Worcester Controls Directional Ball Valves
Series D44/D4, Series D51, Series 18/19
Series D44/D4: A rugged directional ball valve that conforms to the requirements of ANSI B16.34

Diverter Ball Valve

Separate Seats and Body Seals, One Flow Direction

The diverter valve is designed to accept media through a bottom inlet port and direct it out either of two outlet ports. It is commonly used for alternately diverting flow from a single source to two different lines, for example dumping operations in which one outlet permits media to flow from a common source to the process while the other outlet alternately dumps or recirculates excess media.

The Diverter Ball Valve is available with two different porting configurations. V1 Porting is 90° operation for manual, pneumatic or reversing type electric actuation. The flow from the bottom inlet port cannot be shut off, only diverted to either of the two outlet ports.

V2 Porting is 180° operation for manual or 180° electric actuation. With this configuration, the flow can be shut off by simply operating the valve 90°. However, there is no mechanical stop arrangement for this position.

The diverter valve is constructed with separate seat and body seal.

V1 Porting

V2 Porting

Automation

Diverter and 3-way valves with V1 Porting (90° operations) may be automated with Series 34 or 39 pneumatic actuators or Series 75 electric actuators. For V2 Porting configuration (180° operation), use the Series 75 electric actuator, also available with center-off option. The Series 36 electric actuator is not suitable for use with Worcester Controls Directional Ball Valves. 180° pneumatic actuators are available through custom products.
3-Way Ball Valve
One Piece Seat and Body Seal, Bi-Directional Flow

The 3-way ball valve provides greater flexibility in operation. Constructed with a one piece seat and body seal, the 3-way valve permits flow in both directions. It can function as a selector valve, alternately accepting media from either of two inlet sources and directing through a single outlet. Or, it may be used as a true 3-way valve, accepting media from two inlet sources for alternate discharge through either of two outlet ports. For example, in a pressurized line or system, the inlet port pressurizes or fills the system. The valve is then operated through its travel to allow the pressurized contents to be discharged through the second outlet port with the original outlet port now functioning as the inlet.

The 3-way ball valve is available with two different porting configurations. V1 Porting provides 90° operation for manual, pneumatic or reversing type electric actuation. With V1 Porting, alternate side ports are shut off at the 0° and 90° positions. V2 Porting shuts off one side at 0°, the opposite side at 180° and both sides at 90°, but there is no mechanical stop at 90°. V2 Porting permits 0° and 180° operation for manual or electric actuation only. Both positions can be shut off completely.
**Series D44/D4**

**Seat Pressure/Temperature Ratings:**

*Three-way Ball Valve*

![Graph showing Seat Pressure/Temperature Ratings for Three-way Ball Valve](image)

**Seat Pressure/Temperature Ratings:**

*Diverter Ball Valve*

![Graph showing Seat Pressure/Temperature Ratings for Diverter Ball Valve](image)

**Flow Characteristic Curves for Diverter Valve: V1 Porting, 90° Operation**

![Graph showing Flow Characteristic Curves for Diverter Valve](image)

**NOTE:** In three-way ball valves (one piece seat and body seal), 200°F maximum thermal cycle is allowed for Polyfill seats; 100°F maximum thermal cycle for TFE and UHMWPE seats.
Series D44/D4

Dimensions

Metric dimensions are converted from Standard English dimensions. Dimensions are given for layout purposes only; for tolerances, consult factory.

Flanged versions of the diverter valve are available in 2"–8" in carbon steel or stainless steel with ANSI Class 150 flanges. ANSI Class 300 flanges are also available. Consult factory. Refer to Brochure WCABR1020.

Valve Body Pressure Ratings

<table>
<thead>
<tr>
<th>Valve</th>
<th>A, SE, SW, TE</th>
<th>A1 TC</th>
<th>A2 XBO</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>E1 TC</th>
<th>E2 XBO</th>
<th>Side Port Dia.</th>
<th>Bottom Port Dia.</th>
<th>Approx. Wt. lb. / kg</th>
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<td>3.50</td>
<td>5.53</td>
<td>1.55</td>
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<td>5.53</td>
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<td>.34</td>
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<td>44.7</td>
<td>141</td>
<td>57.2</td>
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<td>74.4</td>
<td>9.7</td>
<td>8.6</td>
<td>0.7</td>
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<td>4.00</td>
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<td>1.86</td>
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<td>161</td>
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<td>38.1</td>
<td>35.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Optional High Pressure Valves

