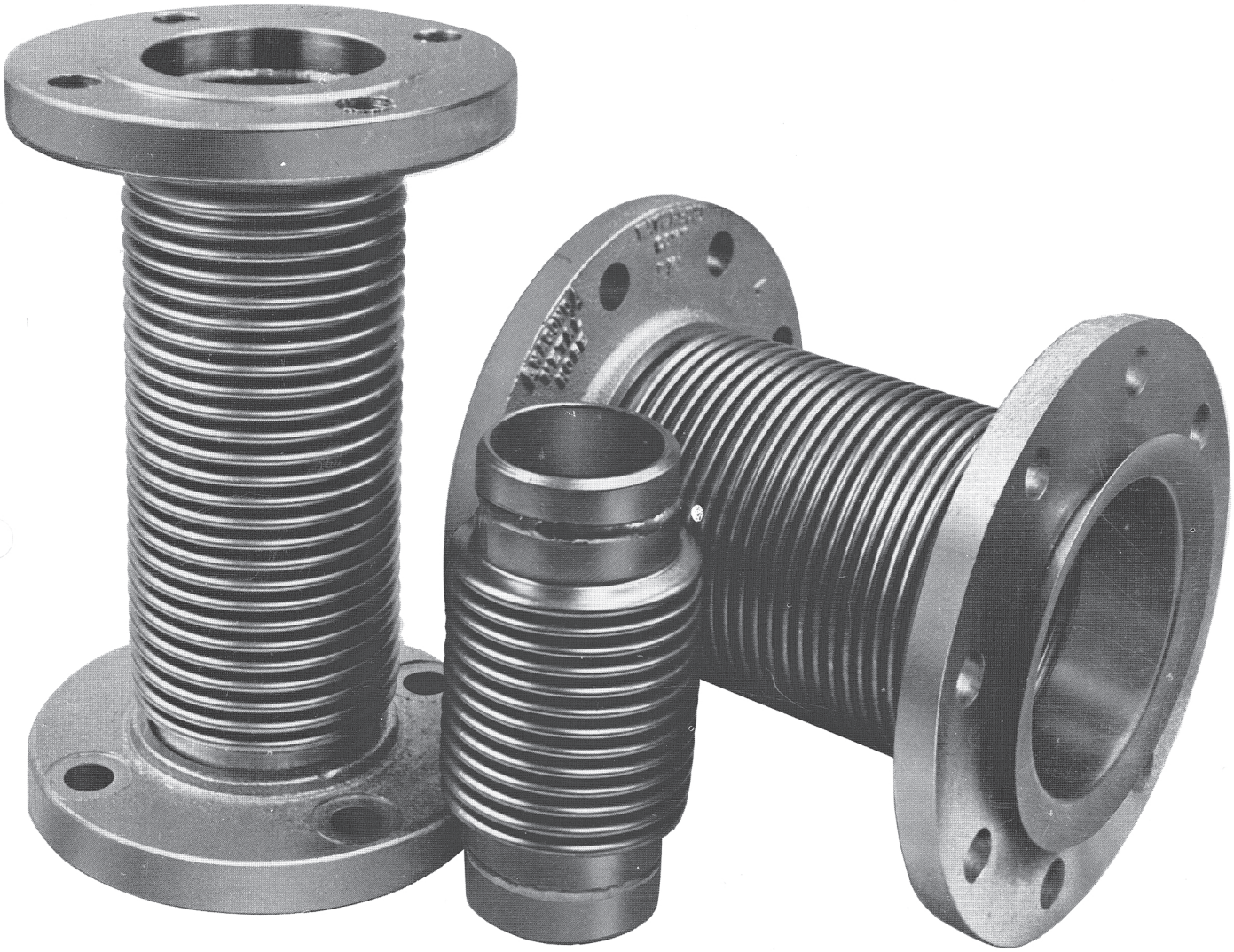
(7 th Ed.)

Expansion Joints



Anaconda Metal Hose

ANACONDA EXPANSION JOINTS . . . .

Anaconda has produced flexible metal hose assemblies for over sixty-five years and has developed a vast amount of knowledge in the design, manufacture and application of metal hose and expansion joints.

This experience combined with extensive testing has been used to develop reliable expansion joint assemblies, available as standard units in a broad range of sizes and types. They may also be custom designed for unusual applications.

The design and performance data in this bulletin minimizes and simplifies computations used in selecting the proper standard Anaconda Expansion Joint unit for a given requirement.

High stresses induced in piping and ducting systems due to temperature change have long been a problem. Five basic compensating devices are:

1. **Inherent pipe flexibility . . .** through use of properly proportioned pipe runs and right angle turns. In many instances, related component locations or lack of space render this method impractical.
2. **Pipe loops . . .** generally very cumbersome and require excessive space.
3. **Packed expansion joints . . .** slip joint type, absorb axial movement only . . . need periodic maintenance.
4. **Flexible metal hose . . .** only for lateral movement.
5. **CORRUGATED METALLIC BELLOWS**
   Anaconda type of expansion joint . . . compact . . . absorbs movement in several directions.

CONTENTS . . .

ANACONDA Metal Hose is an active member of the Expansion Joint Manufacturers Association

WHY AN EXPANSION JOINT WORKS . . .

Anaconda's Expansion Joint ratings have been established to produce a satisfactory cycle life for the Expansion Joint. Expansion Joint bellows are capable of movement in an axial, angular or lateral direction. These motions are possible because of the ability of the convolution sidewall to deflect under load. The cycle life of any bellows is directly affected by the magnitude of the deflection. This is evidenced in the catalog data covering motion vs. cycles. The greater the motion for a given bellows the lower the anticipated life cycles.

BASIC TERMINOLOGY

- **ANGULAR ROTATION**
  The displacement of the longitudinal axis of the Expansion Joint from its initial straight line position into a circular arc. Angular rotation is occasionally referred to as "rotational movement". This is not torsional rotation.

- **AXIAL COMPRESSION**
  The dimensional shortening of an Expansion Joint along its longitudinal axis. Axial compression has been referred to as axial movement, traverse, compression, etc.

- **AXIAL EXTENSION**
  The dimensional lengthening of an Expansion Joint along its longitudinal axis. Axial extension has been referred to as axial movement, traverse, elongation or extension.

- **BELLOWS**
  The flexible element of an Expansion Joint, consisting of one or more convolutions and the end tangents, if any.

- **COLD SPRING OR PRESET**
  The pre-aligning of an Expansion Joint assembly such that in the installed or cold position, the joint is offset one half the expected movement so that when the system heats up, the joint will move through its neutral position and end up in an offset position on the opposite side of the centerline.

- **COMBINED MOVEMENTS**
  Both axial and lateral movements absorbed by the same Expansion Joint.

- **CYCLE**
  One complete movement of an Expansion Joint from initial to extreme position and return.

- **CYCLE LIFE**
  Total number of cycles an Expansion Joint will absorb at rated movement.

- **DEFLECTION FORCE**
  Amount of force to cause movement in an Expansion Joint.

- **EXTERNAL COVER**
  A device used to protect the exterior surface of the bellows of an Expansion Joint from foreign objects or mechanical damage.

- **FITTINGS**
  Welding nipples, fixed flanges or floating flanges attached to the ends of the bellows section.

- **INTERNAL SLEEVE**
  A device which minimizes contact between the inner surface of the bellows of an Expansion Joint and the fluid flowing through it.

- **LATERAL DEFLECTION**
  The relative displacement of the two ends of an Expansion Joint perpendicular to its longitudinal axis. This has been referred to as lateral offset, lateral movement, parallel misalignment, direct shear, transverse movement, etc.

- **MAXIMUM TEST PRESSURE**
  Highest permissible pressure which can be exerted on an Expansion Joint without causing objectionable deformation.

- **MAXIMUM WORKING PRESSURE**
  Greatest pressure which can be exerted on the Joint during operation.

- **MOVEMENT**
  The dimensional changes which the Expansion Joint is required to absorb, such as those resulting from thermal expansion or contraction.

- **PIPE ALIGNMENT GUIDE**
  A pipe alignment guide is a form of sleeve or framework fastened to some rigid part of the installation which permits the pipe line to move freely only along the axis of the pipe.

- **PIPE ANCHOR**
  Device used to firmly fix the location of a point in the piping system. No movement should occur at the anchor point.

- **PURGE CONNECTIONS**
  Purge connections, where required are usually installed at the sealed end of each internal sleeve of an Expansion Joint for the purpose of injecting a liquid or gas between the bellows and the internal sleeve to keep the area clear of errosive and corrosive media and/or solids that could pack the convolutions.

- **RATED MOVEMENT**
  Rated movement is the maximum amount of movement (axial compression, lateral deflection, angular rotation, or any combination thereof) which an Expansion Joint is capable of absorbing.

- **SHIPPING RODS**
  Temporary supporting members attached to the fittings of an Expansion Joint to prevent movement of the joint and retain dimensional stability during shipping, handling and installation.

- **SPRING RATE**
  The force required to compress or extend the Expansion Joint, usually expressed in pounds per inch.

- **THRUST AREA**
  Area over which the effects of pressure in an Expansion Joint will produce a longitudinal force in the piping system.

- **TIE RODS**
  Rods or bar devices for the purpose of restraining the Expansion Joint from the thrust due to internal pressure acting on the thrust area of the Expansion Joint, plus other specified forces.

- **TORSIONAL ROTATION**
  The twisting of one end of the Expansion Joint with respect to the other end about its longitudinal axis. This twisting produces extremely high membrane stresses in the bellows. For this reason, Expansion Joints must not be used to absorb tortional rotation.

- **VELOCITY**
  The speed at which the medium flows through the Expansion Joint, usually specified in feet per second.

LINERS AND COVERS

LINERS (Internal Sleeve) AND EXTERNAL COVERS

A liner should be CONSIDERED AND USED where service conditions warrant. The purpose of a liner is to minimize contact, smooth flow, control erosion and eliminate resonance caused by the medium passing through the bellows.

An external cover should be considered if the unit is to be located where damage may occur. Expansion Joint performance is materially affected by dented or otherwise damaged bellows. In vertical installations, the sleeve should be attached at the upper end to prevent trapping of water, dirt or other foreign materials between it and the bellows.

Where an Expansion Joint is furnished with internal sleeves, external covers, or tie devices spanning the bellows, these components must be designed with adequate clearances to accommodate the lateral deflection or angular rotation of the Expansion Joint. The amount of clearance required is directly proportional to the displacement and, if the Expansion Joint is cold sprung 50%, these clearances can be reduced to a minimum. By this means, internal sleeves of maximum diameter can be furnished, the overall diameter of an Expansion Joint incorporating external covers or tie devices minimized, and the design of external structures simplified.

Internal sleeves should be specified for all Expansion Joints, regardless of the metal of the bellows, in the following cases:

a. Where it is necessary to hold friction losses to a minimum and smooth flow is desired.

b. Where flow velocities are high and could produce resonant vibration of the bellows. (This is dependent on the diameter and media being conveyed).

c. When turbulent flow is generated upstream of the expansion joint by changes in flow direction, valves, tee or elbow sections, cyclonic devices, etc. When sleeves are long or large in diameter and turbulence is high, heavy gauge sleeves may be required.

d. Where there is a possibility of erosion, such as in lines carrying catalyst or other abrasive media, heavy gauge sleeves should be used. At no time should the relatively thin bellows be directly exposed to erosion.

e. Where there is reverse flow, heavy gauge sleeves may be required to prevent buckling of the sleeve and possible damage to the bellows.

f. For high temperature applications to decrease the temperature of the bellows and enable the bellows metal to retain its higher physical properties. (To obtain a maximum effect, the Expansion Joint should not be externally insulated.)

Internal sleeves should not be used where high viscosity fluids such as tars, etc., are being transmitted, since these fluids may cause "packing up", "coking" and "caking" which, in turn, may cause premature Expansion Joint failure. Where the fluid is such that purging will effectively prevent the "packing up", internal sleeves may be used in conjunction with purge connections.

