EXPERIENCE, DEDICATION AND VISION

Introducing Forum Energy Technologies – a global provider of manufactured technologies and applied products and services. We may be a new name to you but our equipment and employees have a long history of solving our customers’ challenges. FET brings together some of the most well-known brands in our industry with an extensive range of mission critical products and services. We are building a world class company to bring innovative solutions to our worldwide customers. With offices in the key energy centers of the globe, Forum is well-positioned to supply our clients with the equipment and related services that improve safety and performance and lower operating costs.

Forum's products and services range from the underground reservoir to the refinery, from the sea floor to the above ground transportation line, to Power plants, mines, and heavy industry. We pride ourselves on giving you a comprehensive offering of solutions to maximize your operations and improve your bottom line. Our customers are our partners and we work with them to solve their ever-changing challenges.
FORUM provides a broad range of chokes/control valves, to meet most applications from basic manual operated to fully automated systems. As the industry continues to increase technology demands, operators select FORUM to obtain best-in-class service, performance and value. We are ISO-9001 certified, thus assuring design and manufacturing of the highest quality products available in the market.

**Plant Applications**

- Typical Combined Cycle
- Typical Fossil Fueled

**Accuseal® SPV Features and Benefits**

- Features and Benefits
- Cutaway Image with Labels

**Accuseal® SPV - Steam Power Ball Valve**

- Bill of Materials
- Size and Pressure Class
- End Connections
- Accuseal® SPV Cv's & Dimensions
- ASME 600 - 1500 Limited Class
- ASME 3200 Limited Class
- ASME 4500 Limited Class

**Accuseal® CSV - Critical Service Ball Valve**

- Applications
- Bill of Materials
- Size and Pressure Class
- End Connections
- Sealing Options
- Features and Benefits
- Accuseal® CSV Cv's and Dimensions

**Accuseal® CR2 Valve**

- Applications
- Bill of Materials
- Sizes and Pressure Class
- End Connections
- Features and Benefits
- Field Repair Kit
- ASME 1500 - 4500 Limited Class

**Low Pressure - Steam Power (SP2) Valve**

- Application Specific Features
- Bill of Materials
- Actuation Controls
- Certifications
- Industries Served
- Dimensions

**Grayloc® Connectors**

- Components
- Service Extremes

**Accuseal® Valves Quality**

- Accuseal® Valves Certifications
- Actuation
- Accuseal® Product Warranty
- Accuseal® Product Test Procedures
**Why Accuseal® MSBVs?**

**Why make Accuseal® your severe service metal-seated ball valve of choice?**

Demands on power generation plants are unprecedented. In combined cycle plants nearly every unit is required to perform as a flexible generating plant, swinging load in response to fluctuations in energy demand. As coal fired plants age, they experience more frequent outages and more starts. Mechanical equipment, including valves, must meet the ever increasing challenges relating to cycling and thermal transience. Reliable, repeatable isolation has never been more critical.

**There is a difference!**

Many claim to be the best. All have a ball, seat and stem. But which valve most consistently provides tight shutoff under the most challenging of conditions? You choose severe service valves with care because the consequences of failure are severe. Accuseal® Valves provides many advantages in power generation applications.

**Accuseal® Valves deliver predictable reliability and performance**

- **Optimized Ball Valve Design and Engineering Software**
  
  Proprietary software fast tracks optimal valve engineering.

- **Superior Valve Coatings**
  
  Accuseal®’s state-of-the-art HP-HVOF (high pressure – high velocity oxygen fuel) coatings provide maximum protection for longer valve life.

- **Exclusive Accuseal Fused and thermally stabilized coatings are metallurgically bonded to the base material, to handle even the most severe thermal stresses.**

- **OMNI-LAP 360°™**
  
  The proprietary Accuseal® mate-lapping process laps the entire spherical surface of the ball and seat surface, not just the sealing band areas.

- **Vacuum Seal Test**
  
  Accuseal® ball and seat sealing is tested prior to valve assembly, ensuring seal integrity.

**Optimized ball valve design and engineering software**

Extensive severe service ball valve engineering experience is combined with proprietary valve optimization CAD/CAM/CAE software and fast-tracks optimized valve design. Service conditions are simulated, providing feedback with engineering analysis, FEA (Finite Element Analysis) and CFD (Computational Fluid Dynamics). Beginning to end, the most current Product Life-Cycle Management (PLM) software is used.

Advantages Include:

- Optimized ball/seat sealing engagement
- Line of sight bore for totally unobstructed media flow
- Optimized ball/stem tang interface
- Thermally stabilized seat geometry allows for rapid sealing
**Superior valve coatings**

Not all HVOF coatings are equal.

- Accuseal®’s HVOF coating formulas are the most consistent and least porous available, matched to the ball/seat material. State of the art technology applies the coating at the highest velocity for greatest density coverage, superior bond strength and surface hardness. Ongoing research ensures the most reliable coating is matched to service conditions.
- Accuseal®’s Fused carbide coating are thermally stabilized to handle high cycle and high thermal cycle applications.
  - Superior coating performance under thermal stress and media bombardment.
  - Longer valve life with smooth surface integrity.
  - No place for leak paths to develop.
  - Reduced torque values to operate the valve.

