Hypresphere®
Trunnion-Mounted Ball Valves
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History

The first Hypresphere ball valve

The first transmission pipeline ball valve manufactured and installed in the United States was a Hypresphere valve. It was installed in 1953 and, to our knowledge, it is still in operation!

The first generation model had a free-floating ball and a bolted body construction. The early Hypresphere ball valves established a reputation for dependable, trouble-free service and — most importantly — bubble-tight shut-off in natural gas applications.

A great valve was made even better

In the early 1970s, a redesign program was developed to reduce service needs as well as to create a more cost efficient design. The design objectives were to:

1. provide dependable, long-term seat and stem sealing systems;
2. utilize top and bottom trunnions, for low torque;
3. have a stem independent of the top trunnion, to provide greater strength and reliability; and
4. use computer analysis to optimize the body design.

The result of this highly successful redesign program was the Hypresphere Trunnion-Mounted Ball Valve (TMBV).

The unique Hypresphere TMBV design

We put more seating — a lot more — where you need it. Our seat covers 6º to 7º of the ball, and as far as we can determine, that is twice as much as our nearest competitor. The wide seat area is especially important for long seat life, or when you rely on an actuator for closing the valve.

All Hypresphere ball valves share the exclusive design features that made them the valves of choice — for one very good reason, the superior sealing system.

Hypresphere ball valves have an exclusive triple-sealing seat system to give you years of bubble-tight, trouble-free service. A distinguishing characteristic of this design is its provision for metal-to-metal sealing contact between the seat and ball, with an elastomeric insert, as an added feature, to enhance the bubble-tightness of the seal. And both of these are backed-up by a fully contained sealant injection system that provides a renewable seal if there is damage to the other elements. The seat system is self-relieving, to eliminate pressure build-up inside the center cavity.

All sizes of Hypresphere ball valves feature a trunnion mounted ball. Trunnion-mounting allows upstream sealing of the valve, so that block and bleed operations can be carried out. It also means the forces exerted against the ball by pipeline pressure are absorbed through the trunnions and body, rather than the sealing elements — and assures dependable, predictable operating torque.

The all-welded, spherical steel body assures reliability when subjected to fire, arctic conditions, and extreme bending moments.

The stem sealing system, which uses elastomeric materials and a sealant injection system, has been verified in all applicable industry tests and years of service.

Whether crude oil in Alaska, natural gas in Algeria, or abrasive mineral slurries in Arizona, the Hypresphere trunnion-mounted ball valve will provide years of bubble-tight, trouble-free service in your pipeline!
Hypresphere TMBV Design Features

1. The smoothly contoured, spherical body consists of a main center section with two tail pieces which are joined by welding to maximize the strength and integrity of the body shell.

2. The ball, with trunnion sockets at the top and bottom and coated with a low-friction material, has a full spherical shape to maintain maximum strength.

3. The triple-feature seat sealing system consists of:
   a) metal-to-metal seating with a wide land area,
   b) a pressure-energized nylon seat insert, and
   c) a sealant injection capability. (Detail on page 5.)

4. The seat assembly is designed to provide automatic pressure relief if excessive pressure builds up in the body cavity.

5. A flat metal tang on the stem (independent of the top trunnion) engages a slot in the spherical ball.

6. The top and bottom (not shown) trunnions reduce torque and weight, while allowing for double block-and-bleed capability (not shown here because of the "cut out" portion of the valve).

7. The stem (and trunnion) sealing system consists of resilient sealing materials, backed up by sealant injection capability. (Detail on page 5.)
Stem Sealing System

Machined dowels
O-ring stem seals with back-up washers
Static O-ring seals
Fitting for stem seal back-up sealant injection

Drain/Vent plug
TFE impregnated thrust bearing
TFE impregnated trunnion bearing

Seat Sealing System

Seat-to-body O-ring seal
Steel fire seal ring
Flat steel compression spring
Seat insert resilient seal O-ring
Nylon resilient seal
Wide land area metal-to-metal seats
Fully contained sealant groove

Note: A Block-and-Bleed drain/vent valve can be installed in one of the drain holes in the body (normally on the lower of the three drain holes).
Hypresphere TMBV

Figure Number System
- Identifies ANSI pressure class:
  3 = Class 300
  6 = Class 600
- Identifies operation method:
  9 = Worm gear operator
- Identifies end type:
  ¼ = Flanged X Butt Weld
  ½ = Butt Weld Ends
  Absence of ° or ° indicates Flanged Ends
- Identifies Design Category (see page 8)
- Identifies type of construction
  SP = Special (see page 8)
  Absence of SP indicates standard

Test Pressures and Working Pressures (Minimum)

<table>
<thead>
<tr>
<th>Pressure Type</th>
<th>ANSI Class 300</th>
<th>ANSI Class 600</th>
<th>PN 50</th>
<th>PN 100</th>
</tr>
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<tbody>
<tr>
<td>Maximum Cold Working Pressure</td>
<td>740</td>
<td>1480</td>
<td>51</td>
<td>102</td>
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<tr>
<td>Hydrostatic Shell Test (psig/bar)</td>
<td>1125</td>
<td>2225</td>
<td>78</td>
<td>153</td>
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<tr>
<td>Hydrostatic Seat Test (psig/bar)</td>
<td>825</td>
<td>1650</td>
<td>57</td>
<td>114</td>
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</tbody>
</table>

Gear Information
Gear mechanisms are enclosed in a grease-retaining weatherproof housing, with a position indicator mounted at the top for easy visibility.
Handwheels will be positioned to the top on Worm/Bevel and Spur/Worm/Bevel units, unless otherwise specified by the purchaser.