Where lateral deflection or rotation is present, the sleeve must be sufficiently smaller in diameter to provide clearance between the O.D. of the sleeve and the I.D. of the bellows or pipe nipple. If this reduction of inside diameter is objectionable, an oversize bellows or an alternate Expansion Joint design must be used, or the Expansion Joint may be cold sprung.

Drain holes should be provided for sleeves in Expansion Joints for steam or liquid service when the flow direction is vertically upward.

GENERAL INFORMATION

STANDARD SERIES OF ANACONDA EXPANSION JOINTS

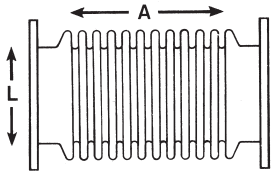
SERIES ES, EL (one ply bellows)

ES and EL Expansion Joints are made from Type 321 Stainless Steel and are available as standard units in pipe sizes from 2" through 48". Standard E-Series units absorb pipe movement in various combinations of directions. Standard Fittings: steel welding nipples and steel fixed and floating flanges, are attached to the bellows by inert-gas, shielded-arc welding.

SERIES MS, ML (Two Ply), FS, FL (Three Ply)

MS, ML, FS and FL Expansion Joints are designed for use where pressure and application requirements exceed the capabilities of the ES and EL Series.

SHORT STYLE

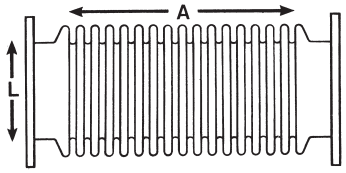


SERIES ES, MS, FS

Small amount of axial "A", slight amount of lateral "L" or a combination of both movements.

Standard E, F and M Series Expansion Joints are designed to take both axial travel and lateral offset.

LONG STYLE



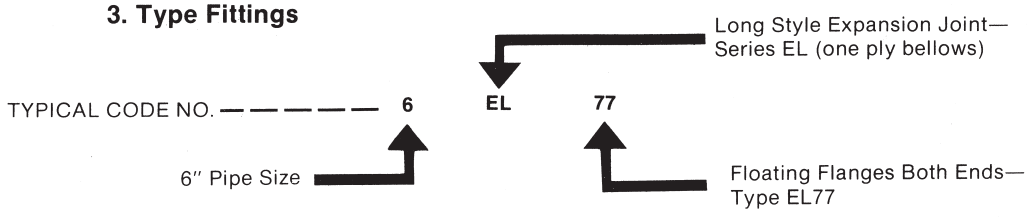
SERIES EL, ML, FL

Large amount of axial "A" (full rated amount in compression and up to ¼" in extension), small amount of lateral "L" or a combination of both movements.

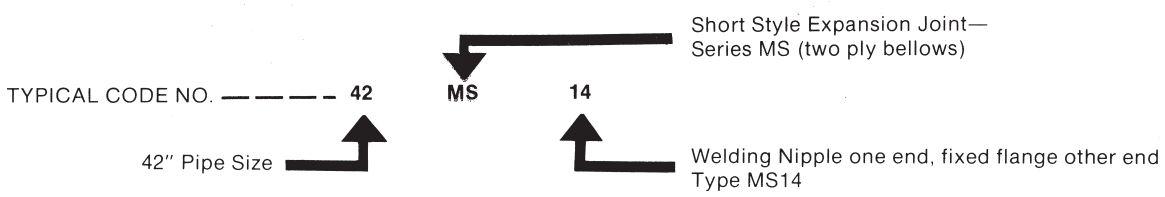
HOW TO SPECIFY

Standard Anaconda Expansion Joints are identified by code numbers, derived from the Specifications

1. Pipe Size
2. Expansion Joint Series
3. Type Fittings



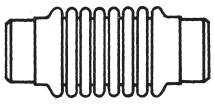
EXAMPLES



NOTES
1. Special fittings can be supplied for individual requirements (including stainless steel).
2. Expansion Joints specified with any combinations of above fittings are considered standard units.

STANDARD TYPES OF ANACONDA EXPANSION JOINTS . . .

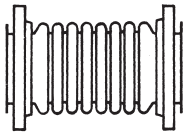
WELDING NIPPLES



TYPE 11

Carbon steel welding nipples, ANSI standard bevel. Schedule 40 pipe sizes through 12". ¼" wall thickness for sizes 14" through 48".

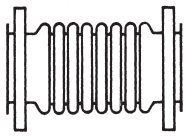
FLOATING FORGED STEEL FLANGES



TYPE 77

All types E, M, and F Series
Forged steel or ductile iron—150# ANSI O.D and drilling. Integral end of bellows van-stoned (flared) to retain flanges and form gasket surface area.

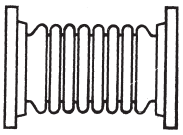
FLOATING PLATE STEEL FLANGES



TYPE 77P

ES, EL, MS and ML Series— sizes through 24"—150# ANSI flat face O.D. and drilling. Sizes over 24" 125# ANSI flat face O.D. and drilling.
FS 77P 300# ANSI O.D. and drilling.
FL 77P 150# ANSI O.D. and drilling.

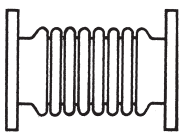
FIXED FORGED STEEL FLANGES



TYPE 44

ES, EL, MS, and ML Series—
Sizes through 24" - Forged steel flanges, 150# ANSI O.D. and drilling.
Sizes over 24" - 125# ANSI flanges.
FS 44—sizes through 8" - 300# ANSI flanges.
Sizes 10" - 24" - 150# ANSI flanges.
Sizes over 24" - 125# ANSI flanges.
FL 44—Sizes through 24" - 150# ANSI flanges.
Sizes over 24" - 125# ANSI flanges.

FIXED PLATE STEEL FLANGES



TYPE 44P

ES, EL, MS, ML Series—sizes through 24"-150# ANSI flat face O.D. and drilling.
Sizes over 24"-125# ANSI flat face O.D. and drilling.
FS 44P—sizes through 8"300# ANSI Raised Face O.D. and drilling.
Sizes 10" through 24" 150# ANSI raised face O.D and drilling.
Sizes over 24" - 125# ANSI flat face O.D. and drilling.
FL 44P—sizes through 24" 150# ANSI raised face O.D. and drilling.
Sizes over 24" 125# ANSI flat face O.D and drilling.

CYCLE LIFE • MOVEMENT

RANGE . . .

Cycle life requirements of different applications vary widely. A piping system that goes through a temperature-induced movement cycle once a year is not comparable to one occurring once a day. The cycle life ranges of Expansion Joints in these two systems must be set on a different basis.

In addition to a 7,000 cycle suggested minimum, the Specifications express rated movement in the 1,000 and 15,000 cycle range. This permits ready selection of a standard unit for a desired cycle life. For higher cycle life requirements consult Anaconda Metal Hose.

EXPECTANCY . . .

Anaconda has conducted extensive research and test programs to accurately determine the fatigue characteristics of bellows used in Anaconda Expansion Joints. The end product of this research is presented in this bulletin.

The design engineer must allow for temperature, pressure or tolerance variations that cause abnormal motion.

TEMPERATURE . . .

Elevated temperatures reduce both rated movement for a given life cycle and pressure capabilities of the Expansion Joint. To compensate, multiply both rated movement and maximum working pressure (from Specifications) by the temperature compensating factor in the chart at right. Standard Expansion Joints have an operating range from -20°F. to +850°F. This is the generally accepted range for carbon steel fittings. Special fittings are available for operating temperatures above and below this range. Physical properties of the bellows alloy are affected by temperatures.

TEMPERATURE °F.	TEMPERATURE COMPENSATING FACTOR
Room Temp.	1.00
200	.94
300	.88
400	.83
500	.78
600	.74
700	.70
800	.66
900	.62
1000	.60
1100	.58
1200	.55
1300	.50
1400	.44
1500	.40

EXAMPLE 1:

If working temperature is +600°F, reduce both rated movement and maximum working pressure with the factor .74 from the table. For a 16 ML 44:

Rated working pressure is 100 PSIG multiplied by the temperature compensating factor of .74. This reduces the maximum working pressure to 74 PSIG. The axial movement capability for 1000 cycles is 5.2 inches, multiplied by the temperature compensating factor of .74. This reduces the axial movement capability for 1000 cycles to 3.85 inches.

EXAMPLE 2:

If the working temperature is +550°F, the temperature compensating factor can be determined by the interpolation between 500°F and 600°F from the table to obtain a factor of .76. For an 8" MS 44:

Rated working pressure is 200 PSIG multiplied by the factor of .76 reduces the working pressure to 152 PSIG. The rated axial movement for 1000 cycles is 2 inches multiplied by the factor of .76, this reduces the axial movement to 1.52 inches.

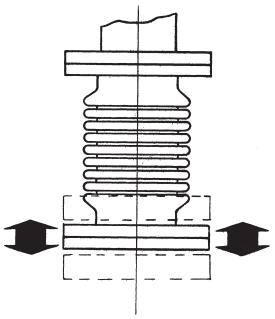
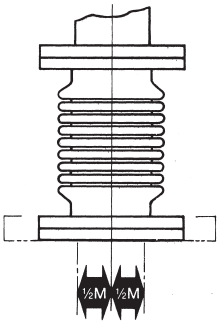


Figure 3

AXIAL TRAVEL

Anaconda Single Short Type Expansion Joints will take their rated total axial travel entirely in compression or entirely in extension. (See Figure 3). Anaconda Single Long Type Expansion Joints will take their rated total axial travel entirely in compression or up to ¼" of extension.

With both extension and compression, the sum of the movements should not exceed the total travel in the specifications.



"A" "B"
Figure 4

LATERAL TRAVEL

Anaconda Single Short and Single Long Series Expansion Joints will take the full rated lateral travel on one side of centerline in 7,000 and 15,000 cycle column. In the case of the 1,000 cycle column, the rated travel SHOULD be distributed in accordance with Figure 4. If even distribution of total travel is impossible, then travel on one side of centerline MUST NOT EXCEED the travel shown in the 7,000 cycle life column.

Recommended motion (M) distribution . . . equal on each side of centerline . . . is generally accomplished by cold-springing the Expansion Joint into position "A" at installation temperature. The Expansion Joint will travel to position "B" when temperature extreme is reached. See Figure 4.

COMBINED MOVEMENTS . . .

The following equation has been developed to determine the suitability of an Anaconda Expansion Joint when subjected to both lateral and axial movements simultaneously.

$$\frac{A}{A_r} + \frac{L}{L_r} \leq 1$$

A = Applied Axial Motion

A_r = Rated Axial Motion

L = Applied Lateral Motion

L_r = Rated Lateral Motion

When the number exceeds 1, the selected unit will not render the desired number of life cycles.
If unable to select suitable standard unit, contact our Engineering Dept.

EXPANSION JOINT SELECTION

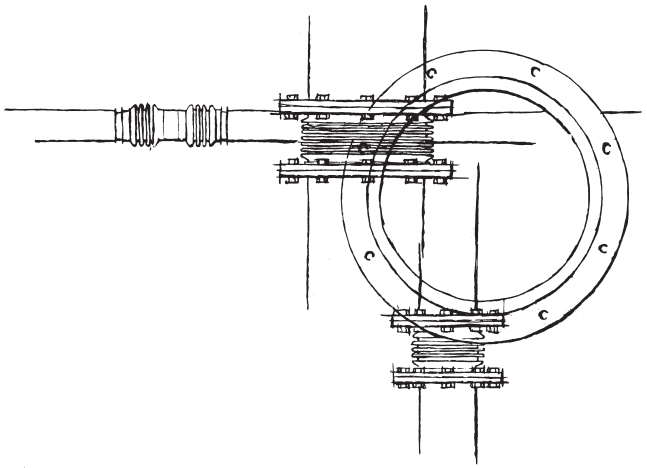
All Anaconda performance rating data applies to the entire Expansion Joint. This eliminates consideration of Spring Rate . . . the force required to extend or compress the Expansion Joint (expressed in pounds per inch).

Some piping engineers have considered Expansion Joints on a "per convolution" basis which necessitates computation of the performance and force characteristics. This is not necessary with Anaconda Standard units, because deflection forces are tabulated.

