PTFE Expansion Joints are used to compensate for movement, misalignment and/or vibration in piping systems. Generally, the more convolutions in the joint design, the greater the range of motions they can compensate. Expansion joints should never be used to compensate for rotation about the pipe axis.

For clarity of the above illustrations, REQUIRED limit bolts or cables are not shown. See section in this manual entitled “Limit Bolts” regarding damage which can result if they are removed. Rotation (or “torsion”) about the longitudinal axis of an expansion joint is prohibited and can lead to premature failure and/or rupture of the unit and may result in property damage, serious personal injury or death.

Use of these units either when improperly installed or beyond the Pressure/ Temperature Rating or Vacuum Rating may cause premature failure and/or rupture of the Unit and may result in property damage, serious personal injury or death. Safety shields must be used in hazardous service.

If components show significant deterioration due to abrasion, damage, or corrosion, the assembly should be removed from service. Failure to periodically perform inspection for abrasion, damage, or corrosion may lead to failure and/or rupture of the assembly resulting in property damage, serious personal injury, or death.

Do not install nuts or connecting bolt heads behind expansion joint flanges or accidental wrench damage may occur to the PTFE element. Do not drill out threads.

A PTFE internal sleeve should be used where abrasive slurries or solids are or may be present.
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R7000 Series - Stainless Steel Armored
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Resistoflex expansion joints are contour molded of paste extruded TEFLON® PTFE by an exclusive patented process. They are corrosion resistant, non-aging, with extraordinary flex life and unmatched reliability. They offer a low spring rate to protect stress-sensitive glass, graphite or FRP equipment and are cost effective. The convoluted PTFE expansion joints are flared over the flanges to eliminate the need for separate gaskets.

Resistoflex uses only TEFLON® T-62 resins by DuPont because of the extraordinary performance it provides.

### Properties of DuPont PTFE T-62

<table>
<thead>
<tr>
<th>Properties</th>
<th>Unit</th>
<th>PTFE-62 Copolymer</th>
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<th>PFA</th>
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</table>

TEFLON® is a registered Trademark of E.I. du Pont de Nemours and Company and is used under license by Crane Resistoflex.

### The benefits of contour molding...

The extraordinary flex life performance of Teflon® T-62 is only part of the story. From the beginning, Resistoflex has recognized the importance of contour molding its bellows from extruded tubing as opposed to machining them from bar or tube stock, or blow molding them from isostatically molded tubes. That’s because only the contour molding process provides the optimal combination of flexibility and tensile strength. It prevents the stress concentrations common in machined bellows, vital because of PTFE’s inherent notch sensitivity. Furthermore, and perhaps most importantly, the activation/deflection forces are an order of magnitude lower with Resistoflex contour molded expansion joints than those made via any other process. Its smooth contours provide a better fit with exterior reinforcing rings, reducing the possibility of joint damage as they flex.
Different by design...

Only Resistoflex offers such a broad array of materials, sizes, and design options, all backed by a cumulative knowledge base begun over 50 years ago. Our familiar R-Series expansion joints are available in 2, 3, and 5 convolute designs, with either standard Resistoflex neutral lengths or a newly available length common to other manufacturers. This newly offered length makes drop-in replacement of underperforming expansion joints simple and painless. Also, our new E-Series expansion joints offer a design alternative with either 2, 3, or 5 convolutions, with basic differences illustrated to the right:

The R7000 Stainless Steel Armored joint, shown on page 18, brings yet another level of performance with multiple length options available in each diameter. This manual provides detailed information on all these designs.

Using the best materials for the best performance...

We know that it’s not all about the resin. That’s why we offer both the E-Series and R-Series with ductile iron, zinc plated steel, or stainless steel flanges - so that the metallurgy suits each application. Only Resistoflex uses NITRONIC® 50 for the critical reinforcing rings on R-Series and E-Series joints. NITRONIC® 50 is an austenitic stainless super-alloy providing the corrosion resistance of MONEL® and twice the yield strength of 316 stainless steel. Resistoflex uses these materials so that the metallic components last as long as our superior bellows.

\[ \text{NOTE: } \text{Not all flange materials are available on all sizes and styles.} \]

Unmatched Experience...

