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ITT Industries, Engineered Valves Group (EVG) has been an innovator and producer of valves for over fifty years. These valves have gained extensive usage in many industries including power generation, pulp and paper, refineries, chemical process, pharmaceutical/bioprocessing and pollution control. As a recognized leader in the valve business, our heritage stems from diaphragm valves.

Through the years, our product offering has grown extensively. Our corrosion handling expertise has provided the impetus for the design of quarter-turn valve products like our Cam-Line® Ball Valve.

Introduction

By developing products such as the Cam-Line that address specific problems encountered in industry, we continue to expand our commitment to remain a leader in flow control.

The performance of our products is surpassed only by the care taken in the many facets of manufacturing. Excellence in quality assurance, product reliability, and product safety will always remain paramount.
The Cam-Line trunnion ball valve was designed to overcome problems inherent in conventional lined plug and ball valves. The design objective was to produce a lined quarter-turn valve with positive shut off at high and low pressures, a valve with a stem seal that seals, and a valve that is convenient and safe to operate.

Design innovation has resulted in the valve we proudly call the Cam-Line. The Cam-Line ball valve combines the proven, patented sealing technology of the Cam-Tite ball valve with a trunnion mounting. The result is tight shut off, reliable stem seal performance, and a dramatic torque reduction never before possible in a plastic lined quarter-turn valve.

The sealing mechanism begins as a sphere with a trunnion running through its vertical center. A waterway (port) passes through the center of the sphere. Around the edge of the waterway the spherical surface is cut away, forming a bevel that passes completely around the edge of the water-way. This is a very important feature of the design since it is the difference in the effective distance across the beveled surfaces and the distance across the spherical surface that actually energizes the seat when the valve is closed.

When the valve is open the seats rest against the beveled surfaces. Sealing takes place during closure of the valve when the spherical surface of the ball engages the seats.

Sealing is the result of designed seat compression, not the result of pressure or of crushing components together. The resultant seal is positive at both high and low pressures. And, since load on the seats is minimized when the valve is in the open position, cold flow of the seat material is dramatically reduced, prolonging seat life. With the sealing load on the seats controlled by the geometry of the components (not external adjustments as in lined plug valves), the Cam-Line is a safe and convenient valve to operate. A 6” Cam-Line requires less than 1,250 inch pounds to operate. No gears or cheaters required here!

An important consideration when using plastics in valves is the dimensional stability of the plastic elements. Reliable performance is dependent upon maintaining design dimensions. The objective is to get two or more components to meet each other so that nothing can get by them. Dimensional stability of the lining in the seal area is thus of prime importance. Conventional plug and ball valves place high loads on the plastic linings to get a seal, but often at the expense of valve life and operating ease.

To maximize valve life, the Cam-Line ball valve uses a trunnion not only to support and center the ball, but also as a method to distribute excess hydraulic load into the valve body in non-critical areas, rather than through the seating area. Result? The Cam-Line performs better and longer, even in thermal cycling applications.

The trunnion also aids the stem seal at the top of the valve. The long trunnion shaft reduces the effects of lateral loading found in conventional ball valves and when coupled with the low operating torques, produces a seal that proves a lined valve can have a good stem seal.

Design innovation didn’t stop with the basic valve. The choice of plastics and plastic processes has a direct effect on performance. So we engineered those, too. Our unique glass reinforced RTFE seats, along with a high stability ETFE thermoplastic lining, complete the package.

The Cam-Line® is an innovative design that gives:

- Positive Shut Off
- Reliable Stem Sealing
- Low Operating Torque
- Convenient and Safe Operation
- Long Service Life

And, to make it easy for you to use, the Cam Line® ball valve features ANSI 150# flanges with standard laying lengths and flange pad mounting.
All PTFE Seats are Not Created Equal
All Cam-Line seats are reinforced PTFE. The finished reinforced seats, when compared to virgin PTFE, exhibit the following performance advantages:

1. Improved dimensional stability
2. More uniform quality
3. Improved sealing characteristics

These properties, obtained through the reinforcing process, result in better sealing and longer seat life. Cam-Line reinforced PTFE seats, combined with the unique beveled edge ball design, result in superior shut-off performance.