Suitable restraint must be designed into the pipe anchoring and guiding arrangement of a piping system utilizing Expansion Joints. Due to Anaconda's low profile construction, pressure thrust loads on anchors and equipment are reduced.

Thrust area, working pressure, deflection force and resistance to sliding friction are all influencing factors which determine the amount of anchoring to be provided. See "Installation Recommendations", page 10.

PROPER SELECTION



1. Determine from piping system specifications:
   - **a.** Pipe size
   - **b.** Maximum working pressure
   - **c.** Maximum working temperature
   - **d.** Type of movement (axial, lateral)
   - **e.** Amount of movement
   - **f.** Desired cycle life (number of cycles)
2. With the Information in Item 1 and Specifications, select the proper type of Standard Anaconda Expansion Joint. Check to make certain that:
   - **a.** Amount of movement and maximum working pressure (from Item 1) fall within limits of "Rated Movement for Desired Cycle Life" and "Maximum Working Pressure" in the Specifications. If maximum working temperature in Item 1 exceeds Room Temperature, "Rated Movement" and "Maximum Working Pressure" values in the Specifications must be reduced with proper temperature compensating factor (see "Temperature", page 7 and two examples, also fig. 3 & 4, page 8) before checking.
   - **b.** If axial and lateral movements are to be combined, check percentage of available movement to be utilized by the Unit, using formula in "Combined Movements," (page 8).

If all conditions in "a" and "b" above are met, the Standard Expansion Joint selected is suitable. If not, a Non-Standard Expansion Joint should be considered or the piping system revised for a different arrangement of Standard Expansion Joints.

3. Select Fittings and check over-all length of Unit in the Specifications. Suitable dimensional allowances can then be made in piping system.
4. See instructions as to "How to Specify E, M and F Series Anaconda Expansion Joints" on page 5.

SPECIAL APPLICATIONS . . . See page 30. Contact nearest Anaconda Metal Hose Sales Office listed on back cover for information regarding Non-Standard Anaconda Expansion Joints.

INSTALLATION RECOMMENDATIONS

PIPING SYSTEMS

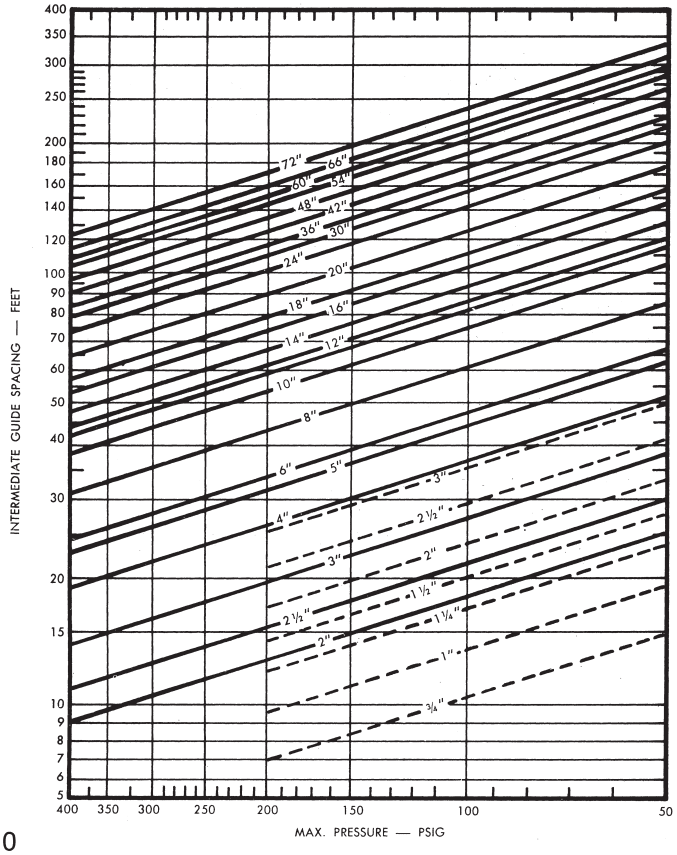
Anaconda Expansion Joints must be both **correctly selected** and **properly installed** for effective performance in service. The reactions created by pressure and movement within the piping system should be carefully considered. The deflection loads and other influencing forces, including pressure thrust, must be recognized when designing anchors and guides. The internal pressure acting on the thrust area of an Expansion Joint can cause very high anchor loads. Thrust areas of Anaconda Expansion Joints are listed in the chart below. The following precautions must be taken during installation:

- System arrangement **must not create torque** on Expansion Joints.
- Piping centerlines should be **precisely aligned** for axial movement.
- Lateral movement should be **divided equally** on each side of the normal pipe centerline wherever possible.
- Anchors must be of **sufficient strength** to withstand the thrust pressure of the pipe section (thrust area of the Expansion Joint x maximum pressure).
- At initial system pressurization, all pipe guides and anchors must be **secure and functioning.**
- Field pressure tests should be **limited to 1.25 x the maximum working pressure** to avoid accidental over-pressurization.
- All shipping rods must be **removed.**

BELLOWS DIMENSIONAL DATA

PIPE SIZE IN INCHES	MAX. BELLOWS O.D. IN INCHES	THRUST AREA SQ. IN.	PIPE SIZE IN INCHES	MAX. BELLOWS O.D. IN INCHES	THRUST AREA SQ. IN.
2	3¼	5.5	12	14⅛	135
2½	3¾	7.5	14	16⅛	181
3	4⅜	10.5	16	18⅛	233
3½	4⅞	13.5	18	20⅛	289
4	5⅜	17	20	22⅝	347
5	6½	27	24	26⅝	492
6	7⅝	37	30	32⅝	755
8	9⅝	62	36	38⅝	1070
10	12	97	42	44⅝	1460
			48	50⅝	1885

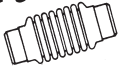
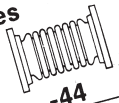
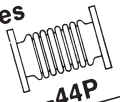
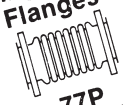
RECOMMENDED MAXIMUM GUIDE SPACING—FOR STANDARD WEIGHT, CARBON STEEL PIPE



Recommended Maximum Spacing of Intermediate Pipe Guides for Application Involving Axial Movement Only. Values Based on Standard Weight Carbon Steel Pipe.

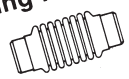
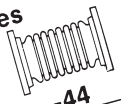
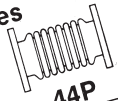
First pipe guide must be located within **four** pipe diameters of Expansion Joint . . . second guide must be within **fourteen** pipe diameters of first guide. See page 32.

Specifications—2" Pipe Size

TYPES		ES one ply short style	EL one ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	200	80
	nippled units (see note 1)	120	50
Welding Nipples  -11	part number	215009	215409
	overall length (in.)	6⅞	10½
	approx. weight (lbs.)	1.5	2.2
Fixed Forged Steel Flanges  -44	part number	215259	215659
	overall length (in.)	6¼	9⅞
	approx. weight (lbs.)	10.5	11
Floating Forged Steel Flanges  -77	part number	—	—
	overall length (in.)	—	—
	approx. weight (lbs.)	—	—
Fixed Plate Steel Flanges  -44P	part number	216909	217109
	overall length (in.)	5 9/16	9¼
	approx. weight (lbs.)	9.8	10.5
Floating Plate Steel Flanges  -77P	part number	—	—
	overall length (in.)	—	—
	approx. weight (lbs.)	—	—
Maximum rated total Axial movement in inches for designated cycle life (see note 3)	1000 cycles	0.9	1.8
	7000 cycles	0.6	1.3
	15000 cycles	0.5	1.1
Axial Deflection Force	pounds per inch	360	175
Maximum rated total Lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.50	2.1
	7000 cycles	.31	1.3
	15000 cycles	.25	1.1
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	68	8
	.20"	107	12
	.30"	141	16
	.50"	—	22
	1.00"	—	36

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications— 2½" Pipe Size

TYPES		ES one ply short style	ES one ply short style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	200	80
	nippled units (see note 1)	120	50
Welding Nipples  -11	part number	215010	215410
	overall length (in.)	7½	11¾
	approx. weight (lbs.)	2.2	3.0
Fixed Forged Steel Flanges  -44	part number	215260	215660
	overall length (in.)	7⅛	11⅜
	approx. weight (lbs.)	15	16
Floating Forged Steel Flanges  -77	part number	—	—
	overall length (in.)	—	—
	approx. weight (lbs.)	—	—
Fixed Plate Steel Flanges  -44P	part number	216910	217110
	overall length (in.)	6¼	10½
	approx. weight (lbs.)	13.5	14.2
Floating Plate Steel Flanges  -77P	part number	—	—
	overall length (in.)	—	—
	approx. weight (lbs.)	—	—
Maximum rated total Axial movement in inches for designated cycle life (see note 3)	1000 cycles	0.9	2.0
	7000 cycles	0.6	1.3
	15000 cycles	0.5	1.0
Axial Deflection Force	pounds per inch	590	280
Maximum rated total Lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.49	2.1
	7000 cycles	.30	1.3
	15000 cycles	.25	1.1
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	108	12
	.20"	171	20
	.30"	224	26
	.50"	—	36
	1.00"	—	57

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

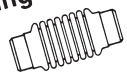
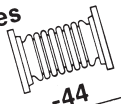
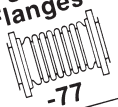
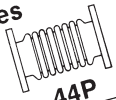
Specifications—3″ Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	140	275	575	60	120	180
	nippled units (see note 1)	120	240	575	50	100	180
Welding Nipples -11	part number	215011	215811	216311	215411	216061	216461
	overall length (in.)	8 7/8	8 7/8	11 5/8	13 1/8	13 1/8	15 7/8
	approx. weight (lbs.)	4	5.1	7.5	4.9	6.9	10.4
Fixed Forged Steel Flanges -44	part number	215261	215911	218111	215661	216161	218211
	overall length (in.)	7 5/8	7 5/8	8 1/2	11 7/8	11 7/8	11 3/4
	approx. weight (lbs.)	17	19	29	18	20	24
Floating Forged Steel Flanges -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges -44P	part number	216911	217311	217711	217111	217511	217911
	overall length (in.)	6 5/8	6 5/8	7 3/8	10 7/8	10 7/8	11 5/8
	approx. weight (lbs.)	15	16	28	16	18	27
Floating Plate Steel Flanges -77P	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	1.1	1.1	1.1	2.3	2.3	2.1
	7000 cycles	0.7	0.7	0.7	1.4	1.4	1.3
	15000 cycles	0.6	0.6	0.6	1.2	1.2	1.1
Axial deflection force	pounds per inch	530	1060	1590	265	530	825
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.52	.52	.52	2.0	2.0	1.8
	7000 cycles	.32	.32	.32	1.2	1.2	1.1
	15000 cycles	.26	.26	.26	1.0	1.0	0.9
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10″	111	222	333	15	29	46
	.20″	176	352	528	23	47	72
	.30″	232	464	696	32	64	99
	.50″	—	—	—	42	84	130
	1.00″	—	—	—	67	134	208

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—3½" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	150	285	575	70	130	180
	nippled units (see note 1)	120	240	575	40	80	180
Welding Nipples  -11	part number	215012	215812	216312	215412	216062	216462
	overall length (in.)	8⅞	8⅞	11⅝	12⅛	12⅛	15⅞
	approx. weight (lbs.)	4.6	5.8	8.5	5.8	8.0	11.6
Fixed Forged Steel Flanges  -44	part number	215262	215912	218112	215662	216162	218212
	overall length (in.)	7¾	7¾	8⅝	12	12	11⅞
	approx. weight (lbs.)	23	25	36	24	26	29
Floating Forged Steel Flanges  -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges  -44P	part number	216912	217312	217712	217112	217512	217912
	overall length (in.)	6⅝	6⅝	7⅜	10⅞	10⅞	11⅝
	approx. weight (lbs.)	18.3	19.5	34	19.3	21.2	32
Floating Plate Steel Flanges  -77P	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	1.1	1.1	1.1	2.3	2.3	2.1
	7000 cycles	0.7	0.7	0.7	1.4	1.4	1.3
	15000 cycles	0.6	0.6	0.6	1.2	1.2	1.1
Axial deflection force	pounds per inch	600	1200	1800	300	600	935
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.46	.46	.46	1.8	1.8	1.7
	7000 cycles	.29	.29	.29	1.1	1.1	1.0
	15000 cycles	.24	.24	.24	0.9	0.9	0.8
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	154	308	462	21	41	65
	.20"	245	490	835	32	64	99
	.30"	322	644	966	42	84	131
	.50"	—	—	—	59	118	183
	1.00"	—	—	—	94	188	293