**Omni-Lap 360°™**

Proprietary mate-lapping produces the tightest, most reliable seal available. All metal seated ball valves rely on continuous, unbroken contact between the metal ball and seat to create an isolating seal. Omni-Lap 360°™ mate-laps the entire ball and seat for optimal roundness, producing 100% ball to seat contact, regardless of positioning.

Traditional cup-lapping methods mate only the sealing band of the ball to seat surfaces creating ridges that distort the ball’s roundness and compromise the coating thickness. The sealing “sweet spot” originates a leak path if even slightly misaligned resulting in reduced valve life, more maintenance and higher actuation costs.

<table>
<thead>
<tr>
<th>Omni-Lap 360°™</th>
<th>Traditional Lapping</th>
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</thead>
<tbody>
<tr>
<td>Automated lapping of the entire spherical surface</td>
<td>Laps only a sealing band</td>
</tr>
<tr>
<td>Consistent 100% roundness</td>
<td>Distorts roundness</td>
</tr>
<tr>
<td>Uniform coating thickness</td>
<td>Compromises coating thickness</td>
</tr>
<tr>
<td>Seals in any position</td>
<td>Creates ridges around “sweet spot”</td>
</tr>
<tr>
<td>100% ball to seat contact</td>
<td>Surface irregularities cause higher torques</td>
</tr>
<tr>
<td>Smooth surfaces reduce friction for lower torques</td>
<td></td>
</tr>
</tbody>
</table>

**Vacuum seal testing**

Accuseal® Valves vacuum testing of every ball and seat prior to assembly verifies 100% ball-to-seat seal to Class VI shut-off.

- Seal reliability is ensured
- Greater manufacturing efficiency means lower cost
- Easier valve assembly — in the factory and in the field
A. Feedwater System
- Deaerator Vent
- Isolation valves on Bypass Lines
- Extraction Steam Drain

B. HRSG
- Boiler Feed Pump Isolation
- Boiler Feed Pump Shell Drain
- Control Valve Isolation
- Boiler Feed Pump Warm-Up Line Drain
- Reheat / Superheat Spray Isolation
- Drum Blowdown Root Valve / Isolation Vents
- Drum Instrument Isolation
- Automatic Relief Valve
- Sight-Glass Block / Drain
- Tandem Blowdown
- Boiler Blowdown
- Primary Superheat Drain / Vent / Instrument Isolation
- Secondary Superheat Drain / Vent / Instrument Isolation
- Reheat Drain / Vent / Instrument Isolation

C. HP Turbine Steam Supply & Extraction Systems
- Main Steam Drain
- Main Steam Before and After Seat Drain
- Main Steam Land Drain
- Turbine Bypass Isolation
- Bypass Valves

D. IP & LP Turbine Steam Supply & Extraction Systems
- Supply Extraction Systems
- Hot Reheat Drain
- Hot Reheat at the CRV Drain
- IP and LP Turbine Extraction Drain
A. Condensate System
- Deaerator Vent
- Isolation Valves on Bypass lines
- Extraction Steam Drain
- Feedwater Heater Drain / Vent
- Shell Side Instrument Isolation

B. HP Feedwater
- Boiler Feed Pump Discharge Isolation
- Boiler Feed Pump Shell or Case Drain
- Boiler Feed Pump Minimum Flow Isolation
- Boiler Feed Pump Warming Line Isolation / Drain
- Reheat / Superheat Spray Isolation
- Feedwater Heater Isolation
- Bypass Valves
- Economizer Drain

C. Boiler System
- Drum Blowdown Root Valve
- Drum Instrument Isolation
- Sight-Glass Isolation
- Water Wall Drain / Vent
- Tandem Blowdown
- Mass Boiler Blowdown
- Primary Superheat Drain / Vent

D. HP Turbine Steam Supply and Extraction Systems
- Supply and Extraction Systems
- Main Steam Drain
- Main Steam Before and After Seat Drain
- Main Steam Lead Drain
- Turbine Bypass Isolation
- Bypass Valves

E. IP and LP Turbine Steam Supply and Extraction Systems
- Supply Extraction Systems
- Hot Reheat Drain
- IP and LP Turbine Extraction Drain

Auxiliary Systems
- Sootblower Piping System
- Sootblowing Header Isolation
- Sootblower Regulator Isolation
- Sootblower Control Valve Block
- Sootblower System Crossover Header Isolation
- Sootblower Bank Isolation
- Individual Sootblower Isolation
- Air Heater Sootblower Steam Supply Line Shutoff
- Sootblower Thermal Drains / Bypass
- HP and LP Steam Supply System to the BFP Turbine
- Main Steam Supply Isolation Valve
- HP BFP Steam Supply Drain
- HP BFP Below and Above Seat Drain
- Bypass Lines
- Extraction Steam Supply to LP BFP Turbine Drains
- LP BFP Below and Above Seat Drain
- Inerting Steam System
- Inert Steam Inlet to Pulverizer Blocking / Automated Isolation
- Steam Supply to Inerting System Pressure Regulator Isolation
- Extraction Steam Supply line to the Inerting Steam Header Drain
- Isolation Valves on the Bypass Lines
- Inserting System Steam Header Thermal Drain
Accuseal® Features & Benefits

1. **Body** – one-piece machined forged bar stock
   - Mechanical and chemical integrity ensured — NO body leaks
   - Extended uni-body design protects seat during Post Weld Heat Treat (PWHT)

2. **Ball** – OMNI-LAP 360°™ provides perfect roundness and eliminates high stress areas due to lapped ridge.

