Consistent performance for industries that demand reliability.

Virgo Triple Offset Butterfly Valves
Solutions for increased efficiency and extended service life in any condition.
Minimal maintenance. Small footprint. Zero leakage. What else could you want in a process valve?

Leaking valves pose safety and environmental hazards and result in operating losses. Your company suffers costly downtime when the process is taken offline to repair or change out valves. Replace unreliable equipment with Virgo’s Triple Offset Butterfly Valves from Emerson.

The Virgo Triple Offset Valve (TOV) is a quarter-turn, metal-to-metal sealing, zero leakage valve. Lighter weight compared to other types of valves, it features low operating torques, high cycle life, an inherently fire-safe design, a one-piece shaft with blowout-proof construction, sealed bearings, and adjustable shaft seals for low emissions.

Virtually maintenance-free, the Virgo TOV provides a longer service life at a lower cost than competing valves.

The versatility of design and construction allows for use in various applications and within a broad range of temperatures.

Unlike conventional butterfly and gate valves whose seats are chafed with every stroke, the design of the Virgo TOV provides a non-rubbing, open/close operation. Additionally, its torque-assisted seal assures tight shut-off and uniform contact without wear which translates to better performance over a longer life.

Virgo Triple Offset valves are the ideal choice for isolation. Where automation is required, actuation packages are available such as emergency shutdown, Safety Instrumented Systems (SIS), line break systems and remote operations.

Virgo TOV provides consistent performance with demanding processes, such as steam, vacuum, high pressure and cycled services. The Virgo TOV is relied upon in oil and gas process lines, refineries, power plants, sea water treatment facilities, pump stations, wastewater effluent treatment plants, circulating water systems, desalination facilities and cooling water system applications.

COMMON APPLICATIONS
- Isolation
- Fire Protection
- Storage and Transfer
- On / Off
- Safety Instrumented Systems
- Bypass Stations
- Emergency Shut-Down
THE VIRGO TRIPLE OFFSET VALVE CONFORMS TO API 609 DESIGN SPECS, MAKING IT APPLICABLE ACROSS A WIDE RANGE OF INDUSTRIES.

**PERFORMANCE ADVANTAGES**

The Virgo triple offset design material configurations afford the highest level of safety, compliance and performance in even the toughest applications.

**Highly reliable** — Virgo products are designed using the latest engineering tools and manufactured in our state-of-the-art facilities, resulting in products that are built to last.

**Lightweight and compact** — The Virgo TOV footprint is half the size of the typical gate valve, making it an ideal substitute. It is compact and lightweight enough to keep in spares inventory for rapid replacement when other valves fail.

**Easy automation** — Low torque and standardized mounting design allow for easy integration in a variety of automated systems.

**Long life expectancy** — Virgo TOV’s metal-to-metal sealing and non-rubbing features mean less wear, resulting in extended service life.

---

**REFINING**
- Isolation
- Steam supply
- Sulfur condenser switch
- FGD
- FCC
- Terminals and tank farms
- Coker plants
- Fire suppression

**PETROCHEMICALS / CPI**
- Flare gas
- Manifold isolation
- Hydrocarbon gas service
- Pump isolation
- ESDV

**UTILITIES**
- Water pipelines
- District storage and distribution
- Steam service

**POWER PLANTS**
- Pump isolation
- Condenser cooling
- Heat exchanger
- Suppression system
- Condensate cooling water
- Steam generation
- Gas turbine isolation

**OTHERS**
- LNG
- GTL
- Tanks and terminals
- Abrasive services
- Fire suppression
- Mining
- Salt water distillation
- Marine
**Technical Details**

OFFSET 1
First offset is a distance by which shaft is displaced from normal to flow line axis, thereby giving camming effect and reduced rubbing rotation while operating the valve.

OFFSET 2
Second offset is between shaft plane and seat plane, which allows complete sealing contact around the seat.

OFFSET 3
The seal is a segment taken from cone where apex of the cone is offset (3rd) from the flow line axis, which eliminates rubbing completely.