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

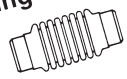
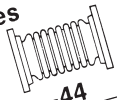
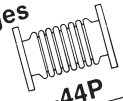
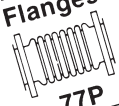
Specifications—4" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	180	360	675	75	150	245
	nippled units (see note 1)	120	240	675	40	80	245
Welding Nipples -11	part number	215013	215813	216313	215413	216063	216463
	overall length (in.)	9⅝	9⅝	11⅝	14¼	14¼	17¼
	approx. weight (lbs.)	5.4	6.7	10.1	6.6	9.1	13.6
Fixed Forged Steel Flanges -44	part number	215263	215913	218113	215663	216163	218213
	overall length (in.)	7⅝	8¼	8⅞	12¼	12⅞	12⅜
	approx. weight (lbs.)	17	28	51	19	32	33
Floating Forged Steel Flanges -77	part number	215363	216013	—	215763	216263	—
	overall length (in.)	7⅝	8¼	—	12¼	12⅞	—
	approx. weight (lbs.)	16	29	—	18	20	—
Fixed Plate Steel Flanges -44P	part number	216913	217313	217713	217113	217513	217913
	overall length (in.)	7⅝	7⅝	7⅞	12¼	12¼	12½
	approx. weight (lbs.)	23	24.2	40	24.1	27	35
Floating Plate Steel Flanges -77P	part number	217013	217413	—	217213	217613	—
	overall length (in.)	6⅞	6⅞	—	11½	11½	—
	approx. weight (lbs.)	23.1	24.6	—	24.4	27	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	1.2	1.2	1.2	2.3	2.3	2.3
	7000 cycles	0.7	0.7	0.7	1.4	1.4	1.4
	15000 cycles	0.6	0.6	0.6	1.1	1.1	1.1
Axial deflection force	pounds per inch	625	1250	1875	310	620	930
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.44	.44	.44	1.8	1.8	1.8
	7000 cycles	.27	.27	.27	1.1	1.1	1.1
	15000 cycles	.23	.23	.23	0.9	0.9	0.9
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	181	362	543	22	45	67
	.20"	286	572	858	35	71	106
	.30"	378	756	1134	46	93	140
	.50"	—	—	—	66	132	198
	1.00"	—	—	—	104	208	312

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—5″ Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	145	290	600	65	130	215
	nippled units (see note 1)	100	200	600	40	80	215
Welding Nipples  -11	part number	215014	215814	216314	215414	216064	216464
	overall length (in.)	10	10	12	15	15	18
	approx. weight (lbs.)	7.3	9	13	8.6	11	18.1
Fixed Forged Steel Flanges  -44	part number	215264	215914	218114	215664	216164	218214
	overall length (in.)	8	8⅞	9½	13	13⅞	13⅜
	approx. weight (lbs.)	22	34	61	22	36	37
Floating Forged Steel Flanges  -77	part number	215364	216014	216414	215764	216264	216564
	overall length (in.)	8	8⅞	10¼	13	13⅞	14⅛
	approx. weight (lbs.)	22	34	64	22	23	40
Fixed Plate Steel Flanges  -44P	part number	216914	217314	217714	217114	217514	217914
	overall length (in.)	8	8	8¼	13	13	13¼
	approx. weight (lbs.)	29	31	46	30	34	41
Floating Plate Steel Flanges  -77P	part number	217014	217414	217814	217214	217614	218014
	overall length (in.)	7½	7½	7¾	12½	12½	12¾
	approx. weight (lbs.)	29	31	47	32	35	41
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	1.3	1.3	1.2	2.7	2.7	2.5
	7000 cycles	0.8	0.8	0.7	1.6	1.6	1.5
	15000 cycles	0.7	0.7	0.6	1.3	1.3	1.2
Axial deflection force	pounds per inch	490	980	1575	245	490	790
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.44	.44	.40	1.8	1.8	1.6
	7000 cycles	.27	.27	.23	1.1	1.1	0.9
	15000 cycles	.23	.23	.20	0.9	0.9	0.8
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10″	177	354	562	23	47	75
	.20″	279	558	894	37	74	119
	.30″	370	740	1170	48	97	155
	.50″	—	—	—	68	136	219
	1.00″	—	—	—	108	216	348

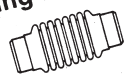
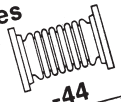
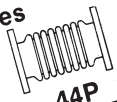
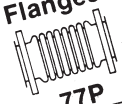
NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—6" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	105	200	525	55	110	185
	nippled units (see note 1)	80	160	525	40	80	185
Welding Nipples -11	part number	215015	215815	216315	215415	216065	216465
	overall length (in.)	10 3/8	10 3/8	12 3/8	15 5/8	15 5/8	18 5/8
	approx. weight (lbs.)	9.4	11	16.8	11	15	22.2
Fixed Forged Steel Flanges -44	part number	215265	215915	218115	215665	216165	218215
	overall length (in.)	8 7/8	9 1/2	10	14 1/8	14 3/4	14 1/4
	approx. weight (lbs.)	28	42	78.6	30	46	46
Floating Forged Steel Flanges -77	part number	215365	216015	216415	215765	216265	216565
	overall length (in.)	8 7/8	9 1/2	10 9/16	14 1/8	14 3/4	14 13/16
	approx. weight (lbs.)	28	39	79	26	30	46
Fixed Plate Steel Flanges -44P	part number	216915	217315	217715	217115	217515	217915
	overall length (in.)	8 3/8	8 3/8	8 7/8	13 5/8	13 5/8	14 1/8
	approx. weight (lbs.)	33	35	63	35	39	51
Floating Plate Steel Flanges -77P	part number	217015	217415	217815	217215	217615	218015
	overall length (in.)	7 7/8	7 7/8	8 3/8	13 1/8	13 1/8	13 5/8
	approx. weight (lbs.)	33	36	64	35	39	51
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	1.6	1.6	1.4	3.2	3.2	2.8
	7000 cycles	1.0	1.0	0.9	2.0	2.0	1.8
	15000 cycles	0.8	0.8	0.7	1.6	1.6	1.4
Axial deflection force	pounds per inch	525	1050	1785	265	530	1015
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.48	.48	.43	1.9	1.9	1.5
	7000 cycles	.30	.30	.27	1.2	1.2	0.9
	15000 cycles	.25	.25	.21	1.0	1.0	0.8
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	225	450	759	28	57	109
	.20"	354	708	1208	46	91	175
	.30"	468	936	1582	59	119	228
	.50"	—	—	—	84	168	321
	1.00"	—	—	—	133	266	509

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

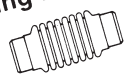
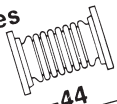
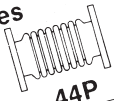
Specifications—8″ Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	100	200	500	50	100	180
	nippled units (see note 1)	80	160	500	35	70	180
Welding Nipples  -11	part number	215017	215817	216317	215417	216067	216467
	overall length (in.)	12 5/8	12 5/8	14 5/8	19 3/8	19 3/8	22 3/8
	approx. weight (lbs.)	17	21	28	20	27	38
Fixed Forged Steel Flanges  -44	part number	215267	215917	218117	215667	216167	218217
	overall length (in.)	10 1/8	11 1/8	12	16 7/8	17 7/8	17 3/8
	approx. weight (lbs.)	40	68	123	43	74	77
Floating Forged Steel Flanges  -77	part number	215367	216017	216417	215767	216267	216567
	overall length (in.)	10 1/8	11 1/8	12 5/8	16 7/8	17 7/8	17 15/16
	approx. weight (lbs.)	37	64	125	40	47	78
Fixed Plate Steel Flanges  -44P	part number	216917	217317	217717	217117	217517	217917
	overall length (in.)	9 5/8	9 5/8	10 1/8	16 3/8	16 3/8	16 7/8
	approx. weight (lbs.)	48	52	87	51	59	77
Floating Plate Steel Flanges  -77P	part number	217017	217417	217817	217217	217617	218017
	overall length (in.)	9 1/8	9 1/8	9 5/8	15 7/8	15 7/8	16 3/8
	approx. weight (lbs.)	49	53	88	52	59	78
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	2.0	2.0	1.7	4.0	4.0	3.4
	7000 cycles	1.2	1.2	1.0	2.5	2.5	2.1
	15000 cycles	1.0	1.0	0.8	2.0	2.0	1.7
Axial deflection force	pounds per inch	460	915	1620	230	460	810
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.59	.59	.50	2.4	2.4	1.7
	7000 cycles	.36	.36	.29	1.5	1.5	1.0
	15000 cycles	.29	.29	.23	1.2	1.2	0.9
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10″	205	410	725	25	50	88
	.20″	323	646	1154	39	79	140
	.30″	427	854	1511	53	105	184
	.50″	—	—	—	74	148	260
	1.00″	—	—	—	117	234	412

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—10″ Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	80	160	280	35	70	125
	nippled units (see note 1)	80	160	280	35	70	125
Welding Nipples  -11	part number	215019	215819	216319	215419	216069	216469
	overall length (in.)	12⅝	12⅝	14⅝	19⅜	19⅜	22⅜
	approx. weight (lbs.)	23	27	35	27	35	46
Fixed Forged Steel Flanges  -44	part number	215269	215919	218119	215669	216169	218219
	overall length (in.)	10⅛	11½	11	16⅞	18¼	17¾
	approx. weight (lbs.)	56	90	92	60	102	103
Floating Forged Steel Flanges  -77	part number						
	overall length (in.)	10⅛	11½	11	16⅞	18¼	18¼
	approx. weight (lbs.)	53	89	94	56	64	105
Fixed Plate Steel Flanges  -44P	part number	216919	217319	217719	217119	217519	217919
	overall length (in.)	9⅝	9⅝	10⅛	16⅜	16⅜	16⅞
	approx. weight (lbs.)	60	64	82	63	71	93
Floating Plate Steel Flanges  -77P	part number	217019	217419	217819	217219	217619	218019
	overall length (in.)	9⅛	9⅛	9⅝	15⅞	15⅞	16⅜
	approx. weight (lbs.)	60	65	107	64	73	95
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	2.3	2.3	2.3	4.5	4.5	4.5
	7000 cycles	1.4	1.4	1.4	2.8	2.8	2.8
	15000 cycles	1.2	1.2	1.2	2.3	2.3	2.3
Axial deflection force	pounds per inch	450	900	1350	225	450	675
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.53	.53	.53	2.1	2.1	2.1
	7000 cycles	.33	.33	.33	1.3	1.3	1.3
	15000 cycles	.27	.27	.27	1.1	1.1	1.1
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10″	316	632	948	39	76	116
	.20″	500	1000	1500	61	122	184
	.30″	660	1320	1980	81	162	243
	.50″	—	—	—	113	226	339
	1.00″	—	—	—	180	360	540

