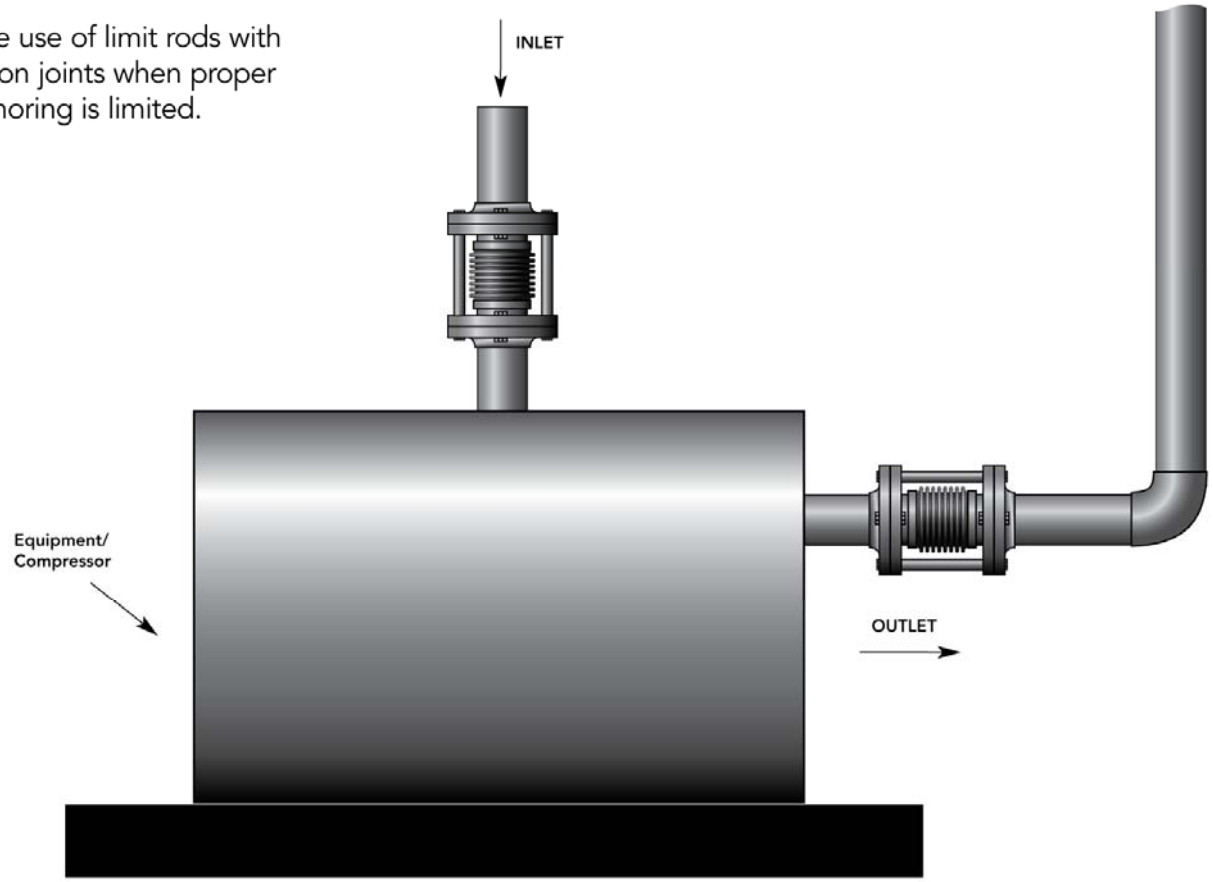
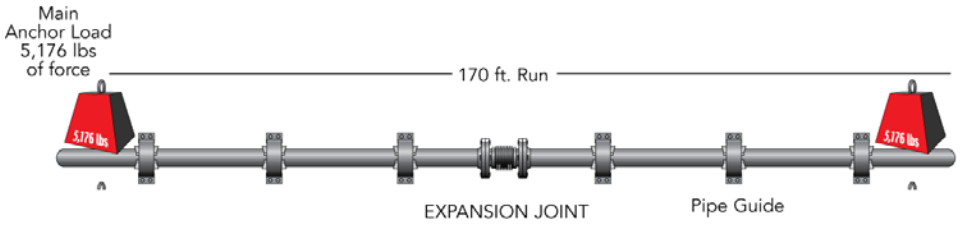
Typical Piping Layout

Showing the use of limit rods with the expansion joints when proper system anchoring is limited.



Expansion joints with limit rods

How much force is at the anchors?



Example using Low Corrugation:

- Pressure Thrust Force = (p)(a)
- Where p = the system pressure (psig), and
  a = the effective area of the expansion joint (in^2)
- Pressure Thrust Force - (150psig)(34.5 in^2) = 5176 lbs

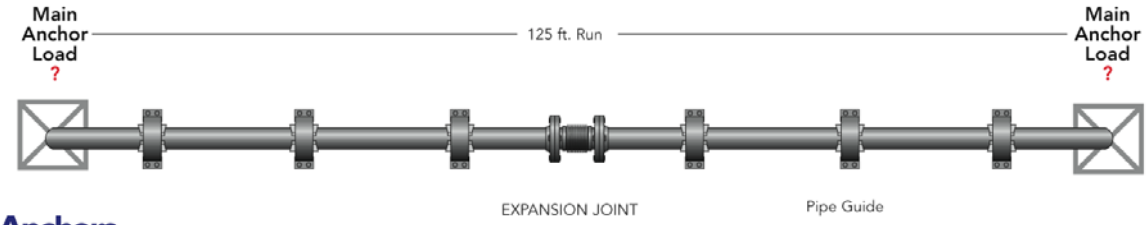
Pipe Expansion Example
170 ft. pipe run

Low corrugation expansion joint has an effective area of 34.5 in^2

Pressure Thrust Force = 5176 lbs

High corrugation expansion joint would have an effective area of 56.7 in^2

Pressure thrust force = 8505 lb.



Main Pipe Anchors

A main anchor is one installed at any of the following locations in a pipe system containing one or more bellows:

1. At a change in direction of flow
2. Between two bellows units of different size installed in the same straight run
3. At the entrance of a side branch on the main line
4. Where a shut-off or pressure-reducing valve is installed in a pipe run
5. At a capped end of pipe

How much force is at the anchors?

A main pipe anchor must be designed to withstand the forces and moments imposed upon it by each of the pipe sections to which it is attached. In a pipe section containing one or more expansion joints, this will consist of the sum of: the pressure thrust at maximum pressure, plus force required to deflect the expansions joints full rated movement plus the frictional forces due to the pipe alignment guides.

Note: The maximum pressure thrust exerted by the expansion joints are during cold water hydrostatic testing*. The main anchors must be designed to absorb the pressure thrust forces created by the test pressure. If the pressure thrust forces that are created by the expansion joint designare too great to be absorbed by main anchors in the pipingsystem the following can be utilized as alternate designs:

- Tied expansion joints (if the rods are always in tension)
- Pressure-balanced expansion joints
- Hinged expansion joints
- Gimbal expansion joints

Determining How Much Force is at the Anchors:

Application: 75# Steam

Example:
An 8" steel pipe line is 125 feet long. Maximum temperature the line will encounter is 320°F. Lowest temperature is 40°F.

Calculation:
125/100 x 2.23 = 2.79" thermal growth
Effective Area = 72.8
Axial Spring Rate = 936.05 lbs/in

Expansion Joint Specified:
Flex-Hose Bellowsflex Single-Ply BF/150-FxF

What are the forces on the anchors and guides?
1) operating conditions
2) *coldwater hydrostatic test at 1.5 x design

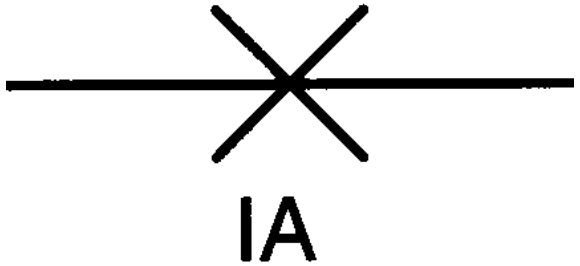
Expansion joint forces acting upon anchors:
Where:
Fs = The static pressure thrust due to internal pressure - lbs
= (Effective area) (Design line pressure)
= (72.8 in^2) (115 lb/in^2)
= 8,372 lbs
F = The force required to deflect the expansion joint
= (Spring rate) (Axial deflection)
= (936.05 lb/in) (2.79 in)

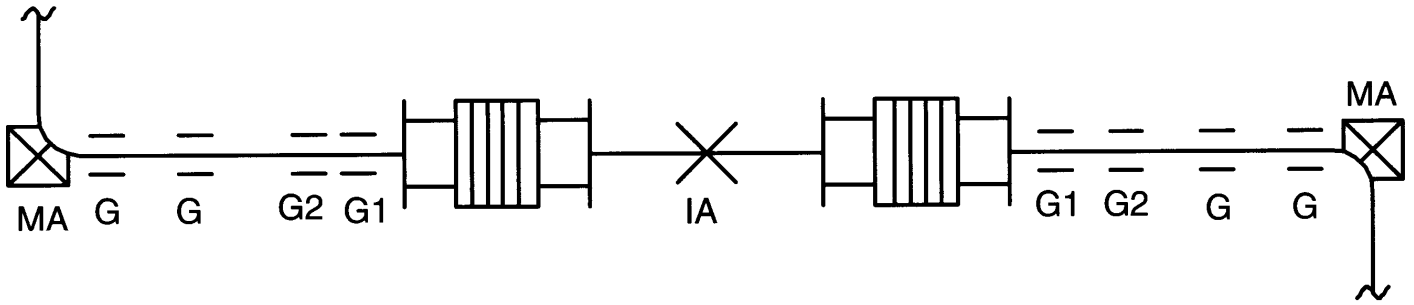
Solution to forces acting on main anchors:
Fx = -Fs - F
Fx = -8,372 - 2,611.58
Fx = 10,983.58 lbs

Maximum lateral forces acting on pipe alignment guides are:
Force acting on main anchor x 0.15
Maximum lateral force = 10,983.58 x 0.15
Maximum lateral force = 1,647.54 lbs

Intermediate Anchor

An intermediate anchor is one which divides a pipeline into individual expanding pipe sections containing multiple expansion devices of the same pipe size. Such an anchor must be designed to withstand the forces and moments imposed upon it by each of the pipe sections to which it is attached. In the case of a pipe section containing one or more bellows units, these forces will consist of forces and/or moments required to deflect the bellows unit plus the frictional forces due to the pipe moving over its guides. The pressure thrust is absorbed by the other anchors or devices on the bellows unit such as limit rods, tie rods, hinged restraints, etc.





MAIN ANCHOR LOAD **= EFFECTIVE AREA x DESIGN LINE PRESSURE**

+

SPRING RATE x AXIAL DEFLECTION

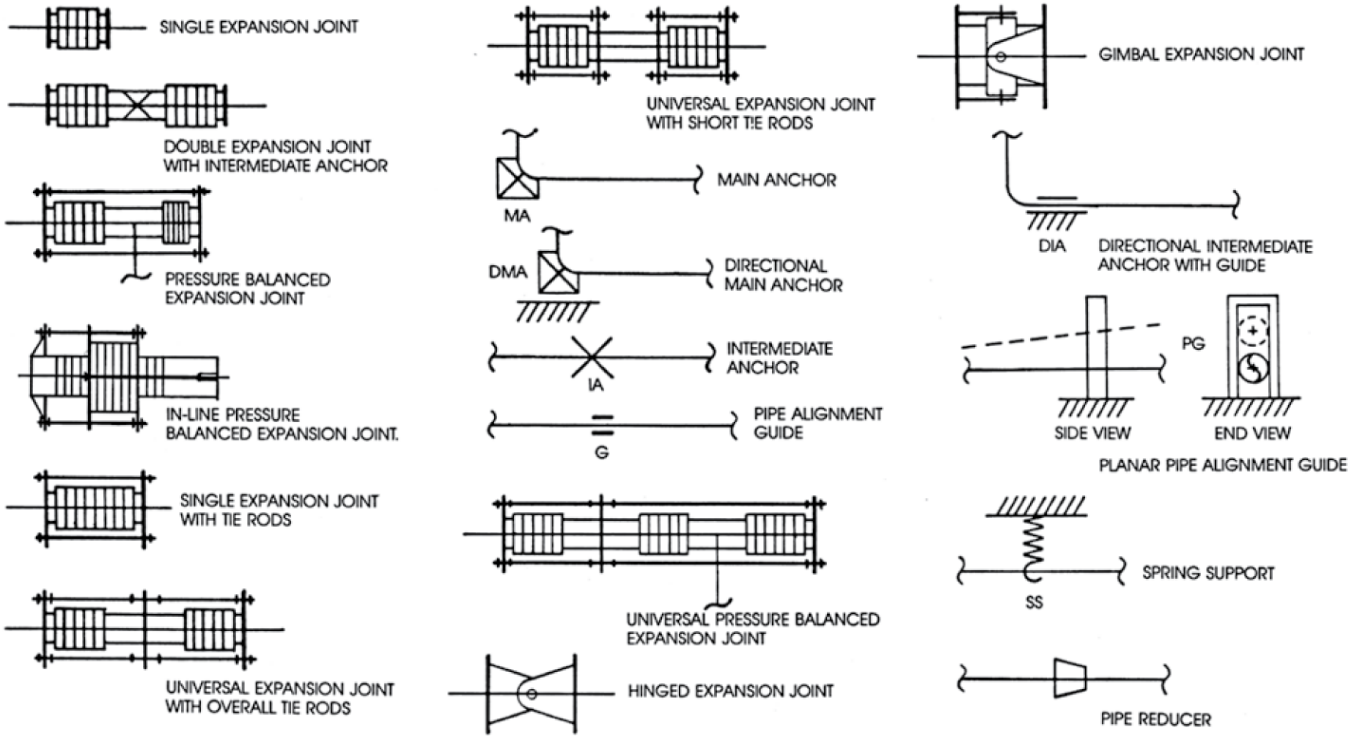
INTERMEDIATE ANCHOR LOAD **= SPRING RATE x AXIAL DEFLECTION**