Expansion joints may be the most critical component in a fluid handling system. We’ve known that since the 1950’s, when we developed them for the U.S. Air Force and the newly formed NASA. We refined our experience to match the needs of the chemical industry’s most demanding applications in the 1960’s, and scaled up our knowledge to build custom expansion joints, some over 30 feet in diameter, for the nuclear industry in the 1970’s. For over 50 years, we’ve been improving our materials, processes, and testing because your process and our reputation depend on it.

\[ \text{...Don’t be fooled by cheap imitations.} \]
**R6904 - 2 Convoluted PTFE Expansion Joint**

**Flange Material Options:**
- Ductile Iron
- Zinc Plated Carbon Steel
- Stainless Steel

**Material Options:**
- Carbon Steel
- Stainless Steel

**Elastic Stop Nut**

**Neoprene Grommet**

**Limit Bolt (factory set)**

**Molded Bellows**
- DuPont Teflon®
- T-62 PTFE

**Steel Washer**

**NITRONIC® 50 Reinforcing Ring**

*For 14” - 24” sizes, retaining ring material is DIN 1.4301 SS

**Elastic Stop Nut**

**Neoprene Grommet**

**Limit Bolt (factory set)**

**Molded Bellows**
- DuPont Teflon®
- T-62 PTFE

**Steel Washer**

**NITRONIC® 50 Reinforcing Ring**

*For 14” - 24” sizes, retaining ring material is DIN 1.4301 SS

**Non-Shock Working Pressure vs. Temperature**

**WARNING**
- Leave Limit Bolts in “As Received” Factory Settings
- Always Use Safety Shields in Hazardous Service

**Graph:**
- **1/2” - 6”**
- **8” - 10”**
- **12” - 24”**
### All Dimension in inches.

† At neutral length with limit bolts in place.

Maximum (axial) travel is based on installation with no misalignment or angular deflection. This is an installation dimension not a limit bolt setting.

** CF = Consult Factory

#### NOTE:
Angular Deflection, maximum of 7 degrees. Consult factory for spring rates for angular deflection.

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<th>B Flare Diameter</th>
<th>C Convolute O.D.</th>
<th>Maximum Misalignment</th>
<th>Compression Force Spring Rate (lb., in.)</th>
<th>Extension Force Spring Rate (lb., in.)</th>
<th>Misalignment Force Spring Rate (lb., in.)</th>
<th>Wt. (lbs.)</th>
<th>Vacuum Rating (in. Hg°/F)</th>
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</table>

#### Stainless

- 316 Stainless steel flanges and limit bolts are available as a standard stock option.
R6905 - 3 Convoluted PTFE Expansion Joint

Elastic Stop Nut

Neoprene Grommet

Limit Bolt (factory set)
Material Options:
- Carbon Steel
- Stainless Steel

Molded Bellows
DuPont Teflon®
T-62 PTFE

Steel Washer

NITRONIC® 50 Reinforcing Ring
* For 10” - 24” sizes, retaining ring material is DIN 1.4301 SS

Flange Material Options:
- Ductile Iron
- Zinc Plated Carbon Steel
- Stainless Steel

WARNING
Leave Limit Bolts in “As Received” Factory Settings

WARNING
Always Use Safety Shields in Hazardous Service

NON-SHOCK WORKING PRESSURE vs. TEMPERATURE

MAXIMUM WORKING PRESSURE - PSI

TEMPERATURE

℃ 10 38 66 93 121 149 177 204 232
℃ 50 100 150 200 250 300 350 400 450

1/2” - 6”

8”

10” - 16”

18” - 24”
**NOTE:** Angular Deflection, maximum of 14 degrees. Consult factory for spring rates for angular deflection.

### Table: Springs with Flanges and Limiting Bolts

<table>
<thead>
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<th>Part # R6905-</th>
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</table>

All Dimension in inches.

† At neutral length with limit bolts in place.

Maximum (axial) travel is based on installation with no misalignment or angular deflection. This is an installation dimension not a limit bolt setting.

CF = Consult Factory

Stainless

- 316 Stainless steel flanges and limit bolts are available as a standard stock option.
R6906 - 5 Convoluted PTFE Expansion Joint

Elastic Stop Nut

Neoprene Grommet

Limit Bolt (factory set)
Material Options:
- Carbon Steel
- Stainless Steel

Molded Bellows
DuPont Teflon®
T-62 PTFE

Steel Washer

NITRONIC® 50 Reinforcing Ring
* For 8” - 20” sizes, retaining ring material is DIN 1.4301 SS

Non-Shock Working Pressure vs. Temperature

Flange Material Options:
- Ductile Iron
- Zinc Plated Carbon Steel
- Stainless Steel

WARNING
Leave Limit Bolts in "As Received" Factory Settings

WARNING
Always Use Safety Shields in Hazardous Service
All Dimension in inches.

† At neutral length with limit bolts in place.