Plastic Lining
All wetted parts of the Cam-Line are lined with plastic. Cam-Line linings are injection molded at high pressure. With injection molding we actually “build” a corrosion resistant plastic valve within the strong metal valve body. With injection molding, wall thickness can be varied to suit the mechanical requirements of the various valve sections, while minimum wall thickness is strictly controlled. In fact, all Cam-Line linings have a 3/16” minimum wall thickness. Cam-Line linings are “keyed” to the valve bore for extra stability. The one piece trunnion/ball of the Cam-Line is fully encapsulated with the plastic lining. The metal core is recessed and keyed to lock the lining in place. With the one-piece trunnion/ball design, the joint between the ball and stem as found in conventional lined ball valves is completely eliminated. You can be sure that the ball is in the position indicated by the top of the trunnion.

Experience Counts
Injection molding of plastic linings is not new to Engineered Valves Group (EVG). Initially introduced with its diaphragm valve product line, EVG has been molding plastic lined valves for the past fifty years. This experience and expertise led to the development of the patented “Boteler” method of injection molding valve linings in 1968. Over the years, thousands upon thousands of ball valves and diaphragm valves have been lined using this time proven method.

Testing
Every valve is tested prior to shipment. Both hydrostatic and seat tests (in accordance with MSS-SP-72) are performed to insure a high integrity, tight sealing valve. In addition, all plastic lined components are 100% spark tested prior to assembly to assure lining integrity.

ETFE Lining
ETFE can best be described as a rugged thermoplastic with an outstanding balance of properties. ETFE can perform successfully in applications where other materials are lacking in mechanical toughness, broad thermal capability, and the ability to meet severe environmental conditions.

Chemically, ETFE is a co-polymer of ethylene and tetrafluoroethylene. Mechanically, ETFE is tough, exhibits high tensile strength and hardness, and is more creep resistant than PTFE, FEP or PFA fluorocarbon resins. The ETFE used in the Cam-Line is reinforced with glass, yielding a tensile strength approaching 12,000 PSI. ETFE has outstanding resistance to attack by chemicals and solvents that often cause rapid deterioration of other plastic materials. ETFE is inert to strong mineral acids, inorganic bases, halogens, and metal salt solutions. Carboxylic acids, anhydrides, aromatic and aliphatic hydrocarbons, alcohols, aldehydes, ketones, ethers, chlorocarbons, and classic polymer solvents have little effect on the material.
Plastic Lined Trunnion Ball Valve

Live loaded multi-ring stem packing
From its inception the Cam-Line ball valve has utilized an emission reduction stem packing design. Multiple V-rings are placed in a deep stuffing box and are loaded via the gland follower using adjustable cap screws. Belleville spring washers are employed to maintain packing compression and to adjust for service variables.
Cam-Line® Technical Data

Operating Torques/Flow Coefficients (Cv)
The actual amount of torque required to operate a valve is dependent upon many variables, such as line pressure, temperature, type of fluid, frequency of operation, etc. The following tables are based on average breakaway torque requirements for a valve handling a clean, particle free liquid such as water. The torque values listed should be adjusted for special service conditions. For fluids with high solids or abrasive content, consult factory for recommendations.

When sizing an actuator for automatic operation, it is recommended not to exceed the Maximum Stem Torque as noted below. This will avoid permanent damage to the valve stem as a result of a blocked valve and an oversized operator.

<table>
<thead>
<tr>
<th>Size</th>
<th>Torque (in lbs.)</th>
<th>Max. Stem Torque (in lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾”-1”</td>
<td>120</td>
<td>709</td>
</tr>
<tr>
<td>1½”</td>
<td>130</td>
<td>1870</td>
</tr>
<tr>
<td>2”</td>
<td>280</td>
<td>1870</td>
</tr>
<tr>
<td>3”</td>
<td>500</td>
<td>3030</td>
</tr>
<tr>
<td>4”</td>
<td>800</td>
<td>5740</td>
</tr>
<tr>
<td>6”</td>
<td>1250</td>
<td>24500</td>
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</table>

Flow Coefficients (Cv)