MAXIMUM LATERAL FORCE (PIPE GUIDE LOAD) **= MAIN ANCHOR LOAD x .15**

Understanding the Customers Intent (Application)

- New Installation
- Replacement of current expansion joint in service
  A. Manufacturer's part numbert
  B. Overall length in service
  C. Overall length when system is down
- Size diameter
- Space restrictions:
  Overall length if dimension is critical
- Temperature:
  - maximum operating
  - minimum ambient temperature
- Working pressure
- System test pressure
- Media being conveyed
- Alloy of piping system

Symbols/Key Guide

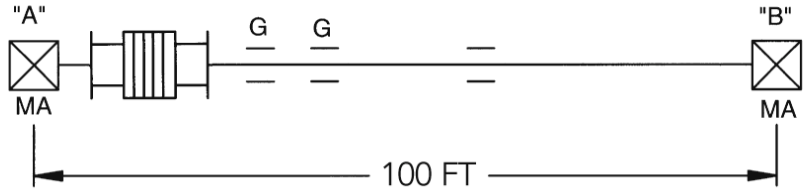


Most Frequent Axial Motion Application

Expansion on a piping run due to an elevated operating temperature (axial motion)

Assumptions:

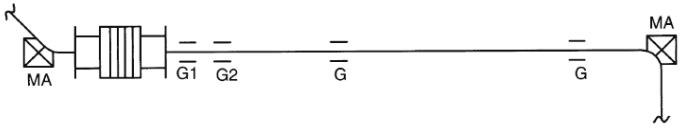
- The piping system is properly supported and guided.
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers and is, therefore, not included.

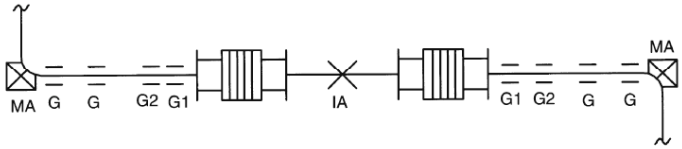


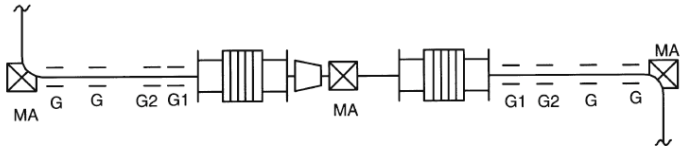
Reduce installation costs by locating the expansion joint to the main anchor no greater than a distance of 4 times the diameter of the pipe, this eliminates the need for a pipe guide.

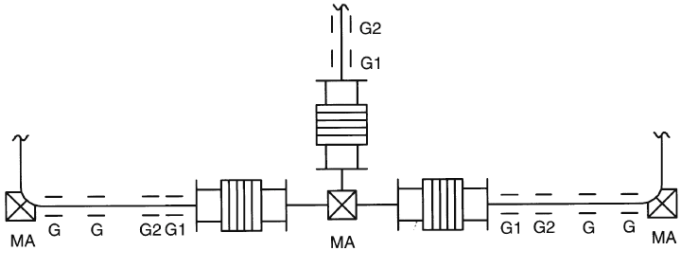
MA = Main Anchor G = Guide

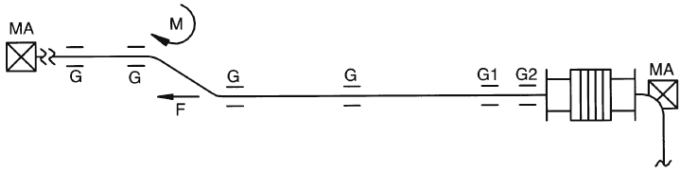
Axial Motion Applications









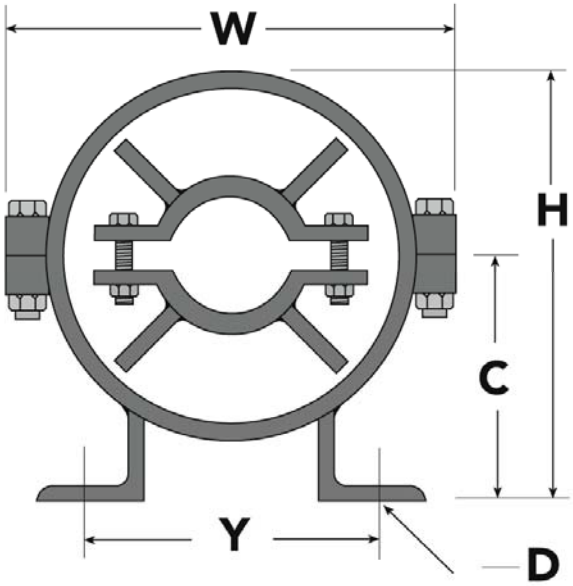


Slight directional change in piping system where offset length is no greater than intermediate guide requirements.

NOTE: Guides should be installed near both ends of the offset to minimize the effects of the bending movement in the piping system.

MA = Main Anchor G = Guide

Pipe Guides



Why Pipe Guides?

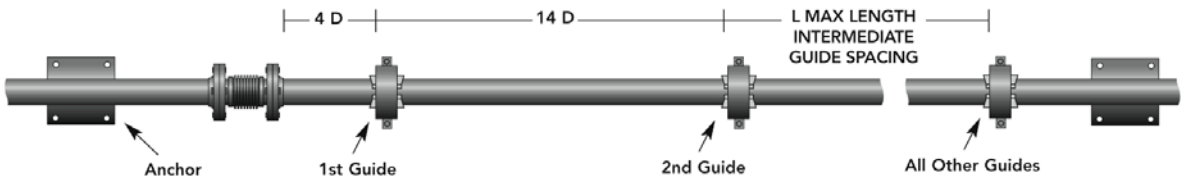
GUIDED

A **pipe alignment guide** is a form of sleeve fastened to some rigid part of the installation which permits the pipeline to move freely in only one direction, i.e. along the axis of the pipe. Pipe alignment guides are designed primarily for use in applications involving axial movement only.

NOT GUIDED

NOTE: Proper guiding and anchoring is essential to an installation of an expansion joint to prevent buckling or squirming of the pipeline.

Intermediate Pipe Guided Spacing

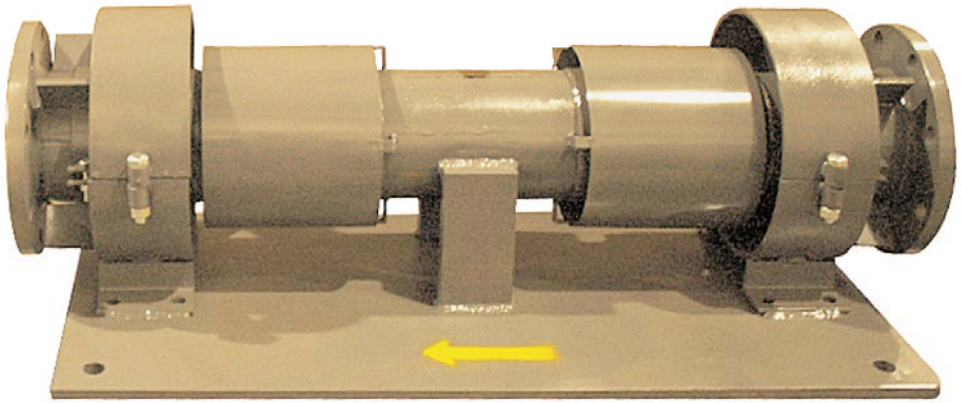


NOTE: First pipe guide must be located within a distance no greater than four pipe diameters from the end of the bellows and the second guide must be located within a distance no greater than fourteen pipe diameters from the first guide.

Nom. Pipe Size (In.)	Maximum Distance from Expansion Joint to 1st Guide or Anchor	Approx. Distance Between 1st and 2nd Guide	Approximate Distance Between Additional Pipe Guides (Ft.)							
			@ 50 PSI	@ 100 PSI	@ 150 PSI	@ 200 PSI	@ 250 PSI	@ 300 PSI	@ 350 PSI	@ 400 PSI
.75	3.00"	10.00"	11.00	7.50	6.00	5.00	5.50	5.00	5.00	5.00
1.00	4.00"	1'-2.00'"	15.00	11.00	8.50	7.50	6.50	6.00	5.50	5.0
1.25	5.00"	1'-5.00"	17.00	13.00	11.00	9.00	8.00	7.25	7.00	6.50
1.50	6.00"	1'-9.00"	22.00	16.00	13.00	11.00	10.00	9.00	8.50	8.00
2.00	8.00"	2'-4.00"	25.00	18.00	14.00	13.00	12.00	11.00	9.50	9.00
2.50	10.00"	2'-11.00"	32.00	23.00	17.00	16.00	14.00	13.00	12.00	11.00
3.00	1'-0"	3'-6.00"	38.00	27.00	22.00	19.00	17.00	16.00	15.00	14.00
4.00	1'-4.00"	4'-8.00"	52.00	37.00	31.00	27.00	24.00	22.00	20.00	18.00
5.00	1'-8.00"	5'-10.00"	62.00	45.00	37.00	32.00	28.00	27.00	24.00	23.00
6.00	2'-0"	7'-0"	67.00	47.00	39.00	34.00	32.00	28.00	26.00	24.00
8.00	2'-8.00"	9'-4.00"	86.00	62.00	51.00	44.00	40.00	36.00	34.00	32.00
10.00	3'-4.00"	11'-8.00"	109.00	76.00	63.00	55.00	48.00	45.00	42.00	38.00
12.00	4'-0"	14'-0"	117.00	84.00	68.00	60.00	54.00	47.00	45.00	42.00
14.00	4'-8.00"	10'-4.00"	120.00	88.00	72.00	62.00	55.00	51.00	46.00	44.00
16.00	5'-4.00"	18'-8.00"	133.00	95.00	78.00	67.00	62.00	55.00	52.00	48.00
18.00	6'-0"	21'-0"	151.00	105.00	87.00	75.00	67.00	62.00	58.00	54.00
20.00	6'-8.00"	23'-4.00"	160.00	107.00	93.00	81.00	72.00	65.00	62.00	57.00
24.00	8'-0"	24'-0"	181.00	130.00	105.00	92.00	85.00	75.00	70.00	65.00

NOTE: The recommendations given for pipe anchors and guides represent the minimum requirements for controlling pipelines which contain expansion joints and are intended to protect the expansion joint and pipe system from abuse and failure. However, additional **pipe supports** are often required between the pipe guides in accordance with accepted piping practices. A **pipe support**is any device which permits free movement of the piping and carries the total weight of in line equipment such as valves, meters, expansion joints, and the weight of the contained fluid. Pipe supports cannot be substituted for pipe alignment guides. Pipe rings, U-bolts, roller supports, and spring hangers are some examples of conventional pipe supports. Additional pipe supports are usually required between guides n accordance with standardpiping practices.

Bellowsflex Dual Series with Factory Assembled Intermediate Anchor Base and Pipe Alignment Guide



Main Anchor Piping System
Save installation time/cost with first set of guides included - Ready to install

Bellowsflex™ Metal Bellows Expansion Joints

The standard bellows element is manufactured with various 300 series stainless steel alloys.

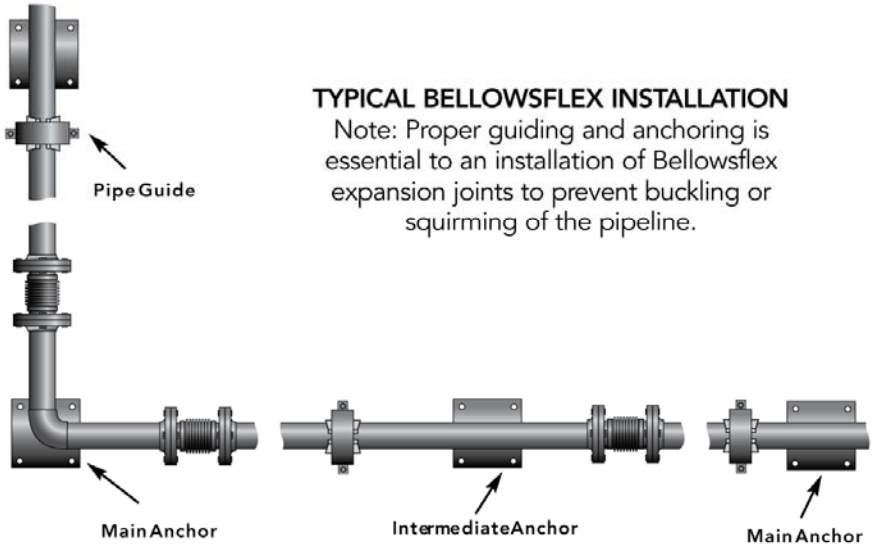
Maximum system test pressure 1.5 times maximum working pressure.

Bellowsflex can also be supplied with accessories such as tie rods, limit rods, flow liners, and protective covers/shrouds.