Maximum (axial) travel is based on installation with no misalignment or angular deflection.
This is an installation dimension not a limit bolt setting.

CF = Consult Factory

NOTE: Angular Deflection, maximum of 20 degrees.
Consult factory for spring rates for angular deflection.

5-Convolute expansion joints are not recommended for vacuum service. Recommended only for low-pressure applications such as weigh tank connections.

---

**Stainless**

- 316 Stainless steel flanges and limit bolts are available as a standard stock option.
E6904 - 2 Convoluted Expansion Joint

NON-SHOCK WORKING PRESSURE vs. TEMPERATURE

- **Flange Material Options:**
  - Ductile Iron
  - Stainless Steel

- **NITRONIC® 50 Reinforcing Ring**
- **Molded Bellows**
  - DuPont Teflon®
  - T-62 PTFE
- **Carbon Steel T-Band**
- **Stainless Steel Limit Cable**

**WARNING**
Always use safety shields in hazardous service.
All Dimension in inches.
Maximum (axial) travel is based on installation with no misalignment or angular deflection.

Flange Material = Painted Ductile Iron
Limit Cable Material = Stainless Steel
Retaining Ring Material = NITRONIC® 50 Stainless Steel
T-Band Material = Carbon Steel

Limit Cables vs. Limit Bolts – which is better?

Limit cables provide a compact installation with no protruding bolt ends. They allow greater lateral and angular misalignment. Expansion joints with limit cables make a very compact package. Cables are permanently installed and cannot be misadjusted. The flexibility of the cable design does have three potential concerns:

- Pipefitters can install this design at lateral misalignments beyond the allowable limits
- The individual strands of stainless steel aircraft cable can rapidly degrade and fray in coastal or chlorine service environments
- The cables do not provide any resistance or indicate that rotational forces (which will lead to premature failure and/or rupture) are present

By comparison, expansion joints with limit bolts are designed specifically to:

- Limit lateral misalignment at installation
- Provide a solid visual indicator (2X stronger than cables)
- Stand up to service in coastal, marine, and chlorine environments
- Provide resistance to rotational forces
- Indicate the presence of rotational forces beyond the limit bolt yield strength

NOTE: Consult factory for spring rates for angular deflection.
**E6905 - 3 Convoluted Expansion Joint**

**Flange Material Options:**
- Ductile Iron
- Stainless Steel

**Molded Bellows**
DuPont Teflon®
T-62 PTFE

**Carbon Steel T-Band**

**NITRONIC® 50 Reinforcing Ring**

**Stainless Steel Limit Cable**

**NON-SHOCK WORKING PRESSURE vs. TEMPERATURE**

![Graph showing non-shock working pressure vs. temperature. The graph includes lines for 1/2" - 6" and 8" connections, with PSI on the y-axis and temperature in °F on the x-axis.]

**WARNING**
Always Use Safety Shields in Hazardous Service
All Dimension in inches.
Maximum (axial) travel is based on installation with no misalignment or angular deflection.

Flange Material = Ductile Iron
Limit Cable Material = Stainless Steel
Retaining Ring Material = NITRONIC® 50 Stainless Steel
T-Band Material = Carbon Steel

NOTE: Consult factory for spring rates for angular deflection.

<table>
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<th>Part #</th>
<th>Nom. Size (I.D.)</th>
<th>A Neutral Length</th>
<th>B</th>
<th>C</th>
<th>Maximum Misalignment</th>
<th>Compression Force Spring Rate (lb./in.)</th>
<th>Extension Force Spring Rate (lb./in.)</th>
<th>Misalignment Force Spring Rate (lb./in.)</th>
<th>Wt. (lbs.)</th>
<th>Vacuum Rating (in. Hg°F)</th>
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<td>9°</td>
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<td>170</td>
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**Why Use T-Bands?**

The addition of a T-band provides a travel limiter and visual indicator that a joint is at its maximum compression. While there are many individuals who see T-bands as a way of providing some protection against dropped tools, T-bands are not designed to replace safeguarding. Wrap around safety shields are specifically designed to provide sprayout protection, and are required for hazardous service.
E6906 - 5 Convoluted Expansion Joint

Non-Shock Working Pressure vs. Temperature

Flange Material Options:
- Ductile Iron
- Stainless Steel

NITRONIC® 50 Reinforcing Ring

Molded Bellows DuPont Teflon® T-62 PTFE

Stainless Steel Limit Cable

Carbon Steel T-Band

1/2” - 6”

WARNING
Always use safety shields in hazardous service.
All Dimension in inches.
Maximum (axial) travel is based on installation with no misalignment or angular deflection.