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—12" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	80	160	290	35	75	140
	nippled units (see note 1)	70	140	290	35	70	140
Welding Nipples -11	part number	215020	215820	216320	215420	216070	216470
	overall length (in.)	12 5/8	12 5/8	14 5/8	19 3/8	19 3/8	22 3/8
	approx. weight (lbs.)	31	35	52	34	44	60
Fixed Forged Steel Flanges -44	part number	215270	215920	218120	215670	216170	218220
	overall length (in.)	10 1/8	12	11 1/2	16 7/8	18 3/4	18 1/4
	approx. weight (lbs.)	91	142	144	94	148	152
Floating Forged Steel Flanges -77	part number	215370	216020	216420	215770	216270	216570
	overall length (in.)	10 1/8	12	12	16 7/8	18 3/4	18 3/4
	approx. weight (lbs.)	88	138	147	91	101	155
Fixed Plate Steel Flanges -44P	part number	216920	217320	217720	217120	217520	217920
	overall length (in.)	9 5/8	9 5/8	10 1/8	16 3/8	16 3/8	16 7/8
	approx. weight (lbs.)	89	96	144	91	102	152
Floating Plate Steel Flanges -77P	part number	217020	217420	217820	217220	217620	218020
	overall length (in.)	9 1/8	9 1/8	10 1/8	15 7/8	15 7/8	16 7/8
	approx. weight (lbs.)	90	98	178	92	104	155
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	2.8	2.8	2.6	5.5	5.5	5.1
	7000 cycles	1.7	1.7	1.6	3.4	3.4	3.1
	15000 cycles	1.4	1.4	1.3	2.8	2.8	2.6
Axial deflection force	pounds per inch	420	840	1350	210	420	675
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.55	.55	.51	2.2	2.2	1.9
	7000 cycles	.34	.34	.32	1.4	1.4	1.2
	15000 cycles	.28	.28	.26	1.1	1.1	0.6
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	404	808	1304	50	100	160
	.20"	635	1270	2074	79	158	254
	.30"	840	1680	2716	103	207	332
	.50"	—	—	—	145	290	466
	1.00"	—	—	—	231	462	742

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—14" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	60	120	225	55	110	185
	nippled units (see note 1)	50	100	225	35	70	185
Welding Nipples -11	part number	215021	215821	216321	215421	216071	216471
	overall length (in.)	14 7/8	14 7/8	16 7/8	20 7/8	20 7/8	23 7/8
	approx. weight (lbs.)	27	35	50	33	47	67
Fixed Forged Steel Flanges -44	part number	215271	215921	218121	215671	216171	218221
	overall length (in.)	11 3/8	11 3/8	13 3/8	17 3/8	17 3/8	19 3/8
	approx. weight (lbs.)	106	114	190	112	126	208
Floating Forged Steel Flanges -77	part number	215371	216021	—	215771	216271	—
	overall length (in.)	11 3/8	11 3/8	—	17 3/8	17 3/8	—
	approx. weight (lbs.)	97	106	—	103	118	—
Fixed Plate Steel Flanges -44P	part number	216921	217321	217721	217121	217521	217921
	overall length (in.)	11 5/8	11 5/8	11 7/8	17 5/8	17 5/8	17 7/8
	approx. weight (lbs.)	121	129	175	127	141	193
Floating Plate Steel Flanges -77P	part number	217021	217421	—	217221	217621	—
	overall length (in.)	10 5/8	10 5/8	—	16 5/8	16 5/8	—
	approx. weight (lbs.)	122	131	—	128	143	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	2.9	2.9	2.9	5.2	5.2	5.2
	7000 cycles	1.8	1.8	1.8	3.2	3.2	3.2
	15000 cycles	1.5	1.5	1.5	2.7	2.7	2.7
Axial deflection force	pounds per inch	650	1300	1950	360	720	1080
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.58	.58	.58	1.9	1.9	1.9
	7000 cycles	.35	.35	.35	1.1	1.1	1.1
	15000 cycles	.29	.29	.29	1.0	1.0	1.0
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	648	1296	1944	112	224	336
	.20"	1020	2040	3060	177	353	530
	.30"	1350	2700	4050	233	465	698
	.50"	—	—	—	325	650	975
	1.00"	—	—	—	520	1040	1560

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—16" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	50	95	210	45	95	200
	nippled units (see note 1)	45	90	210	30	60	200
Welding Nipples -11	part number	215022	215822	216323	215422	216072	216473
	overall length (in.)	1 7/8	1 7/8	1 7/8	2 0/8	2 0/8	2 3/8
	approx. weight (lbs.)	31	40	57	37	53	77
Fixed Forged Steel Flanges -44	part number	215272	215922	218122	215672	216172	218222
	overall length (in.)	1 1/8	1 1/8	1 3/8	1 7/8	1 7/8	1 7/8
	approx. weight (lbs.)	127	135	240	132	148	260
Floating Forged Steel Flanges -77	part number	215372	216022	—	215772	216272	—
	overall length (in.)	1 1/8	1 1/8	—	1 7/8	1 7/8	—
	approx. weight (lbs.)	127	137	—	133	149	—
Fixed Plate Steel Flanges -44P	part number	216922	217322	217722	217122	217522	217922
	overall length (in.)	1 1/8	1 1/8	1 1/8	1 7/8	1 7/8	1 7/8
	approx. weight (lbs.)	145	154	180	151	167	200
Floating Plate Steel Flanges -77P	part number	217022	217422	—	217222	217622	—
	overall length (in.)	1 0/8	1 0/8	—	1 6/8	1 6/8	—
	approx. weight (lbs.)	146	157	—	152	169	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	2.9	2.9	2.9	5.2	5.2	5.2
	7000 cycles	1.8	1.8	1.8	3.2	3.2	3.2
	15000 cycles	1.5	1.5	1.5	2.7	2.7	2.7
Axial deflection force	pounds per inch	740	1480	2220	410	820	1230
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.51	.51	.51	1.6	1.6	1.6
	7000 cycles	.31	.31	.31	1.0	1.0	1.0
	15000 cycles	.26	.26	.26	0.8	0.8	0.8
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	940	1880	2820	164	327	491
	.20"	1480	2960	4440	254	508	763
	.30"	1960	3920	5880	336	672	1008
	.50"	—	—	—	470	940	1410
	1.00"	—	—	—	745	1490	2235

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—18" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	45	90	205	45	90	205
	nippled units (see note 1)	40	80	205	30	60	205
Welding Nipples -11	part number	215023	215823	216325	215423	216073	216475
	overall length (in.)	15¾	15¾	18¾	20⅞	20⅞	23⅞
	approx. weight (lbs.)	36	48	67	42	60	86
Fixed Forged Steel Flanges -44	part number	215273	215923	218123	215673	216173	218223
	overall length (in.)	12¼	12¼	15⅛	17⅜	17⅜	20¼
	approx. weight (lbs.)	131	142	253	136	184	272
Floating Forged Steel Flanges -77	part number	215373	216023	—	215773	216273	—
	overall length (in.)	12¼	12¼	—	17⅜	17⅜	—
	approx. weight (lbs.)	131	144	—	136	157	—
Fixed Plate Steel Flanges -44P	part number	216923	217323	217723	217123	217523	217923
	overall length (in.)	12½	12½	12¾	17⅝	17⅝	17⅞
	approx. weight (lbs.)	146	158	186	153	171	206
Floating Plate Steel Flanges -77P	part number	217023	217423	—	217223	217623	—
	overall length (in.)	11½	11½	—	16⅝	16⅝	—
	approx. weight (lbs.)	148	160	—	154	174	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	3.2	3.2	3.2	5.2	5.2	5.2
	7000 cycles	2.0	2.0	2.0	3.2	3.2	3.2
	15000 cycles	1.6	1.6	1.6	2.7	2.7	2.7
Axial deflection force	pounds per inch	750	1500	2250	460	920	1380
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.56	.56	.56	1.5	1.5	1.5
	7000 cycles	.34	.34	.34	0.9	0.9	0.9
	15000 cycles	.28	.28	.28	0.8	0.8	0.8
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	963	1926	2889	224	448	672
	.20"	1520	3040	4560	358	715	1073
	.30"	2010	4020	6030	465	930	1396
	.50"	—	—	—	660	1320	1980
	1.00"	—	—	—	1040	2080	3120

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—20" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	40	85	195	40	85	195
	nippled units (see note 1)	30	60	195	20	40	195
Welding Nipples -11	part number	215024	215824	216327	215424	216074	216477
	overall length (in.)	14¼	14¼	17¼	21⅜	21⅜	24⅜
	approx. weight (lbs.)	37	48	67	47	68	98
Fixed Forged Steel Flanges -44	part number	215274	215924	218124	215674	216174	218224
	overall length (in.)	10¾	10¾	14	17⅞	17⅞	21⅛
	approx. weight (lbs.)	150	160	327	159	180	358
Floating Forged Steel Flanges -77	part number	215374	216024	—	215774	216274	—
	overall length (in.)	10¾	10¾	—	17⅞	17⅞	—
	approx. weight (lbs.)	150	162	—	160	182	—
Fixed Plate Steel Flanges -44P	part number	216924	217324	217724	217124	217524	217924
	overall length (in.)	11	11	11¼	18⅛	18⅛	18⅜
	approx. weight (lbs.)	186	197	242	196	217	273
Floating Plate Steel Flanges -77P	part number	217024	217424	—	217224	217624	—
	overall length (in.)	10¼	10¼	—	17⅜	17⅜	—
	approx. weight (lbs.)	188	200	—	198	225	—
Maximum rated total axial movement in inches for designated cycle life (see note 3)	1000 cycles	2.5	2.5	2.5	5.2	5.2	5.2
	7000 cycles	1.8	1.8	1.8	3.8	3.8	3.8
	15000 cycles	1.5	1.5	1.5	3.1	3.1	3.1
Axial deflection force	pounds per inch	430	860	1290	200	400	600
Maximum rated total lateral movement in inches for designated cycle life	1000 cycles (see note 4)	.36	.36	.36	1.5	1.5	1.5
	7000 cycles	.22	.22	.22	0.9	0.9	0.9
	15000 cycles	.18	.18	.18	0.8	0.8	0.8
Force in pounds required to achieve Lateral deflection in inches from normal centerline	.10"	1300	2600	3900	151	302	452
	.20"	2050	4100	6150	237	474	711
	.30"	2720	5440	—	310	620	931
	.50"	—	—	—	440	880	1320
	1.00"	—	—	—	695	1390	2085

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.

Specifications—24" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	40	80	180	40	80	180
	nippled units (see note 1)	25	50	180	18	36	180
Welding Nipples -11	part number	215026	215826	216331	215426	216076	216481
	overall length (in.)	14 1/4	14 1/4	17 1/4	21 3/8	21 3/8	24 3/8
	approx. weight (lbs.)	44	57	80	56	81	117
Fixed Forged Steel Flanges -44	part number	215276	215926	218126	215676	216176	218226
	overall length (in.)	11 3/4	11 3/4	14 3/4	18 7/8	18 7/8	21 7/8
	approx. weight (lbs.)	239	252	445	251	276	482
Floating Forged Steel Flanges -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges -44P	part number	216926	217326	217726	217126	217526	217926
	overall length (in.)	11	11	11 1/4	18 1/8	18 1/8	18 3/8
	approx. weight (lbs.)	233	246	302	245	270	339
Floating Plate Steel Flanges -77P	part number	217026	217426	—	217226	217626	—
	overall length (in.)	10 1/4	10 1/4	—	15 3/8	15 3/8	—
	approx. weight (lbs.)	238	255	—	247	274	—
Maximum rated total axial movement in inches for designated cycle life (see notes 3 and 6)	1000 cycles	2.5	2.5	1.6	5.2	5.2	3.5
	7000 cycles	1.8	1.8	1.0	3.8	3.8	2.2
	15000 cycles	1.5	1.5	0.8	3.1	3.1	1.8
Axial deflection force (see note 6)	pounds per inch	520	1040	3270	245	490	1530
Maximum rated total lateral movement in inches for designated cycle life (see note 6)	1000 cycles (see note 4)	.30	.30	.16	1.3	1.3	.74
	7000 cycles	.18	.18	.10	0.8	0.8	.46
	15000 cycles	.15	.15	.08	0.7	0.7	.38
Force in pounds required to achieve Lateral deflection in inches from normal centerline (see note 6)	.10"	1970	3940	12700	224	448	1290
	.20"	3090	6180	20200	358	715	2070
	.30"	—	—	—	465	930	2670
	.50"	—	—	—	660	1320	3800
	1.00"	—	—	—	1040	2080	6000

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.
6. These specifications do not apply to long style 77P series: refer to our Sales Office nearest you.