- 1/4"–2" | Series D4 Diverter Valves with Lubetal® (Delrin®) seats are available for high pressure service.
- 1 1/4"–3/4" | Carbon Steel and S.S. | 3000 psi
- 1" | Carbon Steel and S.S. | 2500 psi
- 1 1/2" and 2" | Carbon Steel and S.S. | 2000 psi

Flow Coefficient

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Cₜ</th>
<th>Equivalent Length of Schedule 40 Pipe (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot;</td>
<td>3</td>
<td>23.1</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>5</td>
<td>36.6</td>
</tr>
<tr>
<td>1&quot;</td>
<td>10</td>
<td>33.4</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>24</td>
<td>55.6</td>
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<tr>
<td>2&quot;</td>
<td>36</td>
<td>90.1</td>
</tr>
</tbody>
</table>
Series D51: A Simple, Dependable Way to Divert Flow to Two Pipe Lines with Tight Shutoff to Either Line

Worcester’s Series D51 is a standardized line of flanged diverter ball valves in sizes 2”, 3”, 4”, 6”, and 8” with ANSI Class 150 flanges.

D51 diverter valves are designed to accept media through a bottom inlet port and direct it out either of two outlet ports. They are commonly used for alternately diverting flow from a single source to two different lines; for example, dumping operations in which one outlet permits media to flow from a common source to the process while the other outlet alternately dumps or recirculates excess media.

Ball porting for D51 diverter valves is referred to as V1 (see illustration opposite) for 90° valve operation. Flow from the bottom inlet port cannot be shut off, only diverted to either of the two outlet ports. At either end of the valve stroke, one port is wide open and the other is shut off bubble-tight. Patented relief slots assist in sealing and reduce torque. The ball is forced into the seat of the blocked port under pressure to affect and maintain a tight seal.

Series D51 Options

V2 porting for 180° full shutoff operations and T51 three-way valves for bidirectional flow applications are available through Custom Products.

Automation

D51 flanged diverter valves may be automated with Series 75 electric actuators (refer to brochure WCABR1014) or Series 39 double piston pneumatic actuators (refer to brochure WCABR1003). Both actuators may be used in on/off or modulating applications. Limit switches, feedback potentiometers, 4-20 mA circuit boards providing remote indication of valve position and other accessories including a full line of advanced positioners are available.

Flow Coefficient

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>C_v</th>
<th>Equivalent Length of Schedule 40 Pipe (feet)</th>
</tr>
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<tbody>
<tr>
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<td>36</td>
<td>95</td>
</tr>
<tr>
<td>3”</td>
<td>135</td>
<td>62.5</td>
</tr>
<tr>
<td>4”</td>
<td>230</td>
<td>81</td>
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<tr>
<td>6”</td>
<td>330</td>
<td>312</td>
</tr>
<tr>
<td>8”</td>
<td>605</td>
<td>387</td>
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Flow Characteristic Curves for Diverter Valve V1 Porting, 90° Operation

Seat Pressure/Temperature Rating

![Graph showing pressure and temperature ratings for Carbon Steel and Stainless Steel pipes, with valve positions at 0° and 90° Rotation indicated.]
Parts Identification and Materials Specifications

