DG5S-8 and DG5S-H8
Two-Stage, Solenoid Controlled, Pilot Operated, Four-Way Directional Valves
Introduction

General Description

The DG5S-8 and DG5S-H8 are two-stage directional valves with an integrally mounted DG4V3(S) (wet armature solenoid) pilot valve.

These valves are used to control the direction of flow in hydraulic circuits. This directional control in turn provides control over the movement of a cylinder or the rotation of a hydraulic motor.

Features and Benefits

- Suitable for the most demanding industrial applications with DG5S-H8 flow capacities up to 530 L/min (140 USgpm) and rated pressure of 310 bar (4500 psi).
- Available with a wide variety of spool and spring arrangements, stroke and pilot choke adjustments, integral check valves, and port orifices.
- Uses Vickers DG4V3(S) pilot valve for exceptional responsiveness, durability, and ease of servicing.
- Numerous electrical options allow full compatibility and easy, reliable connection in any system application.
- Fast response and standard low shock models available.
- Solid cast body and core passages for maximum strength and minimal pressure drop.
- High-force solenoids and centering springs assure consistent shifting through a wide range of pressure and silting extremes.
- Designed and backed by Vickers, with over 70 years as the global leader in fluid power and motion control.

Cross Section of Typical Valve (DG5S-8-6B-T-M-U-H5-30)
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**DG5S-8 Model Series**

### Ratings

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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>To 170 (45)</td>
<td>210 (3000)</td>
<td>210 (3000)</td>
<td>210 (3000)</td>
<td>210 (3000)</td>
<td>210 (3000)</td>
<td>ISO 4401-08, NFPA D08 (formerly D06), and ANSI B93.7</td>
</tr>
</tbody>
</table>

Maximum flow table see page 8

### Model Codes

**DG5S-8***(L)(*)(X)-(*)(E)-(T)(*)(V)-(M)(S*) * (**) **(L)***(**) 5- **30/40-(EN470)

1. **Viton seals**
   - F3 – For mineral oil & fire resistant fluids
   - Blank – Omit if not required

2. **Series designation**
   - D – Directional control valve
   - G – Manifold or subplate mounted
   - S – Sliding spool, pilot operated
   - 210 bar (3000 psi)

3. **Interface**
   - 8 – NFPA D08 (ISO 4401-08)

4. **Spool type**
   - Code  Center position
   - 0 – Open to T all ports
   - 1 – Open P & A to T, closed B
   - 2 – Closed to T all ports
   - 3 – Closed P & B, open A to T
   - **4** – Tandem P to T, closed crossover
   - 6 – Closed P only, open A & B to T
   - 7 – Open P to A & B, closed T
   - **8** – Tandem P to T, open crossover
   - 9 – Open to T all ports over tapers
   - 10 – Open P & B to T, closed A
   - 11 – Closed P & A, open B to T
   - 31 – Closed P, open A & B to T over tapers
   - 52 – Closed center all ports

5. **SPOOL/Spring arrangement**
   - A – Spring offset to A port
   - B – Spring centered, solenoid A removed
   - C – Spring centered
   - D – Pressure centered
   - F – Spring offset to A port, shift to center
   - N – No spring detented (pilot only)

6. **Left hand assembly**
   - L – Left hand, single solenoid only. Omit if not required. (For right hand assembly, P to A port when solenoid A is energized.)
   - Blank – Omit if not required

7. **Manual override**
   - Blank – Plain override solenoid ends only
   - H – Waterproof override solenoid ends only
   - H2 – Waterproof override both ends of single solenoid
   - P2 – Plain override both ends of single solenoid
   - Y – Lockable manual overrides solenoid ends only/DC only
   - Z – No overrides in either end

8. **Response type**
   - X – Fast response
   - Blank – Standard low shock models

9. **Spool control modifications**
   - 1 – Stroke adjustment both ends
   - 2 – Pilot choke (dual) adjustment
   - 3 – Pilot choke and stroke adjustment
   - 7 – Stroke adjustment A port end only
   - 8 – Stroke adjustment B port end only
   - 2-7 – Dual pilot choke and stroke adjustment A port end only
   - 2-8 – Dual pilot choke and stroke adjustment B port end only
   - Blank – Omit if not required

10. **Pilot pressure**
    - E – External pilot pressure
    - Blank – Internal pilot pressure

11. **Pilot drain**
    - T – Internal pilot drain
    - Blank – External pilot drain

12. **Pressure port check valve**
    - K – 0,35 bar (5 psi) cracking pressure
    - R – 3,45 bar (50 psi) cracking pressure
    - S – 5,20 bar (75 psi) cracking pressure
    - Blank – Omit if not required

**Type 4 and 8 spools may spin within the body causing unusual valve body wear. With this and other spool types, valve malfunction may occur. Where these applications exist use the DG5S-8***(L)***(X)***(E)***(T)***(V)***(M)***(S*) **30/40 EN470 special designator for 4C/8C anti-spin spools/springs.**
## Model Codes (continued)

### Solenoid energization identity

- **V** – Solenoid identification determined by position of solenoid (solenoid A at port A end and/or solenoid B at port B end)
- **Blank** – Standard arrangement for ANSI B93.9 (energize solenoid A for flow P to A port)

*(Code V for any valve with code 4 or code 8 spool)*

### Flag symbol

- **M** – Electrical options and features

### Spool indicator switch

(Available on models with high performance pilot DG4V3 only)

- **S3** – Normally open (available on valves with code P* only)
- **S4** – Normally closed (available on valves with code P* only)
- **S5** – Free leads (available on valves with coil type code F only)
- **S6** – LVDT type DC switch with Pg7 connector plug

### Coil type

- **U** – ISO 4400
- **F** – Flying lead
- **SP1** – Single 6.3 mm spade to IEC 760
- **SP2** – Dual 6.3 mm spade to IEC 760

