................................................. Buna N

STANDARD FEATURES
• Built-in system relief valve (non-adjustable), set at 1500 psi
• Balanced select-fit spools for minimum leakage, smooth operation and long life
• 3-position, 4-way spool with spring centering and complete handle assembly
• 3/4” NPTF inlet and outlet ports, 1/2” NPTF work ports
• open center  • 1 or 2 spools

OPTIONAL FEATURES AVAILABLE
• Built-in system relief valve, fixed or adjustable, with optional pressure settings to 2000 psi
• Various spool types, 3 or 4-way, with various actuators and actuator positions
• Various sizes of SAE straight thread or NPTF dryseal pipe thread ports
• Pressure released detents (Model CD) in the “in”, “out” or both positions
• AC or DC solenoid operation (Model CS), from 6 to 24 volt DC, 120 to 480 volts AC

* Limited to 2000 psi when integral relief valve is used.
NOTE: Refer to CROSS Valve Technical/Service Sheet for recommendations and limitations.
DIMENSIONAL DATA: in inches and (millimeters)

SPOOL OPTIONS:

1. 4-WAY, 3-POSITION OPEN (TANDEM) CENTER
2. 4-WAY, 3-POSITION CLOSED CENTER
3. 3-WAY, 3-POSITION OPEN (TANDEM) CENTER
4. 3-WAY, 3-POSITION CLOSED CENTER
5. 4-WAY, 3-POSITION FULL OPEN CENTER (MOTORING SPOOL)
6. 4-WAY, 3-POSITION CLOSED CENTER W/WORK PORTS TO TANK (MOTORING SPOOL)
7. 3-WAY, 3-POSITION FULL OPEN CENTER (MOTORING SPOOL)
8. 3-WAY, 3-POSITION CLOSED CENTER W/WORK PORT TO TANK (MOTORING SPOOL)

TYPICAL 2-SPOOL VALVE (MODEL NO. CA217MABDD)

ACTUATOR OPTIONS:

- W A W: LEVER, SPRING CENTERED
- W B W: LEVER, 3-POSITION DETENT
- W C W: LEVER, NO CENTERING
- W D W: LEVER, 2-POSITION DETENT, PRESSURE RELEASED
- W E W: LEVER, 1-POSITION DETENT (IN) PRESSURE RELEASED
- W F W: LEVER, 1-POSITION DETENT (OUT) PRESSURE RELEASED
- W M W: LEVER, 1-POSITION DETENT (IN) SPRING CENTERED
- W N W: LEVER, 1-POSITION DETENT (OUT) SPRING CENTERED
- W P W: SPRING EXTENDED SPOOL, NO NEUTRAL
- W R W: SPRING RETRACTED SPOOL, NO NEUTRAL
- W W: ROTARY ACTUATOR

NOTE: ALL ACTUATORS MAY BE LOCATED AT EITHER END OF VALVE, EXCEPT ON MODEL CD.
TYPICAL PERFORMANCE DATA:

CA 1-SPOOL VALVE

CA 2-SPOOL VALVE

CA RELIEF VALVE REGULATION
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th># OF SPOOL(S)</th>
<th>SPOOL TYPE</th>
<th>ACTUATOR OPTIONS</th>
<th>RELIEF VALVE(S)</th>
<th>PORT SIZE &amp; TYPE</th>
<th>HANDLE</th>
<th>DET. RELEASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>1</td>
<td>1 - 4-way, 3-position, open center</td>
<td>A</td>
<td>A</td>
<td>1000 psi</td>
<td>0</td>
<td>Complete handle assy. - &quot;A&quot; port end</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2 - 4-way, 3-position, closed center</td>
<td>B</td>
<td>B</td>
<td>In &amp; Out 3/4&quot; NPTF, Work 1/2&quot; NPTF</td>
<td>1</td>
<td>Complete handle assy. - &quot;B&quot; port end</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3 - 3-way, 3-position, open center</td>
<td>C</td>
<td>C</td>
<td>1500 psi</td>
<td>2</td>
<td>Complete handle assy. - &quot;A&quot; port</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4 - 3-way, 3-position, closed center</td>
<td>D</td>
<td>D</td>
<td>In &amp; Out 3/4&quot; NPTF, Work 3/8&quot; NPTF</td>
<td>3</td>
<td>Less complete handle assy. - &quot;B&quot; port</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5 - 4-way, 3-position, open center w/motoring spool</td>
<td>E</td>
<td>E</td>
<td>2000 psi</td>
<td>4</td>
<td>Less handle w/brackets &quot;A&quot; port</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>6 - 4-way, 3-position, closed center w/motoring spool</td>
<td>F</td>
<td>F</td>
<td>None</td>
<td>5</td>
<td>Less handle w/brackets &quot;B&quot; port</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>7 - 3-way, 3-position, open center w/motoring spool</td>
<td>G</td>
<td>G</td>
<td>In &amp; Out SAE #12, Work SAE #8</td>
<td>6</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>8 - 3-way, 3-position, closed center w/motoring spool</td>
<td>H</td>
<td>H</td>
<td>Adj. 750-1250 (set at 1000)</td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Other</td>
<td>I</td>
<td>I</td>
<td>Adj. 1750-2250 (set at 2000)</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Part number building example:
CA217MABDO is a manually operated double spool valve: the first spool being 4-way, 3-position, open center, spring centered with detent in the "in" and "out" position; the second spool being 3-way, 3-position, open center motoring and spring centered. The non-adjustable relief is set at 1500 psi, inlet and outlet ports are SAE #10 and the work ports SAE #8. The complete handle assembly is located on the "A" port end.

NOTES: (1) Model CV (converta) is a standard model without options. A conversion plug for 3-way operation is included & a field installable manual detent kit (1V0294) is available. Refer to Form #VCV9 for details.
(2) If closed center is required on a 2-spool valve, the first spool must be open center.
(3) Not applicable for Model CD.
(4) Model CD - specify detent kick-out pressure if other than 1000 psi (must be at least 200 psi below relief setting).
(5) Model CS
(6) Settings at 10 gpm. Other flow or pressure settings must be specified up to a maximum of 2000 psi.
(7) Omit for CS version valves. Add second number if 2nd spool handle assembly is different from first.

CROSS MANUFACTURING, INC.
100 Factory Street
Lewis, KS 67552
Phone 620/324-5525; Fax 620/324-5737; e-mail: info@crossmfg.com
The CROSS series CV (CONVERTA) valve is a highly versatile 3-way or 4-way, 3 position directional control valve for use with either double-acting or single-acting cylinders.

SPECIFICATIONS
Rated working pressure .................. 2000 psi (138 bar)
Maximum shock and surge pressure ............. 4000 psi (276 bar)
Rated flow capacity .................. 25 gpm (94.6 l/m)
Relief valve setting .................. 2000 psi (138 bar) at 10 gpm (37.8 l/m)
Ports .................. 3/4" NPTF inlet and outlet, 1/2" NPTF work (cylinder)
Basic spool type ........... 4-way, 3-position, spring centered, open (tandem) center
Shipping weight (boxed) .................. 9 lbs. (4 Kg)

CONVERSION
Included in the CV package is a 3-way cylinder port plug and a 3-way conversion plug. To convert from the basic 4-way (double-acting) to a 3-way (single-acting):
1. Insert the cylinder port plug (P/N 2AO349-8) into cylinder port “A” (port nearest handle).
2. Remove the conversion plug (P/N 1VO277), ie, the hex nut located adjacent to the outlet port, (as shown above).
3. Insert the 3-way conversion plug (P/N 2AO354-108).
The valve is now converted for use with a single-acting cylinder or uni-directional motor. (Save the 4-way conversion plug for later reconverting back to 4-way operation).

DETENT KIT
To change from the standard spring centered version to a 3-position detent, order Detent Kit P/N 1VO294. Convert as follows:
1. Remove end cap
2. Remove spring centering mechanism
3. Install detent kit
4. Replace end cap
The valve is now converted from spring centered to 3-position detent.