Series D51

<table>
<thead>
<tr>
<th>Part</th>
<th>Part Name</th>
<th>Qty.</th>
<th>Materials</th>
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</thead>
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<td>Body</td>
<td>1</td>
<td>Carbon Steel - ASTM 216 – WCB</td>
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<td></td>
<td></td>
<td>Stainless Steel - ASTM A351 CF8M</td>
</tr>
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<td>2</td>
<td>End Plug</td>
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<td>Carbon Steel - ASTM A108</td>
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<tr>
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<td></td>
<td></td>
<td>Stainless Steel - ASTM A479 - 316, Cond. A</td>
</tr>
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<td>Ball</td>
<td>1</td>
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<td>Stem</td>
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<td>5</td>
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</tr>
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<td>7</td>
<td>Thrust Bearing</td>
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<td>Polyfill®</td>
</tr>
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<td>Follower</td>
<td>1</td>
<td>Stainless Steel - ANSI 316L</td>
</tr>
<tr>
<td>10*</td>
<td>Belleville Washers</td>
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<td>Carbon Steel - Zinc Plated Stainless Steel 301</td>
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<td>11*</td>
<td>Handle &amp; Ret. Nuts</td>
<td>2</td>
<td>Carbon Steel - Zinc Plated Stainless Steel - ANSI 300 Series</td>
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<tr>
<td>12</td>
<td>Stop Screw</td>
<td>1</td>
<td>Carbon Steel - Black Oxide Coated</td>
</tr>
<tr>
<td>13</td>
<td>Thrust Bearing/ Seal Protector</td>
<td>2</td>
<td>PEEK</td>
</tr>
<tr>
<td>14</td>
<td>Lockwasher</td>
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<td>15</td>
<td>Shipping Screw</td>
<td>4-12</td>
<td>Stainless Steel - ANSI 304</td>
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<td>16</td>
<td>Thrust Bearing</td>
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<td>RTFE - Reinforced</td>
</tr>
<tr>
<td>17</td>
<td>Centering Washer</td>
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<td>Carbon Steel - Black Oxide Coated</td>
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<td></td>
<td></td>
<td>Stainless Steel - ANSI 316</td>
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<td>18</td>
<td>Stem Seals</td>
<td>3</td>
<td>RTFE - Reinforced</td>
</tr>
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<td>19</td>
<td>Stop Plate</td>
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<td>Carbon Steel - Zinc Plated</td>
</tr>
<tr>
<td>20</td>
<td>Retaining Nut</td>
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<td>Carbon Steel - Zinc Plated Stainless Steel - ANSI 300 Series</td>
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<tr>
<td>21</td>
<td>Stop Screw</td>
<td>2</td>
<td>Carbon Steel - Black Oxide Coated</td>
</tr>
<tr>
<td>22</td>
<td>Wrench Extension</td>
<td>1</td>
<td>Carbon Steel - ASTM A53/Galv.</td>
</tr>
<tr>
<td>23</td>
<td>Wrench Assy. Bolt.</td>
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<td>Carbon Steel - SAE J429 GR.2</td>
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<td>24</td>
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<td>Handle</td>
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<td></td>
<td></td>
<td></td>
<td>Stainless Steel - ANSI 300 Series, Vinyl coated</td>
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</tbody>
</table>

* NOTE: Four Belleville washers, and a lock nut (in place of handle and retaining nuts) are used if the valve is automated with a pneumatic or electric actuator.
# Series D51

![Diagram of Series D51 valves](image)

## Dimensions

**inches / millimeters**

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Ball Port A Dia.</th>
<th>Ball Port B Dia.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>Weight lb. / kg</th>
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<td>1.44</td>
<td>7.00</td>
<td>2.68</td>
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<td>.60</td>
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<td>36.6</td>
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<td>28.45</td>
<td>28.45</td>
<td>92.5</td>
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Series 18/19: Upgrade the efficiency of your fluid diverting, filling and distribution systems through piping simplification, automation and safety

Flowserve Worcester Controls’ Series 18 and 19 multi-way valves are designed to improve the efficiency and productivity of your process systems with up to 5 ports, slip-on flanges, multiple seat and body materials, standard or full port, and optional pneumatic and electric automation and anti-fugitive emission design. Screwed, socket weld and butt weld ends are available as are slip-on flanges (ANSI Class 150 or 300).

Worcester Controls’ multi-way valves are available in four general configurations:
- Series 18 side entry, standard port valves
- Series B18 side entry, full port valves
- Series 19 bottom and side entry, standard port valves
- Series B19 bottom and side entry, full port valves

The wide variety of ball ports and piping connections present a large number of diverting possibilities.

Series 18 and 19 multi-way valves are available in sizes 1", 1 1/2", 2", 3", 4" and 6". Standard body materials are carbon steel and type 316 stainless steel; standard seat/seal materials are TFE and Polyfill®.

Flow Coefficient

<table>
<thead>
<tr>
<th>Valve Size (Inches)</th>
<th>Std. Port 90° Flow</th>
<th>Full Port 90° Flow</th>
<th>Operating Torque (in-lb)</th>
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<td>Cv</td>
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<td>95</td>
</tr>
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<td>46</td>
<td>220</td>
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<td>85</td>
<td>305</td>
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<td>149</td>
<td>204</td>
<td>1600</td>
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<td>4</td>
<td>210</td>
<td>360</td>
<td>2500</td>
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<td>6</td>
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<td>880</td>
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Seat Pressure/Temperature Ratings

![Seat Pressure/Temperature Ratings Graph]
### Series 18/19

**Dimensions: Series 18 Side Entry Standard Port Ball Valves**

**Inches / millimeters**

<table>
<thead>
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<th>Valve size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>Port Dia.</th>
<th>M</th>
<th>N</th>
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</tbody>
</table>