### Electrical connections

*(Code F coil only)*

- **T** – Wired terminal block
- **PA** – Instaplug male receptacle only
- **PB** – Instaplug male & female receptacle
- **PA3** – Three pin connector
- **PA5** – Five pin connector
- **Blank** – Omit if not required

### Housing

*(Code F coil only)*

- **W** – \( \frac{1}{2} \) NPT thread wiring housing
- **J** – 20 mm thread wiring housing
- **Blank** – Omit if not required

### Electrical options

*(Code U coil only)*

- **1** – ISO with fitted plug
- **6** – ISO with fitted plug and lights

### Solenoid indicator lights

*(Code F coil with code T electrical connections only)*

- **L** – Indicator lights
- **Blank** – Omit if not required

### Coil identification

- **A** – 110V AC 50 Hz
- **B** – 110V AC 50 Hz/120V AC 60 Hz*
- **C** – 220V AC 50 Hz
- **D** – 220V AC 50 Hz/240V AC 60 Hz*
- **G** – 12 VDC
- **H** – 24 VDC
- **DJ** – 98 VDC
- **P** – 110 VDC

*(For 60 Hz or dual frequency)*

### Pilot valve tank pressure rating

- **2** – 10 bar (145 psi) DG4V3-60 with S3, S4, or S5 spool indicator switch
- **5** – 100 bar (1450 psi) DG4V3S-60
- **6** – 210 bar (3000 psi) DG4V3-60 with AC solenoids and optional S6 spool indicator switch
- **7** – 210 bar (3000 psi) DG4V3-60 with DC solenoids and optional S6 spool indicator switch

### Pilot valve port orifices

<table>
<thead>
<tr>
<th>Code</th>
<th>Orifice diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Solid plug</td>
</tr>
<tr>
<td>03</td>
<td>0.30 mm (0.012 in)</td>
</tr>
<tr>
<td>06</td>
<td>0.60 mm (0.024 in)</td>
</tr>
<tr>
<td>08</td>
<td>0.80 mm (0.030 in)</td>
</tr>
<tr>
<td>10</td>
<td>1.00 mm (0.040 in)</td>
</tr>
<tr>
<td>13</td>
<td>1.30 mm (0.050 in)</td>
</tr>
<tr>
<td>15</td>
<td>1.50 mm (0.060 in)</td>
</tr>
<tr>
<td>20</td>
<td>2.00 mm (0.080 in)</td>
</tr>
<tr>
<td>23</td>
<td>2.30 mm (0.090 in)</td>
</tr>
</tbody>
</table>
| Blank| Omit if not required

*(P, T, A, and/or B as required)*

### Design number

- **30** – DG4V3S-60 pilot valve
- **40** – DG4V3-60 pilot valve

*(Subject to change. Installation dimensions same for designs 30 through 39 and 40 through 49.)*

### Special Feature

*Blank*
DG5S-8 Model Series

Performance Characteristics

Shift Time
Shift time is defined as the elapsed time from when the pilot valve solenoid is energized to the time the main stage spool shifts to its full stroke. Shift time curves are shown for standard low shock and fast response models at 210 bar (3000 psi) system pressure with various pilot pressures and spools. Pressure centering time curves are shown for pressure centered models. Approximate spring centering times are also listed for spring centered models.

Shifting Action
The pilot valve solenoids of spring centered, pressure centered, and spring offset models must be energized continuously to keep the main stage spool in the shifted position. No-spring detented models only need to be energized momentarily (for approximately 0.1 second).

Spring centered and pressure centered models return the valve spool to the center position when both solenoids are de-energized or pilot pressure fails or falls below minimum requirements. Spring offset models return the spool to the offset position by pilot pressure when the solenoid is de-energized.

When no-spring detented models are de-energized, the pilot and main spools remain in their last position as long as there are no unusual shock, vibration, or pressure transients, and the spool axis is horizontal. If pilot pressure fails or falls below the minimum, the main spool will spring center (at spring centered flow rates), but will not drift to a reversal of flow position. The pilot stage will remain in the detented position.

CAUTION
Be careful when setting up flow conditions for the spring centered position of the main stage spool in no-spring detented models. Be sure to consider the effect of the direction of the flow and the pilot pressure. The type 9 main spool may not ensure sufficient pilot pressure in the center position.

Shift Time For AC Models at Rated Flow and Pressure
(Add approximately 25 milliseconds for DC models)

Spring Centering Times at Rated Flow and Pressure

<table>
<thead>
<tr>
<th>Spool Types</th>
<th>AC Models</th>
<th>DC Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 3, 6, 7, 31, 33, 52</td>
<td>.050 sec</td>
<td>.070 sec</td>
</tr>
<tr>
<td>0, 1, 11</td>
<td>.070 sec</td>
<td>.100 sec</td>
</tr>
<tr>
<td>4, 8</td>
<td>.090 sec</td>
<td>.120 sec</td>
</tr>
<tr>
<td>9</td>
<td>.135 sec</td>
<td>.160 sec</td>
</tr>
</tbody>
</table>

Fast Response
Valves with the fast response option have decreased shift time, but increased system shock generation. Fast response is available by adding the symbol "X" in the eighth position of the model code (example: DG5S-8-2CX-M-W*-20). The shift time and centering time curves show both standard and fast response times. Because of the high drain line pressure transients generated during shifting, use of the fast response option is not recommended for pilot pressures exceeding 140 bar (2000 psi).
Spool Type and Center Position

<table>
<thead>
<tr>
<th>Spool Type</th>
<th>Center Position</th>
<th>Spool Type</th>
<th>Center Position</th>
<th>Spool Type</th>
<th>Center Position</th>
<th>Spool Type</th>
<th>Center Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A B</td>
<td>3</td>
<td>A B</td>
<td>6</td>
<td>A B</td>
<td>9</td>
<td>A B</td>
</tr>
<tr>
<td>1</td>
<td>A B (<em>Closed Crossover</em>)</td>
<td>31</td>
<td>A B</td>
<td>33</td>
<td>A B</td>
<td>52</td>
<td>(Below)</td>
</tr>
<tr>
<td>2</td>
<td>A B</td>
<td>6</td>
<td>A B (<em>Open Crossover</em>)</td>
<td>9</td>
<td>A B</td>
<td>33</td>
<td>(Below)</td>
</tr>
</tbody>
</table>