Specifications—30" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	40	80	165	40	80	165
	nippled units (see note 1)	24	48	165	16	32	165
Welding Nipples -11	part number	215030	215830	216337	215430	216080	216487
	overall length (in.)	14¼	14¼	17¼	21⅜	21⅜	24⅜
	approx. weight (lbs.)	56	72	100	71	102	146
Fixed Forged Steel Flanges -44	part number	215280	215930	218130	215680	216180	218230
	overall length (in.)	11¾	11¾	11¾	18⅞	18⅞	18⅞
	approx. weight (lbs.)	320	335	350	335	366	396
Floating Forged Steel Flanges -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges -44P	part number	216930	217330	217730	217130	217530	217930
	overall length (in.)	11¼	11¼	11¼	18⅜	18⅜	18⅜
	approx. weight (lbs.)	371	387	402	387	417	448
Floating Plate Steel Flanges -77P	part number	217030	217430	—	217230	217630	—
	overall length (in.)	10¾	10¾	—	15⅞	15⅞	—
	approx. weight (lbs.)	377	398	—	389	422	—
Maximum rated total axial movement in inches for designated cycle life (see notes 3 and 6)	1000 cycles	2.5	2.5	1.6	5.2	5.2	3.5
	7000 cycles	1.8	1.8	1.0	3.8	3.8	2.2
	15000 cycles	1.5	1.5	0.8	3.1	3.1	1.8
Axial deflection force (see note 6)	pounds per inch	665	1330	4040	310	620	1890
Maximum rated total lateral movement in inches for designated cycle life (see note 6)	1000 cycles (see note 4)	.24	.24	.13	1.0	1.0	.60
	7000 cycles	.15	.15	.08	0.6	0.6	.37
	15000 cycles	.12	.12	.06	0.5	0.5	.31
Force in pounds required to achieve Lateral deflection in inches from normal centerline (see note 6)	.10"	3460	6720	23600	396	793	2400
	.20"	5440	10900	—	629	1260	3800
	.30"	—	—	—	827	1660	5000
	.50"	—	—	—	1160	2320	7000
	1.00"	—	—	—	—	—	—

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.
6. These specifications do not apply to long style 77P series: refer to our Sales Office nearest you.

Specifications—36″ Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	35	70	150	35	70	150
	nippled units (see note 1)	20	40	150	14	28	150
Welding Nipples -11	part number	215036	215836	216343	215436	216086	216493
	overall length (in.)	14¼	14¼	17¼	21⅜	21⅜	24⅜
	approx. weight (lbs.)	67	86	121	85	122	175
Fixed Forged Steel Flanges -44	part number	215286	215936	218136	215686	216186	218236
	overall length (in.)	11¾	11¾	11¾	18⅞	18⅞	18⅞
	approx. weight (lbs.)	487	506	525	505	542	580
Floating Forged Steel Flanges -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges -44P	part number	216936	217336	217736	217136	217536	217936
	overall length (in.)	11¼	11¼	11¼	18⅜	18⅜	18⅜
	approx. weight (lbs.)	497	516	535	515	552	589
Floating Plate Steel Flanges -77P	part number	217036	217436	—	217236	217636	—
	overall length (in.)	10¾	10¾	—	15⅞	15⅞	—
	approx. weight (lbs.)	504	529	—	518	557	—
Maximum rated total axial movement in inches for designated cycle life (see notes 3 & 6)	1000 cycles	2.5	2.5	2.5	5.2	5.2	5.2
	7000 cycles	1.8	1.8	1.8	3.8	3.8	3.8
	15000 cycles	1.5	1.5	1.5	3.1	3.1	3.1
Axial deflection force (see note 6)	pounds per inch	800	1600	2400	375	750	1125
Maximum rated total lateral movement in inches for designated cycle life (see note 6)	1000 cycles (see note 4)	.20	.20	.20	0.9	0.9	0.9
	7000 cycles	.12	.12	.12	0.5	0.5	0.5
	15000 cycles	.10	.10	.10	0.4	0.4	0.4
Force in pounds required to achieve Lateral deflection in inches from normal centerline (see note 6)	.10″	5870	11700	17570	672	1344	2000
	.20″	9250	18500	—	1060	2120	3180
	.30″	—	—	—	1400	2800	4190
	.50″	—	—	—	1960	3920	5880
	1.00″	—	—	—	—	—	—

NOTES:

1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.
6. These specifications do not apply to long style 77P series: refer to our Sales Office nearest you.

Specifications—42" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	30	60	110	30	60	110
	nippled units (see note 1)	18	36	110	12	24	110
Welding Nipples -11	part number	215042	215842	216349	215442	216092	216499
	overall length (in.)	14¼	14¼	17¼	21⅜	21⅜	24⅜
	approx. weight (lbs.)	78	100	141	99	142	204
Fixed Forged Steel Flanges -44	part number	215292	215942	218142	215692	216192	218242
	overall length (in.)	11¾	11¾	11¾	18⅞	18⅞	18⅞
	approx. weight (lbs.)	678	700	722	699	742	785
Floating Forged Steel Flanges -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges -44P	part number	216942	217342	217742	217142	217542	217942
	overall length (in.)	11¼	11¼	11¼	18⅜	18⅜	18⅜
	approx. weight (lbs.)	641	663	685	662	705	748
Floating Plate Steel Flanges -77P	part number	217042	217442	—	217242	217642	—
	overall length (in.)	10¾	10¾	—	15⅞	15⅞	—
	approx. weight (lbs.)	648	678	—	665	710	—
Maximum rated total axial movement in inches for designated cycle life (see notes 3 & 6)	1000 cycles	2.5	2.5	1.6	5.2	5.2	3.5
	7000 cycles	1.8	1.8	1.0	3.8	3.8	2.2
	15000 cycles	1.5	1.5	0.8	3.1	3.1	1.8
Axial deflection force (see note 6)	pounds per inch	940	1880	5590	440	880	2610
Maximum rated total lateral movement in inches for designated cycle life (see note 6)	1000 cycles (see note 4)	.17	.17	.09	0.8	0.8	.43
	7000 cycles	.11	.11	.06	0.5	0.5	.27
	15000 cycles	.09	.09	.05	0.4	0.4	.22
Force in pounds required to achieve Lateral deflection in inches from normal centerline (see note 6)	.10"	9160	18300	61000	1060	2110	6250
	.20"	14400	28900	—	1670	3340	9900
	.30"	—	—	—	2200	4400	12900
	.50"	—	—	—	3090	6180	—
	1.00"	—	—	—	—	—	—

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.
6. These specifications do not apply to long style 77P series: refer to our Sales Office nearest you.

Specifications—48" Pipe Size

TYPES		ES one ply short style	MS two ply short style	FS three ply short style	EL one ply long style	ML two ply long style	FL three ply long style
Maximum working pressure at room temperature—PSIG (see note 2)	flanged units	25	50	75	25	50	75
	nippled units (see note 1)	15	30	75	10	20	75
Welding Nipples -11	part number	215048	215848	216355	215448	216098	216505
	overall length (in.)	14¼	14¼	17¼	21⅜	21⅜	24⅜
	approx. weight (lbs.)	89	114	161	113	162	234
Fixed Forged Steel Flanges -44	part number	215298	215948	218148	215698	216198	218248
	overall length (in.)	13¼	13¼	13¼	20⅜	20⅜	20⅜
	approx. weight (lbs.)	877	902	927	901	951	1000
Floating Forged Steel Flanges -77	part number	—	—	—	—	—	—
	overall length (in.)	—	—	—	—	—	—
	approx. weight (lbs.)	—	—	—	—	—	—
Fixed Plate Steel Flanges -44P	part number	216948	217348	217748	217148	217548	217948
	overall length (in.)	11¼	11¼	11¼	18⅜	18⅜	18⅜
	approx. weight (lbs.)	756	781	806	780	830	878
Floating Plate Steel Flanges -77P	part number	217048	217448	—	217248	217648	—
	overall length (in.)	10¾	10¾	—	15⅞	15⅞	—
	approx. weight (lbs.)	764	797	—	783	836	—
Maximum rated total axial movement in inches for designated cycle life (see notes 3 & 6)	1000 cycles	2.5	2.5	1.6	5.2	5.2	3.5
	7000 cycles	1.8	1.8	1.0	3.8	3.8	2.2
	15000 cycles	1.5	1.5	0.8	3.1	3.1	1.8
Axial deflection force (see note 6)	pounds per inch	1090	2180	6360	510	1020	4970
Maximum rated total lateral movement in inches for designated cycle life (see note 6)	1000 cycles (see note 4)	.15	.15	.08	0.7	0.7	.38
	7000 cycles	.09	.09	.05	0.4	0.4	.24
	15000 cycles	.08	.08	.04	0.3	0.3	.19
Force in pounds required to achieve Lateral deflection in inches from normal centerline (see note 6)	.10"	15150	30300	89500	1720	3450	9150
	.20"	—	—	—	2730	5460	14480
	.30"	—	—	—	3590	7170	18960
	.50"	—	—	—	5040	10080	—
	1.00"	—	—	—	—	—	—

NOTES:
1. Nippled units can be provided to equal pressure capabilities of flanged units.
2. For elevated temperatures, refer to page 7 for our pressure correction factor. For pressure in excess of those listed above, contact our Sales Office nearest you.
3. See "Movements—Axial Travel", page 8.
4. Total travel must be distributed. See "Movements—Lateral Travel", page 8.
5. Specifications here pertain to Stainless Steel type 321 only.
6. These specifications do not apply to long style 77P series: refer to our Sales Office nearest you.

SPECIALS . . .
NON-Standard ANACONDA

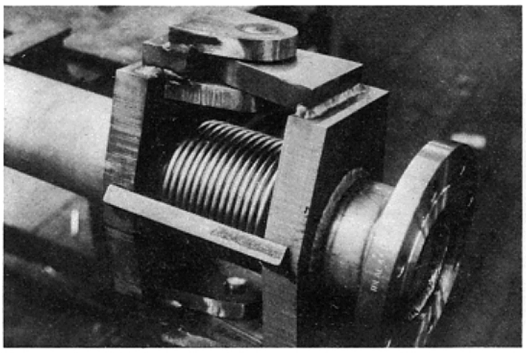
EXPANSION JOINTS

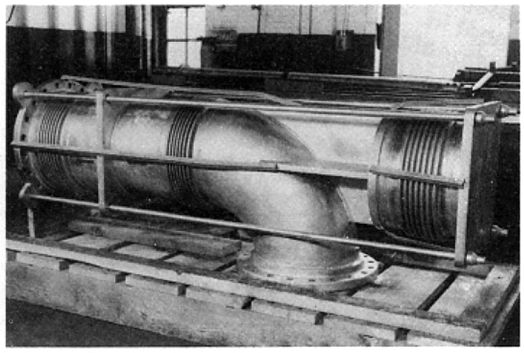
For applications beyond the operating ranges of standard Anaconda Expansion Joints, our engineering staff and manufacturing facilities are available to assist you with your piping problems. Call the sales office nearest you (listed on back cover).

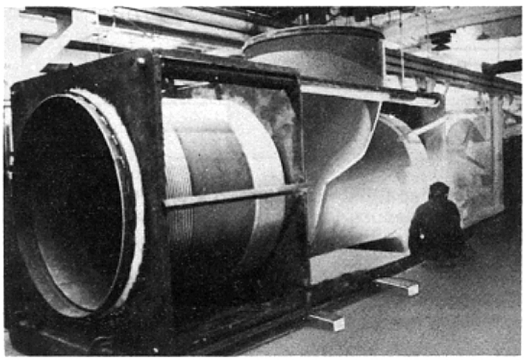
* Available in sizes up to 12 feet (144 in.) diameter
* For higher pressure capabilities, 4 or more plies are available.
* Other alloys available (Standard is type 321 S.S.)
  - —Stainless Steel Type 316L
  - —Stainless Steel Type 304L
  - —Monel 400
  - —Cupro Nickel
  - —Carpenter 20
  - —Incoloy 800
  - —Incoloy 825
  - —Inconel 625
  - —Inconel 600
  - —Aluminum
  - —Titanium

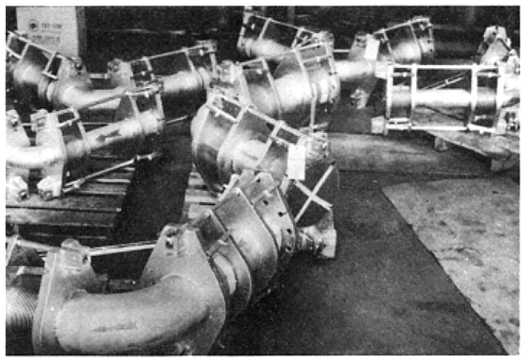
SPECIAL CONSTRUCTION TYPES:

* Universal
* Pressure balanced
* Hinged
* Gimbal
* Tied
* Dual
* Pedestal









THRUST AREAS & FORCES

THRUST IN PIPING SYSTEMS . . .