---

### Hydro Seat Testing (Drops per minute)

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>TriTork</th>
<th>Metal Seated Valve (Gate &amp; Ball)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2”</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2-1/2” - 6”</td>
<td>0</td>
<td>2 / NPS</td>
</tr>
<tr>
<td>8” - 12”</td>
<td>0</td>
<td>2 / NPS</td>
</tr>
<tr>
<td>&gt;14”</td>
<td>0</td>
<td>2 / NPS</td>
</tr>
</tbody>
</table>

### Gas Seat Testing (Bubbles per minute)

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>TriTork</th>
<th>Metal Seated Valve (Gate &amp; Ball)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2”</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2-1/2” - 6”</td>
<td>0</td>
<td>4 / NPS</td>
</tr>
<tr>
<td>8” - 12”</td>
<td>0</td>
<td>4 / NPS</td>
</tr>
<tr>
<td>&gt;14”</td>
<td>0</td>
<td>4 / NPS</td>
</tr>
</tbody>
</table>

**Notes:**
1. Gas test is carried out using air.
2. For metal seated valves, allowable leakage rate values are taken from API 598.
3. As per API 598, ‘Zero’ drops means no visible leakage per minimum specified test duration for liquid test and ‘Zero’ bubbles means less than one bubble per minimum specified test duration for gas test.
4. Performance is in preferred direction only.
5. NPS = Nominal Pipe Size
<table>
<thead>
<tr>
<th>Body</th>
<th>Size</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Flanged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Short Pattern)</td>
<td>3” to 56”</td>
<td>150, 300</td>
</tr>
<tr>
<td></td>
<td>3” to 48”</td>
<td>600</td>
</tr>
<tr>
<td>Double Flanged</td>
<td>3” to 56”</td>
<td>150</td>
</tr>
<tr>
<td>(Long Pattern)</td>
<td>3” to 36”</td>
<td>300, 600</td>
</tr>
<tr>
<td>Lug / Wafer</td>
<td>3” to 56”</td>
<td>150, 300</td>
</tr>
<tr>
<td></td>
<td>8” to 24”</td>
<td>600</td>
</tr>
</tbody>
</table>

### PRESSURE-TEMPERATURE RATING
(AS PER ASME B16.34)

![Pressure-Temperature Rating Chart]

### TYPICAL FLOW CHARACTERISTICS

![Typical Flow Characteristics Graph]

**Notes:**
- For higher pressure classes, please contact your Emerson Automation Solutions representative.
- Standard seal 575°F limit. Optional seals available for higher temperatures.

### REFERENCE STANDARDS

<table>
<thead>
<tr>
<th>Design and Manufacturing</th>
<th>API 609 (Category B), ASME B16.34, BS EN 593</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-Face / End-to-End</td>
<td>API 609, ASME B16.10, ISO 5752 Series 13, ISO 5752 Series 14</td>
</tr>
<tr>
<td>End Connection</td>
<td>ASME B 16.5 for flanged end up to 24” / ASME B16.47 for larger size Series A and B</td>
</tr>
<tr>
<td>Testing</td>
<td>API 598, ANSI / FCI 70-2</td>
</tr>
<tr>
<td>Safety</td>
<td>SIL3</td>
</tr>
<tr>
<td>Fire Test</td>
<td>API 607 / ISO 10497-5, API 6FA</td>
</tr>
<tr>
<td>Fugitive Emission Testing</td>
<td>MESC 77/312, ISO 15848-1</td>
</tr>
<tr>
<td>Material Conformance</td>
<td>NACE MR 01-75</td>
</tr>
<tr>
<td>Product Compliance</td>
<td>Pressure Equipment Directives PED (97/23/EC), EAC</td>
</tr>
</tbody>
</table>

*Note: Environmental restrictions may apply. End User’s responsibility to request*
Design Features

LOW EMISSION SHAFT SEAL
Adjustable shaft packing with multiple graphite rings located between two anti-extrusion rings control fugitive emission and give longer packing life. Gland packing with live loading is available as an option.

METAL-TO-METAL ‘ZERO’ LEAKAGE
Laminated resilient seal ring flexes to give uniform wedging effect and ensures ‘ZERO’ leakage. Resiliency of seal ring allows for the valve body and disc to expand or contract relative to each other without the risk of jamming while maintaining tight shut-off. Seal ring, secured but not locked in the disc by retainer ring and bolting, has radial freedom of movement. Spiral wound gasket behind seal ring ensures leak proof joint.

EXTERNALLY RETAINED BLOW-OUT PROOF DESIGN
Engineered gland design gives shaft blow-out proof protection externally, conforming to the requirements of API 609, (Category B).
STANDARD MOUNTING
Bracket top side drilling and shaft connection as per ISO 5211.