Flange Material = Ductile Iron
Limit Cable Material = Stainless Steel
Retaining Ring Material = NITRONIC® 50 Stainless Steel
T-Band Material = Carbon Steel

NOTE:
Consult factory for spring rates for angular deflection.

5-Convolute expansion joints are not recommended for vacuum service. Recommended only for low-pressure applications such as weigh tank connections.

Safeguarding
Not enough can be said about safeguarding. Unless they are armored, expansion joints only provide a single process containment layer, and are vulnerable to the abuse common in some process plants. Placing an expansion joint into hazardous service without safeguarding increases the risk of serious personal injury or death. Resistoflex requires that safeguarding, such as wrap around safety shields, be used on all expansion joints in hazardous service.
# R7000 Series - Stainless Steel Armored PTFE Expansion Joint

**Standard**
- Liner - PTFE
- Housing - 321 SS
- Flange - Zinc Plated Carbon Steel
- Limit Rod - Carbon Steel

**Stainless**
- Liner - PTFE
- Housing - 321 SS
- Flange - 321 SS
- Limit Rod - Stainless Steel

*Custom materials available for housing and flanges.*

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<th>Nom. Size (L.D.)</th>
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<th>Max Travel + or -</th>
<th>Spring Rate (lb, / in.)</th>
<th>Weight (lbs.)</th>
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All dimensions are in inches.
Consult factory for requirements over 12”.
Neutral length tolerance +5% / -1.5%

**NOTE:** Custom lengths are available.
**Flange Dimensional Data**

Bolts should be tightened using the following torques as a guide and with lightly oiled threads.

### Flange Dimensional Data

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<td>21</td>
<td>21</td>
<td>13/16</td>
<td>27 9/16</td>
<td>23 1/2</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>21 1/4</td>
<td>22 3/4</td>
<td>29</td>
<td>29</td>
<td>31 1/2</td>
<td>27 1/2</td>
<td>25</td>
</tr>
<tr>
<td>18</td>
<td>1 1/8 - 7</td>
<td>22 3/4</td>
<td>35 29/32</td>
<td>32</td>
<td>37 62/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>25</td>
<td>CF</td>
<td>CF</td>
<td>39 27/32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>29 1/2</td>
<td>CF</td>
<td>CF</td>
<td>CF</td>
<td>CF</td>
<td>CF</td>
<td>CF</td>
<td>CF</td>
</tr>
</tbody>
</table>

^* Add bolt diameter to length for stud bolts.  ** Lap-joint flanges may require 1/4" longer bolt in some instances.  CF = Consult Factory  † Applicable to R-Series only

**NOTE:** Flanges are available in Class 300, DIN, and other drillings upon request.

**Bolt Torque Information**

Bolts should be tightened using the following torques as a guide and with lightly oiled threads.

<table>
<thead>
<tr>
<th>Nominal Expansion Joints Size (Inches)</th>
<th>1</th>
<th>1 1/2</th>
<th>2</th>
<th>2 1/2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flanges Drilled for Glass Pipe Bolt Torque (ft-lbs)</strong></td>
<td>8 - 10</td>
<td>12 - 20</td>
<td>20 - 33</td>
<td>-</td>
<td>-</td>
<td>35 - 51</td>
<td>20 - 34</td>
<td>-</td>
<td>37 - 62</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTE:** The values in this table are a guide. In some instances, higher torque may be required. However, excessive torque should be avoided.
Expansion Joint Part Numbering System

Example: E6904-032WDN

<table>
<thead>
<tr>
<th>R 6904</th>
<th>008 - .5&quot;</th>
<th>096 - 6&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 6905</td>
<td>012 - .75&quot;</td>
<td>128 - 8&quot;</td>
</tr>
<tr>
<td>R 6906</td>
<td>016 - 1&quot;</td>
<td>160 - 10&quot;</td>
</tr>
<tr>
<td>R 6904E</td>
<td>024 - 1.5&quot;</td>
<td>192 - 12&quot;</td>
</tr>
<tr>
<td>R 6905E</td>
<td>032 - 2&quot;</td>
<td>224 - 14&quot;</td>
</tr>
<tr>
<td>R 6906E</td>
<td>040 - 2.5&quot;</td>
<td>256 - 16&quot;</td>
</tr>
<tr>
<td>E 6904</td>
<td>048 - 3&quot;</td>
<td>288 - 18&quot;</td>
</tr>
<tr>
<td>E 6905</td>
<td>064 - 4&quot;</td>
<td>320 - 20&quot;</td>
</tr>
<tr>
<td>E 6906</td>
<td>080 - 5&quot;</td>
<td>364 - 24&quot;</td>
</tr>
<tr>
<td>R 7001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R 7002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R 7003</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

W - White
B - Black
D - Painted Ductile Iron
C - Carbon Steel Zinc Plated
S - Stainless Steel

D - DIN PN10 Drilling
G - Glass Bolt Drilling
J - JIS 10K Drilling
K - Kynar Coated Flanges
N - Nozzle Liner
P - Polypropylene Flanges
S - Stainless Steel Hardware
3 - ANSI Class 300 Drilling

NOTE: See dimensional pages for size availability of each style.