<table>
<thead>
<tr>
<th>Size</th>
<th>Flow Coefficients (Cv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾”-1”</td>
<td>30</td>
</tr>
<tr>
<td>1½”</td>
<td>73</td>
</tr>
<tr>
<td>2”</td>
<td>160</td>
</tr>
<tr>
<td>3”</td>
<td>355</td>
</tr>
<tr>
<td>4”</td>
<td>751</td>
</tr>
<tr>
<td>6”</td>
<td>800</td>
</tr>
</tbody>
</table>

Pressure/Temperature Curve for ETFE Lining Reinforced PTFE Seats

Cam-Line Options

External Protection with Corrosion Resistant PVDF
For ultimate exterior corrosion protection in aggressive chemical environments, Cam-Line ball valves can be externally coated with PVDF. A popular feature of the Dia-Flo® Diaphragm Valve, this optional 6-8 mil coating is applied to all ductile iron components of the Cam-Line prior to the valve being lined. The result is a mechanically tough coating that is resistant to spills, splash, and corrosive atmospheres at temperatures to 200°F. ETFE lined Cam-Line ball valves coated with PVDF are equipped with stainless steel fasteners to enhance total corrosion resistance.
Cam-Line® Options (continued)

Cavity Vents/Chlorine
When specified, Cam-Line ball valves can be provided with a vented seat to relieve excess pressure within the body cavity. Such valves are unidirectional and include an external tag with an arrow to indicate the direction of seat tightness. Use suffix “V” in the configuration number to specify a vented cavity only. Use “CLV” to specify a vented valve prepared for chlorine service. Note: As the Cam-Line is an ANSI 150# design, Engineered Valves Group (EVG) only recommends the valve for Class 1 dry chlorine gas service.

Grounding Devices
Upon request Cam-Line ball valves can be equipped with a grounding strap to provide electrical continuity between all metal components. Grounded valves receive a continuity test prior to shipment to assure a resistance reading less than 5 ohms. Use suffix “G” in the configuration number to specify a grounding device.

Oxygen Service
Cam-Line ball valves can be prepared for oxygen service. Oxygen preparation includes special cleaning, assembly, testing, and packaging. Valves prepared for oxygen service are lubricated with Krytox® 206 and are equipped as standard with a grounding strap. Use suffix “OX” in the configuration number to specify oxygen preparation.

Locking Devices
When required, Cam-Line ball valves can be supplied with a locking handle device to provide lockout in both the open and closed positions. These locking devices, designed to meet the requirements of OSHA 1910.147, can be supplied with new valves or can be retrofit to existing valves which have drilled and tapped flange pads. Stainless steel is the standard material of construction for the Cam-Line locking device. Use suffix “LDS” in the configuration number to specify this lockout feature.

Handle Options
The unique low torque design of the Cam-Line allows the use of lever handles throughout the entire size range. In addition to the standard lever handles, the following handle options can be supplied:

• Oval Safety Handwheels (through 2”)
• 45° T Handles for chain operation (specify valve in vertical or horizontal position)
• Extended Handles (specify extension length)

For additional information on how to order the above options, see page 18 of the catalog. For additional technical information, contact your Engineered Valves Group (EVG) Technical Sales Representative.
With its simple, 90 degree rotation, the Cam-Line ball valve can be easily supplied with a variety of quarter-turn operators for automated valve service. Utilizing flange pads for actuator mounting, the low torque design of the Cam-Line allows smaller, less costly actuation devices to be employed.

Another advantage of actuating the Cam-Line comes from the camming action of the ball. Since there is virtually no load on the seats when the valve is in the open position, there is no high “breakaway torque” associated with beginning the closing cycle. The actuator is able to start motion from the open position with little resistance. Only when the valve is essentially closed does the actuator see the design torque of the valve. This operation is extremely beneficial for “fail closed” valves in hostile service conditions.

The Cam-Line ball valve can be equipped with a wide range of actuator types (pneumatic and electric) and can be packaged with an assortment of accessory components, such as solenoid valves and limit switches.