- **A**: ANSI Class 150 / ANSI Class 300
- **B**: ANSI Class 150 / ANSI Class 300
- **C**: ANSI Class 150 / ANSI Class 300
- **D**: Fractional
- **E**: Fractional
- **F**: Fractional
- **G**: Fractional
- **H**: Fractional
- **J**: Fractional
- **K**: Fractional
- **L**: Fractional
- **Port Dia.**: Fractional
- **M**: Fractional
- **N**: Fractional
Series 18/19

**Dimensions: Series B18 Side Entry Standard Port Ball Valves**

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<td>148</td>
<td>255</td>
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</tbody>
</table>

**NOTE:** Dimensions for the Series 19 and B19 bottom and side entry ball valves are similar to the Series 18 and B18 with the addition of the bottom flange with dimension C from the centerline. Weights of Series 18/19 valves vary depending upon the number of ports selected. Consult Flowserve.
### Series 18/19 Diverting Options (Plan Views)

#### Three-Way Series 18 and B18 Options 90° — Side Entry

<table>
<thead>
<tr>
<th>L Port</th>
<th>T Port</th>
<th>T Port</th>
<th>T Port</th>
<th>T Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA1</td>
<td>TA1</td>
<td>TA2</td>
<td>TA3</td>
<td>TA4</td>
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</table>

#### Three-Way Series 18 and B18 Options 180° — Side Entry

<table>
<thead>
<tr>
<th>L Port</th>
<th>T Port</th>
<th>T Port</th>
<th>T Port</th>
<th>T Port</th>
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<tbody>
<tr>
<td>LB1</td>
<td>TB1</td>
<td>TB2</td>
<td>TB3</td>
<td>TB4</td>
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#### Series 19 and B19 — Bottom Entry

<table>
<thead>
<tr>
<th>Two-Way Option 90°</th>
<th>Two-Way Option 180°</th>
<th>Three-Way Option 180°</th>
<th>Four-Way Option 360°</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Port</td>
<td>L Port</td>
<td>L Port</td>
<td>L Port</td>
</tr>
<tr>
<td>LA1</td>
<td>LB1</td>
<td>TB1</td>
<td>LD1</td>
</tr>
</tbody>
</table>
Flowserve Worcester Directional Ball Valves

⚠️ CAUTION: Ball valves can retain pressurized media in the body cavity when closed. Use care when disassembling. Always open valve to relieve pressure prior to disassembly.

Due to continuous development of our product line, we reserve the right to alter the information contained in this brochure as required.

Worcester is a registered trademark of Flowserve Corporation. Polyfill® is a registered trademark of Flowserve Corporation. Lubetal® is a trademark of Garlock Inc. Delrin® and Viton® are registered trademarks of E.I. DuPont de Nemours and Company.
### How to Order

**Series D44/D4**

<table>
<thead>
<tr>
<th>Size</th>
<th>D Type</th>
<th>Special Service Options</th>
<th>Series</th>
<th>Body &amp; Pipe Ends</th>
<th>Ball &amp; Stem</th>
<th>Seats*</th>
<th>Body Seals*</th>
<th>End Types §</th>
<th>Porting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>D – Diverter</td>
<td>V – Vacuum Service</td>
<td>44</td>
<td>1 – Brass (1/2&quot;-2&quot;)</td>
<td>6 – 316 Stainless Steel</td>
<td>T – TFE</td>
<td>T – TFE</td>
<td>SE – Screw End</td>
<td>V1</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>T – 3-way</td>
<td>X – Oxygen Service</td>
<td></td>
<td>4 – Carbon Steel</td>
<td></td>
<td>P – Polyfill</td>
<td>B – Buna</td>
<td>SW – Socket Weld</td>
<td>V2</td>
</tr>
<tr>
<td>1&quot;</td>
<td>G – Grounded Stem</td>
<td></td>
<td></td>
<td>6 – 316 Stainless Steel</td>
<td></td>
<td>Y – Lubetal</td>
<td>E – EPR</td>
<td>TE† – Tube End</td>
<td></td>
</tr>
<tr>
<td>11/2&quot;</td>
<td>E – No handle, Valve built for automation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R – Reinforced TFE</td>
<td>M – TFE Coated Gasket</td>
<td>TC – Quick Disconnect</td>
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<td>2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U – UHMWPE</td>
<td>V† – Viton®</td>
<td>XBO – Extended Butt Weld</td>
<td></td>
</tr>
</tbody>
</table>

**ORDERING EXAMPLE:** 1" Diverter Valve for Oxygen Service, Stainless Steel Body and Pipe Ends with Stainless Steel Ball and Stem, TFE Seats and Seals, Socket Weld Ends, and V1 Porting.

