VACUUM INSULATED PIPE

MVE SHRINK-FIT BAYONET™ TECHNOLOGY

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Inner Pipe</th>
<th>PART NUMBERS</th>
<th>DIMENSIONS</th>
<th>Outer Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>O-Ring</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>1/2” PS</td>
<td>2322231</td>
<td>21016797</td>
<td>3513241</td>
</tr>
<tr>
<td>1” PS</td>
<td>2322291</td>
<td>21019174</td>
<td>3513261</td>
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<tr>
<td>1-1/2” PS</td>
<td>2323341</td>
<td>20627715</td>
<td>3514781</td>
</tr>
<tr>
<td>2” PS</td>
<td>2300321</td>
<td>20627715</td>
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Chart’s dissimilar metal bayonet design uses the thermal contraction/expansion that low cryogenic temperature gives to metals. It provides a mechanical connection for sections of vacuum jacketed pipe that have a leak-tight shrink fit seal.

When cryogenic liquid passes through the bayonet, the stainless steel nose of the female bayonet (Item A) contracts and forms a tight seal on the nose of the male bayonet (Item B). The nose piece of the male bayonet is precision machined out of Invar® 36. Invar 36 was developed, with the help of NASA, to produce a material that does not shrink when exposed to cryogenic temperatures. A secondary o-ring seal (Item C) is used at the flange. To disassemble the system, simply drain the line of liquid and warm it to ambient temperature.
THE ANATOMY OF VACUUM INSULATED PIPE

**INNER PIPE**
Schedule 5, T304 stainless steel or Invar® pipe designed per ASME B31.3

**OUTER PIPE**
Schedule 5, T304 stainless steel pipe, available with high-shine exterior polish

**GAS TRAP**
Installed for only vertical drops to prevent ice build up on un-insulated components like isolation valves

**INNER EXPANSION BELLows**
Required to expand as inner pipe cryogenically shrinks 1/32" per foot *

**MALE BAYONET**
T304 stainless steel with Invar® tip for minimum cryogenic shrinkage to allow female bayonet to create a shrink fit cryogenic seal

**FEMALE BAYONET**
T304 stainless steel, interfaces with male bayonet and cryogenically shrinks around male bayonet Invar® tip for a leak-free seal

**V-BAND CLAMP**
Secures bayonets together with O-ring for secondary gas seal

**INNER PIPE**
T304 stainless steel, interfaces with male bayonet and cryogenically shrinks around male bayonet Invar® tip for a leak-free seal

**MULTI-LAYER INSULATION**
Alternating layers of paper and aluminium foil to reduce radiation heat transfer from the outer to the inner pipe

**CHEMICAL GETTERS**
Installed for only vertical drops to prevent ice build up on uninsulated components like isolation valves

**SUPPORT ASSEMBLY**
Fiberglass construction engineered for movement when inner cryogenically shrinks and to reduce conductive heat transfer from the outer to the inner

**EXCLUSIVE MVE SHRINK-FIT BAYONET™ TECHNOLOGY**
- Dissimilar metals - Invar® / SS
- LN₂ shrinks stainless steel around Invar® for a leak-tight seal
- Flexible orientation
- Industry standard for 40 years

**ANNULAR SPACE**
The voided space between the inner and the outer under high vacuum (10 microns) to eliminate convective heat transfer by removing all air molecules during manufacturing – 10 year vacuum warranty

**HASTINGS DV-6R VACUUM GAUGE TUBE**
A rugged thermocouple for testing the vacuum level with a matching meter

**PUMP OUT PORT**
Allows final evacuation of the VIP component in production and for field service

\* Inner Expansion Bellows not required with Invar® inner pipe