Compact Actuator
The Compact quarter-turn pneumatic actuator has been developed to be a simple, reliable, and efficient valve operator by utilizing a patented rack and pinion design. Four separate racks, each driven by its own piston, develop torque around the centrally located pinion. The four rack concept permits operating air pressure to be applied to four pistons simultaneously, increasing torque output and reducing piston diameter and overall actuator size, compared to single and double rack designs. Symmetrically spaced at 90 degree angles around the central pinion, the Compact’s four racks also achieve a more uniform load distribution between the rack and pinion, greatly reducing gear wear at these contact points and curbing stress on the pinion and piston seals. The result is a high cycle actuator design.

A look at the design of the Compact reveals several other important product advantages:

- Minimal air consumption
- Energy efficiency
- Fast response
- Compact, lightweight design

The table below shows the Compact actuator sizing for Cam-Line ball valves. This table is based on standard operating torques for a valve handling a clean, particle-free liquid such as water. For dirty fluids or media with high solids or abrasive contents, consult the factory for sizing recommendations.

### Compact Spring Return or Double Acting
Cam-Line Ball Valve

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>DN</th>
<th>Available Operating Air</th>
<th>Double Acting</th>
<th>Spring Return-Fail Closed</th>
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<tbody>
<tr>
<td>1½”</td>
<td>40</td>
<td>C20DA</td>
<td>C15DA</td>
<td>C25-2A2B</td>
</tr>
<tr>
<td>2”</td>
<td>50</td>
<td>C25DA</td>
<td>C25DA</td>
<td>C35-2A2B</td>
</tr>
<tr>
<td>3”</td>
<td>80</td>
<td>C30DA</td>
<td>C25DA</td>
<td>C45-2A2B</td>
</tr>
<tr>
<td>4”</td>
<td>100</td>
<td>C35DA</td>
<td>C30DA</td>
<td>C60-2A2B</td>
</tr>
<tr>
<td>6”</td>
<td>150</td>
<td>C45DA</td>
<td>C35DA</td>
<td>C60-2A2B</td>
</tr>
</tbody>
</table>

Notes: 1. Actuator sizing based on 20% safety factor.
2. Use higher safety factor when handling gases, viscous liquids and crystallizing media - consult factory.
### Dimensions for Manual Valves, Materials of Construction

#### Inches

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<thead>
<tr>
<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>I'</th>
<th>K</th>
<th>Weight Lbs</th>
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<tbody>
<tr>
<td>³/₄&quot;</td>
<td>5.00</td>
<td>4.72</td>
<td>6.50</td>
<td>0.75</td>
<td>2.03</td>
<td>4.25</td>
<td>2.75</td>
<td>2.81</td>
<td>*</td>
<td>8.7</td>
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<tr>
<td>1&quot;</td>
<td>6.50</td>
<td>5.06</td>
<td>8.50</td>
<td>1.12</td>
<td>2.59</td>
<td>5.00</td>
<td>3.88</td>
<td>3.00</td>
<td>0.62</td>
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<td>1½&quot;</td>
<td>7.00</td>
<td>5.38</td>
<td>11.50</td>
<td>1.50</td>
<td>3.03</td>
<td>6.00</td>
<td>4.75</td>
<td>3.12</td>
<td>0.75</td>
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<td>2&quot;</td>
<td>8.00</td>
<td>6.47</td>
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<td>3.91</td>
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#### MM