Minimum Pilot Pressure Requirements

<table>
<thead>
<tr>
<th>Spool-Spring Arrangement</th>
<th>Spool Type</th>
<th>For Recommended Flow at System Pressure Up to 210 bar (3000 psi)</th>
<th>For Maximum Flow Without Malfunction at System Pressure of 210 bar (3000 psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Centered</td>
<td>0, 1, 4, 7, 8, 9, and 11</td>
<td>5 (75)</td>
<td>5 (75)</td>
</tr>
<tr>
<td>Spring Offset</td>
<td>2, 3, 6, 31, 33, and 52</td>
<td>8 (120)</td>
<td>10 (150)</td>
</tr>
<tr>
<td>No-Spring Detented</td>
<td>0, 1, 4, 7, 8, 9, and 11</td>
<td>P to A: 5 (75)</td>
<td>P to A: 5 (75)</td>
</tr>
<tr>
<td></td>
<td>2, 3, 6, 31, and 33</td>
<td>P to B: 10 (150)</td>
<td>P to B: 10 (150)</td>
</tr>
</tbody>
</table>

Application Guidance

The pilot pressure stated is based on internally piloted and externally drained models in which the pilot pressure is equal to pressure at the "P" port. With models having open center spools, pilot pressure can be assured by imposing a back pressure of at least the required minimum pilot pressure at the tank outlet connection (this back pressure will be present at cylinder ports if the spool type is 0, 1, 9, or 11), or by using an integral check valve that will not impose the additional pressure at the cylinder ports (see integral check valve note). Normally, internal pilot pressure for closed center spools is readily available. When pilot pressure from a separate source is required for either open or closed center spools, an external connection in the valve can be provided. (Add "E" to the model code.)

NOTE

Surges of oil in a common pilot valve drain line serving these and other valves can be of sufficient magnitude to cause inadvertent shifting of these valves. This is particularly critical in the no-spring detented type valves. Separate tank lines or a vented drain manifold with a continuous downward path to tank is necessary.

Any sliding spool, if held shifted under pressure for long periods of time, may stick and not spring return due to fluid residue formation (siling) and, therefore, should be cycled periodically to prevent this from happening.

When using as other than a normal four-way valve, consult your local Vickers representative.

Mounting Position

No-spring detented type valves must be installed with the longitudinal axis horizontal for good machine reliability. Mounting position of spring centered and spring offset valves is unrestricted provided that the pilot pressure is maintained as required. (Spring offset valves do not have a spring in the main spool section.)
Flow Ratings

<table>
<thead>
<tr>
<th>Valve Type</th>
<th>Spool Type</th>
<th>Recommended Flow Capacity at 210 bar (3000 psi) L/min (USgpm)</th>
<th>Maximum Flow Without Malfunction at:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>70 bar (1000 psi) L/min (USgpm)</td>
<td>140 bar (2000 psi) L/min (USgpm)</td>
</tr>
<tr>
<td>Spring Offset 'A'</td>
<td>0, 2, 6, 9, 33</td>
<td>170 (45)</td>
<td>380 (100)</td>
</tr>
<tr>
<td>Spring Centered Single Solenoid 'B'</td>
<td>0, 2, 3, 6, 31, 33, 52*</td>
<td>170 (45)</td>
<td>380 (100)</td>
</tr>
<tr>
<td>Spring Offset 'C'</td>
<td>1, 4, 7, 11</td>
<td>170 (45)</td>
<td>303 (80)</td>
</tr>
<tr>
<td>Spring Offset Shift to Center 'F'</td>
<td>8</td>
<td>170 (45)</td>
<td>303 (80)</td>
</tr>
<tr>
<td>Pressure Centered 'D'</td>
<td>0, 1, 2, 3, 4, 6, 7, 8, 9, 11, 31, 33</td>
<td>170 (45)</td>
<td>380 (100)</td>
</tr>
<tr>
<td>No-Spring Detented 'N'</td>
<td>0, 2, 6, 9, 33</td>
<td>170 (45)</td>
<td>380 (100)</td>
</tr>
</tbody>
</table>

† Fast valve switching of large oil volumes without adequate decompression circuitry can develop instantaneous flows well above maximum ratings. Type 4 and 8 spools may spin within body causing unusual valve body wear. With this and other spool types, valve malfunction may occur. Where these applications exist use the DG5S-8*-30/40 EN470 special feature designator for 4C/8C anti-spin spools/prings.

* Spool type 52 for Spring Centered 'C' type valves only.
Pressure Drop

The following table lists the appropriate pressure drop curve between ports for each spool type.

<table>
<thead>
<tr>
<th>Spool Type</th>
<th>Pressure Drop Curve Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P→A</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>33</td>
<td>3</td>
</tr>
<tr>
<td>52</td>
<td>3</td>
</tr>
</tbody>
</table>

Contact your Vickers representative.

♦ 13.8 bar (200 psi) at 95 L/min (25 USgpm) and 43.3 bar (700 psi) at 170 L/min (45 USgpm)

For example, to find the pressure drop from “P” to “B” for a valve with a type 2 spool, first locate 2 in the Spool Type column. The reference curve number at the intersection of the type 2 row and the P→B column is 3.