Product Performance Testing

1. Flex Life

In this test, one expansion joint of each size is installed at neutral length on the flex tester and is flexed at 100% of the maximum allowable compression and extension. One cycle is defined as neutral-compression-neutral-extension-neutral at a specified pressure and temperature. Units are certified to 100,000 cycles while still retaining full pressure handling capability.

This flex test comparison was performed with 2” 3-convolute expansion joints from various manufacturers. The test was performed at 250°F with 75 psig hot oil. Neutral-Extended-Neutral-Compressed-Neutral position equals one cycle. Each joint was extended and compressed to the published maximum allowable position.

NOTE: While all other eight manufacturer’s joints failed at 300,000 cycles or less, Resistoflex® joints continued to perform beyond 575,000 cycles without failure and the test was discontinued.
2. Static Test

The static test is the most rigorous test Resistoflex performs on the expansion joint product line. This test consists of 3 pressure stages for each expansion joint. The procedures for this test are outlined in the chart below.

<table>
<thead>
<tr>
<th>Test Cycle</th>
<th>Test Sequence</th>
<th>Time from Previous Change, hrs.</th>
<th>Elapsed Time, hrs.</th>
<th>Temp. °F</th>
<th>Stage 1 Pressure, psig</th>
<th>Stage 2 Pressure, psig</th>
<th>Stage 3 Pressure, psig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Start</td>
<td>0</td>
<td>150</td>
<td>1.0 x rated pressure</td>
<td>1.5 x rated pressure</td>
<td>2.0 x rated pressure</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>250</td>
<td>1.0 x rated pressure</td>
<td>1.5 x rated pressure</td>
<td>2.0 x rated pressure</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>48</td>
<td>48</td>
<td>350</td>
<td>1.0 x rated pressure</td>
<td>1.5 x rated pressure</td>
<td>2.0 x rated pressure</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td>72</td>
<td>72</td>
<td>450</td>
<td>1.0 x rated pressure</td>
<td>1.5 x rated pressure</td>
<td>2.0 x rated pressure</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
<td>96</td>
<td>96</td>
<td>Purge to Amb. Temp</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Repeat above for total of 4 test cycles. Time to cool to ambient temperature is added to elapsed time for each cycle. At the end of each stage, units must not show any signs of visible deterioration, stress marks, crazing, cracks, delaminations, splits, or holes. Rated pressure is defined as the published maximum operating pressure at the test temperature for that unit. Product Performance Testing is for design qualification and not performed on each individual joint manufactured.

3. Vacuum Data

Maximum Temperature for Full Vacuum (29.9" Hg)

<table>
<thead>
<tr>
<th>Size</th>
<th>R6904 E6904</th>
<th>R6905 E6905</th>
<th>R6906 E6906</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>425°F</td>
<td>400°F</td>
<td>Not Rated for Vacuum Service</td>
</tr>
<tr>
<td>4</td>
<td>400°F</td>
<td>400°F</td>
<td></td>
</tr>
<tr>
<td>5 - 6</td>
<td>400°F</td>
<td>300°F</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>250°F</td>
<td>125°F</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>250°F</td>
<td>CF</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>75°F</td>
<td>CF</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Using internal vacuum support rings or SHD liner allows for a full vacuum rating at elevated temperatures. Consult factory for additional information.

These ratings are for expansion joints in the fully extended condition. When they are at the neutral length or compressed, it is sometimes possible to exceed the listed temperature at full vacuum. Consult Factory.

CF = Consult Factory

For R7000 and larger size vacuum data, please consult factory.

Vacuum data above representative of standard products without internal support ridges.

Quality Assurance

Testing... For Your Safety

Resistoflex has a more vigorous quality assurance program than any other expansion joint manufacturer. The following tests are performed on 100% of our expansion joints, ensuring that every unit meets performance specifications.