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<th>E'</th>
<th>F'</th>
<th>G'</th>
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<th>I'</th>
<th>K</th>
<th>Weight Kgs</th>
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<tr>
<td>³/₄&quot;</td>
<td>127.0</td>
<td>119.9</td>
<td>165.1</td>
<td>19.1</td>
<td>51.6</td>
<td>108.0</td>
<td>70.0</td>
<td>71.4</td>
<td>*</td>
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<td>4.00</td>
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<tr>
<td>1&quot;</td>
<td>165.1</td>
<td>128.5</td>
<td>215.9</td>
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<td>65.8</td>
<td>127.0</td>
<td>98.6</td>
<td>76.2</td>
<td>15.7</td>
<td>7.9</td>
<td>4.3</td>
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<tr>
<td>1½&quot;</td>
<td>177.8</td>
<td>136.7</td>
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<td>77.0</td>
<td>152.4</td>
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<td>19.1</td>
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<tr>
<td>2&quot;</td>
<td>203.2</td>
<td>164.3</td>
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<td>57.2</td>
<td>99.3</td>
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<td>*19.1</td>
<td>22.3</td>
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<tr>
<td>4&quot;</td>
<td>228.6</td>
<td>187.5</td>
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<tr>
<td>6&quot;</td>
<td>266.7</td>
<td>230.1</td>
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<td>241.3</td>
<td>155.4</td>
<td>*22.4</td>
<td>66.6</td>
<td></td>
</tr>
</tbody>
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* *3/4"* 150 Lb. class flanged bolt holes are tapped 1/2"-13 UNC class 2B. Top two flanged bolt holes on 3" & 4" 150 Lb. class valves are drilled and tapped 5/8"-11 UNC class 2B. Top four flanged bolt holes on a 6" 150 Lb. class valve are drilled and tapped 3/4"-10 UNC class 2B.

#### Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Material</th>
<th>Qty</th>
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<td>1</td>
<td>Body (Lined)</td>
<td>DI ASTM A395 GR. 60-40-18</td>
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<td>2</td>
<td>Seat</td>
<td>Reinforced PTFE</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Cover (Lined)</td>
<td>DI ASTM A395 GR. 60-40-18</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Packing, &quot;O&quot;-Ring (Complete Set)</td>
<td>PTFE</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Follower, Gland-PVDF Coated</td>
<td>DI ASTM A536 GR. 65-45-12</td>
<td>1</td>
</tr>
<tr>
<td>6*</td>
<td>Washer, Thrust</td>
<td>PTFE</td>
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</tr>
<tr>
<td>6**</td>
<td>O-Ring</td>
<td>CS</td>
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<td>7</td>
<td>Screw, Hex Soc. Hd. Cap</td>
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*Lubricant DuPont KRYTOX® GPL-206*
### Dimensions for Actuator Mounting

#### Inches

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>A&quot;</th>
<th>B&quot;</th>
<th>C&quot;</th>
<th>D&quot;</th>
<th>E&quot;</th>
<th>F&quot;</th>
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For ultimate exterior corrosion protection in aggressive chemical environments, Cam-Line ball valves can be externally coated with PVDF. A popular feature of the Dia-Flo® Diaphragm Valve, this optional 6–8 mil coating is applied to all ductile iron components of the Cam-Line prior to the valve being lined. The result is a mechanically tough coating that is resistant to spills, splash, and corrosive atmospheres at temperatures to 200° F. ETFE lined Cam-Line ball valves coated with PVDF are equipped with stainless steel fasteners to enhance total corrosion resistance.

Data, recommendations, and suggestions contained herein are based on experiences in actual field applications as well as common corrosion data. However, because of so many possible variances in practices from plant to plant, these recommendations are intended for use only as a guide and should not be interpreted as a guarantee.

Selections in the following pages have been made with safety and serviceability as the foremost considerations.

Many variables enter into the question of serviceability. Factors such as concentration, temperature, pressure, velocity, percent solids, temperature cycling, vacuum, cleaning practices, etc. are all important in determining whether or not a particular material will give satisfactory service.

Of the endless number of chemical compounds many are insoluble in water and would consequently cause no corrosion problems when in water. However, some of these simple services can become difficult when it is necessary to make such materials soluble through use of some other solvent. For example, sulfuric acid is commonly used as a solvent for silver chloride. Then the recommendation must take into account both silver chloride and sulfuric acid. As a general rule, it is recommended that pipeline or tank material be used for the valve body whenever possible.

Engineered Valves cannot accept responsibility for the accuracy, currency or reliability of the information contained herein. Selection of materials is at the sole risk of the user. Consult factory for services not listed.
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# How to Order Cam-Line Valves

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## Flanged Ends – Lined

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<td>1159</td>
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<td>ETFE Lined (PVDF Coated)</td>
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## Exterior Trim

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<td>ET1</td>
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<td>Carbon Steel</td>
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## Handle Options

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<td>HANDWHEEL</td>
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<td>HD4</td>
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## Locking Device

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## Grounding Strap

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<td>C3</td>
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## Optional Preparation

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<td>CLV</td>
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## Extended Stem

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## Compact Actuator

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<td>LS2N</td>
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## Filter Regulator

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<td>SC</td>
<td>Schrader 337-1001</td>
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1. **CONTROLLING PROVISIONS:** These terms and conditions shall control with respect to any purchase order or sale of Seller's products. No waiver, alteration or modification of these terms and conditions whether on Buyer's purchase order or otherwise shall be valid unless the waiver, alteration or modification is specifically accepted in writing and signed by an authorized representative of Seller.