NOTE: This valve is not intended for use in lifting circuits. See reverse side for complete parts list, exploded view, and dimensions. See Directional Control Valve Specification sheet “C Series” for additional information.
The CROSS AUTO-CYCLE valve is a modified series C directional control valve (Model Number CD213FFGAO) applied in a unique manner to provide automatic cycling.

For proper auto-cycle operation, the “A” and “D” ports must be inter-connected. If system flow rate exceeds 10 gpm (38 l/m), 1/2” minimum I.D. hose should be used.

The standard version valve (CD213FFGAO) is supplied with an adjustable relief valve (set at 2000 psi at 10 gpm), 3/4” inlet and outlet ports, 1/2” inlet ports, and complete handle assemblies located on the “A” port end of the valve. However, all C series relief, port and handle options are available. (Refer to C Series Directional Control Valve Specification Sheet).

OPERATION (Typical)

When both levers are pulled out, oil flow is directed from the inlet port, out the “B” port, to the piston side of the cylinder, causing the cylinder to extend. Return oil passes from the rod side of the cylinder through the valve “A” port to the outlet port back to the reservoir. Upon reaching the end of the cylinder stroke, pressure increases to the pre-set detent kick-out pressure, causing the first valve spool to return to neutral. Oil flow is then directed from the inlet port through the open center first spool and out the “D” port, thereby causing the cylinder to retract. Return oil from the piston side of the cylinder passes through the “B” port and out the outlet port back to the reservoir. When the cylinder is fully retracted, pressure increases to “kick-out” the second spool detent, returning it to neutral.

The system has now completed its full cycle and is ready to again be re-activated.

APPLICATIONS (Typical): Compactors, Presses

NOTE: NOT RECOMMENDED FOR LOGSPLITTERS.
ADJUSTABLE RELIEF OPTION

ADJUSTABLE RELIEF CARTRIDGE

THE SELECT-FIT HONING PROCESS AT FACTORY, WHICH FITS A SPOOL TO AN INDIVIDUAL VALVE BODY, ELIMINATES THE POSSIBILITY OF ORDERING THE VALVE BODY AND SPOOL AS SEPARATE ITEMS.

CROSS MANUFACTURING, INC.
100 Factory Street
Lewis, Kansas 67552
Phone: 620-324-5525
The CROSS series CS solenoid operated directional control valves use standard solenoid cartridges to control the pilot flow for actuating the main valve spool. The pilot supply is obtained through drilled internal passages which connect pump pressure to the solenoid/pilot sections.

REQUIREMENTS
In order to move the valve spool hydraulically, a minimum of 30 psi (2.1 bar) is required. 50 to 60 psi (3.4 to 4.1 bar) is optimum, and 100 psi (6.9 bar) is maximum. 10 micron filtration is required for the CS valve.

CLOSED CENTER APPLICATIONS
All necessary porting for operation of the CS valve is accomplished internally. No adjustments or modifications are necessary.

OPEN CENTER APPLICATIONS
In order to have ample pilot pressure available (30 psi minimum), it is necessary to install a back pressure check valve (formerly known as R-75) in the tank port and to vent the ends of both solenoid blocks back to tank. (If not vented, the valve spool would not shift as pressure is supplied to both ends of the spool).

PILOT PRESSURE KITS
Each kit includes the back pressure check valve plus the necessary fittings and tubing to complete the assembly. If the CS valve is supplied with other than ¾" NPTF outlet port, two additional adaptor fittings are necessary.