3. **Seat**
   - Thermally stabilized and optimized seat geometry maintains maximum seal, even during thermal transience.

4. **Wave Spring**
   - Superior performance to Belleville springs
   - More predictable force on ball to seat seal—even at low pressure
   - Longer spring life means longer valve life

5. **Stem** – One piece with surface hardening
   - Eliminates galling potential between rotating parts
   - Stem standard ASME keyed for reliable adaption

6. **Dual Inconel 718 Pins**
   - Oversized pins contained in thrust collars
   - Blow-out proof stem to ASME B16.34

7. **Mounting Flange**
   - Precision machined to ISO 5211
   - External mounting flange provides rigid mounting for ease of actuation
   - Direct mounting option reduces hysteresis and stem deflection

8. **Lockout Standard**
   - Fulfills Open/Closed lockout requirements

9. **Articulating Gland Flange**
   - Spherically engages with packing follower
   - Prevents stem binding and galling during adjustments

10. **Live Loaded Packing**
    - Standard with Belleville spring washers
    - Eliminates routine gland adjustments
    - Reduces maintenance
    - Guarantees zero stem emissions

11. **Open/Closed Indicator**
    - Scribed lines on stem and articulating gland flange
    - Ensures proper ball to seat alignment
    - Positive Open/Closed indicator

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**Field Repair Kit**

**BALL AND SEAT**
- Inconel 718 ball and seat
- Fused Carbide coating - thermally stabilized
- OMNI-LAP 360°™

Computer optimized sealing geometry.
All field repair kits are vacuumed tested to ensure Class VI shut-off.

**WAVE SPRING**
- Superior performance to Belleville springs
- More predictable force on ball to seat seal — even at low pressure
- Longer spring life means longer valve life

---

*Optimized Seat  Ball  Load Ring  Wave Spring*
Socketweld ends per ASME B16.11

Optimized Seat

Articulating Gland Flange

Wave Spring

1 ring = F22  
2 rings = A105  
3 rings = F91

PWHT guide line per ASME B31.1 (see IOM for details)

Nameplate
Accuseal® - Steam Power Valve (SPV)

Applications
- Boiler Drains and Vents
- Turbine Drains and Vents
- Control Valve Isolation
- Equipment Isolation
- Longer lasting alternative to gate and globe valves

Size
½” – 2½” (various bore sizes available)

ASME Pressure Class
600 - 4500 Limited Class

End Connections
- SW – ASME B16.11 (Standard)
  Per customer specifications

Features and Benefits
- OMNI-LAP 360°™ optimized roundedness and matched ball and seats assemblies ensure 100% seal
- 410 HVOF trim for boiler drains and vents
- 718 Fused Carbide trim for HP drains, HRH drains, turbine drains and any high cycle or high thermal stress applications
- Withstands severe thermal shocks
- Tight shutoff to API 598/MSS SP-61
- Wave spring maximizes thermal cycling strength for longer life
- ISO 5211 Mounting Patterns

5 year warranty standard for all steam and feedwater services

Bill of Materials - Accuseal® SPV

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>A105</td>
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<tr>
<td></td>
<td></td>
<td>A182 F22 Cl.3</td>
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<tr>
<td></td>
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<td>A182 F91</td>
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<td>2</td>
<td>Ball</td>
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<tr>
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<td>Inconel 718 / Spray &amp; Fuse (Std. 3200 – 4500 Cl.)</td>
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<tr>
<td>3</td>
<td>Seat</td>
<td>410 HVOF / CC Coating (Std. 600-3200 Cl.)</td>
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<td></td>
<td></td>
<td>Inconel 718 / Spray &amp; Fuse (Std. 3200 – 4500 Cl.)</td>
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<tr>
<td>4</td>
<td>Wave Spring</td>
<td>A-286</td>
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<td>5</td>
<td>Stem</td>
<td>Inconel 718 / A-286 Hardfaced</td>
</tr>
<tr>
<td>6</td>
<td>Packing Bushing</td>
<td>316 SS Hardfaced</td>
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<tr>
<td>7</td>
<td>Packing Rings</td>
<td>Grafoil</td>
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<td>Anti-Extrusion Ring</td>
<td>Inconel Wire Reinforced Grafoil</td>
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<td>9</td>
<td>Packing Follower</td>
<td>316 SS Hardfaced</td>
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<td>10</td>
<td>Articulating Gland Flange</td>
<td>4130 Hardfaced</td>
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<td>11</td>
<td>Live Loading Belleville Springs</td>
<td>Stainless Steel</td>
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<td>12</td>
<td>Retaining Pins</td>
<td>Inconel 718</td>
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<tr>
<td>13</td>
<td>Guide Bearing</td>
<td>Ni-Al-Brz</td>
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<td>14</td>
<td>Stem Retaining Ring</td>
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<td>15</td>
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<td>Carbon Steel</td>
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<td>16</td>
<td>Transition Piece</td>
<td>410 SS</td>
</tr>
<tr>
<td>17</td>
<td>Load Ring/Retaining Ring</td>
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Special alloys and coatings available upon request
CC = Chrome Carbide coating
### Dimension – ASME 600, 900, 1500 Limited Class