EXTERNAL INDICATOR FOR DISC POSITION
Disc position is indicated by dimple on shaft. When the dimple is in-line with flow axis, disc is open.

BEARING PROTECTION
Graphite ring in bearing ensures protection against ingress of line media in to the bearing surface and thus avoids jamming of shaft.

ONE-PIECE SHAFT
One-piece shaft is guided by long bearings, which are placed nearer to disc for close support. Bearings are super finished and nitrided for trouble free life. Within the pressure boundary area, the shaft design provides added strength.
## Diagram and Parts List

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Carbon Steel</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BODY</td>
<td>ASTM A216 Gr. WCB*</td>
<td>ASTM A351 Gr. CF8M*</td>
</tr>
<tr>
<td>1a</td>
<td>SEAT (INTEGRAL WITH BODY)</td>
<td>(STELLIET®) COBOLT CHROMIUM ALLOY 21</td>
<td>(STELLIET®) COBOLT CHROMIUM ALLOY 21</td>
</tr>
<tr>
<td>2</td>
<td>DISC</td>
<td>ASTM A216 Gr. WCB (with ENP)</td>
<td>ASTM A351 Gr. CF8M</td>
</tr>
<tr>
<td>3</td>
<td>SEAL RING**</td>
<td>DUPLEX+ GRAPHITE #</td>
<td>DUPLEX+ GRAPHITE #</td>
</tr>
<tr>
<td>4</td>
<td>SEAL RING LOCATING PIN</td>
<td>SS 316</td>
<td>SS 316</td>
</tr>
<tr>
<td>5</td>
<td>RETAINER RING</td>
<td>ASTM A516 Grade 60 (with ENP)</td>
<td>ASTM A240 TYPE 316</td>
</tr>
<tr>
<td>6</td>
<td>DISC GASKET **</td>
<td>SPIRAL WOUND SS316+GRAPHITE</td>
<td>SPIRAL WOUND SS316+GRAPHITE</td>
</tr>
<tr>
<td>7</td>
<td>RETAINER SCREWS</td>
<td>ASTM A193 Gr. B8M</td>
<td>ASTM A193 Gr. B8M</td>
</tr>
<tr>
<td>8</td>
<td>SHAFT</td>
<td>ASTM A479 TYPE 410</td>
<td>ASTM A564 TYPE 630</td>
</tr>
<tr>
<td>9</td>
<td>DISC PIN $</td>
<td>ASTM A479 TYPE 410</td>
<td>ASTM A564 TYPE 630</td>
</tr>
<tr>
<td>10</td>
<td>BEARING</td>
<td>ASTM A479 TYPE 316 (NITRIDED)</td>
<td>ASTM A479 TYPE 316 (NITRIDED)</td>
</tr>
<tr>
<td>11</td>
<td>BEARING PROTECTOR **</td>
<td>GRAPHITE</td>
<td>GRAPHITE</td>
</tr>
<tr>
<td>12</td>
<td>SPACER</td>
<td>ASTM A479 TYPE 316</td>
<td>ASTM A479 TYPE 316</td>
</tr>
<tr>
<td>13</td>
<td>GLAND PACKING **</td>
<td>GRAPHITE</td>
<td>GRAPHITE</td>
</tr>
<tr>
<td>14</td>
<td>GLAND</td>
<td>ASTM A479 TYPE 316</td>
<td>ASTM A479 TYPE 316</td>
</tr>
<tr>
<td>15</td>
<td>ANTI-BLOW OUT RING</td>
<td>ASTM A479 TYPE 316</td>
<td>ASTM A479 TYPE 316</td>
</tr>
<tr>
<td>16</td>
<td>GLAND PLATE</td>
<td>CARBON STEEL</td>
<td>STAINLESS STEEL</td>
</tr>
<tr>
<td>17</td>
<td>GLAND STUD</td>
<td>ASTM A193 Gr. B7M</td>
<td>ASTM A193 Gr. B8M</td>
</tr>
<tr>
<td>18</td>
<td>GLAND NUT</td>
<td>ASTM A194 Gr. 2HM</td>
<td>ASTM A194 Gr. 8M</td>
</tr>
<tr>
<td>19</td>
<td>SHAFT KEY (Not Shown)</td>
<td>UNS G10400</td>
<td>UNS G10400</td>
</tr>
<tr>
<td>20</td>
<td>BRACKET</td>
<td>CARBON STEEL</td>
<td>STAINLESS STEEL</td>
</tr>
<tr>
<td>21</td>
<td>BRACKET HEXBOLT</td>
<td>ASTM A193 Gr. B7M</td>
<td>ASTM A193 Gr. B8M</td>
</tr>
<tr>
<td>22</td>
<td>THRUST WASHER</td>
<td>ASTM A479 TYPE 316 (NITRIDED)</td>
<td>ASTM A479 TYPE 316 (NITRIDED)</td>
</tr>
<tr>
<td>23</td>
<td>STOP WASHER</td>
<td>ASTM A479 TYPE 316 (NITRIDED)</td>
<td>ASTM A479 TYPE 316 (NITRIDED)</td>
</tr>
<tr>
<td>24</td>
<td>ADJUSTABLE SCREW</td>
<td>ASTM A193 Gr. B8M</td>
<td>ASTM A193 Gr. B8M</td>
</tr>
<tr>
<td>25</td>
<td>BOTTOM FLANGE</td>
<td>ASTM A516 Grade 60</td>
<td>ASTM A240 TYPE 316</td>
</tr>
<tr>
<td>26</td>
<td>BOTTOM FLANGE GASKET **</td>
<td>SPIRAL WOUND SS316+GRAPHITE</td>
<td>SPIRAL WOUND SS316+GRAPHITE</td>
</tr>
<tr>
<td>27</td>
<td>BOTTOM FLANGE SCREWS</td>
<td>ASTM A193 Gr. B7M</td>
<td>ASTM A193 Gr. B8M</td>
</tr>
</tbody>
</table>