1. Roll Test

100% of Resistoflex expansion joints are roll tested before they are molded into convoluted form. In this test, the liner is compressed to 50% of its diameter in two different planes to detect liner defects. Any non-conformance found is cause for rejection. Roll tests CANNOT be performed with isostatically molded expansion joints.

2. Hydro Test

100% of Resistoflex expansion joints are hydrostatically tested prior to shipping. This ensures that the final product is free from defects. All expansion joints are hydrostatically tests at 1.5 times their ambient temperature pressure rating - any leakage is cause for rejection.
1. **Scope**

1.1 This specification provides information for the procurement of PTFE expansion joints with 2, 3, or 5 convolutions.

1.2 The subjects covered include Materials, Design and Construction, Qualification and Performance, Inspection, and Handling and Shipping.

2. **Materials**

2.1 The fluoropolymer components shall be made from a PTFE copolymer fine powder resin conforming to ASTM D4895, Type I, Grade 4, Class B such as Teflon® T-62.

2.2 Standard flanges shall be ductile iron conforming to ASTM A395 and coated with a hydrophobic acrylic polymer for maximum corrosion resistance, or 316SS. Carbon Steel flanges shall be zinc-plated.

2.3 Reinforcing rings shall be NITRONIC® 50 or conform to ASTM A276, Grade XM-19.

2.4 Standard limit bolts will be carbon steel or stainless steel with elastic stop nuts. Limit cables shall be stainless steel.

3. **Design & Construction Details**

3.1 The flanges shall be one-piece construction. No welding is allowed.

3.2 Standard flanges shall have bolting patterns conforming to ASME B16.5, Class 150. The bolt holes shall be threaded to accommodate the bolts specified in ASME B16.5.

3.3 All ductile iron flanges shall be coated with chemical resistant hydrophobic acrylic polymer unless otherwise specified.

3.4 The convolutions shall be contour molded to uniform radii and free from sharp corners and other areas of stress concentration.

3.5 The gasket face of the expansion joint shall be concentric with the bore and conform to the standard ASME B16.5, Class 150 flange raised face diameter for the equivalent pipe size.

3.6 All flanged assemblies will be equipped with limit bolts or limit cables to restrict maximum extension, misalignment, and angular deflection.

3.7 A neoprene grommet shall be inserted in the limit bolt hole to reduce friction and vibration while protecting the limit bolts.

4. **Testing**

4.1 Prior to forming the expansion joint convolutions, each tube must be roll tested to 1/2 the nominal ID in at least two planes to identify liner defects.

4.2 Each tube must be visually inspected for imperfections.

4.3 Each assembly must be hydrostatically tested at 1.5 times the 70°F working pressure.

5. **Handling & Shipping**

5.1 All assemblies shall have their gasket faces protected by wooden covers and secured by metal clips or bolts. End covers are not to be removed except for inspection, testing, or installation.

5.2 Each unit will be packed in a separate container and clearly marked to identify product.

5.3 Each packed assembly must be further protected by corrugated boxes or other containers that will protect them from damage during handling, shipping, and storage.

5.4 Each unit will include a detailed installation instruction sheet showing at minimum recommended procedures, bolt tightening sequence and torque, unit pressure/temperature ratings, unit minimum and maximum travel, and all warnings associated with the proper use of the product.
Common Applications

Misalignment
Perhaps the most common use of expansion joints is as a means to compensate for differences between what appears on the designers work station and what takes place in the field during construction. Good designers recognize installation variability and use expansion joints so that the flexibility required by the piping is not improperly constrained by the location of fixed equipment.

FRP Piping
Stress sensitive FRP piping has a thermal expansion coefficient 10 times greater than carbon steel and cannot absorb the stresses at flanged connections like carbon steel piping can. For these reasons, expansion joints are critical in FRP piping, and according to FRP manufacturers, joints requiring low activation energy are essential. Only Resistoflex joints provide the ideal combination of low activation energy along with the strength and flex life to provide years and even decades of trouble free performance.

Glass Lined Equipment
The flange faces of glass lined equipment such as pumps or vessels are extremely sensitive to shock, vibration, and compressive forces which may result from uncompensated pipe expansion. Because such equipment is usually used in severe service applications, PTFE expansion joints provide the ideal solution. Contour molded joints of Teflon® T-62 from Resistoflex provide the low spring rates and high flex life required to protect such sensitive and expensive equipment.

Weigh Tanks
Process control systems often rely upon load cells to meter accurate quantities of reactants to a process, or finished products to packaging systems. The low spring rate of the Resistoflex expansion joints result in improved scale accuracy and less frequent calibration requirements.