<table>
<thead>
<tr>
<th>Model</th>
<th>Bore (inches)</th>
<th>Class</th>
<th>SW End</th>
<th>Pipe Size (inches) / Schedule</th>
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<td>1500</td>
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### Maximum Operating Pressure Rating vs. Temperature

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>-20° to 100°</th>
<th>100°</th>
<th>200°</th>
<th>300°</th>
<th>400°</th>
<th>500°</th>
<th>600°</th>
<th>700°</th>
<th>800°</th>
<th>900°</th>
<th>950°</th>
<th>1000°</th>
<th>1050°</th>
<th>1100°</th>
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<tbody>
<tr>
<td>Temp (°C)</td>
<td>-29° to 38°C</td>
<td>38°C</td>
<td>54°C</td>
<td>66°C</td>
<td>79°C</td>
<td>93°C</td>
<td>106°C</td>
<td>119°C</td>
<td>132°C</td>
<td>149°C</td>
<td>165°C</td>
<td>182°C</td>
<td>199°C</td>
<td>216°C</td>
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### Cv – ASME 600, 900, 1500 Limited Class

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<tr>
<th>Bore (inches)</th>
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<th>0.75</th>
<th>0.75</th>
<th>1.00</th>
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<tr>
<td>SCH 80</td>
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<td>16</td>
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</table>

### Maximum ratings shown above are limited by material design considerations.

The valve body is designed in accordance with ASME B16.34 Limited Class pressure rating requirements for the designated pressure class.
ASME 3200 LTD

![Valve Diagram]

## Cv – ASME 3200 Limited Class

<table>
<thead>
<tr>
<th>Bore (inches)</th>
<th>Pipe Size (inches) / Schedule</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Weight</th>
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<td>0.50 0.50</td>
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### Maximum Operating Pressure Rating vs. Temperature

<table>
<thead>
<tr>
<th>ASME 3200 LTD</th>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>200°</th>
<th>300°</th>
<th>400°</th>
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<th>600°</th>
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<th>950°</th>
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</thead>
<tbody>
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</tr>
</tbody>
</table>

(1) Not recommended for prolonged use above 800°F / 427°C
(2) Not recommended for prolonged use above 1100°F / 593°C
(3) 1.69 SPV is rated at 2500 LTD Class, not 3200 LTD Class.

NOTE: MAXIMUM differential pressure across valve = 4500 psig

Reduced ratings shown above are limited by material design considerations.
The valve body is designed in accordance with ASME B16.34 Limited Class pressure rating requirements for the designated pressure class.
## Cv – ASME 4500 Limited Class

| Bore (inches) | 0.50 | 0.50 | 0.75 | 0.75 | 1.00 | 1.00 | 1.50 | 1.50 | 2.00 | 2.00 | 2.50 | 2.50 | SCH 160 | SCH 160 | SCH XXS | SCH XXS | SCH 160 | SCH XXS | SCH 160 | SCH XXS | SCH 160 | SCH XXS |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Dimension – ASME 4500 Limited Class | | | | | | | | | | | | | | | | | | | | | |
| Model | Bore | Class | SW End | Pipe Size (inches) / Schedule |
| Accuseal® | 0.66 | 4500 | 0.75 | 8.50 | 215.90 | 4.75 | 120.65 | 18.00 | 457.20 | 5.09 | 129.29 | 7.79 | 197.87 |
| Accuseal® | 1.00 | 4500 | 1.50 | 7.25 | 184.15 | 4.75 | 120.65 | 18.00 | 457.20 | 5.09 | 129.29 | 7.79 | 197.87 |
| Accuseal® | 2.00 | 4500 | 2.00 | 8.00 | 203.20 | 4.75 | 120.65 | 18.00 | 457.20 | 5.09 | 129.29 | 7.79 | 197.87 |
| Accuseal® | 1.00 | 4500 | 1.50 | 8.25 | 209.55 | 5.38 | 136.53 | 18.00 | 457.20 | 6.25 | 158.75 | 9.35 | 237.49 |
| Accuseal® | 2.00 | 4500 | 2.00 | 8.25 | 209.55 | 5.38 | 136.53 | 18.00 | 457.20 | 6.25 | 158.75 | 9.35 | 237.49 |
| Accuseal® | 2.50 | 4500 | 2.50 | 8.25 | 209.55 | 5.38 | 136.53 | 18.00 | 457.20 | 6.25 | 158.75 | 9.35 | 237.49 |