Standard sizes
2 to 24" I.D.
Custom sizes available to 60"

Design Pressure 50, 150, 300, 600 PSIG

For movement up to 3.5"



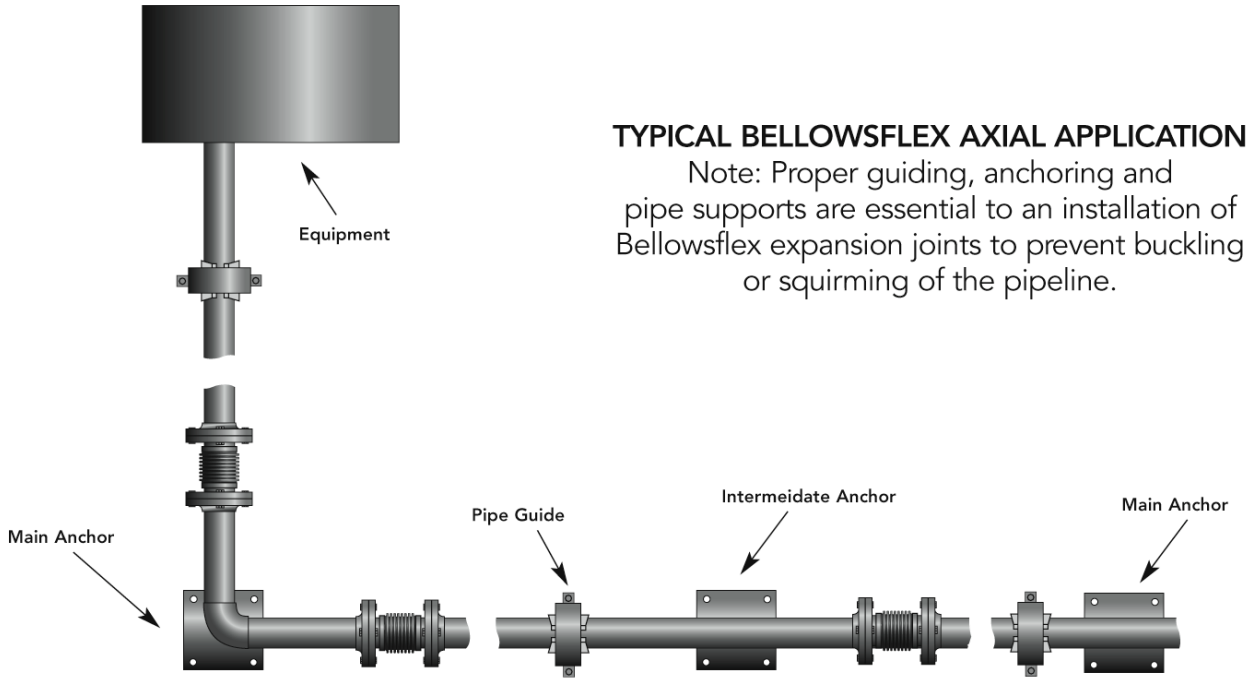
TYPICAL BELLOWSFLEX INSTALLATION
Note: Proper guiding and anchoring is essential to an installation of Bellowsflex expansion joints to prevent buckling or squirming of the pipeline.

Most Frequent Axial Motion Application

Expansion on a piping run due to an elevated operating temperature (axial motion)

Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)



TYPICAL BELLOWSFLEX AXIAL APPLICATION

Note: Proper guiding, anchoring and pipe supports are essential to an installation of Bellowsflex expansion joints to prevent buckling or squirming of the pipeline.

Design Considerations

Low Corrugated *vs.* *High Corrugated*

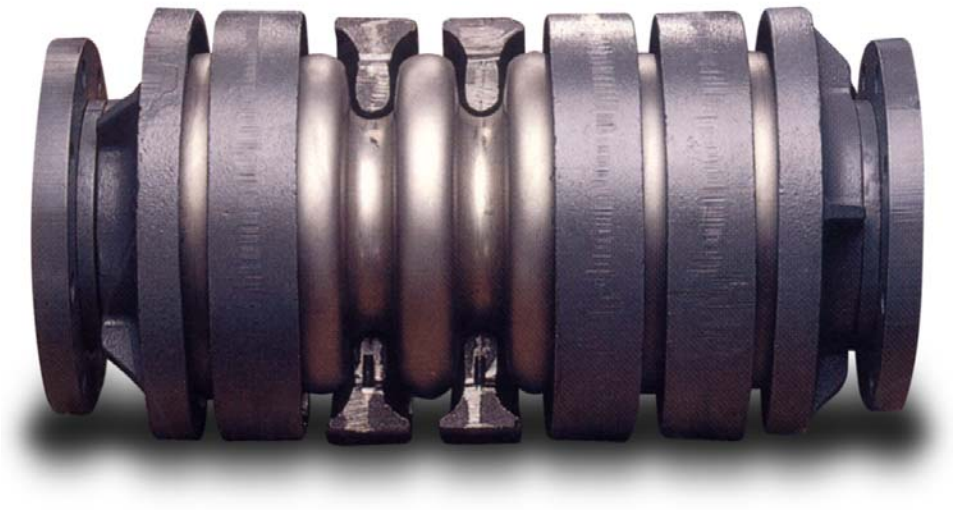
Flexhose State-of-the-Art
Technology Low Corrugation

FLEX-HOSE CO. INC.

Design Considerations

Low Corrugated *vs.* *High Corrugated*

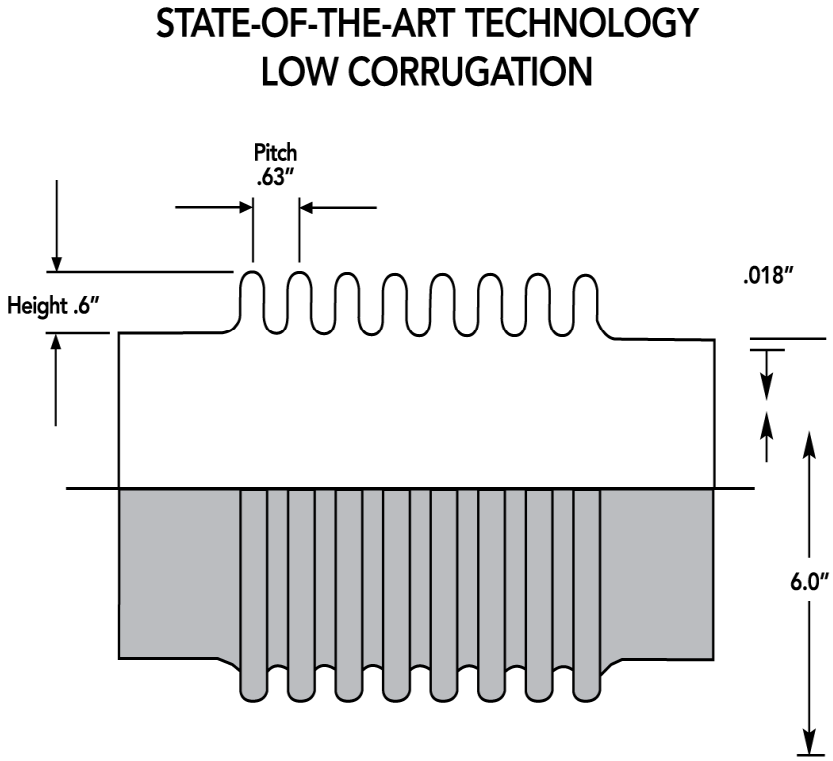
Old Technology
High Corrugation



Low Corrugation vs. High Corrugation

Low Corrugation Features

- No ring reinforcement required
- Lower rod and hinge hardware required
- Over 60% smaller effective area reduces anchoring costs
- Extension allowance normally eliminates precompression at installation site
- Lighter weights reduce shipping costs and simplify installation

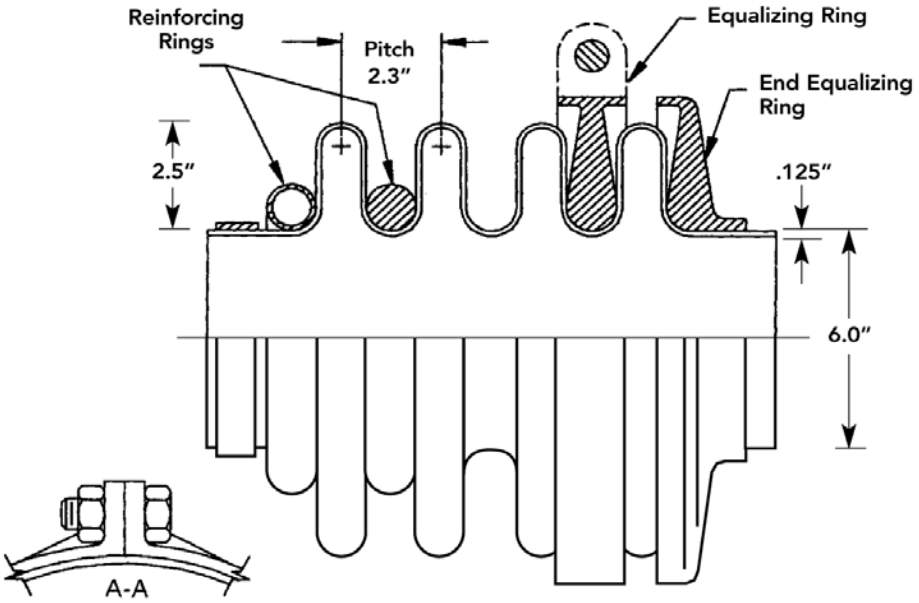


High corrugation is yesteryear's technology which typically requires reinforcing rings to achieve higher working pressure over 50 psi.

The extreme height and pitch of the convolutions cause the expansion joint to have very little hoop strength, requiring external structure such as root rings or reinforcing rings for pressures greater than 50 psi.

The increased effective area of the bellows significantly increases the overall cost of a project by creating the need for larger anchors and structure to attach the pipe guides to.

OLD TECHNOLOGY
HIGH CORRUGATION



Internally and Externally Pressurized Expansion Joints

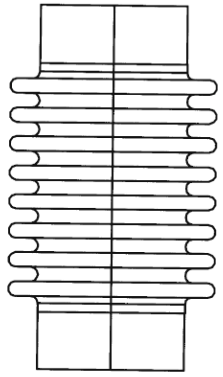
Internally Pressurized Bellows
Bellows Stability
An internally pressurized expansion joint will eventually buckle at some internal pressure loading. This buckling is called squirm. Squirm is detrimental to bellows performance in that it can greatly reduce both cycle life and pressure capacity.

Every internally pressurized bellows will squirm if the pressure is increased to a high enough level. For a given diameter bellows, the greater the convoluted length the lower the pressure required to cause squirm.

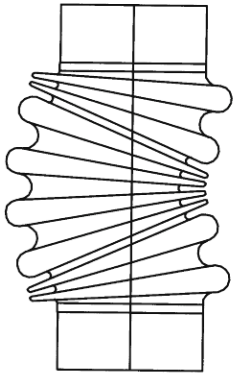
For a giving pressure, the larger the diameter, the greater the convoluted length can be before the bellows will squirm. Therefore, the smaller diameter bellows will have a shorter convoluted length and a reduced ability to absorb motion when compared to a larger diameter bellows.

Externally Pressurized Bellows
Bellows Stability
External pressure does not produce squirm no matter how long the convoluted length.

Expansion joints designed with externally pressurized bellows can accommodate greater axial movements even in small diameters.



NORMAL



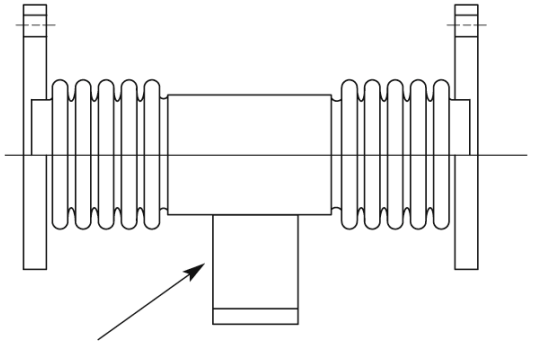
SQUIRM

Bellowsflex Dual Metal Bellows Expansion Joints

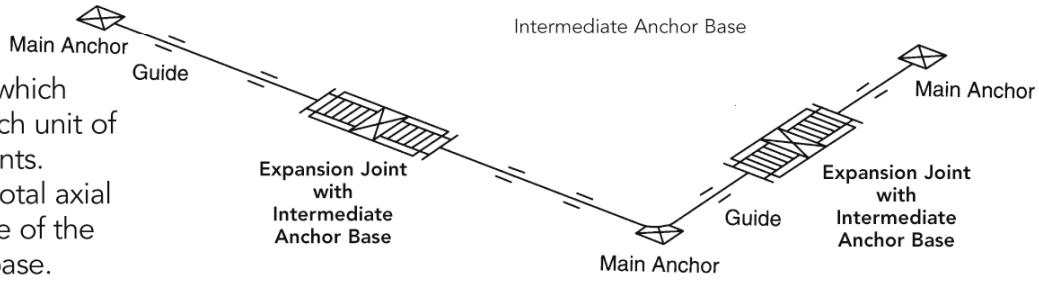
Dual Bellows Expansion Joint with Intermediate Anchor Base

Main Anchor Piping System

By using a dual unit with an intermediate anchor at the center of a long run of pipe, movement is limited to an amount which can be handled by each unit of the dual expansion joint.



NOTE: Movement is limited to an amount which can be handled by each unit of the dual expansion joints.
i.e.: Unit rated for 6" total axial travel, 3" axial per side of the intermediate anchor base.