Centrifugal Pumps
The energy and vibration generated by centrifugal pumps must be dissipated. Most of that energy is transferred to the conveyed fluid. What is not, is transferred to the adjacent piping and to the bearings and packings of the pump, causing leaks, increased maintenance, and downtime. With their unparalleled flex life, Resistoflex expansion joints are designed to absorb this energy, and provide the ideal solution to this common problem.

Hydraulic Shock
Many fluid systems are subject to hydraulic shock, or “water hammer”. These rapid fluctuations in line pressure cause stress and noise in a piping systems, resulting in leaks and stress cracking. Expansion joints compensate for the movement and vibration often caused by hydraulic shock, reducing stress and noise.

Vibration
Vibrations inherent in engines must be absorbed to prolong life and reduce noise. With large engines, such as diesel generators, vibration must also be isolated from the fuel, lubrication, and coolant systems connected to them by rigid piping systems. Expansion joints provide the ideal solution to isolating vibration, thereby reducing noise and maintenance.

Noise in HVAC systems
Architects and building designers learned centuries ago that noise should be minimized for the comfort of its occupants. Heating and air conditioning systems are one of the most common sources of noise, and transmission through piping and ducts provide the path to the occupants. The high acoustical resistance of PTFE expansion joints makes them ideally suited to reducing if not eliminating the transmission of noise in such systems. They are used in commercial buildings of all types and sizes, from schools to hospitals to airports.

WARNING
Always Use Safety Shields in Hazardous Service
Expansion Joint Installation and Operating Instructions

- Do not bore out threads in bolt holes.
- Do not exceed pressure/temperature or vacuum ratings.
- Safeguard expansion joint units in hazardous service, per ASME B31.3.
- Leave limit bolts in “as received” factory settings. Severe damage can result if the limit bolts and stop nuts are removed, replaced or altered to exceed the factory setting. (See Limit Bolt notes below)
- Remove flange covers only when ready to install expansion joints.
- Insure that sealing faces are clean, smooth & parallel.
- For hot service install nearly extended; for cold service install nearly compressed.
- Thread installation bolt from mating flange side to prevent possible damage to the PTFE element.
- Do not extend bolts behind expansion joint flange more than 1-2 threads. Do not use nuts on inside of flanges.

Additional information & specific bolt torque data will be found on the detailed installation instruction sheet included in the box of each & every unit shipped.

**WARNING:** Failure to follow the above installation instructions may cause premature failure and/or rupture of the unit resulting in property damage, serious personal injury, or death.

**Safeguarding**

The Process Piping Code, ANSI/ASME B31.3, in Appendix G outlines recommendations for safeguarding piping systems. Resistoflex subscribes to this emphasis on safety and requires the code suggestion for shielding bellows units where hazardous fluids are conveyed. Safety shields are designed to prevent sprayout of hazardous fluids. Please contact RAMCO Manufacturing Company, Roselle Park, NJ at (908) 245-4500 for Expando-Gard safety shield information.

**Limit Bolts**

Limit bolts with elastic stop nuts are factory set at the maximum travel position to prevent overextension. Severe damage, personal injury, or death can result if the limit bolts and stop nuts are removed or altered to exceed the factory setting, or if non-locking nuts are installed.

**Limit Cables**

Limit cables are not designed to withstand all possible forces generated in a piping system. Maintenance personnel should periodically check the limit cables. If a limit cable appears to be in tension, or shows signs of having been stretched, the limit of expansion joint travel has been reached. This is an indication that excess motion or stress generated in the piping system is threatening failure. If a cable shows frayed strands, or is corroded, the joint should be replaced immediately.

**Maintenance**

Maintenance personnel should periodically check expansion joints in the piping system. If a limit cable or limit bolt appears to be in tension, or shows signs of having been stressed, the limit of expansion joint travel has been reached. This is an indication that excess motion or stress generated in the piping system is threatening to cause failure. If components show significant deterioration due to abrasion, damage, or corrosion, the assembly should be removed from service. Failure to periodically perform inspection for abrasion, damage, or corrosion may lead to failure and/or rupture of the assembly resulting in property damage, serious personal injury, or death.
Instructions

Suggested Installation as Pump Connectors

End Suction Vertical Discharge Pump
Pump is solid mounted
Pipe is anchored to support it and to stabilize expansion joint flanges farthest from pump. Use “H-frame” anchor for vertical discharge and pipe leg anchor for horizontal suction piping.