The pressure drop curves give approximate pressure drop (ΔP) when passing 21 cSt (100 SUS) fluid(s) having 0.865 specific gravity (G). To calculate the pressure drop for any other specific gravity (G₁), use the formula ΔP₁=ΔP(G₁/G). For any other viscosity, the pressure drop will change as follows:

<table>
<thead>
<tr>
<th>Viscosity (cSt)</th>
<th>Percentage of ΔP (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 (75)</td>
<td>93</td>
</tr>
<tr>
<td>32 (150)</td>
<td>111</td>
</tr>
<tr>
<td>43 (200)</td>
<td>119</td>
</tr>
<tr>
<td>54 (250)</td>
<td>126</td>
</tr>
<tr>
<td>65 (300)</td>
<td>132</td>
</tr>
<tr>
<td>76 (350)</td>
<td>137</td>
</tr>
<tr>
<td>86 (400)</td>
<td>141</td>
</tr>
</tbody>
</table>

Pressure Drop Curves

![Pressure Drop Curves Graph]
DG5S-8 Model Series

Dimensions in mm (inches)

Tank port
Ø 23.00 (.906)

Pressure port
Ø 23.00 (.906)

Pilot drain port “Y”
(For external pilot drain models)

Pilot pressure port “X”
(For external pilot pressure models)

Clearance for removal of solenoid coil
51 (2.01) AC DG4V-3
45 (1.77) AC DG4V-3S
61 (2.40) DC

Mounting bolt clamp height
6 Places

Mounting surface
(seals furnished)

Port “B” test connection
.4375-20 UNF-2B straight thread

Port “A” test connection
.4375-20 UNF-2B straight thread
Pilot Choke and Stroke Adjustments

Pilot Choke Adjustment(s)

Pilot choke is adjusted by backing off locknuts and turning adjusting screws inward (clockwise) to decrease rate of spool travel and outward (counterclockwise) to increase the rate. Pilot oil for models with this feature should be taken from a source having a constant pressure. See spool control modifications in model code.

Stroke Adjustment(s)

Stroke adjustment limits movement of the main stage spool. Backing off the jam nut and turning the adjusting screw inward (clockwise) decreases spool stroke. See spool control modifications in model code.

Pilot Valve Port Restrictor Plugs

Restrictor plugs are available for use in ports P, T, A, or B. These can be used for restricting flow or for circuit dampening. Restrictor plugs are not recommended for use above 210 bar (3000 psi) system pressure.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Orifice (mm)</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>694353</td>
<td>Blank</td>
<td>*00</td>
</tr>
<tr>
<td>694341</td>
<td>0.30 (0.012)</td>
<td>*03</td>
</tr>
<tr>
<td>694342</td>
<td>0.60 (0.024)</td>
<td>*06</td>
</tr>
<tr>
<td>694343</td>
<td>0.80 (0.030)</td>
<td>*08</td>
</tr>
<tr>
<td>694344</td>
<td>1.00 (0.040)</td>
<td>*10</td>
</tr>
<tr>
<td>694345</td>
<td>1.30 (0.050)</td>
<td>*13</td>
</tr>
<tr>
<td>694346</td>
<td>1.50 (0.060)</td>
<td>*15</td>
</tr>
<tr>
<td>694347</td>
<td>2.00 (0.080)</td>
<td>*20</td>
</tr>
<tr>
<td>694348</td>
<td>2.30 (0.090)</td>
<td>*23</td>
</tr>
</tbody>
</table>

* Available in multiples of 25 per part number

M5 x 0.8-6H thread for plug extraction
Optional Features

Integral Check Valves

For Internal Pilot Pressure:

An integral pressure port check is required for "internally piloted" valves with open center spools (0, 1, 4, 8, 9, and 11). The pilot pressure generated is the total of the "P→T" drop through the valve in the center condition, the pressure drop through the check valve, and the pressure at the tank port. For proper operation, the total pressure drop must be greater than the minimum required pilot pressure (see chart).

To Prevent Load Drop:

A check valve in the pressure port can be used to prevent reverse flow from a cylinder port to the pressure port.

For minimum pilot pressure table see page 7

Pressure Centered Valves

This option provides faster spring centering time by using pilot pressure to center the spool. The centering springs are used in addition to pilot pressure to insure positive centering of the spool. The valve spool is returned to center position by pilot pressure and centering springs when both solenoids are de-energized. If pilot pressure fails or falls below the required minimum, the spool will return to center position at minimum pilot pressure flow rates for pressure centered valves. Pilot pressure is not available through use of an integral check valve. The pressure centering times for pressure centered models are shown in curves for various pilot pressures. See page 6.
DG5S-H8 Model Series

Ratings

<table>
<thead>
<tr>
<th>Recommended Flow* L/min (USgpm)</th>
<th>Maximum Operating Pressure (Ports P, A, &amp; B) bar (psi)</th>
<th>Maximum Pilot Pressure bar (psi)</th>
<th>Maximum Tank Line Pressure bar (psi)</th>
<th>Mounting Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>To 265 (70)</td>
<td>310 (4500)</td>
<td>310 (4500)</td>
<td>210 (3000)</td>
<td>ISO 4401-08, NFPA D08 (formerly D06), and ANSI B93.7</td>
</tr>
</tbody>
</table>

*See maximum flow table on page 17.

Model Codes

F3-DG5S-H8- ** (L)( *) (X) -( *) -(E)-(T) -(*)( V)-(S *) * ( **) ** (L)- ** 5- **** -6*/7*

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

1  Viton seals  
F3 – For mineral oil & fire resistant fluids  
Blank – Omit if not required

2  Series designation  
D – Directional control valve  
G – Manifold or subplate mounted  
5 – Solenoid controlled, pilot operated  
S – Sliding spool, rated pressure  
310 bar (4500 psi)

3  High flow interface  
8 – NFPA D08 (ISO 4401-08)

4  Spool type  
Code  Center position  
0 – Open to T all ports  
1 – Open P & A to T, closed B  
2 – Closed to T all ports  
3 – Closed P & B, open A to T  
4 – Tandem P to T, closed crossover  
6 – Closed P only, open A & B to T  
8 – Tandem P to T, open crossover  
9 – Open to T all ports over tapers  
11 – Open P & B to T, closed A  
31 – Closed P & A, open B to T  
33 – Closed P, open A & B to T over tapers