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5. **SELLER’S LIABILITY:** Seller will not be liable for any loss, damage, cost of repairs, incidental or consequential damages of any kind, whether based upon warranty (except for the obligation accepted by Seller under “Warranty” above), contract or negligence, arising in connection with the design, manufacture, sale, use or repair of the products or of the engineering designs supplies to Buyer.

6. **RETURNS:** Seller cannot accept return of any products unless its written permission has been first obtained, in which case same will be credited subject to the following: (a) All material returned must, on its arrival at Seller’s plant, be found to be in first-class condition; if not, cost of putting in saleable condition will be deducted from credit memoranda; (b) A handling charge will be made from all credit memoranda issued for material returned; (c) Transportation charges, if not prepaid, will be deducted from credit memoranda.

7. **SHIPMENTS:** All products sent out will be carefully examined, counted and packed. The cost of any special packing or special handling caused by Buyer’s requirements of requests shall be added to the amount of the order. No claim for shortages will be allowed unless made in writing within ten (10) days of receipt of a shipment. Claims for products damaged or lost in transit should be made on the carrier, as Seller’s responsibility ceases, and title passes, on delivery to the carrier.

8. **SPECIAL PRODUCTS:** Orders covering special or non-standard products are not subject to cancellation except on such terms as Seller may specify on application.

9. **PRICES AND DESIGNS:** Prices and designs are subject to change without notice. All prices are F.O.B. Point of Shipment, unless otherwise stated.

10. **TAXES:** The amount of any sales, excise or other taxes, if any, applicable to the products covered by this order, shall be added to the purchase price and shall be paid by Buyer unless Buyer provides Seller with an exemption certificate acceptable to the taxing authorities.

11. **MINIMUM INVOICE:** $200.00 plus transportation on complete valve assemblies. $100.00 plus transportation on replacement parts.

12. **TERMS:** Cash, net 30 days unless otherwise specified.

**WARNING**

Engineered Process Solutions Group Valves are designed and manufactured using good workmanship and materials, and they meet all applicable industry standards. These valves are manufactured with various materials, and they should be used only in services recommended by a company engineer. Misapplication of the product may result in injuries or property damage. A selection of valve components of the proper material and consistent with the particular performance requirement is important for proper application.

Examples of the misapplication or misuse of any Engineered Process Solutions Group products include use in an application in which the pressure / temperature rating is exceeded or failure to maintain valve performance requirement is important for proper application.

If the valve exhibits any indication or leakage, do not operate. Isolate valve and either repair or replace.

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Cam-Line® is a registered trademark of ITT Industries

Cam-Tite® is a registered trademark of ITT Industries

Dia-Flo® is a registered trademark of ITT Industries
ITT Engineered Valves: 65 Years of Providing Quality, Innovative Solutions

ITT Engineered Valves has earned the reputation for delivering the highest quality, innovative valve solutions for a wide range of industrial fluid control needs. These best in-class quality valves have been the foundation for industries such as Mining, Power Generation, Pollution Control, Pulp and Paper, Chemical Processing, Water Treatment, Pharmaceutical, Food and Beverage, and Bio-Processing.

Through both standard and custom designed valve assemblies, ITT Engineered Valves is your partner in providing the best quality and value engineered solutions for your unique flow control needs.

- Dia-Flo® Diaphragm Valves
- Fabri-Valve® Knife Gate, Slide Gate, Wedge Gate and Custom-Fabricated Valves
- Cam-Tite® Hazardous and Critical Duty Ball Valves
- Cam-Line® Plastic Lined Ball Valves
- Skotch® Burner Safety Shut-Off valves