## Dimension – ASME 4500 Limited Class

<table>
<thead>
<tr>
<th>Model</th>
<th>Bore</th>
<th>Class</th>
<th>SW End</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Weight</th>
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<td>0.75</td>
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<td>120.65</td>
<td>18.00</td>
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<td>5.09</td>
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<td>4500</td>
<td>1.50</td>
<td>7.25</td>
<td>215.90</td>
<td>4.75</td>
<td>120.65</td>
<td>18.00</td>
<td>457.20</td>
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<td>Accuseal®</td>
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<td>4500</td>
<td>2.00</td>
<td>8.00</td>
<td>203.20</td>
<td>4.75</td>
<td>120.65</td>
<td>18.00</td>
<td>457.20</td>
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## Maximum Operating Pressure Rating vs. Temperature

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>ASME 4500 LTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20° to 100°</td>
<td>6000</td>
</tr>
<tr>
<td>200°</td>
<td>6000</td>
</tr>
<tr>
<td>300°</td>
<td>6000</td>
</tr>
<tr>
<td>400°</td>
<td>6000</td>
</tr>
<tr>
<td>500°</td>
<td>6000</td>
</tr>
<tr>
<td>600°</td>
<td>6000</td>
</tr>
<tr>
<td>700°</td>
<td>6000</td>
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<tr>
<td>800°</td>
<td>6000</td>
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<tr>
<td>900°</td>
<td>6000</td>
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<tr>
<td>950°</td>
<td>6000</td>
</tr>
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<td>1000°</td>
<td>6000</td>
</tr>
<tr>
<td>1050°</td>
<td>6000</td>
</tr>
<tr>
<td>1100°</td>
<td>6000</td>
</tr>
</tbody>
</table>

(1) Not recommended for prolonged use above 800°F / 427°C
(2) Not recommended for prolonged use above 1100°F / 593°C

**NOTE:** MAXIMUM differential pressure across valve = 6000 psig

Reduced ratings shown above are limited by material design considerations.
The valve body is designed in accordance with ASME B16.34 Limited Class pressure rating requirements for the designated pressure class.
Accuseal® CR2

Applications
- Boiler Drains and Vents
- Turbine Drains and Vents
- Control Valve Isolation
- Equipment Isolation
- Longer lasting alternative to gate and globe valves

Sizes
1” - 8” (various bore sizes available)

Pressure Class
600 - 4500 Limited Class

Socket weld, Buttweld and Hub Connections
Complies with the ASME Section VIII Div. 1, 2 and 3 Boiler and Pressure Vessel codes. ASME Certificates of Authorization for ASME Section VIII Div. 1 (“U”), 2 (“U2”) and 3 (“U3”) are currently maintained.

Features and Benefits
- Provides reduced total cost of ownership for operator
- Hub eliminates welding and PWHT requirements after installation
- Designed for extended lifespan with easy disassembly, maintenance, and complete repairability in the field
- Omni-Lap 360° TM optimized roundness and matched ball and seat assemblies ensure 100% seal
- TSO (Tight shut-off) to API 598/MSS SP-61
- Withstands severe thermal shocks

5 year warranty standard

Bill of Materials - Accuseal® CR2

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>A105</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A182 F22 Cl.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A182 F91</td>
</tr>
<tr>
<td>2</td>
<td>End Connect</td>
<td>A105</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A182 F22 Cl.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A182 F91</td>
</tr>
<tr>
<td>3</td>
<td>Ball</td>
<td>Inconel 718 / Spray &amp; Fuse</td>
</tr>
<tr>
<td>4</td>
<td>Seat</td>
<td>Inconel 718 / Spray &amp; Fuse</td>
</tr>
<tr>
<td>5</td>
<td>Wave Spring</td>
<td>A-286</td>
</tr>
<tr>
<td>6</td>
<td>Stem</td>
<td>Inconel 718 / A-286 Hardfaced</td>
</tr>
<tr>
<td>7</td>
<td>Packing Bushing</td>
<td>316 SS Hardfaced</td>
</tr>
<tr>
<td>8</td>
<td>Packing Rings</td>
<td>Grafoil</td>
</tr>
<tr>
<td>9</td>
<td>Anti-Extrusion Ring</td>
<td>Inconel Wire Reinforced Grafoil</td>
</tr>
<tr>
<td>10</td>
<td>Packing Follower</td>
<td>316 SS Hardfaced</td>
</tr>
<tr>
<td>11</td>
<td>Articulating Gland Flange</td>
<td>4130 Hardfaced</td>
</tr>
<tr>
<td>12</td>
<td>Live Loading Belleville Springs</td>
<td>Stainless Steel</td>
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<tr>
<td>13</td>
<td>Retaining Pins</td>
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<td>14</td>
<td>Guide Bearing</td>
<td>Ni-Al-Brz</td>
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<td>Stem Retaining Ring</td>
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<td>16</td>
<td>Mounting Flange</td>
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<td>17</td>
<td>Gasket</td>
<td>Graphite</td>
</tr>
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<td>18</td>
<td>Retaining Sleeve</td>
<td>304 SS</td>
</tr>
</tbody>
</table>

Bidirectional designs available. Special alloys and coatings available upon request.