<table>
<thead>
<tr>
<th>Kit Number</th>
<th>SAE</th>
<th>NPTF</th>
<th>DESCRIPTION OF KIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1V1991</td>
<td>1V</td>
<td>0266</td>
<td>For 1-spool valve (except 3-way motoring spool) or 2-spool valve w/1st manual</td>
</tr>
<tr>
<td>1V1992</td>
<td>1V</td>
<td>0266A</td>
<td>For 2-spool valve w/1st spool solenoid, 2nd spool manual</td>
</tr>
<tr>
<td>1V1993</td>
<td>1V</td>
<td>0267</td>
<td>For 2-spool valve, both solenoid (except 3-way motoring spools)</td>
</tr>
<tr>
<td>1V1994</td>
<td>1V</td>
<td>0268</td>
<td>For 1-spool valve with 3-way motoring spool</td>
</tr>
<tr>
<td>1V1995</td>
<td>1V</td>
<td>0543</td>
<td>For 2-spool valve with 1-spool as a 3-way motoring spool</td>
</tr>
<tr>
<td>1V1996</td>
<td>1V</td>
<td>0544</td>
<td>For 2-spool valve with both spools 3-way motoring spools</td>
</tr>
</tbody>
</table>
HYDRAULIC PRODUCT SAFETY

WARNING: Valve lever (spool) may "stick" (not center) under certain conditions allowing the hydraulic equipment to continue to operate and could cause serious injury, death or equipment failure.

VALVE SAFETY: Read and follow instructions carefully. Failure to observe instructions and guidelines may cause serious injury, death or equipment failure. A sticking valve (spool bind) may be caused by one or more of the following factors:

DIRTY OIL: Oil must be filtered to a minimum of 25 microns. Filters should be changed regularly - spin-on types after 50 hours of initial use and then after every two hundred fifty hours of use. Use of a condition indicator is recommended. Consult your tractor or implement owner's manual for filtration and changing recommendations for internal systems.

OIL REQUIREMENTS: Premium quality anti-wear type oil with a viscosity between 100 and 200 SSU at operating temperatures. Certain synthetic oils may cause spool seals to swell and the valve to stick. If in doubt, call CROSS Engineering.

IMPROPER HOOK UP OR MOUNTING: Always use the proper size fittings. Hook up "in" & "out" as noted on the valve body. Do not overtorque pipe fittings. Mounting surfaces should be flat and care should be used when tightening mounting bolts. Over-tightened bolts can cause spool bind and casting breakage. When hooking a valve in series, always use a power beyond sleeve. Consult your tractor or implement manual to make sure you have the proper quick disconnect line connected to the inlet of the remote valve.

MISAPPLICATION: Always use the proper valve for the job. CONVERTA, CD, CS or CA valves should never be used for metered heavy load lifting - loaders or similar applications. Use an open center valve for open center applications and a closed center valve for closed applications. If in doubt, check with your tractor dealer. Contact CROSS if the valve allows the hydraulic equipment to creep excessively.

MAINTENANCE: Make sure all bolts are tightened and torqued to the recommended specification. Bent or broken parts should not be used. Replace immediately. Always use exact replacements. Always protect valve spool from paint overspray. Faulty quick disconnects can cause high back pressures and sticking spools. Check quick disconnects periodically to make sure they are functioning properly. If valve spool does not center or appears to stick, do not use!

PUMPS & MOTORS SAFETY:
A relief or bypass in your hydraulic system is necessary to prevent pump from breakage due to overpressurization. Use correct fittings and proper oil as noted in the technical service manual packed with each unit. Change oil as recommended by your implement or tractor manufacturer.

CYLINDER SAFETY:
Check clevis clearances before, during and after extending the cylinder and before using the cylinder under pressure to avoid possible injury, or bent or broken rods caused by binding. Never operate a cylinder above recommended pressures. Never use a cylinder as a safety device when transporting equipment.

PINHOLE LEAKS:
If you observe a pinhole leak, discontinue use of the component. If oil has penetrated your skin or contacted your eye, seek medical attention immediately!
The CROSS DV series directional control loader valve offers extremely low leakage with outstanding load-holding capability in a compact, space saving model. All ports come out the same surface of the valve and it will fit in a space less than 6 inches wide. Float and regen capabilities, load checks, built-in power beyond and single handle actuator make this valve ideally suited for the mobile loader market.