<table>
<thead>
<tr>
<th>Gear Ratio</th>
<th>No. of Turns for 90° Operation</th>
<th>Gearing Type</th>
<th>Gear Weight (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50:1</td>
<td>12.5</td>
<td>Worm</td>
<td>64</td>
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<tr>
<td>64:1</td>
<td>16</td>
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<td>90</td>
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<td>80:1</td>
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<td>96:1</td>
<td>24</td>
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<td>200</td>
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<td>Worm/Bevel</td>
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<td>476:1</td>
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<tr>
<td>764:1</td>
<td>191</td>
<td>Worm/Bevel/Bevel</td>
<td>630</td>
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</tbody>
</table>

Gear Ratios: 50, 64, 80 & 96
Gear Ratios: 200, 400 & 478
Gear Ratio: 764
### Dimensional Data and Weights

#### Figure Number 39, 39\(\frac{1}{4}\), and 39\(\frac{1}{2}\) (ANSI Class 300)

<table>
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<th>Size</th>
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<th>B</th>
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<th>P</th>
<th>Q</th>
<th>S</th>
<th>T</th>
<th>U</th>
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<th>Gear Ratio</th>
<th>Turns To Open</th>
<th>Weight Less Gearing</th>
<th>Weight With Gearing</th>
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#### Figure Number 69, 69\(\frac{1}{4}\), and 69\(\frac{1}{2}\) (ANSI Class 600)

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</tbody>
</table>

**Top, bold numbers designate inches and pounds, bottom numbers designate millimeters and kilograms.**

To determine the end-to-end length for Butt Weld x Flanged add \(\frac{1}{2}\) the Flanged length to \(\frac{1}{2}\) the Butt Weld length. Please note, the Butt Weld end of valve will be on the right-hand side.

\(B\) = Outside diameter (O.D.) of the minimum bore valve configuration.

*Conforms to API 6D4, paragraph 2.4c, and is marked accordingly.

Other pressure classes may be available upon request.
Hypresphere TMBV
Materials of Construction

This table shows standard construction materials for the design categories listed.

Consult your Nordstrom representative for other materials and/or service conditions.

<table>
<thead>
<tr>
<th>Design Category</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-20°F to 250°F</td>
<td>-50°F to 225°F</td>
<td>-20°F to 250°F</td>
<td>-50°F to 225°F</td>
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<tr>
<td>Construction</td>
<td>Standard</td>
<td>Low Temperature</td>
<td><em>NACE</em></td>
<td><em>NACE/Low Temperature</em></td>
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<tr>
<td>Body Shell</td>
<td>ASTM A216 Grade WCC</td>
<td>ASTM A352 Grade LCC*</td>
<td>ASTM A216 Grade WCC</td>
<td>ASTM A352 Grade LCC*</td>
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<tr>
<td>Sphere</td>
<td>ASTM A48 Class 50B, with permanently bonded MoS2</td>
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<tr>
<td>Seats</td>
<td>8&quot; to 24&quot;</td>
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<td></td>
<td>26&quot; to 42&quot;</td>
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<td>Stem</td>
<td>ASTM A322 Grade 4140</td>
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<td>Top Trunnion</td>
<td>ASTM A519 Grade 4140/42</td>
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<tr>
<td>Bottom Trunnion</td>
<td>ASTM A576 Grade 1045</td>
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<tr>
<td>Seat Spring</td>
<td>8&quot; to 16&quot;</td>
<td>ASTM A688 Grade 4140</td>
<td>ASTM A705 Type 630</td>
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<td>18&quot; to 42&quot;</td>
<td>ASTM A688 Grade 4140</td>
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<td>Gear Flange and</td>
<td>ASTM A516 Grade 70</td>
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</table>

* All materials meet the hardness limitations of NACE MR-01-75.