5  Spool/Spool arrangement  
A – Spring offset to A port  
B – Spring centered, solenoid A removed  
C – Spring centered  
F – Spring offset to A port, shift to center  
N – No spring detented (pilot only)

6  Left hand assembly  
L – Left hand, single solenoid only. Omit if not required. (For right hand assembly, P to A port when solenoid A is energized.)  
Blank – Omit if not required

7  Manual override  
Blank – Plain override solenoid ends only  
H – Waterproof override solenoid ends only  
H2 – Waterproof override both ends of single solenoid  
P2 – Plain override both ends of single solenoid  
Y – Lockable manual overrides solenoid ends only/DC only  
Z – No overrides in either end

8  Response type  
X – Fast response  
Blank – Standard low shock models

9  Spool control modifications  
1 – Stroke adjustment both ends  
2 – Pilot choke (dual) adjustment  
3 – Pilot choke and stroke adjustment  
7 – Stroke adjustment A port end only  
8 – Stroke adjustment B port end only  
2-7 – Dual pilot choke and stroke adjustment A port end only  
2-8 – Dual pilot choke and stroke adjustment B port end only  
Blank – Omit if not required

10  Pilot pressure  
E – External pilot pressure  
Blank – Internal pilot pressure

11  Pilot drain  
T – Internal pilot drain  
Blank – External pilot drain

12  Pressure port check valve  
K – 0.35 bar (5 psi) cracking pressure  
R – 3.45 bar (50 psi) cracking pressure  
S – 5.20 bar (75 psi) cracking pressure  
Blank – Omit if not required
DG5S-H8 Model Series

Model Codes (continued)

13 Solenoid energization identity
V – Solenoid identification determined by position of solenoid (solenoid A at port A end and/or solenoid B at port B end)
Blank – Standard arrangement for ANSI B93.9 (energize solenoid A for flow P to A port)
(Code V for any valve with code 4 or code 8 spool)

14 Flag symbol
M – Electrical options and features

15 Spool indicator switch
(Applicable on models with high-performance pilot DG4V3 only)
S3 – Normally open (available on valves with code P* only)
S4 – Normally closed (available on valves with code P* only)
S5 – Free leads (available on valves with coil type code F only)
S6 – LVDT type DC switch with Pg7 connector plug

16 Coil type
U – ISO 4400
F – Flying lead
SP1 – Single 6.3 mm spade to IEC 760
SP2 – Dual 6.3 mm spade to IEC 760

17 Electrical connections
(Code F coil only)
T – Wired terminal block
PA – Instaplug male receptacle only
PB – Instaplug male & female receptacle
PA3 – Three pin connector
PA5 – Five pin connector
Blank – Omit if not required

18 Housing
(Code F coil only)
W – 1/2 NPT thread wiring housing
J – 20 mm thread wiring housing
Blank – Omit if not required

19 Electrical options
(Code U coil only)
1 – ISO with fitted plug
6 – ISO with fitted plug and lights

20 Solenoid indicator lights
(Code F coil with code T electrical connections only)
L – Indicator lights
Blank – Omit if not required

21 Coil identification
A – 110V AC 50 Hz
B – 110V AC 50 Hz/120V AC 60 Hz*
C – 220V AC 50 Hz
D – 220V AC 50 Hz/240V AC 60 Hz*
G – 12 VDC
H – 24 VDC
DJ – 98 VDC
P – 110 VDC

* For 60 Hz or dual frequency

22 Pilot valve tank pressure rating
2 – 10 bar (145 psi) DG4V3-60 with S3, S4, or S5 spool indicator switch
5 – 100 bar (1450 psi) DG4V3S-60
6 – 210 bar (3000 psi) DG4V3-60 with AC solenoids and optional S6 spool indicator switch
7 – 210 bar (3000 psi) DG4V3-60 with DC solenoids and optional S6 spool indicator switch

23 Pilot valve port orifices
Code | Orifice diameter
*00 – Solid plug
*03 – 0.30 mm (0.012 in)
*06 – 0.60 mm (0.024 in)
*08 – 0.80 mm (0.030 in)
*10 – 1.00 mm (0.040 in)
*13 – 1.30 mm (0.050 in)
*15 – 1.50 mm (0.060 in)
*20 – 2.00 mm (0.080 in)
*23 – 2.30 mm (0.090 in)
Blank – Omit if not required

24 Design number
60 – DG4V3S-60 pilot valve
70 – DG4V3-60 pilot valve
(Subject to change. Installation dimensions same for designs 60 through 69 and 70 through 79.)
61 – For DG4V3-3S-60 piloted valves with 4C/8C type special anti-spin main stage spools/spring.
71 – For DG4V3-3 piloted valves with 4C/8C type special anti-spin main stage spools/springs.
Performance Characteristics

Shift Time
Shift time is defined as the elapsed time from when the pilot valve solenoid is energized to the time the main stage spool shifts to its full stroke. Shift time curves are shown for standard low shock and fast response models at 210 bar (3000 psi) system pressure with various pilot pressures and spools. Pressure centering time curves are shown for pressure centered models. Approximate spring centering times are also listed for spring centered models.

Shifting Action
The pilot valve solenoids of spring centered and spring offset models must be energized continuously to keep the main stage spool in the shifted position. No-spring detented models only need to be energized momentarily (for approximately 0.1 second).

Spring centered models return the valve spool to the center position when both solenoids are de-energized or pilot pressure fails or falls below minimum requirements. Spring offset models return the spool to the offset position by pilot pressure when the solenoid is de-energized.

When no-spring detented models are de-energized, the pilot and main spools remain in their last position as long as there are no unusual shock, vibration, or pressure transients, and the spool axis is horizontal. If pilot pressure fails or falls below the minimum, the main spool will spring center (at spring centered flow rates), but will not drift to a reversal of flow position. The pilot stage will remain in the detented position.