GENERAL SPECIFICATIONS
- Number of spools: two
- Rated working pressure: 3000 psi
- Maximum shock and surge pressure: 4000 psi
- Rated flow capacity (2 spool options available): 8-10 gpm, 15 gpm
- Mounting - bottom surface: Two mounting holes for 5/16" dia. bolts
- Maximum spool leakage (at 1000 psi w/120 SUS oil at 120°F): 5 cc/min

MATERIAL SPECIFICATIONS
- Body: Class 50 grey iron
- Spools: Ground, plated and polished steel alloy
- Seals: Buna N

STANDARD FEATURES
- Parallel operation
- Excellent spool metering characteristics
- Open center: 4 way, 4 position (float) on first spool; 4 way, 3 position or regen on second spool
- Integral load holding check valves prevent reverse when shifting from neutral
- Integral differential poppet type relief valve, adjustable
- Balanced, select-fit spools to provide minimum leakage, smooth operation
- 3/4 - 16 (SAE #8) inlet, outlet and power beyond with 3/4-16 (SAE #8) work ports
- Built-in power beyond capability
- Handles or single handle actuator assembly with rubber boot
HYDRAULIC VALVE

DIMENSIONAL DATA in inches

SPOOL OPTIONS

1

4 WAY - 3 POS. (2 SPOOL) OPEN CENTER

2

4 WAY - 3 POS. (2 SPOOL) CLOSED CENTER

5

4 WAY - 3 POS. (MOTOR SPOOL) OPEN CENTER

6

4 WAY - 3 POS. (MOTOR SPOOL) CLOSED CENTER

A

4 WAY - 4 POS. (FLOAT SPOOL) OPEN CENTER

B

4 WAY - 4 POS. (FLOAT SPOOL) CLOSED CENTER

Y

4 WAY - 4 POS. (REGEN SPOOL) OPEN CENTER

ACTUATOR OPTIONS

W

SPRING CENTERED

A

LEVER 3-POS. DETENT

B

LEVER CENTERING

C

2-POS. DETENT SPRING CENTERED

M

1-POS. DETENT-IN SPRING CENTERED

N

LEVER DETENT-OUT SPRING CENTERED

P

4-POS. DETENT-IN FLOAT POSITION SPRING CENTERED

X

LEVER SPRING CENTERED REGEN IN

Y

SPRING CENTERED

WSH

SINGLE HANDLE ACTUATOR SPRING CENTERED
TYPICAL PERFORMANCE DATA

**DV10**
PRESSURE DROP (with 100 SUS oil at 100° F. SAE #8 in & out, #6 work ports)

**DV15**
PRESSURE DROP (with 100 SUS oil at 100° F. #8 SAE # all ports)
### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Model No.</th>
<th>No. Spools</th>
<th>Spool Type</th>
<th>Actuator Options</th>
<th>Relief Valve</th>
<th>Power Beyond</th>
<th>Outlet Port Location</th>
<th>Port Size &amp; Type</th>
<th>Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV10</td>
<td>2</td>
<td>1</td>
<td>A</td>
<td>A</td>
<td>0</td>
<td>P</td>
<td>9/16-18 SAE Work Ports, 3/4-16 In &amp; Out</td>
<td>0</td>
</tr>
<tr>
<td>10 GPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Handle</td>
</tr>
<tr>
<td>DV15</td>
<td>2</td>
<td>2</td>
<td>B</td>
<td>B</td>
<td>3</td>
<td>1</td>
<td>Top Outlet BYD. 3/4-16 SAE</td>
<td>1</td>
</tr>
<tr>
<td>15 GPM</td>
<td>5</td>
<td>4-Way, 3-Pos. Closed Ctr.</td>
<td>B</td>
<td>B</td>
<td>3</td>
<td>1</td>
<td>Top Outlet BYD. 3/4-16 SAE</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-Way, 3-Pos. Open Ctr. Motoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Less Hdl. Ass’y. (drilled hole in ball)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-Way, 3-Pos. Open Ctr. Motoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-Way, 3-Pos. Open Ctr. Motoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-Way, 4-Pos. Open Ctr. Float Spool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-Way, 4-Pos. Open Ctr. Float Spool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-Way, 4-Pos. Open Ctr. Regen IN Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DV10</td>
<td>2</td>
<td>AC</td>
<td>XY F G</td>
<td>3</td>
<td>P</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Example: DV102ACXYF3P03 is a DV10 10 GPM manually operated double spool valve. First spool is 4-way, 4-position spring centered with detent in float. Second spool is 4 way, 4 position, open center, regen "In", spring centered with regen. Adjustable relief valve is set @ 1500 psi. Power beyond has conversion plug. Standard port location: inlet and outlet SAE #8, 3/4-16 thread, work ports SAE #6, 9/16-18 thread with single handle actuator location.