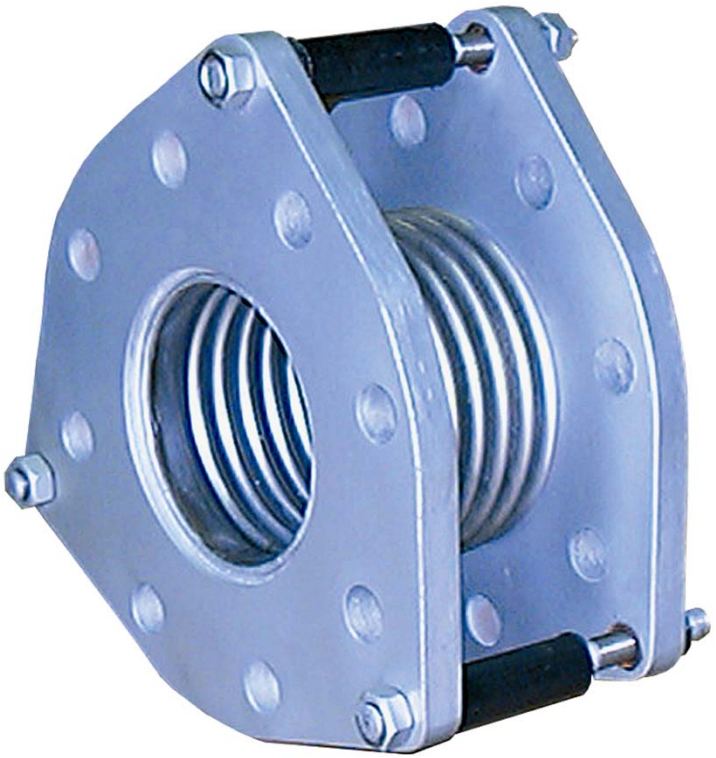
Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)

Bellows Pump Connectors/ Expansion Joints

304 series stainless steel bellows construction. Series EJPC has a short face-to-face dimension for compact installations.

.5” axial compression.

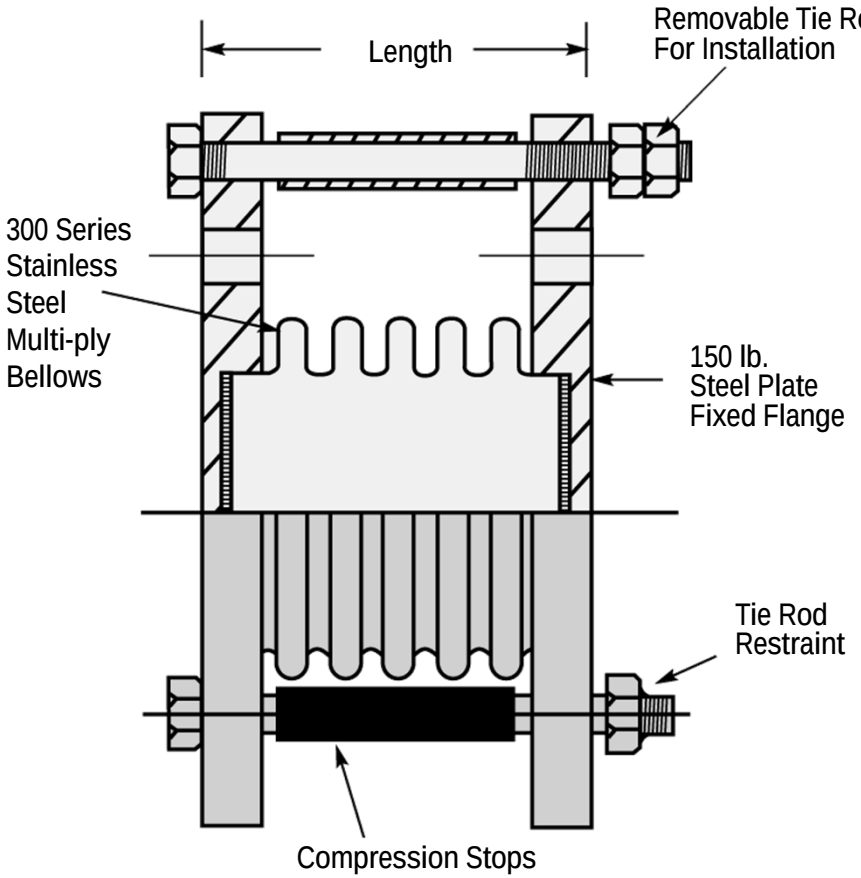


Standard Sizes

2” to 12” I.D.

Additional alloys, styles, sizes and higher working pressures available. Please consult factory.

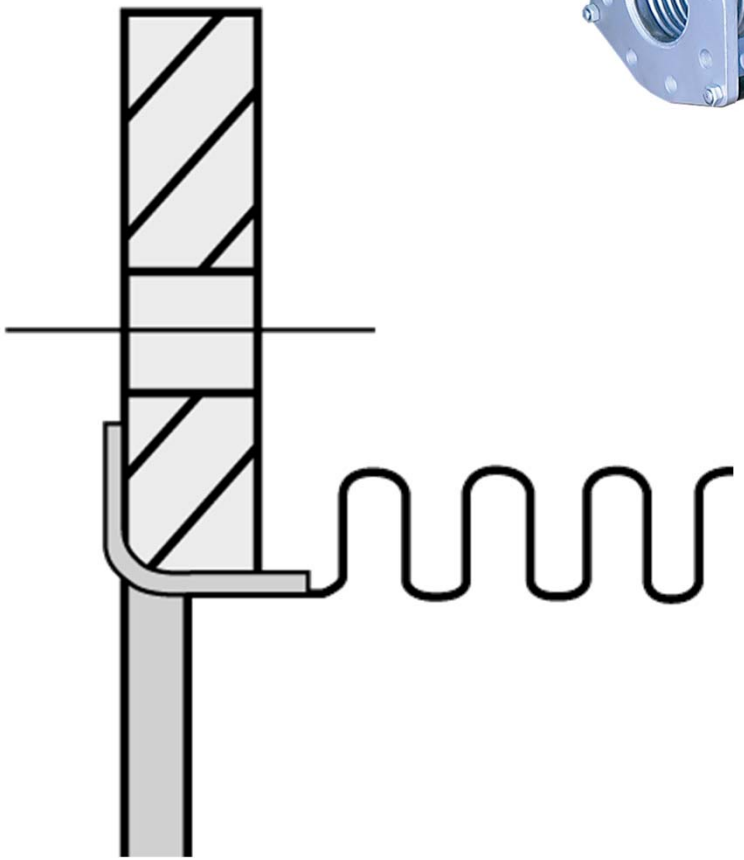
Bellows Pump Connectors/ Expansion Joints



Bellows Pump Connectors/ Expansion Joints

OPTIONAL VANSTONE FLANGE

Vanstone flanges provide a cost-effective means of isolating the media from the standard carbon steel flange.
The Vanstone option, without the use of tie rods, allows full rotation of the backup flange to allow for bolt hole alignment.



Standard Sizes

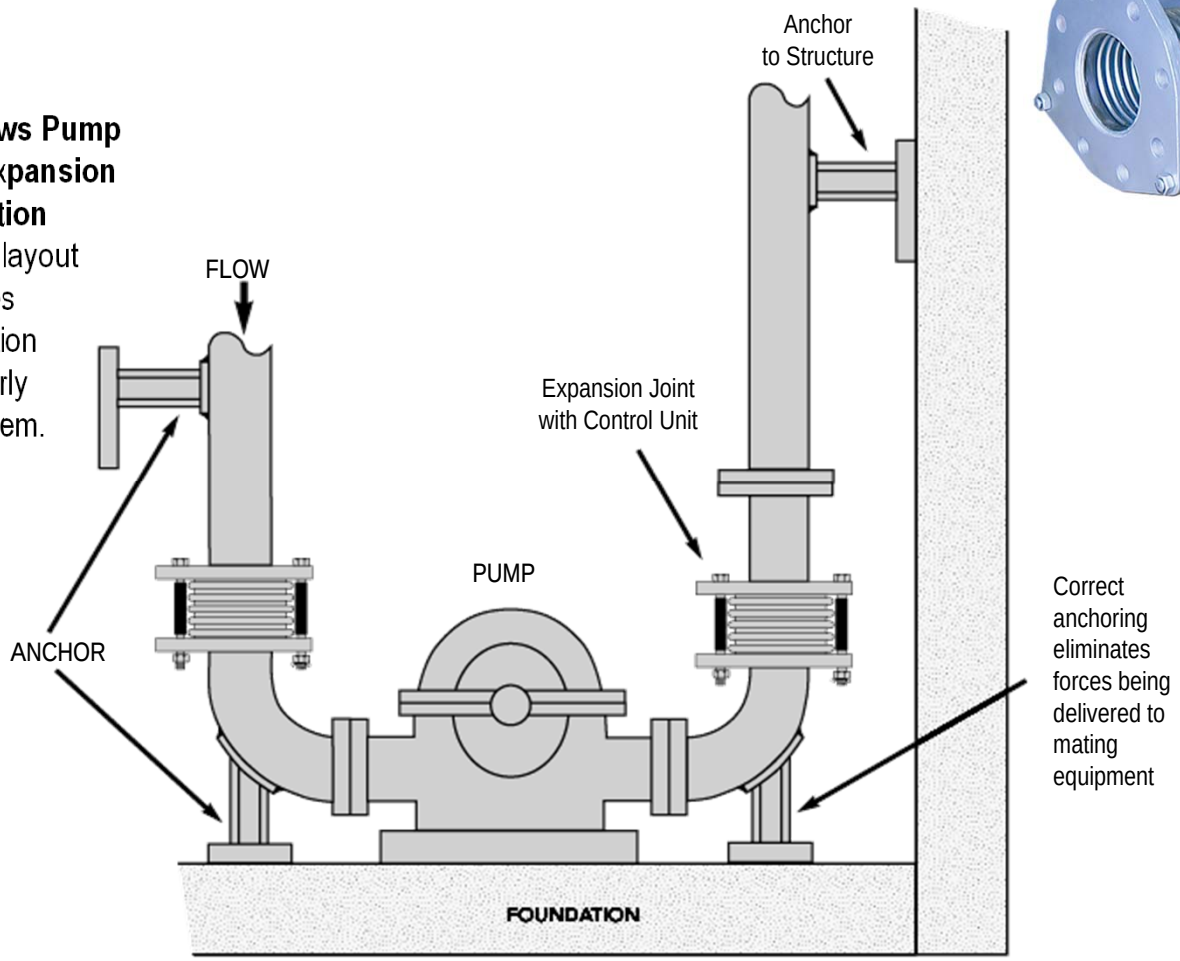
2” to 12” I.D.

Additional alloys, styles, sizes and higher working pressures available. Please consult factory.

Bellows Pump Connectors/Expansion Joints

Typical Bellows Pump Connector/Expansion Joint Installation

Typical piping layout showing Series EJPC installation within a properly anchored system.



Flexcomp™

Expansion Compensators

Main Anchor Piping System –

For movement up to 2” axial travel.

Hot water and chilled water piping system (steel)

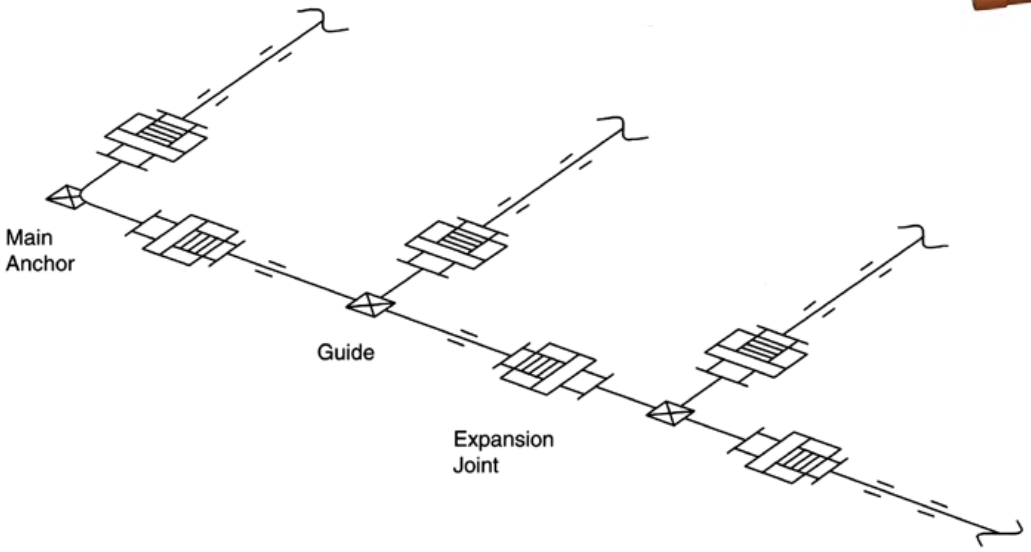
Domestic hot water piping system (copper)

External cover, assuring safety and reliability.

Standard working pressure ratings up to 200 psi.

Standard Sizes

3/4” to 4” I.D.