The Accuseal® Hub-End CR2 allows repair or replacement with no welding or hot work permit. A field repair kit and 2 new hub gaskets are all that is required.
Accuseal® CR2

Maximum Operating Pressure Rating vs. Temperature

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>-20° to 100°</th>
<th>200°</th>
<th>300°</th>
<th>400°</th>
<th>500°</th>
<th>600°</th>
<th>650°</th>
<th>700°</th>
<th>750°</th>
<th>800°</th>
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<th>900°</th>
<th>950°</th>
<th>1000°</th>
<th>1050°</th>
<th>1100°</th>
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<tbody>
<tr>
<td>ASME 1500 LTD</td>
<td>A 105 (1)</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
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<td>-</td>
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<td>-</td>
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<td></td>
<td>A 182 Gr. F22 Cl. 3 (2)</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
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<table>
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<th>Temp (°C)</th>
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<th>343°</th>
<th>371°</th>
<th>399°</th>
<th>427°</th>
<th>454°</th>
<th>482°</th>
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<th>593°</th>
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<td>4500</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>-20° to 100°</th>
<th>200°</th>
<th>300°</th>
<th>400°</th>
<th>500°</th>
<th>600°</th>
<th>650°</th>
<th>700°</th>
<th>750°</th>
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<th>950°</th>
<th>1000°</th>
<th>1050°</th>
<th>1100°</th>
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<tbody>
<tr>
<td>ASME 4500 LTD</td>
<td>A 105 (1)</td>
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<tr>
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<td>6000</td>
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</tbody>
</table>

(1) Not recommended for prolonged use above 800°F / 427°C
(2) Not recommended for prolonged use above 1100°F / 593°C

NOTE: MAXIMUM differential pressure across valve = 6000 psig

Reduced ratings shown above are limited by material design considerations.
The valve body is designed in accordance with ASME B16.34 Limited Class pressure rating requirements for the designated pressure class.
Accuseal® Critical Service Ball Valve (CSV)

Applications
• Critical Isolation
• Custom designed to solve problem applications

Size
½” – 30” (larger sizes available)

ASME Pressure Class
150 - 4500 (standard, limited and special classes)

Sealing Options
• Uni-directional - Standard
• Bi-directional - Optional

End Connections
Per customer specifications

Features and Benefits
• Omni-Lap® 360° ball and seat
• Application specific coatings
• Coating matched to ball and seat materials to withstand thermal shocks
• Articulating gland flange prevents stem binding and galling during adjustments
• External and internal guide bearings insure proper alignment preventing lateral motion of the stem, even during side loading
• Replaceable ball and seats provide field repairability

1 year warranty on standard service
(contact Accuseal® Valves for details)

Bill of Materials - Accuseal® CSV

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
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<td></td>
<td>A182 F91</td>
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<tr>
<td>2</td>
<td>Ball</td>
<td>410 SS / CC Coating</td>
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<tr>
<td></td>
<td></td>
<td>Inconel 718 / Spray &amp; Fuse</td>
</tr>
<tr>
<td>3</td>
<td>Seats</td>
<td>410 SS / CC Coating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inconel 718 / Spray &amp; Fuse</td>
</tr>
<tr>
<td>4</td>
<td>Belleville Spring</td>
<td>Inconel 718</td>
</tr>
<tr>
<td>5</td>
<td>Stem</td>
<td>A-286 Hardfaced</td>
</tr>
<tr>
<td>6</td>
<td>Inner Stem Seal</td>
<td>410 SS / CC Coating Hardfaced</td>
</tr>
<tr>
<td>7</td>
<td>Packing Bushing</td>
<td>316 SS Hardfaced</td>
</tr>
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<td>8</td>
<td>Packing Rings</td>
<td>Grafoil</td>
</tr>
<tr>
<td>9</td>
<td>Anti-Extrusion Ring</td>
<td>Inconel Wire Reinforced Grafoil</td>
</tr>
<tr>
<td>10</td>
<td>Packing Follower</td>
<td>316 SS Hardfaced</td>
</tr>
<tr>
<td>11</td>
<td>Articulating Gland Flange</td>
<td>410 SS Hardfaced</td>
</tr>
<tr>
<td>12</td>
<td>Live Loading Belleville</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>13</td>
<td>Stem Retaining Ring</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>14</td>
<td>Mounting Flange</td>
<td>Carbon Steel</td>
</tr>
<tr>
<td>15</td>
<td>Body Gasket</td>
<td>Spiral Wound Grafoil Filled/Inconel 718 Gold Plated</td>
</tr>
</tbody>
</table>

Special alloys and coatings available upon request.

Body Gaskets
Spiral Wound Gaskets
• Grafoil filled
• 1500 pressure class and below

Engineered Body Seal
• 2500 pressure class and above
• Gold plated Inconel 718
• Pressure assisted seal

Buttweld ends per ASME B16.25
Accuseal® Critical Service Ball Valve (CSV)

1. ASME 4500 pressure class bore / Cv varies according to application (values determined based on customer needs). Contact Accuseal® Valves for sizes and pressure classes not listed.