CAUTION
Be careful when setting up flow conditions for the spring centered position of the main stage spool in no-spring detented models. Be sure to consider the effect of the direction of the flow and the pilot pressure. The type 9 main spool may not ensure sufficient pilot pressure in the center position.

Shift Time For AC Models at Rated Flow and Pressure
(Add approximately 25 milliseconds for DC models)

<table>
<thead>
<tr>
<th>Spool Types</th>
<th>AC Models</th>
<th>DC Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 3, 6, 31, 33</td>
<td>.076 sec</td>
<td>.088 sec</td>
</tr>
<tr>
<td>0, 1, 9, 11</td>
<td>.088 sec</td>
<td>.100 sec</td>
</tr>
<tr>
<td>4, 8</td>
<td>.110 sec</td>
<td>.130 sec</td>
</tr>
</tbody>
</table>

Fast Response
Valves with the fast response option have decreased shift time, but increased system shock generation. Fast response is available by adding the symbol “X” in the eighth position of the model code (example: DGSS-H8-2CX-M-W*-70). The shift time and centering time curves show both standard and fast response times. Because of the high drain line pressure transients generated during shifting, use of the fast response option is not recommended for pilot pressures exceeding 140 bar (2000 psi).
**DG5S-H8 Model Series**

### Spool Type and Center Position

<table>
<thead>
<tr>
<th>Spool Type</th>
<th>Center Position</th>
<th>Spool Type</th>
<th>Center Position</th>
<th>Spool Type</th>
<th>Center Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>![Diagram](AB PT)</td>
<td>3</td>
<td>![Diagram](AB PT)</td>
<td>8</td>
<td>![Diagram](AB PT)</td>
</tr>
<tr>
<td>1</td>
<td>![Diagram](AB PT)</td>
<td>4</td>
<td>![Diagram](AB PT)</td>
<td>9</td>
<td>![Diagram](AB PT)</td>
</tr>
<tr>
<td>2</td>
<td>![Diagram](AB PT)</td>
<td>6</td>
<td>![Diagram](AB PT)</td>
<td>11</td>
<td>![Diagram](AB PT)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spool-Spring Arrangement</th>
<th>Spool Type</th>
<th>Minimum Pilot Pressure bar (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Centered</td>
<td>0, 1, 4, 8, 9, and 11 (open center)</td>
<td>5 (75) 5 (75)</td>
</tr>
<tr>
<td>Spring Offset</td>
<td>2, 3, 6, 31, and 33 (closed center)</td>
<td>8 (120) 10 (150)</td>
</tr>
</tbody>
</table>

### Application Guidance

The pilot pressure stated is based on internally piloted and externally drained models in which the pilot pressure is equal to pressure at the “P” port. With models having open center spools, pilot pressure can be assured by imposing a back pressure of at least the required minimum pilot pressure at the tank outlet connection (this back pressure will be present at cylinder ports if the spool type is 0, 1, 9, or 11), or by using an integral check valve that will not impose the additional pressure at the cylinder ports (see integral check valve note). Normally, internal pilot pressure for closed center spools is readily available. When pilot pressure from a separate source is required for either open or closed center spools, an external connection in the valve can be provided. (Add “E” to the model code.)

**NOTE**

Surges of oil in a common pilot valve drain line serving these and other valves can be of sufficient magnitude to cause inadvertent shifting of these valves. This is particularly critical in the no-spring detented type valves. Separate tank lines or a vented drain manifold with a continuous downward path to tank is necessary. Any sliding spool, if held shifted under pressure for long periods of time, may stick and not spring return due to fluid residue formation (siling) and, therefore, should be cycled periodically to prevent this from happening.

When using as other than a normal four-way valve, consult your local Vickers representative.

### Mounting Position

No-spring detented type valves must be installed with the longitudinal axis horizontal for good machine reliability. Mounting position of spring centered and spring offset valves is unrestricted provided that the pilot pressure is maintained as required. (Spring offset valves do not have a spring in the main spool section.)
### Graphical Symbols

#### SPRING OFFSET ‘A’

![Graphical Symbol for SPRING OFFSET ‘A’](image)

#### SPRING OFFSET SHIFT TO CENTER ‘F’

![Graphical Symbol for SPRING OFFSET SHIFT TO CENTER ‘F’](image)

#### SPRING CENTERED SINGLE SOLENOID ‘B’

![Graphical Symbol for SPRING CENTERED SINGLE SOLENOID ‘B’](image)

#### NO-SPRING DETENTED ‘N’

![Graphical Symbol for NO-SPRING DETENTED ‘N’](image)

#### SPRING CENTERED ‘C’

![Graphical Symbol for SPRING CENTERED ‘C’](image)

### Flow Ratings

<table>
<thead>
<tr>
<th>Valve Type</th>
<th>Spool Type</th>
<th>Recommended Flow Capacity at 210 bar (3000 psi) L/min (USgpm)</th>
<th>Maximum Flow Without Malfunction at:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Offset ‘A’</td>
<td>0, 2, 6, 9, 33</td>
<td>265 (70)</td>
<td>70 bar (1000 psi) L/min (USgpm) 530 (140)</td>
</tr>
<tr>
<td>Spring Centered ‘B’</td>
<td>0, 2, 3, 4, 6, 31, 33</td>
<td>265 (70)</td>
<td>70 bar (1000 psi) L/min (USgpm) 530 (140)</td>
</tr>
<tr>
<td></td>
<td>1, 11</td>
<td>265 (70)</td>
<td>70 bar (1000 psi) L/min (USgpm) 530 (140)</td>
</tr>
<tr>
<td>Spring Offset ‘C’</td>
<td>8</td>
<td>265 (70)</td>
<td>70 bar (1000 psi) L/min (USgpm) 530 (140)</td>
</tr>
<tr>
<td>Shift to Center ‘F’</td>
<td>9</td>
<td>265 (70)</td>
<td>70 bar (1000 psi) L/min (USgpm) 265 (70)</td>
</tr>
<tr>
<td>No-Spring Detented ‘N’</td>
<td>0, 2, 6, 9, 33</td>
<td>265 (70)</td>
<td>70 bar (1000 psi) L/min (USgpm) 530 (140)</td>
</tr>
</tbody>
</table>

† Fast valve switching of large oil volumes without adequate decompression circuitry can develop instantaneous flows well above maximum ratings. Type 4 and 8 spools may spin within body causing unusual valve body wear. With this and other spool types, valve malfunction may occur. Where these applications exist use DGSS-H8*-61/71 designs for special 4C/8C anti-spin spools/springs.
DG5S-H8 Model Series

Pressure Drop

The following table lists the appropriate pressure drop curve between ports for each spool type.