** Impact tested to API 6D acceptance criteria.

Design Options (Accessories & Trim)

Hypresphere TMBVs are available with several different accessory and trim options, either singly or in combination. As explained on page 6, these options are indicated by the suffix "SP" on the the valve figure number. These options include, but are not limited to:

- Transition pieces attached after test (purchaser furnishes the pipe).
- Transition pieces attached before test (purchaser furnishes the pipe).
- Locking device (chain).
- 2:1 ratio auxilliary bevel gear (vertical drive unit).
- .003" electroless nickel plated ball, stem, and trunnions.
- .003" electroless nickel plated ball (only).
- .001" electroless nickel plated ball and stem.
- Watertight gearing for vaults or buried service.
- Valve less gearing, for field mounting of actuator.
- Motor actuated through the valve gear head.
- With gearing and adapters for motor actuator, but less actuator.
- Power actuator mounted direct to valve stem.
- Special drain/vent valve.
- Offshore, above water trim for corrosive atmosphere.
- Epoxy coating of flow passages, for water service.
- Corrosion resistant primers and coatings.
- Optional NDE or pressure tests (see page 11).
- Elevated gearing (or actuator mounting) for valves for buried service.
- Viton seals.
- Operating shaft extensions for valves for buried service with roadbox.
Actuators

Stem mounted

Hypersphere ball valves can be supplied with direct stem mounted power actuators in place of manual gearing “on application”. Types available include:

• pneumatic, double acting piston actuators
• pneumatic, fail safe spring return piston actuators
• gas/hydraulic, vane piston actuators
• gas/hydraulic, double acting piston actuators

Nordstrom will also mount actuators furnished by the purchaser on Hypersphere ball valves and test the assemblies.

Gear head mounted

Hypersphere trunnion-mounted ball valves can be supplied with electric, pneumatic or gas motor actuators which are mounted to the input shaft of the manual gearing.

Valves can also be supplied with adaptation for motor actuators, but without the actuators.

Nordstrom will also mount actuators furnished by the purchaser on Hypersphere ball valves and test the assemblies.

Elevations for Buried Installations

Nordstrom can supply elevations (like the one shown here) for valve operators on all Hypersphere ball valves, whether equipped with simple worm gearing, bevel worm gearing, a hydraulic actuator, a pneumatic actuator, or an electric actuator.

When ordering elevations, please be sure to specify:

• Valve Size and Figure Number
• Dimension “A”, “B”, or “AA”.

These 3 “dimensions” are defined as:

“A”: Distance from the centerline of the valve to the centerline of the handwheel (when horizontal).

“B”: Distance from the centerline of the valve to the top attachment flange of the elevation spool.

“AA”: (For larger valves with compound gearing.) Distance from the centerline of the valve to the top of the handwheel (when horizontal).
Hypresphere TMBV

Codes and Standards

Hypresphere trunnion-mounted ball valves are designed, rated, manufactured and tested in accordance with the latest edition of:

ANSI — American National Standards Institute
B16.5 Pipe Flanges and Flanged Fittings
B16.34 Valves - Flanged, Threaded & Welding End

API — American Petroleum Institute
6D Specification for Pipeline Valves
598 Valve Inspection and Testing
Q1 Specification for Quality Programs

MSS — Manufacturers Standardization Society of the Valve and Fittings Industry
SP-44 Steel Pipe Line Flanges
SP-55 Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components

DOT - United States Department of Transportation
49 CFR Part 192 Pipeline Safety Regulations

On special application (contact your Nordstrom representative for further information) Hypresphere trunnion-mounted ball valves are also available in conformance with:

MSS — Manufacturers Standardization Society of the Valve and Fittings Industry
SP-53 Quality Standard for Steel Castings - Magnetic Particle Examination Method
SP-54 Quality Standard for Steel Castings - Radiographic Examination Method

MR-O1-75 Standard Material Requirements Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment (Valves for NACE Service)
Standard Tests and Non-Destructive Examination

All body shell castings are visually examined in accordance with MSS SP-55.

All butt-weld ends are radiographically examined for a distance of 2" back from the end, in accordance with MSS SP-54 to a level 2 acceptance criteria.

All finish machined butt-weld end bevels are magnetic particle examined in accordance with MSS SP-53 acceptance criteria.

All body joint welds are spot radiographed in accordance with ASME Section VIII, section UW-52 (6 inches for every 50 feet of weld).

The first 5 body shell castings from each new pattern, or when a pattern is modified or is moved from one foundry to another, are 100% radiographed to determine the quality level. Additional castings are radiographed as necessary to determine a quality level indicative of level 3 throughout, with level 2 in weld joint/weld end areas.

All valves are hydrostatically tested to meet the requirements of API 6D, ANSI B16.34, and MSS SP-61.

- Shell tests are performed at 1.5 x the rating of the valve.
- Seat tests are performed at 1.1 times the rating of the valve.
- An air test (80 psig minimum) per API 598, is performed on all valves.

The acceptance criteria for all pressure testing is no visible leakage.

Optional Tests and Non-Destructive Examination

Special higher pressure tests:
- Shell tests up to 2 times the rating of the valve
- Seat tests up to 1.5 times the rating of the valve

Extended duration chart tests (pressure & temperature).

Special air seat tests (80 psig air seat test is standard).

100% radiography/ultrasonic examination of body joint welds.

Critical area radiography of body casting (MSS SP-54).

Magnetic particle examination of body casting (MSS SP-53).

Mount and adjust actuator furnished by purchaser.
Around the world, Nordstrom valves have worked for over 75 years

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Value • Quality • Dependability

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