End Suction Vertical Discharge Pump
Pump is mounted on spring-supported inertia block
Discharge and suction piping have been arranged to be parallel with drive shaft of pump. Locating expansion joints further away from pump minimizes strain from misalignment or angular deflection.

Double Suction Split Case Pump Solid Mounted
Flexible connectors in vertical lines
“H-frame” supports contain end thrust and prevent lateral motion that might cause excessive misalignment. Anchors are welded to pipe before installation of flexible connector. Weight of pipe should not compress the expansion joint.

Double Suction Split Case Pump Solid Mounted Expansion Joint in horizontal lines
Anchors are located at 90 elbows where piping changes from horizontal to vertical. Flanges farthest from pump are stabilized. Design prevents excessive misalignment or angular deflection. Pipe-leg anchor and floor flange must be designed to withstand the forces and movements imposed on it by the piping system.

Use of Internal Sleeves in Expansion Joints

Certain abrasive applications, such as slurries, or high velocity flow rates may damage the PTFE convolution or radius surface at the end of the flares and cause catastrophic failure. In such circumstances an internal PTFE or metallic nozzle liner should be installed at the inlet side of the expansion joint to help protect the unit or smooth out the flow. While such liners may greatly extend useful service life, they will restrict parallel or angular movement unless the factory is consulted to supply an internal liner with smaller O.D. Unless otherwise specified, overall length is 6”.

WARNING
Always Use Safety Shields in Hazardous Service
Company Name:____________________________________________________________________________________________

Address: ________________________________________________________________________________________________

Contact: ________________________________________________________________________________________________

Description of application (include type of equipment plus description of Fluid system.)
____________________________________________________________________________________________________
____________________________________________________________________________________________________

Diameter (if known) __________________________ Neutral Length ________________________________________

If size is unknown, specify fluid and flow rate ________________

Movement Requirements

Axial Compression _____________________________ Axial Extension ________________________________________________

Misalignment _____________________________ Angular Deflection ____________________________________________

Fluid being conveyed ____________________________________________________________

Fluid temperature __________________________ °F Max. __________ °F Min. __________ °F Normal

Temperature of surrounding atmosphere __________________________ °F Max. __________ °F Min.

Fluid Pressure ___________________________ PSI Max. __________ Vacuum __________ (inches, Hg)

Pressure Cycle ___________________________ PSI Max. __________ PSI Min. __________ Frequency

Surges (please explain) ____________________________

Installation Description (Please make a sketch on separate sheet.)

If flexing is involved, please specify the following:

Frequency ___________________________ Amplitude of Motion ________________________________________________

Additional special requirements: ________________________________________________________________

__________________________________________________________________________________________________

__________________________________________________________________________________________________

Sleeve or guard required __________________________________________________________

Other factors involved ________________________________________________________________

Number of units required ________________________________________________________________

FAX: 828-724-4783 www.PTFEflexjoints.com
Let Resistoflex help solve all of your pump connection problems.

FLANGED PLASTIC-LINED PIPE
Resistoflex plastic lined pipe is made with a locked-in liner to minimize the adverse affects of differential thermal expansion between the liner and the steel. Available liners are: PP, Kynar PVDF, and Teflon PTFE or PFA.

Thermalok Pipe
- Stress relieved liner
- Unlimited housing material options
- Sizes ranging from 1” - 24” diameter

Swaged Pipe
- Used exclusively for CONQUEST® and MULTI-AXIS®
- Sizes ranging from 1” - 8”
- Threaded flanges and rotatable flange assemblies only

CONQUEST® CONNECTIONS
- Patented flangeless joint design
- Performance of a welded system
- Available in 1” - 4” for all liner types
- Zero maintenance

PLASTIC-LINED FITTINGS
PP, Kynar PVDF, and Teflon PFA fittings are all injection or transfer molded. TEFZEL® lined fittings and special shapes are roto-lined in custom housings. Teflon® PTFE liners are made by isostatic molding.

SPECIAL SHAPES
- Custom fittings and small vessels
- Lined with TEFZEL® ETFE
- Available through 24” diameter

RESISTOFLEX® ConneXion™
Longer gaps, higher pressures, too much misalignment...Let Resistoflex’s PTFE Teflon® Hose ConneXion fill in. With a variety of hose styles such as seamless convoluted, True ID smooth bore, and even dual containment, we have many ways to protect your piping system from shock, stresses, corrosion, and other key factors in pump protection. Combine that with our PTFE Teflon® expansion joints to compensate for axial movement or misalignment. Resistoflex can fit your needs with a variety of fittings including flare through flanged ends, male pipe, sanitary, and other fittings necessary to connect your pump and piping system.
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