### ASME 150

| Size (inches) | Valve Size | 0.75 | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 | Note 1 |
|---------------|------------|------|------|------|------|------|-------|
| 0.5           | 75         | 54   | 48   | 43   | 39   | 39   | 36    |
| 1             | 144        | 126  | 110  | 102  | 102  | 92   |       |
| 1.5           | 270        | 251  | 223  | 198  | 198  | 83   |       |
| 2             | 549        | 498  | 429  | 382  | 382  | 163  |       |
| 2.5           | 948        | 842  | 720  | 421  | 421  | 236  |       |
| 3             | 1474       | 1250 | 1114 | 1076 | 682  | 438  | Note 1|
| 4             | 2932       | 2539 | 2134 | 1600 | 1283 | 919  |       |
| 6             | 6393       | 6316 | 5366 | 4101 | 3281 | 2482 |       |
| 8             | 12497      | 11931| 9966 | 7468 | 6106 | 5508 |       |
| 10            | 20612      | 19966| 15889| 12737| 9933 | 8772 |       |
| 12            | 30897      | 29974| 24953| 18474| 14641| 13051|       |

### ASME 2500

- **Accuseal® CSV – Bore**
- **Accuseal® CSV Cv – Full Bore**
- **Accuseal® CSV 0.5" - 12" Dimensions**

1. ASME 4500 pressure class bore / Cv varies according to application (values determined based on customer needs). Contact Accuseal® Valves for sizes and pressure classes not listed.

### ASME 900

### ASME 1500

### ASME 600

### ASME 2500
Low Pressure - Steam Power (SP2) Valve

Application Specific Features

- **FULL BORE**
  Straight through, smooth full bore flow path allows for highest flowing capacity (Cv or Kv) with no flow interruptions.

- **AUTOMATED LAPPING**
  An automated mate-lapping system laps the ball and seat in unison, creating 100% matched sealing surfaces (a mirror-like finish) that equates to gas-tight sealing.

- **INTEGRAL SEAT DESIGN, 2-PIECE CONSTRUCTION**
  HVOF Chromium Carbide Coated Ball & Seat

- **ZERO LEAKAGE SEAT TIGHTNESS**
  All (100%) valves are tested to ‘Zero Leakage’ acceptance criteria API 598 with low pressure gas test.

- **MOUNTING FLANGE FOR AUTOMATION**
  Mounting Flange allows user to adapt many actuators with ease.

- **REPAIRABLE**
  Valve is repairable and can be supplied with spare parts kit.

### BILL OF MATERIALS - SP2 VALVE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>CARBON &amp; LOW ALLOY STEEL</th>
<th>AUSTENITIC STAINLESS STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>A105, A182 F22, A182 F5, F9, F91</td>
<td>A182 F316, A182 F317, A182 F347</td>
</tr>
<tr>
<td>2</td>
<td>End Connect</td>
<td>A105, A182 F22, A182 F5, F9, F91 with HVOF Chromium Carbide</td>
<td>A182 F316, A182 F317, A182 F347 with HVOF Chromium Carbide</td>
</tr>
<tr>
<td>3</td>
<td>Ball</td>
<td>410 SS, HVOF Chromium Carbide</td>
<td>316 SS, HVOF Chromium Carbide</td>
</tr>
<tr>
<td>4</td>
<td>Seat</td>
<td>410 SS/ Nitrided</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Stem</td>
<td>410 SS/ Nitrided</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Spring</td>
<td>Inconel 718</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Gland</td>
<td>316 SS</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Inner Stem Bearing</td>
<td>410 SS Nitrided</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Body Bolting</td>
<td>B7 &amp; B16</td>
<td>B8</td>
</tr>
<tr>
<td>10</td>
<td>Gland Bolting</td>
<td>B8</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Body Gasket</td>
<td>Spiral Wound</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Packing</td>
<td>Graphite Per API 622</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Live Load Springs</td>
<td>17-7 PH SS</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Lever</td>
<td>Steel with Handle Grip</td>
<td></td>
</tr>
</tbody>
</table>

1. Please consult factory for materials not listed.
2. Not shown.

Actuation and Controls

Accuseal Valves has access to all types of Actuation and Controls:
- Pneumatic and Hydraulic actuators
- Spring Fail and Double-Acting
- Electric actuators
- Volume boosters & tanks
- Solenoids, Filters, Positioners
**Industries Served**

- **POWER**
  - Condensate Isolation
  - LP, IP, and CRH Vents and Drains
  - Heater drains and vents
  - Instrument Isolation
  - Tight Shutoff to API 598/MSS SP-61

- **REFINING**
  - Petrochemical
  - Chemical
  - Hydrocracking and Hydro-processing

- **MINING**
  - Vent and Drains
  - Water Service with Solids

### STEAM POWER VALVE, LOW PRESSURE – SP2

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE</th>
<th>CHARACTERISTICS</th>
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<tbody>
<tr>
<td>1</td>
<td>Design</td>
<td>ASME B16.34</td>
</tr>
<tr>
<td>2</td>
<td>Temperature</td>
<td>-20 to 1,000°F (537°C)</td>
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<tr>
<td>3</td>
<td>ASME Class Ratings</td>
<td>150, 300, and 600</td>
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<tr>
<td>4</td>
<td>Size</td>
<td>1/2 to 2 (DN15 to DN50)</td>
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<tr>
<td>5</td>
<td>Material Type</td>
<td>Forgings</td>
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<tr>
<td>6</td>
<td>End Types</td>
<td>Buttwwelding Ends, Socketwelding Ends, Threaded Ends, Flanged Ends</td>
</tr>
<tr>
<td>7</td>
<td>Sealing</td>
<td>Uni - Directional</td>
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<tr>
<td>8</td>
<td>Testing</td>
<td>Zero Leakage, API 598</td>
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<tr>
<td>9</td>
<td>Special</td>
<td>NACE MR0103, Non Destructive Examination (NDE), Positive Material Identification (PMI), Low-E Packing for Fugitive Emissions</td>
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<td>10</td>
<td>Certifications</td>
<td>ISO 9001-2008, PED / CE, API 607, Canadian Registry Number (CRN), Indian Boiler Regulations (IBR)</td>
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</table>