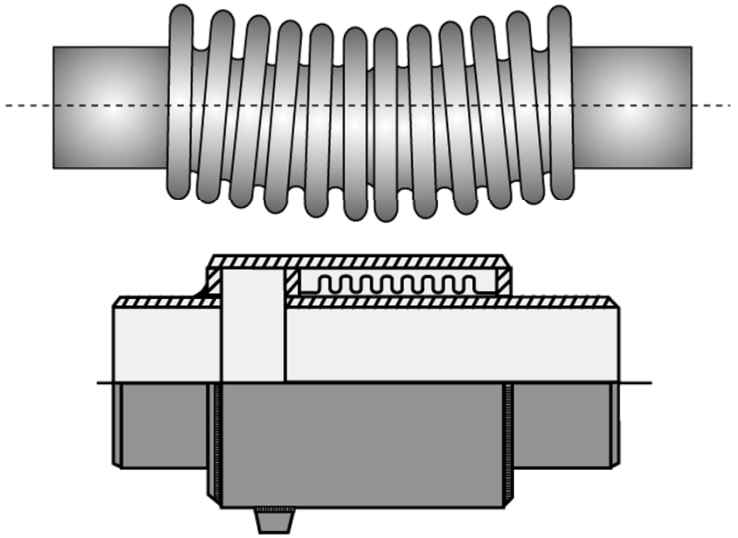


Design Considerations

Spring Rate *Pressure Thrust* *Squirm* *Main Anchor*

Flexpress™

Externally Pressurized Expansion Joints

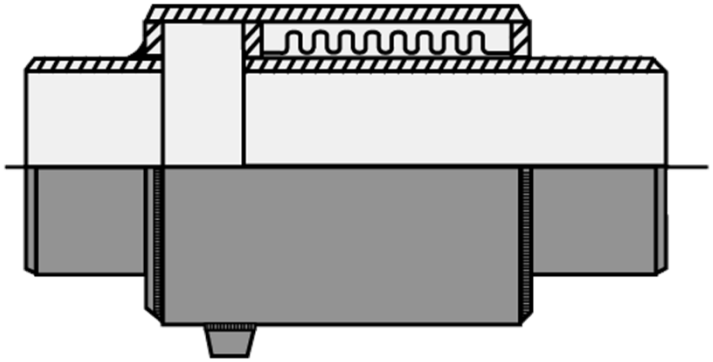


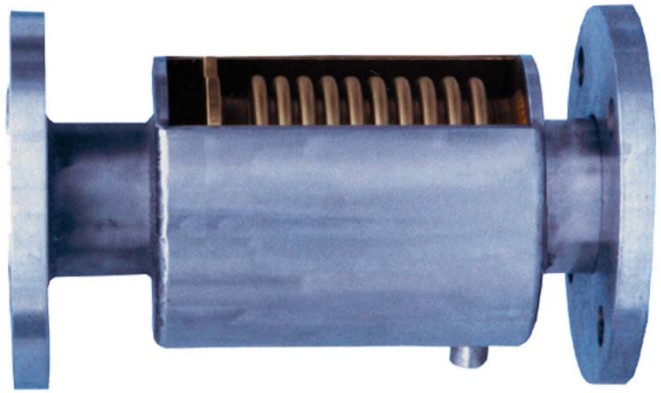
Convolutions can be added to increase movement without sacrificing cycle life, but there is a limit to this process which is reached when the bellows, under internal pressure, exhibits a condition known as squirm (bellows instability).

Flex-Hose Series EJXP externally pressurized bellows are not subject to this condition, as they become more stable under pressure. A bellows is a a flexible seal. This convoluted part of the expansion joint is designed to flex when thermal movement in the piping system occurs. Therefore, by determining the thermal movements that will occur in the piping system, expansion joints may be specified, manufactured, and installed in the system to accommodate these movements.

Flexpress™

Series EJXP (welded ends)
Cut-away side view





Suitable for virtually any axial movement.

Bellows element is completely enclosed to preclude external damage, internal contact with the flow, and containment of the media in the event of bellows rupture

External pressurization of bellows eliminates squirm or instability — even if over-pressurization occurs.

Internal guides insure alignment

External guiding is necessary but minimized by internal guides in the joint.

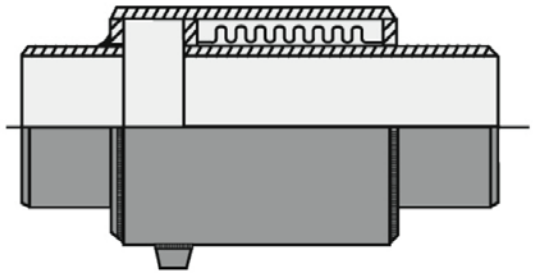
Standard Sizes

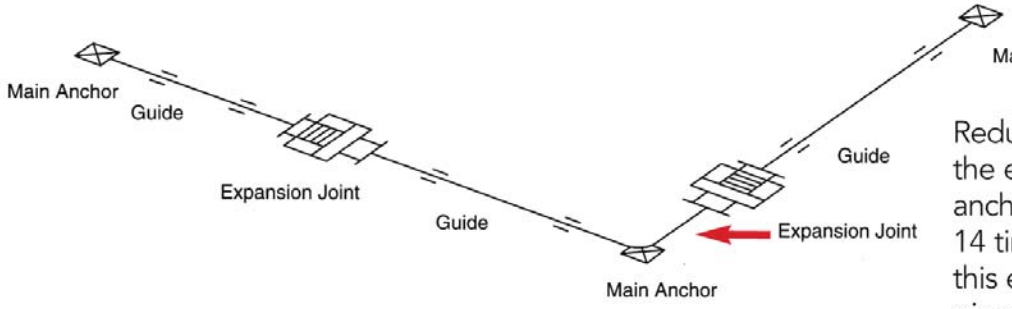
2” to 24” I.D.

Flexpress™ Externally Pressurized Guided Expansion Joints

Flexpress FPS-Single

Main Anchor Piping System
For movement up to 8" axial travel
Externally pressurized guided expansion joints reduce the number of pipe guides in a piping system. EJXP internal guide ring eliminates the first set of pipe guides required (4" pipe dia.)

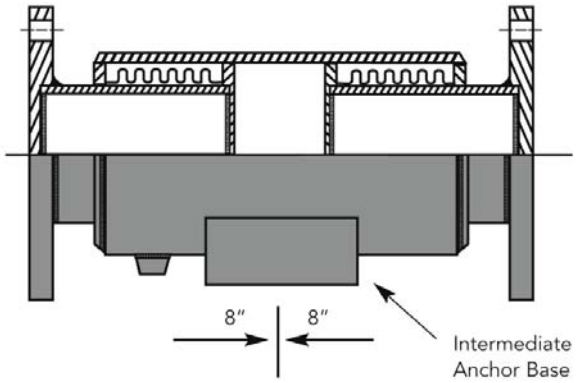




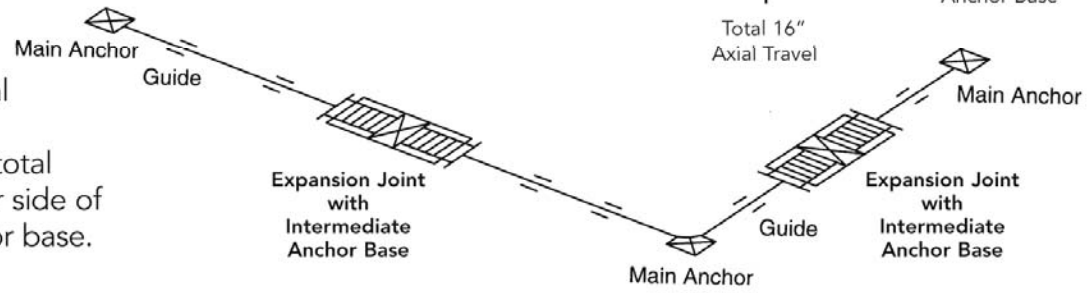
Reduce installation costs by locating the expansion joint to the main anchor no greater than a distance of 14 times the diameter of the pipe, this eliminates the need for a pipe guide.

Flexpress FPD-Dual

Main Anchor Piping System
For movement up to 16" axial travel
By using a dual unit with an intermediate anchor at the center of a long run of pipe, movement up to 16" can be handled by the expansion joint.



NOTE: Movement is limited to an amount which can be handled by each unit of the dual expansion joints.
i.e.: Unit rated for 16" total axial travel, 8" axial per side of the intermediate anchor base.



Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)

Bellows Xhaust™

Exhaust Type Expansion Joints

Low pressure (up to 50 psi) and high temperature (1200°F) applications.

Assembly weights have been reduced to permit use in thin wall flue duct systems.

Applications are exhaust connections on diesel, gasoline or gas turbine engine installations

Ducting conveying corrosive gases

Standard Sizes

4” to 48” I.D.

Other corrosion resistant alloys available.
Please consult factory.

Design Pressure 50 PSIG

Bellows Xhaust™

Exhaust Type Expansion Joints

Standard Sizes
4" to 48" I.D.

Other corrosion resistant alloys available.
Please consult factory.

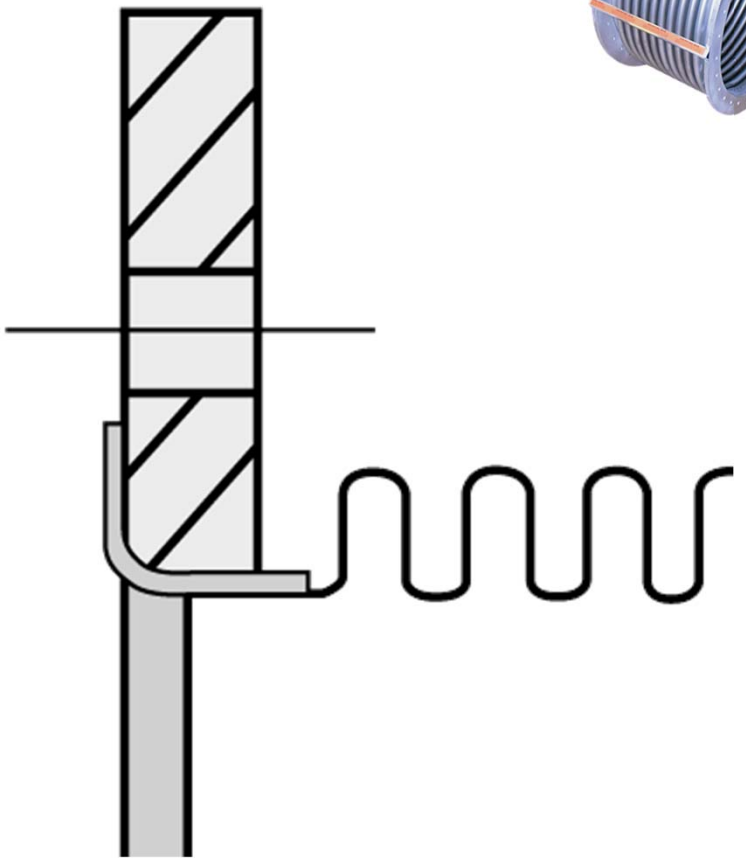
Typical BellowsXhaust Flow Diagram

Bellows Xhaust™

Exhaust Type Expansion Joints

OPTIONAL VANSTONE FLANGE

Vanstone flanges provide a cost-effective means of isolating the media from the standard carbon steel flange vs. a bellows exhaust unit with high alloy flanges. The Vanstone design are available for ease of bolt hole alignment.



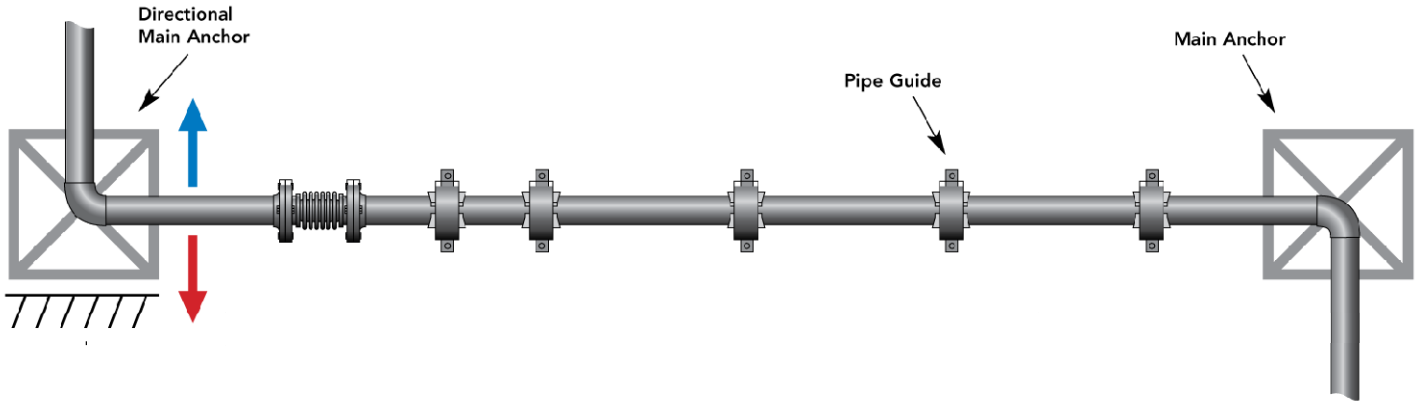
Standard Sizes

4” to 48” I.D.

Other corrosion resistant alloys available. Please consult factory.