**Notes:**
- * Solid metal seal ring can be made available on request.
- * Other materials of construction such as Alloy Steel, Super Austenitic SS, Inconel®, Duplex SS, Super Duplex SS, etc. can be made available on request.
- ** Available as spares
- $ For 3” and 4” sizes, “Disc Keys” are used.
### PRODUCT SELECTION CODES

<table>
<thead>
<tr>
<th>Series</th>
<th>Ends</th>
<th>Size</th>
<th>Rating</th>
<th>Body</th>
<th>Disc</th>
<th>Seat (Integral)</th>
<th>Seal Ring</th>
<th>Shaft</th>
<th>Operator</th>
<th>Application/Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTF</td>
<td>RF</td>
<td>03</td>
<td>1</td>
<td>41</td>
<td>41</td>
<td>H</td>
<td>TN</td>
<td>TV</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>TG</td>
<td>RS</td>
<td>04</td>
<td>2</td>
<td>42</td>
<td>42</td>
<td>Z</td>
<td>89</td>
<td>A3</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>TL</td>
<td>FF</td>
<td>06</td>
<td>3</td>
<td>43</td>
<td>43</td>
<td>I8</td>
<td>QI</td>
<td>CY</td>
<td>G</td>
<td>F</td>
</tr>
<tr>
<td>TW</td>
<td>FS</td>
<td>08</td>
<td>6</td>
<td>44</td>
<td>44</td>
<td>CY</td>
<td>C9</td>
<td>H</td>
<td>J</td>
<td></td>
</tr>
<tr>
<td>TB</td>
<td>RT</td>
<td>10</td>
<td>9</td>
<td>45</td>
<td>45</td>
<td>D1</td>
<td>FW</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>BW</td>
<td></td>
<td>12</td>
<td>36</td>
<td>46</td>
<td>46</td>
<td>D1</td>
<td></td>
<td></td>
<td>EH</td>
<td>Z</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14</td>
<td>40</td>
<td>47</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>42</td>
<td>30</td>
<td>30</td>
<td>ZZ</td>
<td>L6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>48</td>
<td>31</td>
<td>31</td>
<td>ZZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>56</td>
<td>9</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td></td>
<td>IN</td>
<td>IN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S9</td>
<td>S9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>QN</td>
<td>QN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RF</td>
<td>RF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ZZ</td>
<td>ZZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Example:**

This code stands for double flanged (short pattern), raised face serrated, 8" #150, body & disc WCB, seat hard faced (Stellite®), seal laminated duplex + graphite, shaft SS 410, gear operated without special requirements.