1. Suitable restraint must be designed into the pipe anchoring and guiding arrangement of a piping system utilizing Expansion Joints.

2. Thrust area, working pressure, deflection force and resistance to sliding friction are all influencing factors which determine the amount of anchoring to be provided.

BELLOWS DIMENSIONAL DATA

PIPE SIZE IN INCHES	MAX. BELLOWS O.D. IN INCHES	THRUST AREA SQ. IN.	PIPE SIZE IN INCHES	MAX. BELLOWS O.D. IN INCHES	THRUST AREA SQ. IN.
2	3¼	5.5	12	14⅛	135
2½	3¾	7.5	14	16⅛	181
3	4⅜	10.5	16	18⅛	233
3½	4⅞	13.5	18	20⅛	289
4	5⅜	17	20	22⅝	347
5	6½	27	24	26⅝	492
6	7⅝	37	30	32⅝	755
8	9⅝	62	36	38⅝	1070
10	12	97	42	44⅝	1460
			48	50⅝	1885

3. When an Expansion Joint is pressurized an internal thrust force is created. Force is developed due to the internal pressure acting on the effective cross section area of the bellows. This area is called the thrust area, and is tabulated above.

4. In order to evaluate the loads upon piping, supports, or equipment, it is necessary to determine the forces required to move an Expansion Joint. The catalog contains force data for the standard units offered. This data is expressed as the force required to move a bellows unit 1" axially. Lateral force data is also tabulated.

5. In a piping system containing Expansion Joints, it is sometimes impractical to use main anchors to absorb the pressure thrust or to transmit this force to the connected equipment. In such cases, the proper use of tied, hinged or gimbal Expansion Joints can solve the problem. The use of such Expansion Joints require that the connections between the pipe and the tie rods, hinges or gimbals be properly designed to absorb the forces imposed by the pressure in the piping system.

   The thrust absorbing members of an Expansion Joint (tie rods, hinges, gimbals and attaching structures) are normally designed to restrain only the pressure thrust developed within the piping system and the force required to move the bellows.

   If other forces are considered in the Expansion Joint design, this fact, along with information regarding the magnitude and direction of these forces, must be provided to the Expansion Joint designer. These additional forces to be considered include the following:

   a. Unsupported weight of connecting pipe and insulation between a pair of bellows.

   b. Weight of contained fluid under operation and/or test conditions.

   c. Wind, earthquake and/or impact loads.

The effects of temperature and flow conditions must be accounted for in conjunction with the above forces and loads.

APPLICATIONS FOR AXIAL MOVEMENT

ABSORBING AXIAL MOVEMENT IN PIPING SYSTEMS

Component spacing is extremely important. Expansion Joints should be near anchors . . . alignment guide #1 near Expansion Joints . . . relationship of guide #2 to guide #1 and positioning of additional guides along pipe should be as shown in diagrams.

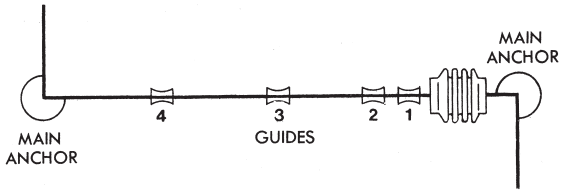


DIAGRAM #1 Single Expansion Joint used to absorb axial pipe line movement and positioned as shown between two main anchors.

DIAGRAM #2 Two Expansion Joints in longer pipe run than that shown in Diagram #1. Intermediate anchor between main anchors forms individual expanding and contracting sections. Expansion Joints are installed between intermediate and main anchors.

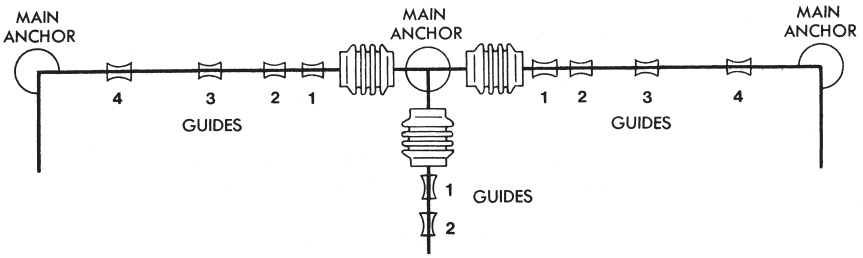


DIAGRAM #3 Expansion Joints, guides and anchors, absorbing movement in piping layout with branch connection. Anchor at the junction serves as a main anchor and is designed to resist thrust from the branch line Expansion Joint.

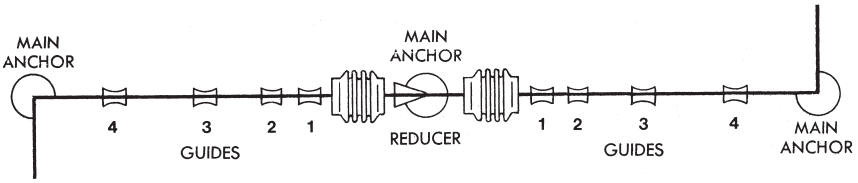


DIAGRAM #4 Expansion Joints, guides and anchors absorbing axial pipe line movement in a piping system having a reducer. One main anchor at reducer (center of diagram) is designed to resist the differential in the thrust of both expansion joints.

FOR RECOMMENDATIONS ON GUIDE SPACING, SEE PAGE 10

Pipe guides and anchors are essential to the proper functioning of expansion joints and are the responsibility of the piping designer. His knowledge of the total system will determine how many guides and anchors must be used and their locations.

APPLICATIONS FOR LATERAL MOVEMENT

SINGLE EXPANSION JOINT

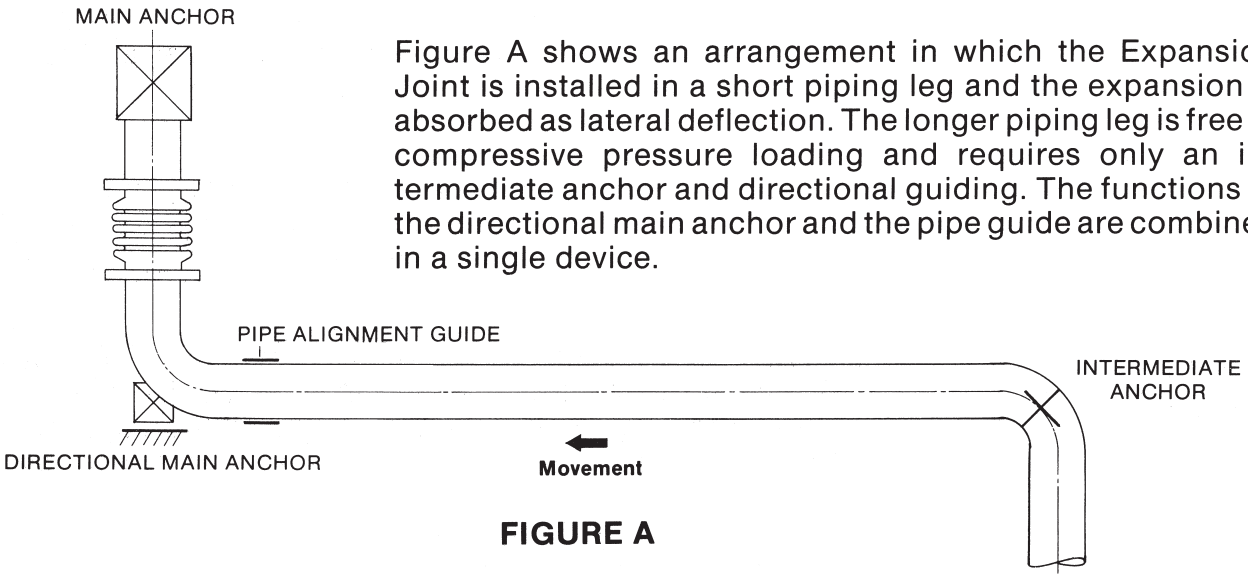


Figure A shows an arrangement in which the Expansion Joint is installed in a short piping leg and the expansion is absorbed as lateral deflection. The longer piping leg is free of compressive pressure loading and requires only an intermediate anchor and directional guiding. The functions of the directional main anchor and the pipe guide are combined in a single device.

FIGURE A

A single expansion joint can absorb combined axial and lateral movements. The Expansion Joint is located at one end of the long piping run with main anchors at each end. Guides must be properly spaced to provide for both movement control and protection of the piping against buckling.

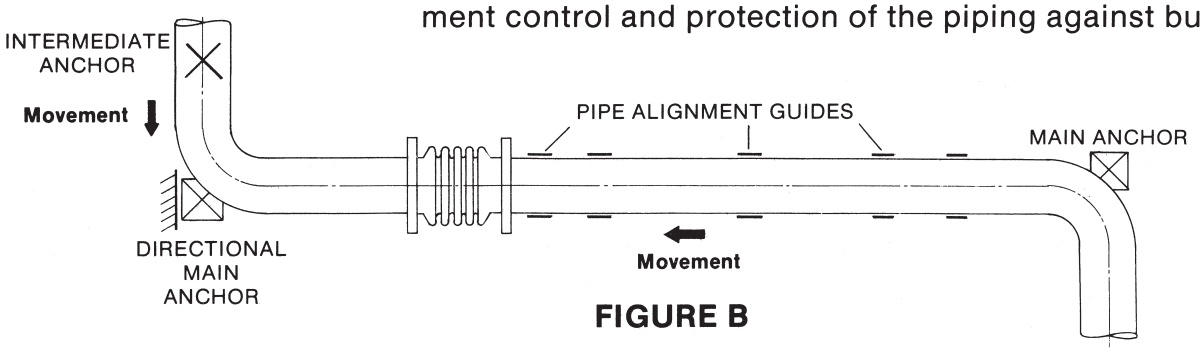


FIGURE B

The anchor at the left (Figure B) is a directional main anchor which absorbs the main load in the direction of the Expansion Joint axis and permits the growth of the short piping leg to act upon the Expansion Joint as lateral deflection. Because the main anchor loading exists only in the piping segment containing the Expansion Joint, the anchor at the end of the shorter piping leg is an intermediate anchor.

APPLICATIONS FOR LATERAL MOVEMENT, CONTINUED

When the piping configuration permits, the use of tie rods adjusted to prevent axial movement simplifies and reduces the cost of the installation (See Figure C).

Consequently, the growth of the longer pipe is absorbed by the tied Expansion Joint as lateral movement. This arrangement eliminates the need for main anchors.

Appreciable lateral deflection causes shortening of the Expansion Joint resulting from the lateral displacement of the tie rods. The piping should be flexible enough to absorb this deflection.