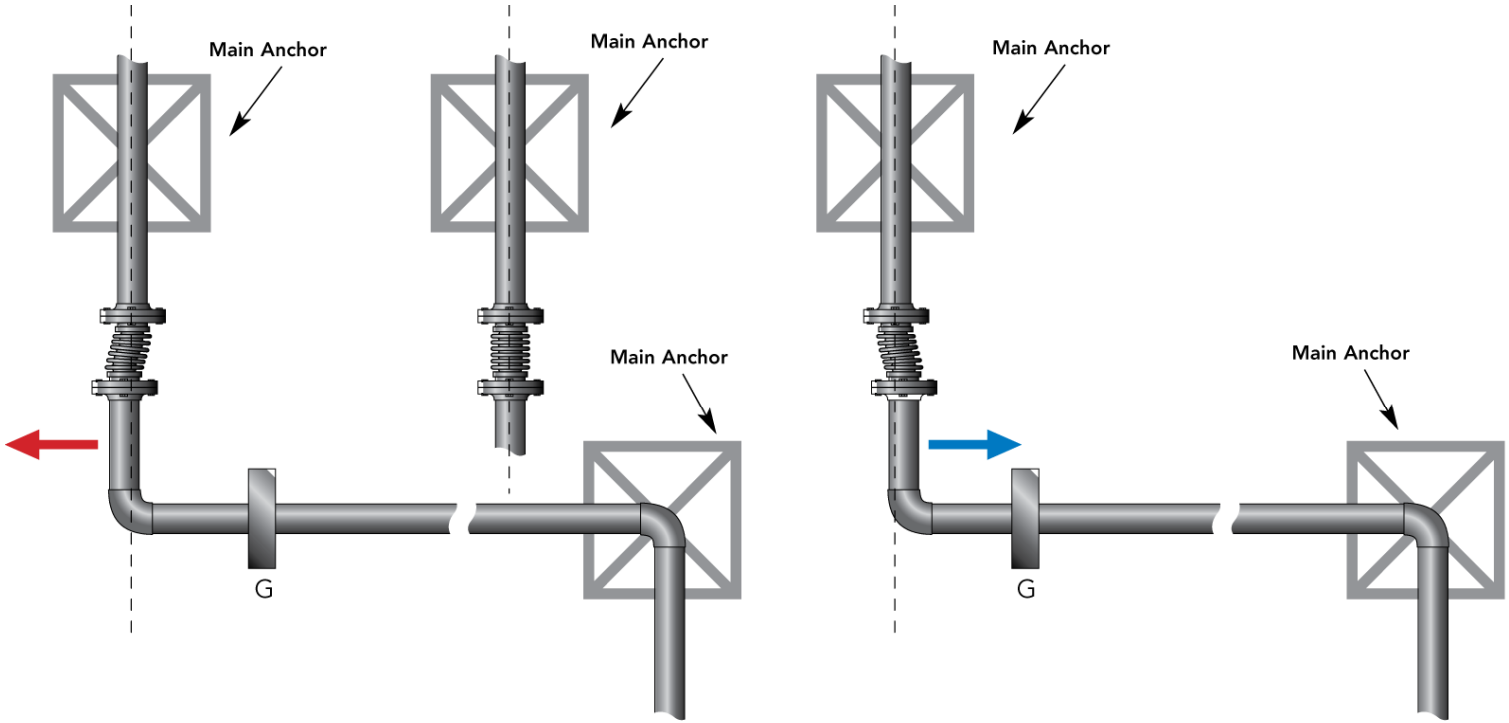
Design Pressure 50 PSIG

Lateral Movement Applications



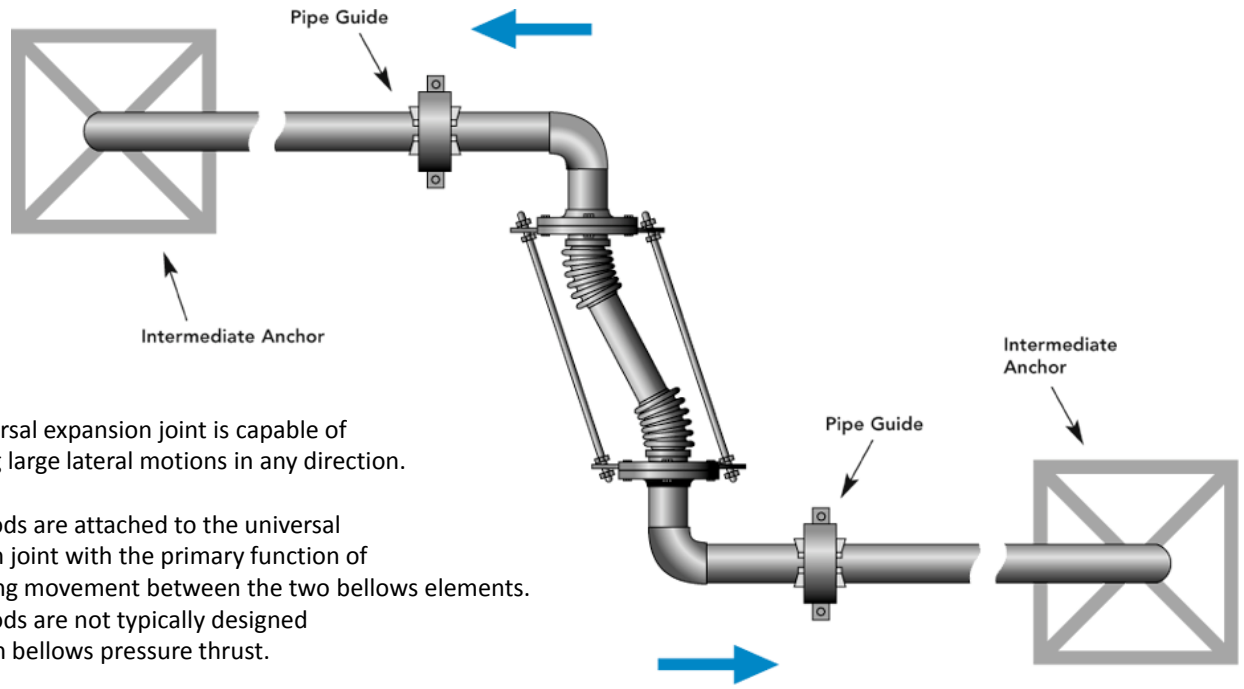
Directional Anchor

A directional anchor, or sliding anchor, is one which is designed to absorb loads in one direction while permitting motion in another. It may be either a main or intermediate anchor, depending upon the application considered. When designing a directional anchor, an effort should be made to minimize the friction between its moving or sliding parts, since this will reduce the loading on the pipe and equipment, and will ensure proper function of the anchor.



Single expansion joints have very limited lateral capability

Universal Tied Expansion Joints

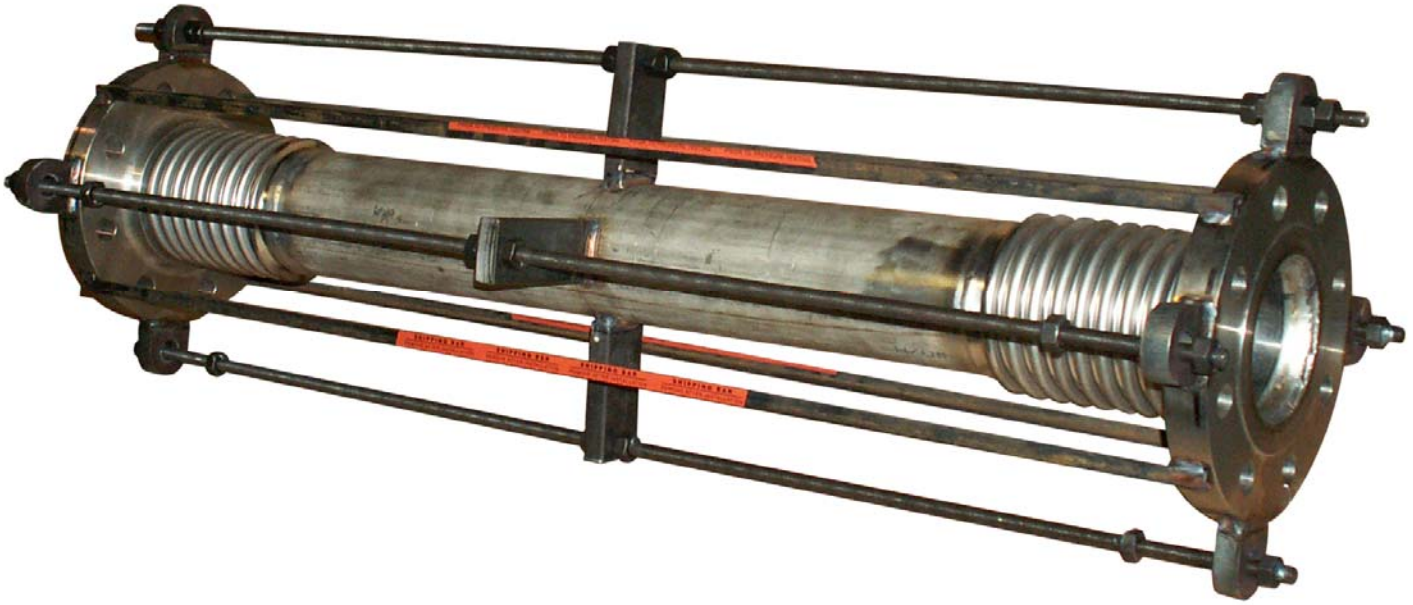


The universal expansion joint is capable of absorbing large lateral motions in any direction.

Control rods are attached to the universal expansion joint with the primary function of distributing movement between the two bellows elements. Control rods are not typically designed to restrain bellows pressure thrust.

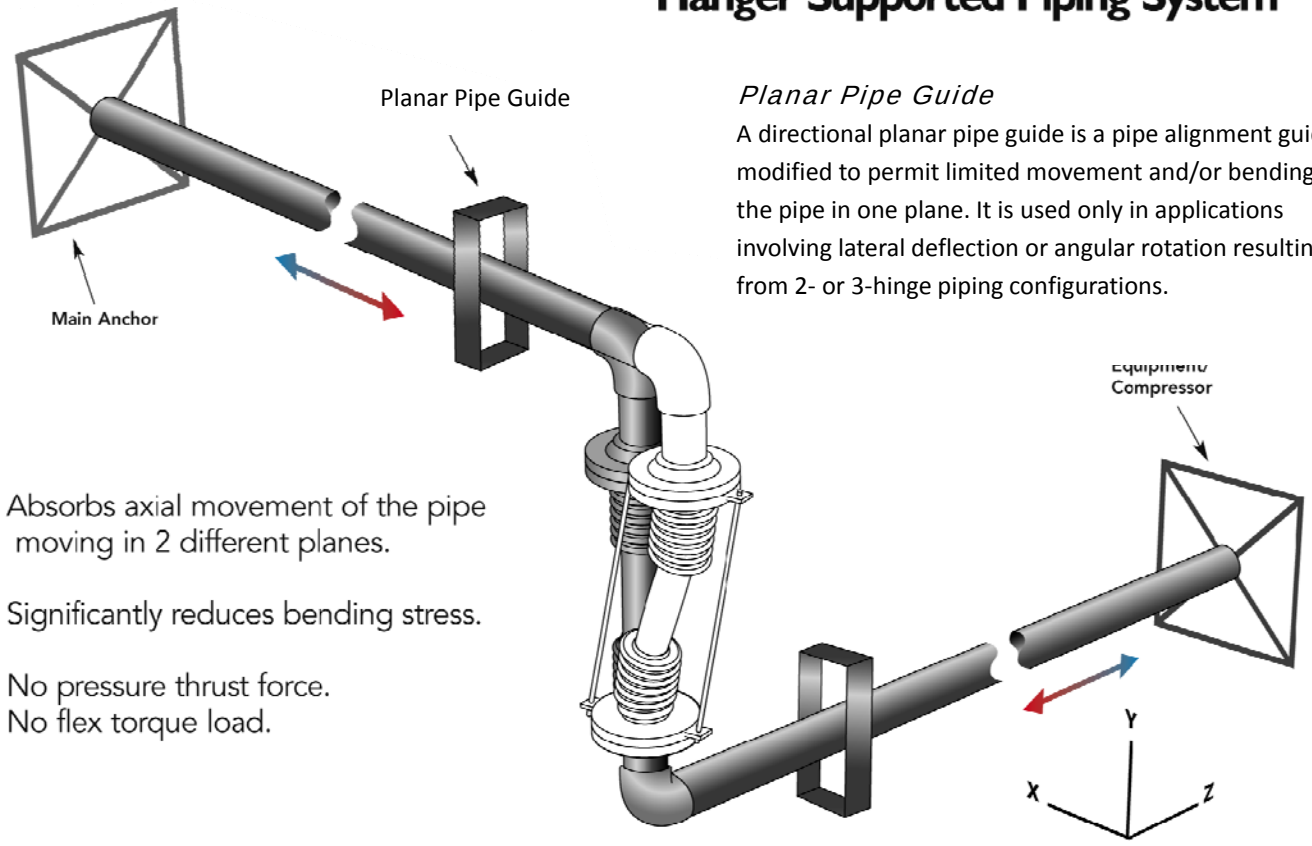
Universal expansion joints will not transmit pressure thrust to the piping system when experiencing lateral motion only as the control rods will be in constant tension. However, if the universal expansion joint will see concurrent motions involving axial deflection than the anchor requirements will change to main anchors as a result of the control rods no longer remain in tension.