**Butt Weld End Valves can be provided on request.**

*Stellite® is the registered trademark of the Kennametal Stellite Company.*

*Inconel® is a registered trademark of Special Metals Corporation.*

---

**Series**
- TTF: Double Flanged (Short Pattern)
- TG: Double Flanged (Long Pattern)
- TL: Lug (End Connection with Tapped Holes)
- TW: Lug (End Connection with Thru Holes)
- TB: Butt Weld End connection

**Ends**
- RF: Raised Face Serrated
- RS: Raised Face Smooth
- FF: Flat Face Serrated
- FS: Flat Face Smooth
- RT: Ring Type Joint

**Size**
- 3 – 3:" 16 – 16"
- 4 – 4:" 18 – 18"
- 5 – 5:" 20 – 20"
- 6 – 6:" 24 – 24"
- 8 – 8:" 30 – 30"
- 10 – 10:" 40 – 40"
- 12 – 12:" 48 – 48"
- 14 – 14:" 56 – 56"

**Rating**
- 1: #150
- 2: #1500
- 3: #300
- 6: #600
- 9: #900

**Body & Disc**
- 41: WCB
- 42: LCB
- 43: CF8
- 44: WCC
- 45: CF8M
- 46: CF3M
- 47: CF3
- 30: WC6
- 31: WC9
- 9: LCC
- IN: Inconel®
- S9: Gr. 4A
- QN: Gr. 5A
- RF: Gr. 6A
- ZZ: Others

**Seat (Integral)**
- H: Hard Faced (Stellite®)
- Z: Others

**Seal Ring**
- TN: Duplex + Graphite
- 89: SS 316 + Graphite
- I8: Inconel® 625 + Graphite
- CY: XM 19 + Graphite
- D1: Duplex
- 64: SS 316
- QZ: XM 19
- ZZ: Others

**Shaft**
- TV: SS 410
- A3: Inconel® 718
- C9: F6a
- FW: XM 19
- D1: F51
- J3: F53
- L6: F55
- ZZ: Others

**Operator**
- B: Bare Shaft
- E: Electrical Actuator
- G: Gear Operator
- H: Hydraulic Actuator
- P: Pneumatic Actuator
- EH: Electro-Hydraulic Actuator

**Application/Service**
- C: Cryogenic
- E: Extended Shaft
- F: Finned Bonnet
- J: Jacketed
- P: Purge applications
- Z: Standard requirement

---

*Stellite® is the registered trademark of the Kennametal Stellite Company.*

*Inconel® is a registered trademark of Special Metals Corporation.*
Why Virgo?
RELIBALE PRODUCTS AT A COMPETITIVE PRICE
Emerson’s investment in superior manufacturing equipment, an ongoing commitment to keep their employees well-trained and the quest for upper quartile performance are just a few items that drive our mission for the highest in-class quality. At the same time, our global supply chain and manufacturing allows us to produce products at very competitive prices when compared to other high-quality valve manufacturers.

EXPERT PROJECT MANAGEMENT
Virgo valves have been supplied to over 2300 projects around the globe, both large and small. We help our customers maintain project certainty by presale design collaboration, a structured project execution process and maintaining flexibility throughout the manufacturing process. The result is a responsive supplier that supports you throughout the process and meets the promised delivery dates.

SINGLE POINT ACCOUNTABILITY
Emerson owns the complete process from design, manufacturing, assembly, automation, proof testing, integration, and lifecycle coverage. Emerson goes to great lengths to maintain full process accountability that only a few industry-leading manufacturers can provide. This includes having our own in-house foundry, which enables Emerson to maintain the highest quality standards on all Virgo products.

LOCAL SUPPORT AND A GLOBAL PRESENCE
Our vast network of Sales Offices and Local Business Partners (LBPs) are available to support our customers around the globe. We provide our customers superior pre- and post-sales support, local inventory as well as a comprehensive range of other services.

SAFE, PROVEN PRODUCTS
We are committed to delivering quality products that meet or exceed our customers’ expectations. This commitment starts with thorough testing of our products to ensure they comply with the latest standards and maintain the highest safety ratings. These products are then certified by respected third party organizations. Our commitment is backed by years of experience in many of the most demanding applications around the globe. We have supplied over 1 million valves to more than 150 of the world’s leading EPCs, OEMs, and end users and they keep coming back to Emerson over and over.

For more information about Virgo Triple Offset Valves, contact your local Emerson sales office or Emerson Automation Solutions representative.