### DIMENSIONS in/mm

<table>
<thead>
<tr>
<th>NPS (inches)</th>
<th>DN</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>WEIGHT</th>
<th>C_v</th>
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<tbody>
<tr>
<td>0.5</td>
<td>15</td>
<td>6.50</td>
<td>165.1</td>
<td>3.74</td>
<td>95.0</td>
<td>1.61</td>
<td>41.0</td>
<td>3.32</td>
<td>84.5</td>
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<tr>
<td>0.75</td>
<td>20</td>
<td>6.50</td>
<td>165.1</td>
<td>3.74</td>
<td>95.0</td>
<td>1.61</td>
<td>41.0</td>
<td>3.32</td>
<td>84.5</td>
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<tr>
<td>1</td>
<td>25</td>
<td>8.00</td>
<td>203.2</td>
<td>4.92</td>
<td>125.0</td>
<td>1.89</td>
<td>48.0</td>
<td>3.66</td>
<td>93.0</td>
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<tr>
<td>1.5</td>
<td>40</td>
<td>9.50</td>
<td>241.3</td>
<td>5.83</td>
<td>148.0</td>
<td>2.52</td>
<td>64.0</td>
<td>4.59</td>
<td>116.5</td>
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<tr>
<td>2</td>
<td>50</td>
<td>11.50</td>
<td>292.1</td>
<td>6.70</td>
<td>170.0</td>
<td>3.15</td>
<td>80.0</td>
<td>4.92</td>
<td>125.0</td>
</tr>
</tbody>
</table>
A Grayloc® Connector has three components:

**Metal Seal Ring** – The Grayloc® seal ring achieves a self-energized and pressure-energized bore seal that will hold vacuum or external pressures. The metal Grayloc® seal ring consists of a rib and two lips. During make-up, the seal ring lips deflect inward as the connector is assembled. This deflection is controlled and is within the elastic limits of the seal ring material.

**Two Hubs** – The clamp fits over the two hubs and forces them against the seal ring rib. As the hubs are drawn together by the clamp assembly, the seal ring lips deflect against the inner sealing surfaces of the hubs. This deflection elastically loads the lips of the seal ring against the inner sealing surface of the hub, forming a self-energized seal.

**Clamp Assembly** – The clamp is the primary pressure-retaining member of the Grayloc® connector, not the bolting. The two-piece clamp configuration insures equal loading around the entire connector. The clamp carries all of the internal pressure loads as well as axial and bending loads transmitted by the pipe. No specific orientation is required when the clamps are installed around the hubs.

**Service Extremes**

Vibration, heat, cold and thermal shock often accompany service where Grayloc® connectors are heavily loaded. Grayloc® connectors consistently withstand severe situations without routine maintenance. Special designs permit maintenance-free service even under the extreme conditions shown at left.
Accuseal® Valves Quality

Accuseal® Valves manufactures to ASME B16.34

Certifications

Actuation
- ISO 5211 mounting patterns
- Accuseal® Valves automates to customer specifications

COOPER® Product Warranty

Accuseal® SPV, CR2 – Steam Power Ball Valves
- Standard: 5 years
- High cycle: 1 year
Contact Accuseal® Valves for additional warranty information

Accuseal® CSV – Critical Service Ball Valves
- Standard: 1 year

Accuseal® SP2 –
- Standard: 1 year
Contact Accuseal® Valves for additional warranty information

Accuseal® Product Test Procedures
- Standard valve testing to meet or exceed MSS SP-61, FCI 70-2, and API 598
- Exclusive vacuum testing of ball and seat to verify seal prior to valve assembly
Our goal is to become the leading provider of mission critical oilfield products and related services in terms of customer satisfaction, safety and financial performance.

Our experienced management team and employees are dedicated to solving our customers’ problems. We invest in long term relationships and cooperate on product development with our clients, we consider them our partners.

OUR CORE VALUES

**Integrity:** In everything we do, in every interaction, both internally and externally, we strive to operate with the utmost integrity and mutual respect.

**Long-term view:** We are building our company for the long-term, a company that we can be proud of.

**Open communication:** We believe partnerships with our customers and co-workers must be based on trust, professionalism and transparency.

**Customer focused:** Our products enhance our customer’s performance and we listen to their needs and work with them to solve their challenges.

**Good place to work:** We are committed to creating a workplace that fosters innovation, teamwork and pride. Every team member is integral to our success and is treated equally and fairly.

**No one gets hurt:** The safety of our employees and customers is our first priority coupled with a healthy respect for the environment.

For more information about our products and full Terms & Conditions please visit www.f-e-t.com.