Universal Tied Expansion Joints



Universal Tied Expansion Joint for 2-Plane Movement

Bellowsflex™ Universal Tied Expansion Joint
Hanger Supported Piping System



Planar Pipe Guide

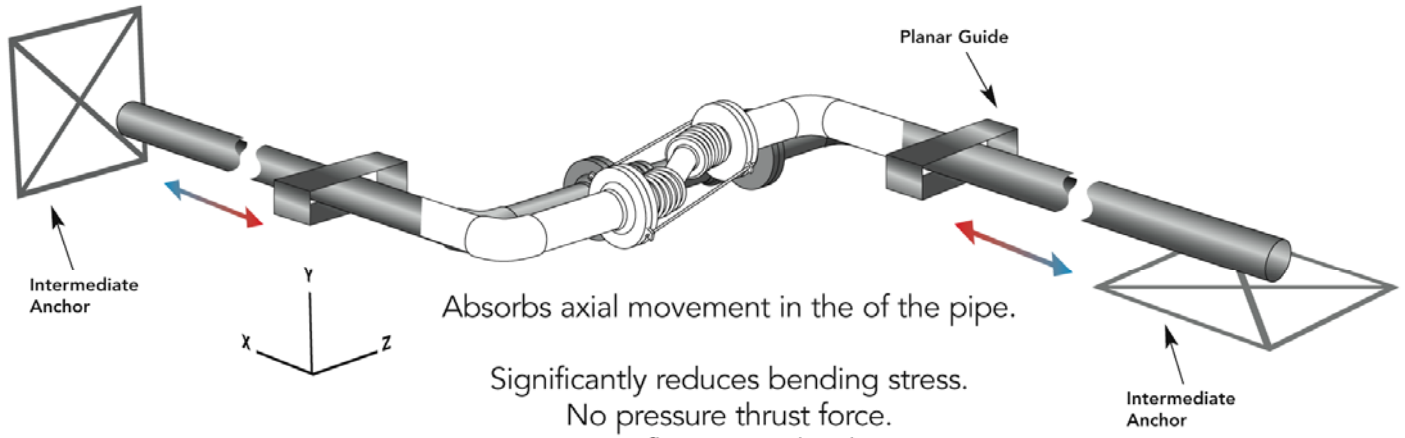
A directional planar pipe guide is a pipe alignment guide modified to permit limited movement and/or bending of the pipe in one plane. It is used only in applications involving lateral deflection or angular rotation resulting from 2- or 3-hinge piping configurations.

Absorbs axial movement of the pipe moving in 2 different planes.

Significantly reduces bending stress.

No pressure thrust force.
No flex torque load.

Universal Tied Expansion Joint "Dog Leg" System



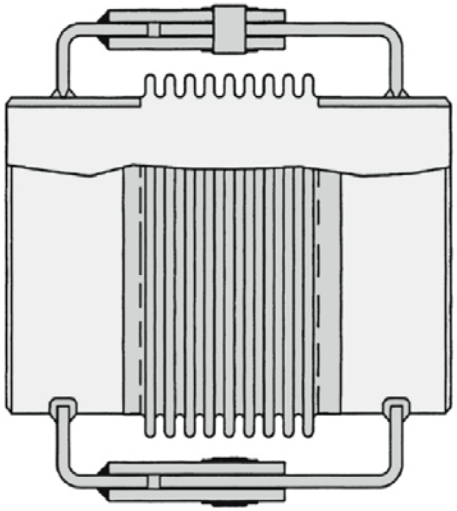
Absorbs axial movement in the of the pipe.

Significantly reduces bending stress.
No pressure thrust force.
No flex torque load.

Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)

Hinged Expansion Joints

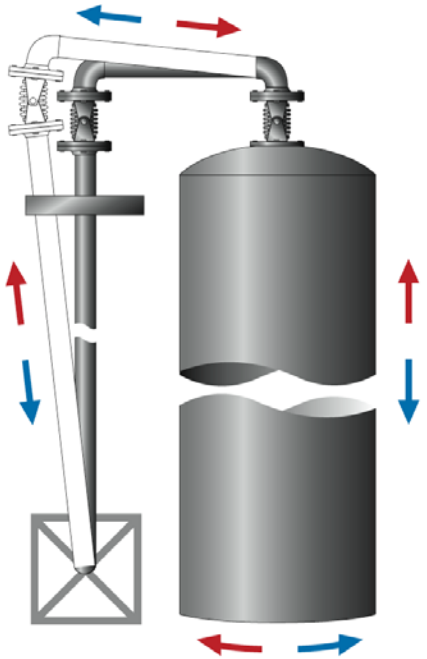


Features:

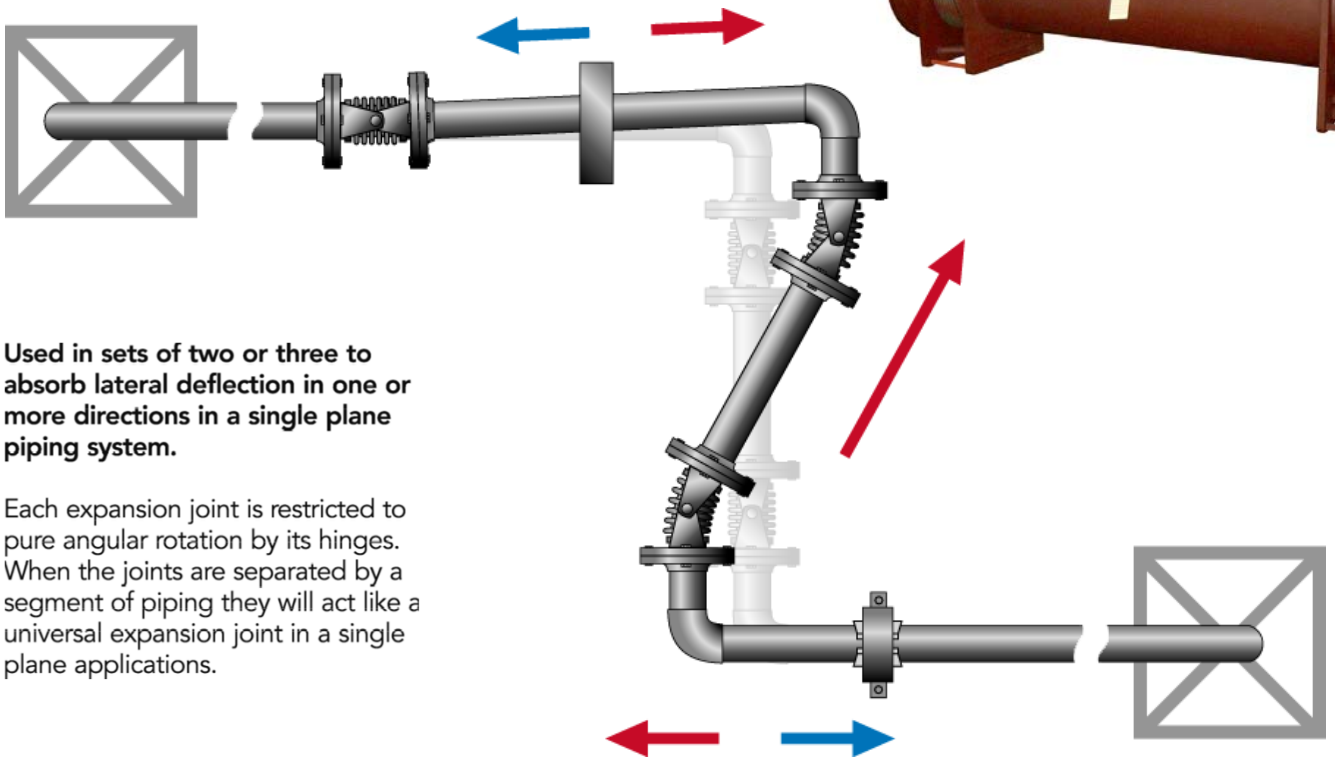
- Angular motion in one plane only
- Positive control over movement
- Eliminates pressure thrust forces
- Transmits external loads
- Supports dead weight
- Prevents torsion on bellows
- No main anchors required
- Minimum guiding required
- Low forces on piping system

Benefits:

- Compact in size
- Great rigidity & strength
- Can be used in irregular and complex piping systems, simplifying the integration of the expansion joints layout.
- Hinge structure can transmit loads



Hinged Expansion Joints



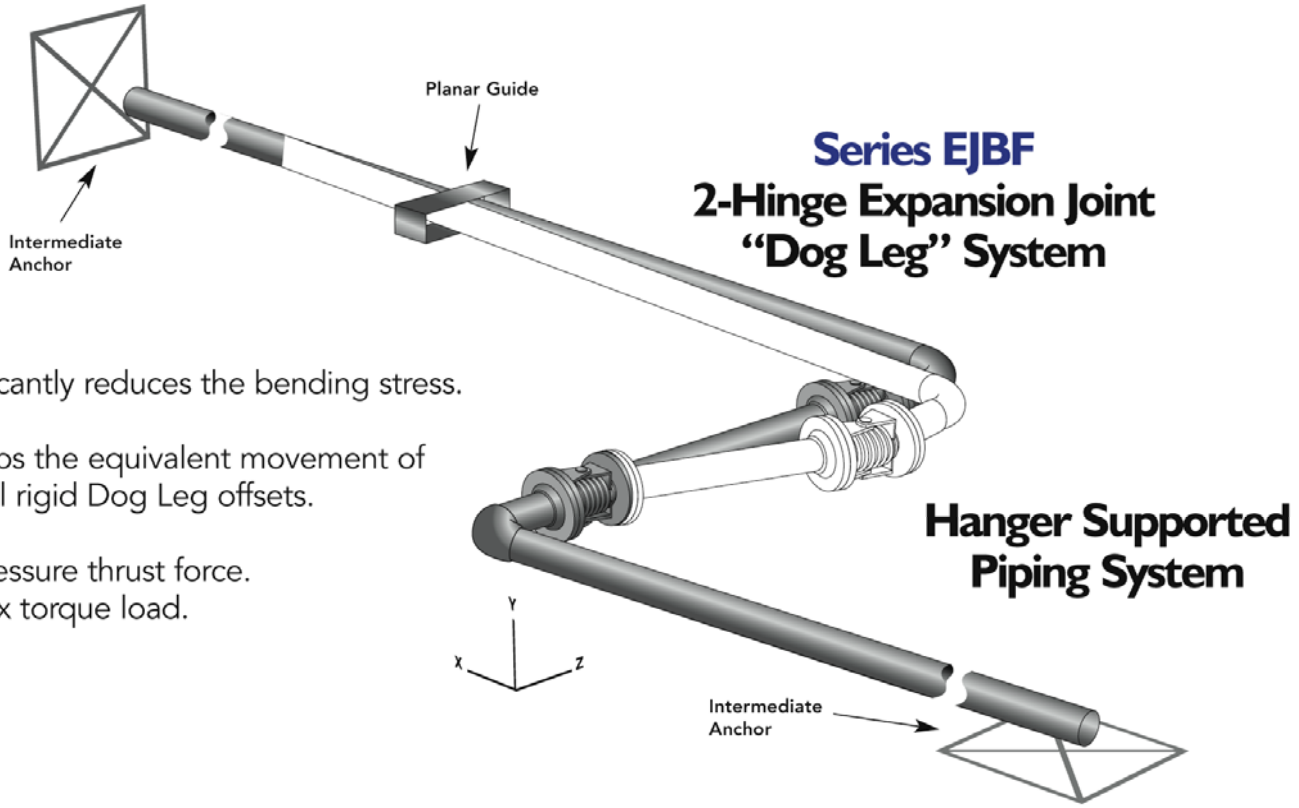
Used in sets of two or three to absorb lateral deflection in one or more directions in a single plane piping system.

Each expansion joint is restricted to pure angular rotation by its hinges. When the joints are separated by a segment of piping they will act like a universal expansion joint in a single plane applications.

Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers (not shown)

Hinged Expansion Joints



Series EJBF
2-Hinge Expansion Joint "Dog Leg" System

Hanger Supported Piping System

Significantly reduces the bending stress.

Absorbs the equivalent movement of several rigid Dog Leg offsets.

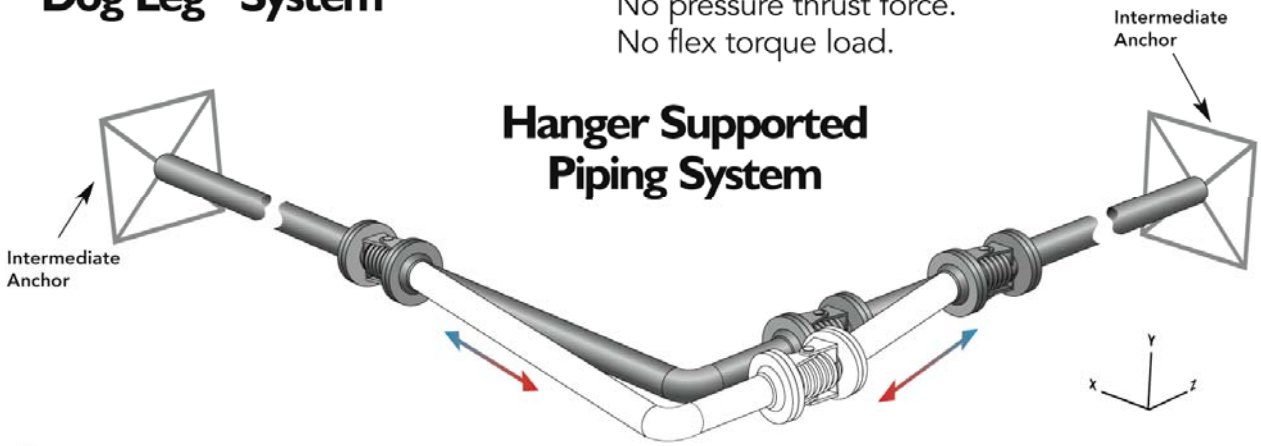
No pressure thrust force.
No flex torque load.

Hinged Expansion Joints

Series EJBF
3-Hinge Expansion Joint
"Dog Leg" System

Absorbs axial movement in both legs of pipe.