CROSS MANUFACTURING INC.
100 James H. Cross Blvd.
Lewis, Kansas 67552
Phone (620) 324-5525 Fax (620) 324-5737
www.crossmfg.com
e-mail: info@crossmfg.com

Form DVD1 9/08
Power Beyond Conversion

Remove plug from Top Power Beyond and plumb directly into top power beyond location (3/4-16). (No Power Beyond Sleeve is required.)

Install #1V2853 Conversion Plug Assy. in End Outlet Location.

The CROSS DV series loader valve was designed for the mobile loader market but its compact size and versatility make it suitable for many applications. It is proving to be a durable, low leakage valve with excellent metering characteristics. The DV is available in a 10 and 15 gpm version and features a newly designed manual joystick control with protective boot or conventional handles.

Standard DV valve models (SDV) are listed in our Full Line catalog and will be discounted as the full line products or see DV specification sheet for a full list of options. (Current surcharges are applicable.)

We invite your inquiries and look forward to serving your needs!

CROSS MANUFACTURING, INC.
100 James H. Cross Blvd.
Lewis, KS 67552
Phone 620/324-5525, FAX 620/324-5734; e-mail: info@crossmfg.com
FOR CROSS SERIES A, B, C, SD and VS DIRECTIONAL CONTROL VALVES

The CROSS spool type, monoblock construction, directional control valves have been designed, manufactured and tested to insure the highest possible quality. This manual has been prepared to assist in the application and installation in order to obtain optimum performance. Refer to individual Specification Sheets for detailed data. All CROSS directional control valves, with proper maintenance, will provide long, dependable service.

See HYDRAULIC SAFETY SHEET.

<table>
<thead>
<tr>
<th>VALVE SERIES</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>SD</th>
<th>VS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of spools</td>
<td>1, 2, or 3</td>
<td>1, 2, or 3</td>
<td>1 or 2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of positions</td>
<td>3 or 4</td>
<td>3 or 4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Rated working pressure</td>
<td>3000 psi</td>
<td>2500 psi</td>
<td>2500 psi</td>
<td>2500 psi</td>
<td>2500 psi</td>
</tr>
<tr>
<td>Max. shock &amp; surge pressure</td>
<td>4000 psi</td>
<td>4000 psi</td>
<td>4000 psi</td>
<td>4000 psi</td>
<td>4000 psi</td>
</tr>
<tr>
<td>Rated flow capacity</td>
<td>15 gpm</td>
<td>30 gpm</td>
<td>32 gpm</td>
<td>40 gpm</td>
<td>20/40 gpm</td>
</tr>
<tr>
<td>Maximum spool leakage</td>
<td>16 cc/min.</td>
<td>16 cc/min.</td>
<td>32 cc/min.</td>
<td>16 cc/min.</td>
<td>16 cc/min.</td>
</tr>
<tr>
<td>Integral relief valve, adjustable</td>
<td>Std.</td>
<td>Std.</td>
<td>Opt.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Integral load holding check valves</td>
<td>Std.</td>
<td>Std.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

VALVE SELECTION AND APPLICATION:
It is necessary to use the proper valve according to application requirements. Common application errors to be avoided are as follows: (Series B & C valves)

- Using an open center valve in a closed center system (should use closed center valve).
- Using a closed center valve in an open center system (should use open center valve).
- Using outlet port flow to second valve (should use power beyond option - Series B).
- Using Series C valve in load lifting application (should use Series B with load checks).
- Using valve without motoring spool in hyd. motor drives (can damage motor and valve).
- Using 3-way valve with double acting cylinder or 4-way valve with single acting cylinder.