<table>
<thead>
<tr>
<th>Spool Type</th>
<th>Pressure Drop Curve Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P→A</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
</tr>
</tbody>
</table>

For example, to find the pressure drop from “P” to “B” for a valve with a type 2 spool, first locate 2 in the Spool Type column. The reference curve number at the intersection of the type 2 row and the P→B column is 1.

The pressure drop curves give approximate pressure drop (ΔP) when passing 21 cSt (100 SUS) fluid(s) having 0.865 specific gravity (G). To calculate the pressure drop for any other specific gravity (G₁), use the formula ΔP₁=ΔP(G₁/G). For any other viscosity, the pressure drop will change as follows:

<table>
<thead>
<tr>
<th>Viscosity cSt (SUS)</th>
<th>Percentage of ΔP (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 (75)</td>
<td>93</td>
</tr>
<tr>
<td>32 (150)</td>
<td>111</td>
</tr>
<tr>
<td>43 (200)</td>
<td>119</td>
</tr>
<tr>
<td>54 (250)</td>
<td>126</td>
</tr>
<tr>
<td>65 (300)</td>
<td>132</td>
</tr>
<tr>
<td>76 (350)</td>
<td>137</td>
</tr>
<tr>
<td>86 (400)</td>
<td>141</td>
</tr>
</tbody>
</table>
Dimensions in mm (inches)

Pilot pressure port “X”
(For external pilot pressure models)

Tank port
∅ 25.00 (.984)

Pressure port
∅ 25.00 (.984)

Pilot drain port “Y”
(For external pilot drain models)

∅ 13.50 (.531)
(6 holes for mounting)

Port “B”

Port “A”

Clearance for removal
of solenoid coil
51 (2.01) AC DG4V-3
45 (1.77) AC DG4V-3S
61 (2.40) DC

Pressure port
∅ 25.00 (.984)

Pilot drain port “Y”
(For external pilot drain models)

Port “B”

Port “A”

Clearance for removal
of solenoid coil
51 (2.01) AC DG4V-3
45 (1.77) AC DG4V-3S
61 (2.40) DC

Mounting surface
(seals furnished)

Port “B” test connection
.4375-20 UNF-2B straight thread

Port “A” test connection
.4375-20 UNF-2B straight thread

6 Places
∅ 6.4 (.25)
(2 rest pins)

Mounting bolt clamp
height
6 Places

∅ 6.4 (.25)
(2 rest pins)
**Pilot Choke and Stroke Adjustments**

**Pilot Choke Adjustment(s)**

Pilot choke is adjusted by backing off locknuts and turning adjusting screws inward (clockwise) to decrease rate of spool travel and outward (counterclockwise) to increase the rate. Pilot oil for models with this feature should be taken from a source having a constant pressure. See spool control modifications in model code.

**Stroke Adjustment(s)**

Stroke adjustment limits movement of the main stage spool. Backing off the jam nut and turning the adjusting screw inward (clockwise) decreases spool stroke. See spool control modifications in model code.

---

**Pilot Valve Port Restrictor Plugs**

Restrictor plugs are available for use in ports P, T, A, or B. These can be used for restricting flow or for circuit dampening. Restrictor plugs are not recommended for use above 210 bar (3000 psi) system pressure.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Orifice (mm)</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>694353</td>
<td>Blank</td>
<td>*00</td>
</tr>
<tr>
<td>694341</td>
<td>0.30 (0.012)</td>
<td>*03</td>
</tr>
<tr>
<td>694342</td>
<td>0.60 (0.024)</td>
<td>*06</td>
</tr>
<tr>
<td>694343</td>
<td>0.80 (0.030)</td>
<td>*08</td>
</tr>
<tr>
<td>694344</td>
<td>1.00 (0.040)</td>
<td>*10</td>
</tr>
<tr>
<td>694345</td>
<td>1.30 (0.050)</td>
<td>*13</td>
</tr>
<tr>
<td>694346</td>
<td>1.50 (0.060)</td>
<td>*15</td>
</tr>
<tr>
<td>694347</td>
<td>2.00 (0.080)</td>
<td>*20</td>
</tr>
<tr>
<td>694348</td>
<td>2.30 (0.090)</td>
<td>*23</td>
</tr>
</tbody>
</table>

† – Available in multiples of 25 per part number
* – P, T, A, or B as required
Optional Features

Integral Check Valves

For Internal Pilot Pressure:
An integral pressure port check is required for "internally piloted" valves with open center spools (0, 1, 4, 8, 9, and 11). The pilot pressure generated is the total of the "P→T" drop through the valve in the center condition, the pressure drop through the check valve, and the pressure at the tank port. For proper operation, the total pressure drop must be greater than the minimum required pilot pressure (see chart).

To Prevent Load Drop:
A check valve in the pressure port can be used to prevent reverse flow from a cylinder port to the pressure port.