* The body seal is integral with the seat (one piece) on 3-way valves. 3-way valves are available with Fluoropolymer (T), Polyfill (P), or UHMWPE (U) seats only. When ordering 3-way valves, ignore the body seal column. Example: 1TX4466USEV1.

** Optional high pressure valve with Lubetal seats only.

§ In some cases, other pipe end styles are available for the right and/or left ports. Consult your Worcester Controls Distributor.

† Carbon Steel or Stainless Steel only.

†† Brass only.

**NOTE:**
- 3-way valves cannot be used in steam service or applications with large thermal cycles.
- 3-way valves do not have a separate body seal.
- Diverter valves with metal body seals as well as filled metal seats are available. Consult Worcester Controls.
- Multiport (diverter) valves are also available. Refer to brochure WCABR1002.
- WK44 with XBO and TC end connections available as Three-Way. Refer to brochure WCABR1035.
- Lubetal Seats cannot be used for oxygen service.

**Series D51**

<table>
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<tr>
<th>Size</th>
<th>D Type</th>
<th>Series</th>
<th>Body &amp; Pipe Ends</th>
<th>Ball &amp; Stem</th>
<th>Seats &amp; Body Seals</th>
<th>End Types</th>
<th>Porting</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>D – Diverter</td>
<td>51 - Flanged Valve</td>
<td>4 – Carbon Steel</td>
<td>6 – 316 Stainless Steel</td>
<td>T – TFE</td>
<td>150 – ANSI Class 150 Flanges</td>
<td>V1 - Porting 1*</td>
</tr>
<tr>
<td>3&quot;</td>
<td></td>
<td></td>
<td>6 – Stainless Steel</td>
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<td>4&quot;</td>
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</tr>
</tbody>
</table>

** Variations (V–Numbered Options) are noted at the end of the order number if needed. Leave blank if no variations. See list below for details.

Ordering Example: 3" Series D51 Flanged Diverter Valve with stainless steel body, stainless steel ball and stem, TFE Seats and body seal, ANSI Class 150 Flanges, and V1 Porting.

Note: Series D51 valves use standard Series 51 repair kits. Multiport diverter valves are also available. Refer to brochure WCABR1002.

⚠️ **CAUTION:** Series D51 flanged diverter valves with V1 porting (90° operation) lack indication of flow direction. The user should consider providing external flow indication when using these valves. Ball valves can retain pressurized media in the body cavity when closed. Use care when disassembling. Always open valve to relieve pressure prior to disassembly.

**Variations (V-numbers):** Listing of V-Number Descriptions

- **V5** - Hydrostatic Testing
- **V6** - Source Inspection
- **V14** - Handleless Valves
- **V17** - Grounding Thrust Bearing
- **V36** - Certificate of Compliance
- **V37** - Cert. of Compliance & Hydro Testing
- **V46** - Silicon Free Lubricant
- **V51** - High Cycle Stem Build
- **V66** - Cert. of Compliance for European valve orders/contracts
## How to Order

### Series 18/19

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<th>18</th>
<th>4</th>
<th>6</th>
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<th>T</th>
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<tbody>
<tr>
<td>Size</td>
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<td>Body &amp; Pipe Ends</td>
<td>Ball &amp; Stem</td>
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<td>Body Seals</td>
<td>End Types</td>
<td>Diverting Options</td>
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<td>Blank – Standard Port with Handle</td>
<td>18 – Side Entry</td>
<td>4 – Carbon Steel</td>
<td>6 – Stainless Steel</td>
<td>150 – ANSI Class 150 Flanges</td>
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<tr>
<td>1½&quot;</td>
<td>E – Standard Port, no Handle</td>
<td>19 – Bottom and side Entry</td>
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<td>P – Polyfill</td>
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<tr>
<td>2&quot;</td>
<td>B – Full Port, with handle</td>
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<td>T – TFE</td>
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</tr>
<tr>
<td>3&quot;</td>
<td>BE – Full Port, no handle</td>
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</tr>
</tbody>
</table>

The above code describes a 2" Series B18 side entry, full port valve (with handle) with carbon steel body and flanges, stainless steel trim, Polyfill seats, TFE body seals and ANSI Class 150 flanges, with LA1 porting.

**NOTE:** These valves are custom products. Please consult Flowserve for multi-way valve torque and more detailed dimensional information.
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The purchaser/user should read and understand the Installation Operation Maintenance (IOM) instructions included with the product, and train its employees and contractors in the safe use of Flowserve products in connection with the specific application.

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