VALVE CONVERSIONS:
The Series B valve, if ordered with the power beyond option, can be converted from open center to closed center by installing a closed center plug in the power beyond port and setting the relief valve at least 500 psi higher than system pressure (or replacing the relief valve with “D” plug 1R0035). The CV version valve includes a conversion plug for changing from 4-way to 3-way operation. (Refer to CROSS literature “Directional Control Valve Accessories - Conversion Plug” for detailed information).

VALVE ADJUSTMENTS:
Series B and C valves are available with adjustable relief valves - the “F” designation from 500 to 1500 psi (factory preset at 1000 psi) “G” designation from 1500 to 2500 psi (factory preset at 2000 psi). Pressure settings are made at 10 gpm and hence, pressures will be slightly higher at higher flow rates and slightly lower at lower flow rates. To reset, remove acorn nut, loosen lock nut, turn screw clockwise to increase pressure or counter-clockwise to reduce pressure. Series B valves are available with pressure released detents which are factory preset at 1000 psi which can be adjusted in the same manner as the system relief valves. (Should be at least 200 psi less than relief valve setting).

NEVER ATTEMPT TO ADJUST PRESSURE WITHOUT THE USE OF A RELIABLE GAGE IN THE SYSTEM.
HANDLE POSITION:
Symmetrical mounting holes permit the valve handles to be mounted in any of 4 positions, at 90° intervals. Series B and C valves are limited to 3 positions and multiple spool valves to the up or down position. If handle position is changed from the factory assembled position, the capscrews should be “LOCTITED” when reassembled. CAUTION: Handle extensions should not be used as the resulting increased force could damage valves. When mounting, be sure there is adequate space to permit full handle movement.

Valves may be mounted in any position. Series B and C valves have 3 mounting feet: SD and VS have 2. BC, C, SD and VS4 use 3/8” bolts (19-20 ft. lbs. torque). Bolts for the VS are 5/16” (11-12 ft.lbs. torque). Mounting surfaces must be flat and care should be used when tightening mounting bolts. Over-tightening bolts on uneven surfaces can distort the valve body and cause spool binding and casting breakage.

START-UP PROCEDURE:
Prior to installation, check valve for possible damage in shipping or handling.
1. Install valve and tighten fittings. OVER-TIGHTENED PIPE FITTINGS CAN DAMAGE VALVE.
2. Fill reservoir as necessary, using the correct, clean oil.
3. Start system and check for leaks. CAUTION: DO NOT USE HANDS.
4. Bleed air from system, as necessary.
5. Gradually increase load, checking for leaks, abnormal noises, binding, etc.

MAINTENANCE:
1. Clean and replace filters on a regular basis, as needed.
2. Check for presence of water in oil (cloudy appearance), air in oil (foaming oil), or burnt oil (rancid odor). Correct problem as necessary.
3. Check reservoir level regularly. Fill as needed.

TROUBLE SHOOTING:
There are only 3 potential spool valve problems: external leakage, excessive internal leakage, or spool bind. External leakage due to seal failure can be corrected by replacing seals. Leakage due to a cracked valve body requires complete valve replacement. Excessive internal leakage is usually caused by worn spools due to contaminates in the oil. Replace valve and system oil. Spool bind is caused by contamination, excessive heat, improper mounting or misalignment of valve linkage. Correct problem as needed. Refer to CROSS Trouble Shooting Guide for system overheating problems.

REPAIR:
CROSS spool type directional control valves are not field repairable except for seal replacement and relief valve cartridges. Spool seals are easily replaced by removing the handle bracket, end cap and o-rings. Replace o-rings using standard seal kits, (refer to appropriate parts list). Reassemble valve and “LOCTITE” capscrews. Standard seal kits include o-rings for relief valve cartridges and conversion plugs (if appropriate). CS (solenoid) version valves do not have spool seals; however, the solenoid cartridge seals can be easily replaced if needed. Worn detents can be repaired by installing a replacement detent kit. Temporary repair is possible by removing the handle and rotating the spool 180°.