Eliminates bending stress.
No pressure thrust force.
No flex torque load.



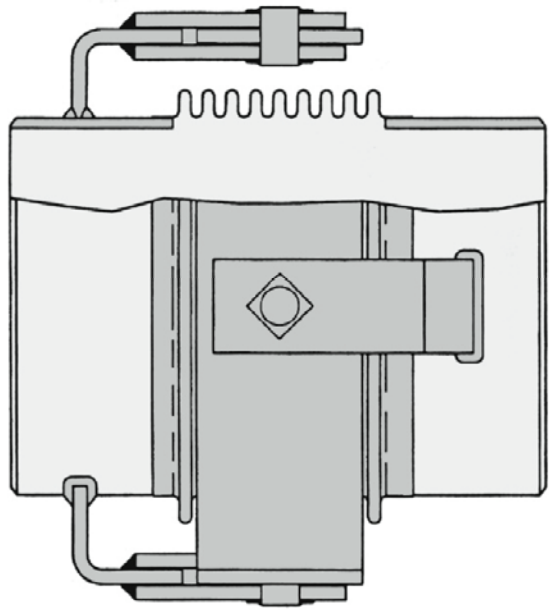
Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)

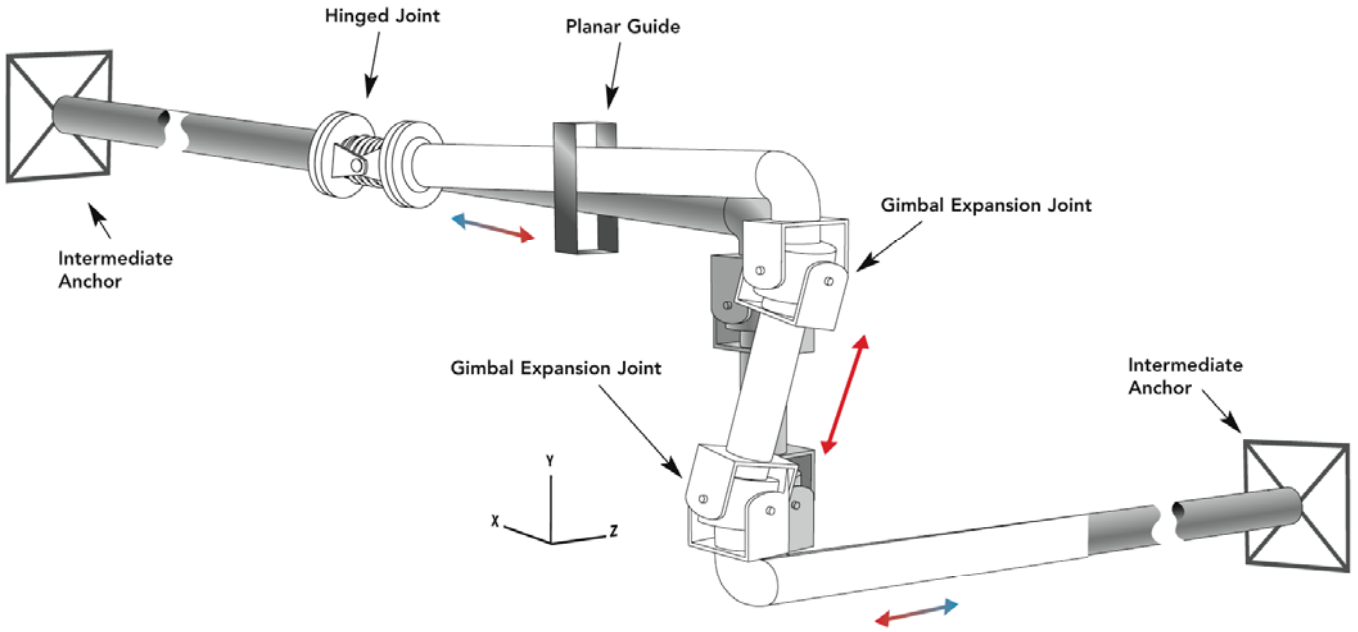
Gimbal Expansion Joints

Features

- Angular motion in all planes
- Positive control over movement
- Eliminates pressure thrust forces
- Transmits external loads
- Supports dead weight
- Prevents torsion on bellows
- No main anchors required
- Minimum guiding required
- Low forces on piping system



Gimbal Expansion Joints



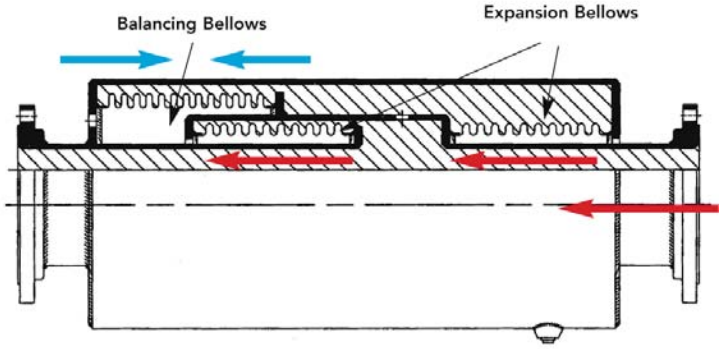
Used in sets of two (occasionally more) to absorb
lateral deflection in multi-plane systems.
Advantages are similar to hinged expansion joint systems
except they are not restricted to single plane systems.

Flexpress™ Pressure Balanced
Externally Pressurized Guided Expansion Joint

For up to 8" of movement

Flexpress externally pressurized guided expansion joint eliminates the requirements for main anchors. The inline pressure balanced expansion joint utilizes a balancing bellows to absorb the pressure thrust within the expansion joint itself.

Flexpress provides a reliable means of absorbing high axial motions. It offers a totally enclosed, externally pressurized stainless steel bellows that is protected from external damage by and external cover. The carbon steel pipe integral liner is designed to prevent bellows impingement or fatigue due to flow induced vibration. The internal guide ring maintains the longitudinal centerline of the expansion joint and eliminates the first set of pipe guides required on each side of the expansion joint saving material and labor.



Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)

Flexpress™ Pressure Balanced
Externally Pressurized Guided Expansion Joint

Determining How Much Force is at the Anchors:

Application: 75# Steam

Example: An 8" steel pipe line is 275 feet long. Maximum temperature the line will encounter is 320°F. Lowest temperature is 40°F.

Calculation: 275/100 x 2.23 = 6.13" thermal growth

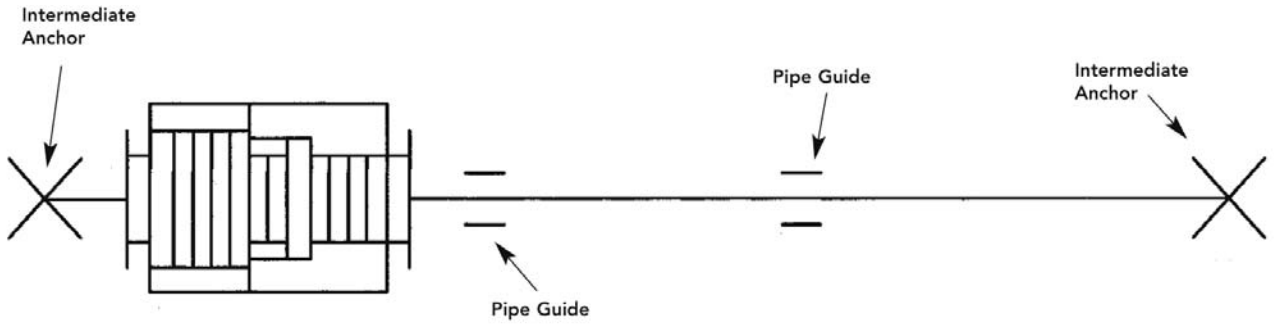
Expansion Joint Specified:
Flex-Hose Flexpress Pressure Balanced
Externally Pressurized Guided Expansion Joint

What are the forces on the anchors and guides?
1) operating conditions
2) *coldwater hydrostatic test at 1.5 x design

Expansion joint forces acting upon anchors:
Where:
F = The force required to deflect the expansion joint
= (Spring rate) (Axial deflection)
= (1,166 lb/in) (6.13 in)

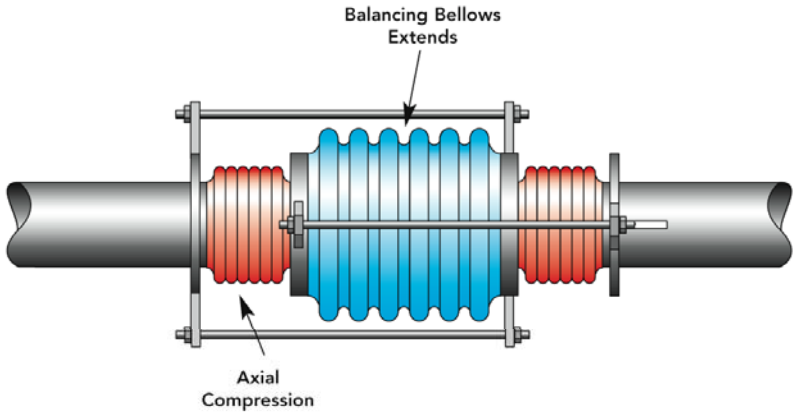
Solution to forces acting on main anchors: **Fx = 7,148 lbs**

Maximum lateral forces acting on pipe alignment guides are:
Force acting on main anchor x 0.15
Maximum lateral force = 7,148 x 0.15
Maximum lateral force = 1,072.2 lbs



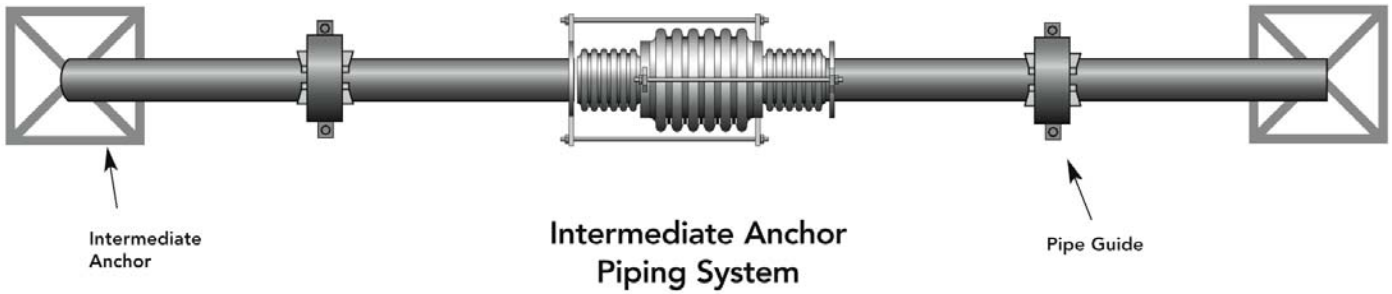
In-Line Pressure Balanced Expansion Joint

Pressure balanced expansion joints contain the pressure thrust forces in the expansion significantly reducing anchor requirements. This is accomplished by utilizing a balancing bellows. The bellows taking the thermal expansion is compressed and the balancing bellows then extends, resulting in the thrust rods always in tension. This design allows the balancing bellows to absorb the pressure thrust. The expansion joint can accept axial compression, axial extension, and lateral movements.



In-Line pressure balanced expansion joints consist of single or double (universal) bellows to accept the piping thermal movement induced for small to medium aixal motion, lateral and angular movements. The larger bellows creates a pressure chamber that produces thrust forces which, by tying to each end of the joint, balance the pressure thrust. They are typically used in straight pipe runs between intermediate anchors.

In-Line Pressure Balanced Expansion Joint

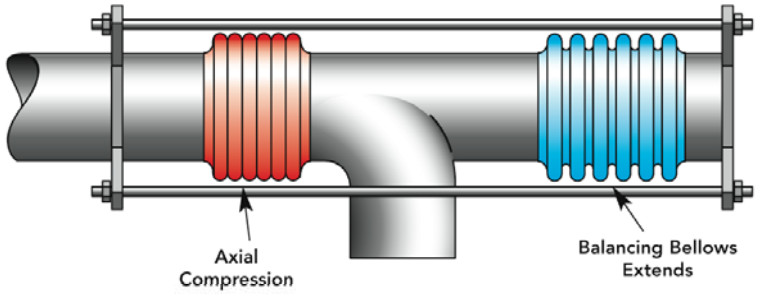


Assumptions:

- The piping system is properly supported and guided
- The weight of the piping system and the fluid being conveyed is carried by properly designed supports and hangers. (not shown)

Universal Pressure Balanced Expansion Joint Elbow Assembly

Pressure balanced expansion joints contain the pressure thrust forces in the expansion joint to the piping system anchors. This is accomplished by utilizing a balancing bellows. The bellows taking the thermal expansion is compressed and the balancing bellows then extends, resulting in the thrust rods always in tension. This design allows the balancing bellows to absorb the pressure thrust. The expansion joint can accept axial compression, axial extension, and lateral movements.



Pressure balanced elbows are expansion joints which can consist of a single (depicted above) or double (universal) bellows, but they also contain an elbow which has attached to its outer elbow a balancing bellows and blind flange to the opposite end of the expansion joint and under pressure these tie rods balance the pressure thrust. This expansion joint can accept axial compression and extension and lateral movements.

6801 Crossbow Drive • East Syracuse, New York 13057-1026
Telephone 315.437.1611 • **Toll Free 1-877-Tri-Flex (874-3539)** • Fax 315.437.1903
email:flexhose@flexhose.com

www.flexhose.com