For minimum pilot pressure table see page 16

Pressure Drop Across Check Valve

![Graph showing pressure drop across check valve for different flow rates and spring loads.](image-url)
## Accessories and Weights

### Mounting Subplates

<table>
<thead>
<tr>
<th>Model</th>
<th>&quot;E&quot; Thread</th>
<th>Tubing O.D.</th>
<th>&quot;F&quot; Diameter</th>
<th>Weight (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DGSM–8–10–T12</td>
<td>1.0625–12 UN</td>
<td>.750</td>
<td>23.79 (.937)</td>
<td></td>
</tr>
<tr>
<td>DGSM–8–10–T16</td>
<td>1.3125–12 UN</td>
<td>1.000</td>
<td>24.61 (.969)</td>
<td>4.9 kg. (11 lb.)</td>
</tr>
<tr>
<td>DGSM–8–10–T20</td>
<td>1.6250–12 UN</td>
<td>1.250</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bolt Kits

Bolt kits are used for mounting valves to a subplate or manifold. Valves, subplates, and mounting bolts must be ordered separately.

Two center mounting bolts are optional. All six bolts are recommended for maximum seal life at pressures of 140 bar (2000 psi) and higher.

When a subplate is not used, a machined pad (as indicated by subplate shaded area) must be provided for mounting. The pad must be flat within 0.0013 mm (0.0005 inch) and smooth within 1.6 μm (63 microinch). If mounting bolts are provided by the customer, they should be SAE grade 7 or better.

The maximum recommended mounting bolt torque is 79 N-m (700 lb (f) in).

Model and Assembly Numbers

<table>
<thead>
<tr>
<th>Model Series</th>
<th>Kit Model Number</th>
<th>Quantity</th>
<th>Thread Size × Length</th>
<th>Assembly Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG5S-8</td>
<td>BKDG06635 (inch bolts)</td>
<td>6</td>
<td>.500-13 × 2.50”</td>
<td>255635</td>
</tr>
<tr>
<td></td>
<td>BKDG8655M (metric bolts)</td>
<td>6</td>
<td>M12 × 65 mm</td>
<td>255655</td>
</tr>
<tr>
<td>DG5S-H8</td>
<td>BKDGH06618 (inch bolts)</td>
<td>6</td>
<td>.500-13 UNC × 3.00”</td>
<td>255618</td>
</tr>
<tr>
<td></td>
<td>BKDGH8658M (metric bolts)</td>
<td>6</td>
<td>M12 × 80 mm</td>
<td>255658</td>
</tr>
</tbody>
</table>

Valve Weights

<table>
<thead>
<tr>
<th>Model Series</th>
<th>Pilot Valve Solenoids</th>
<th>Additional Features</th>
<th>Weight kg (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–</td>
<td></td>
<td>14.5 (32)</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td></td>
<td>15.0 (33)</td>
</tr>
<tr>
<td>2</td>
<td>Pressure centered</td>
<td></td>
<td>16.8 (37)</td>
</tr>
<tr>
<td>2</td>
<td>Pilot choke (meter out)</td>
<td></td>
<td>16.1 (35.5)</td>
</tr>
<tr>
<td>2</td>
<td>Stroke adjustment (one end)</td>
<td></td>
<td>15.7 (34.5)</td>
</tr>
<tr>
<td>2</td>
<td>Stroke adjustment (both ends)</td>
<td></td>
<td>16.4 (36)</td>
</tr>
<tr>
<td>2</td>
<td>Pilot choke and stroke adjustment (both ends)</td>
<td>17.5 (38.5)</td>
<td></td>
</tr>
<tr>
<td>DG5S-H8</td>
<td>–</td>
<td></td>
<td>16.8 (37)</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td></td>
<td>17.3 (38)</td>
</tr>
<tr>
<td>2</td>
<td>Pilot choke (meter out)</td>
<td></td>
<td>18.4 (40.5)</td>
</tr>
<tr>
<td>2</td>
<td>Stroke adjustment (one end)</td>
<td></td>
<td>17.8 (39)</td>
</tr>
<tr>
<td>2</td>
<td>Stroke adjustment (both ends)</td>
<td></td>
<td>18.2 (40)</td>
</tr>
<tr>
<td>2</td>
<td>Pilot choke and stroke adjustment (both ends)</td>
<td>19.3 (42.5)</td>
<td></td>
</tr>
</tbody>
</table>

Installation and Application Data

Fluids and Seals

The use of synthetic fire resistant fluids requires valve with special seals (fluorocarbon).

Electrical Information

Installation and Application Data

Pilot Valve Drain (Internal/External)

“Internal Drain” models drain the pilot valve through the tank port of the main stage. “External Drain” models drain the pilot valve through the “Y” port of the main stage. To provide proper operation without malfunction, the pilot pressure must always exceed tank or drain line pressure by the “Minimum Pilot Pressure” required per valve and spool type. (Refer to minimum pilot pressure table see page 16.) Tank or drain line surges which would reduce this differential are to be avoided. Such surges may cause the main stage spool to shift.

Main stage tank pressure is limited to the tank line rating of the pilot valve on “Internal Drained” models (those that include “T” in the model code). “Internal Drain” may be used with all models, except the DG5S-8 model series pressure centered “D” models. Pressure centered valves must be externally drained through “Y” and “W” ports. To achieve the maximum tank line rating (3000 psi) of the main stage an “External” pilot drain must be used, and it is recommended that a separate line be provided directly to tank.

Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of components, elevated viscosity, and inclusion of air.

Vickers supports and recommends the hydraulic Systems Standards For Stationary Industrial Machinery advanced by the American National Standards Institute; ANSI/(NFPA/JIC) T2.24.2-1991. Key elements of the Standard, as well as other vital information on the correct methods for treating hydraulic fluid, are included in Vickers publication 561 “Vickers Guide to Systemic Contamination Control” available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in this publication.

Recommended cleanliness levels using petroleum oil under common conditions is based on the highest fluid pressure levels in the system:

<table>
<thead>
<tr>
<th>Product</th>
<th>System Pressure Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000 psi</td>
</tr>
<tr>
<td>Directional Valves</td>
<td>20/18/15</td>
</tr>
</tbody>
</table>

Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.