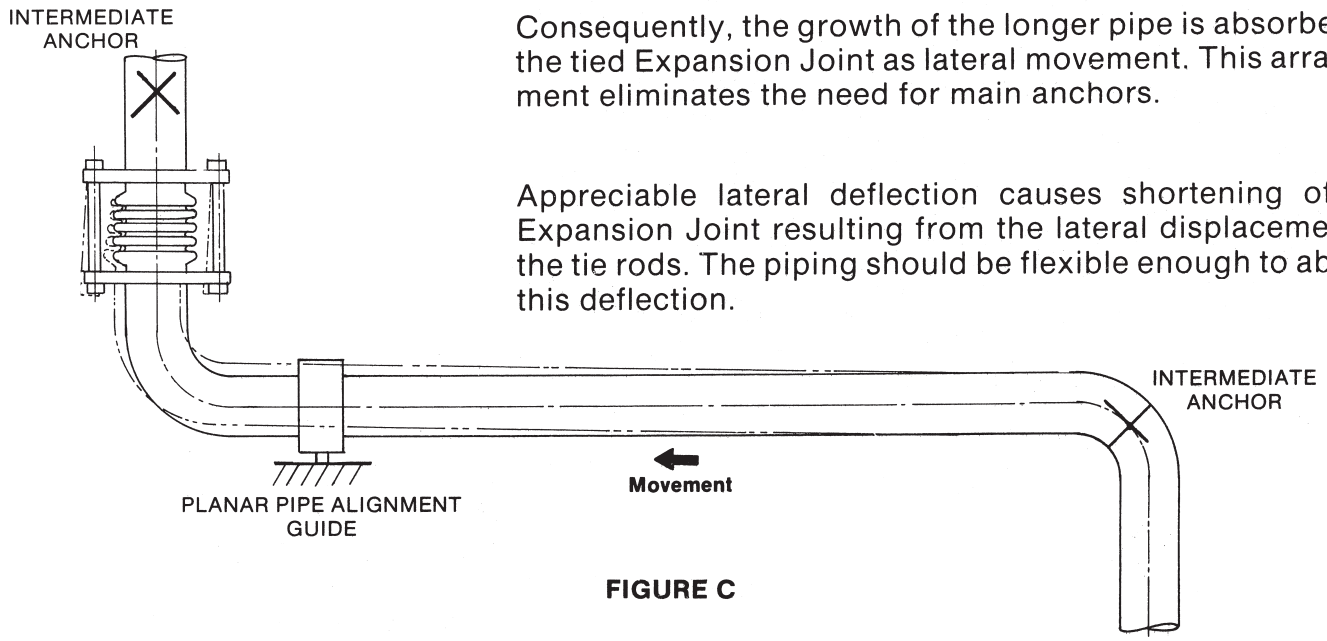


FIGURE C

UNIVERSAL EXPANSION JOINT

Where large amounts of lateral movement are encountered, a Universal Expansion Joint should be used (See Figure D on Page 35).

If necessary, the Expansion Joint should be designed to fill the entire piping leg so its expansion is absorbed within the tie rods as axial movement. The movement of the horizontal line is absorbed as lateral deflection by the Universal Expansion Joint.

Only intermediate anchors are required since the pressure loading is absorbed by the tie rods. However, directional piping guides must be provided.

WHERE A UNIVERSAL EXPANSION JOINT MUST ABSORB AXIAL MOVEMENT OTHER THAN ITS OWN THERMAL GROWTH, IT CANNOT FUNCTION AS A TIED EXPANSION JOINT AND MUST BE USED IN COMBINATION WITH MAIN ANCHORS TO ABSORB PRESSURE LOADING.

UNIVERSAL EXPANSION JOINT, CONTINUED

As a direct result of increasingly high operating pressures and temperatures, and lighter building construction methods, universal Expansion Joints are finding increasing use in steam and hot water distribution systems where, due to their ability to absorb large amounts of movement with minimum guiding and anchoring, they offer impressive savings in overall cost.

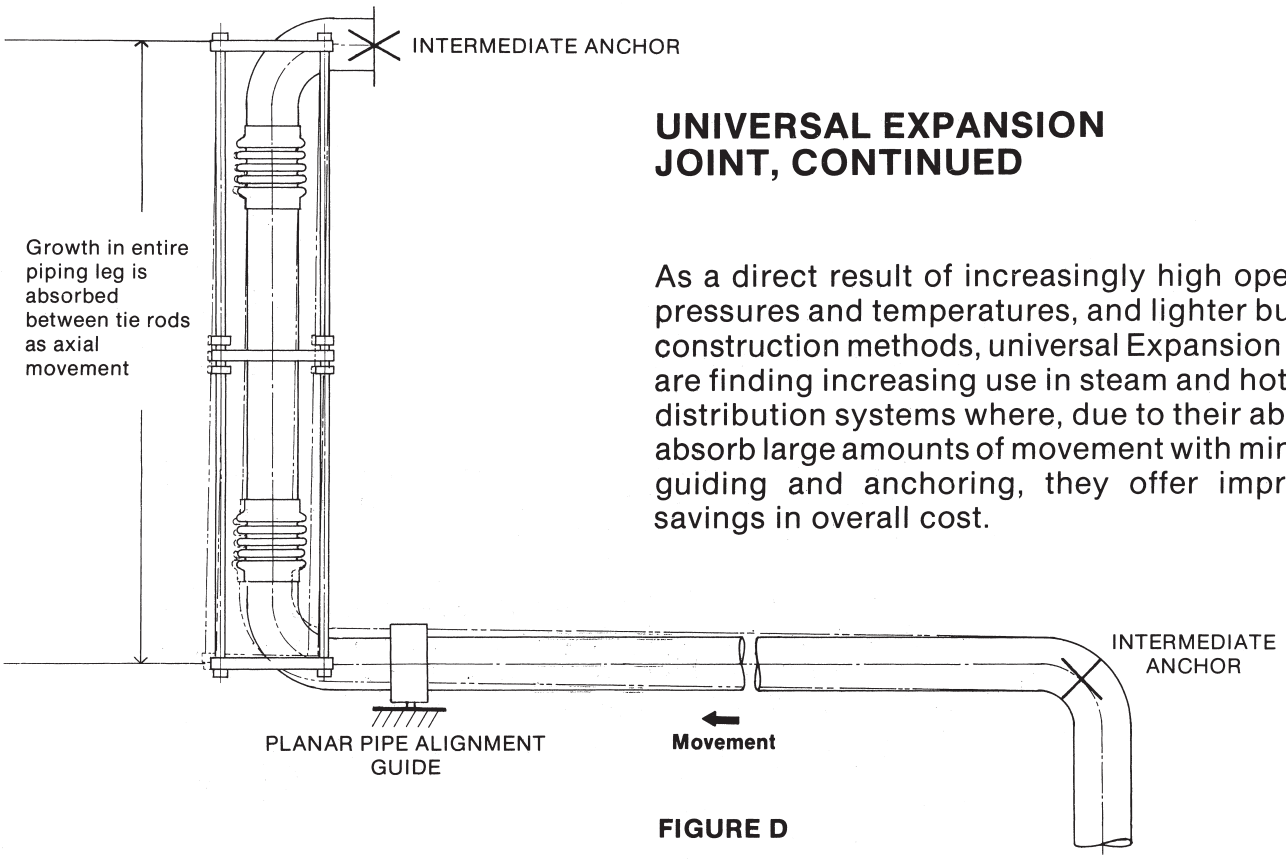
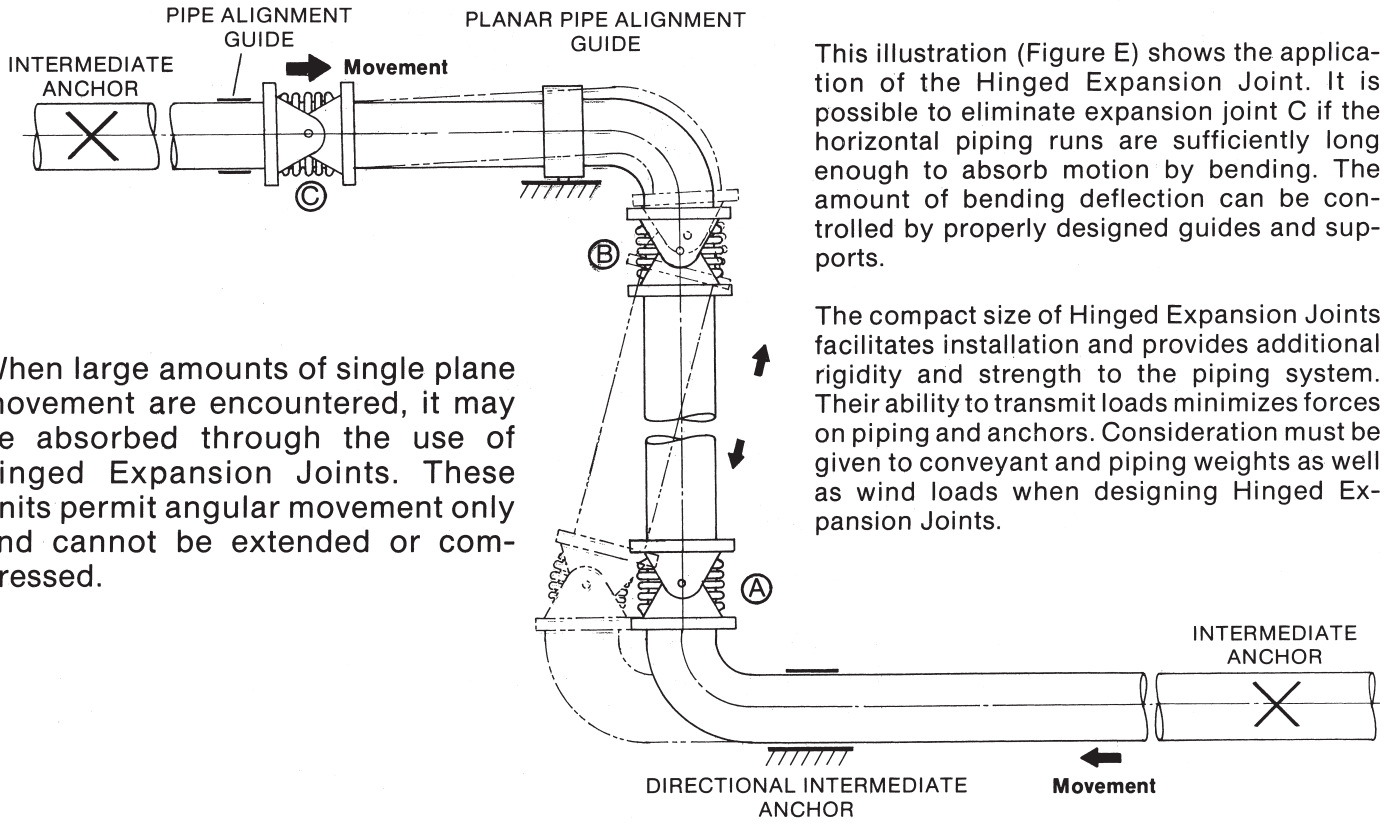


FIGURE D

APPLICATIONS FOR ANGULAR MOVEMENT

When large amounts of single plane movement are encountered, it may be absorbed through the use of hinged Expansion Joints. These units permit angular movement only and cannot be extended or compressed.



This illustration (Figure E) shows the application of the Hinged Expansion Joint. It is possible to eliminate expansion joint C if the horizontal piping runs are sufficiently long enough to absorb motion by bending. The amount of bending deflection can be controlled by properly designed guides and supports.

The compact size of Hinged Expansion Joints facilitates installation and provides additional rigidity and strength to the piping system. Their ability to transmit loads minimizes forces on piping and anchors. Consideration must be given to conveyant and piping weights as well as wind loads when designing Hinged Expansion Joints.

FIGURE E

APPLICATIONS FOR PRESSURE BALANCED EXPANSION JOINTS

THE PRESSURE BALANCED EXPANSION JOINT

The Pressure Balanced Expansion Joint (Figure F) is used most frequently in applications similar to those shown for the Single Expansion Joint, but where pressure thrust loading upon piping or equipment is considered excessive or objectionable.

The pressure balanced bellows creates an equal and opposite force to the working bellows. The usual arrangement is to have a balance and a flow side or working bellows, separated by an elbowed mid-section.

The bellows elements are connected by tie rods which allow them to balance pressure thrust forces. When pressure is applied, both bellows react simultaneously and the tie rods absorb the thrust forces, thus keeping loads off mating equipment. Movements X, Y & Z imposed on the Pressure Balance Unit are usually referenced to the applicable working points, by a 3-dimensional coordinate system. Related forces and moments are determined from this information.

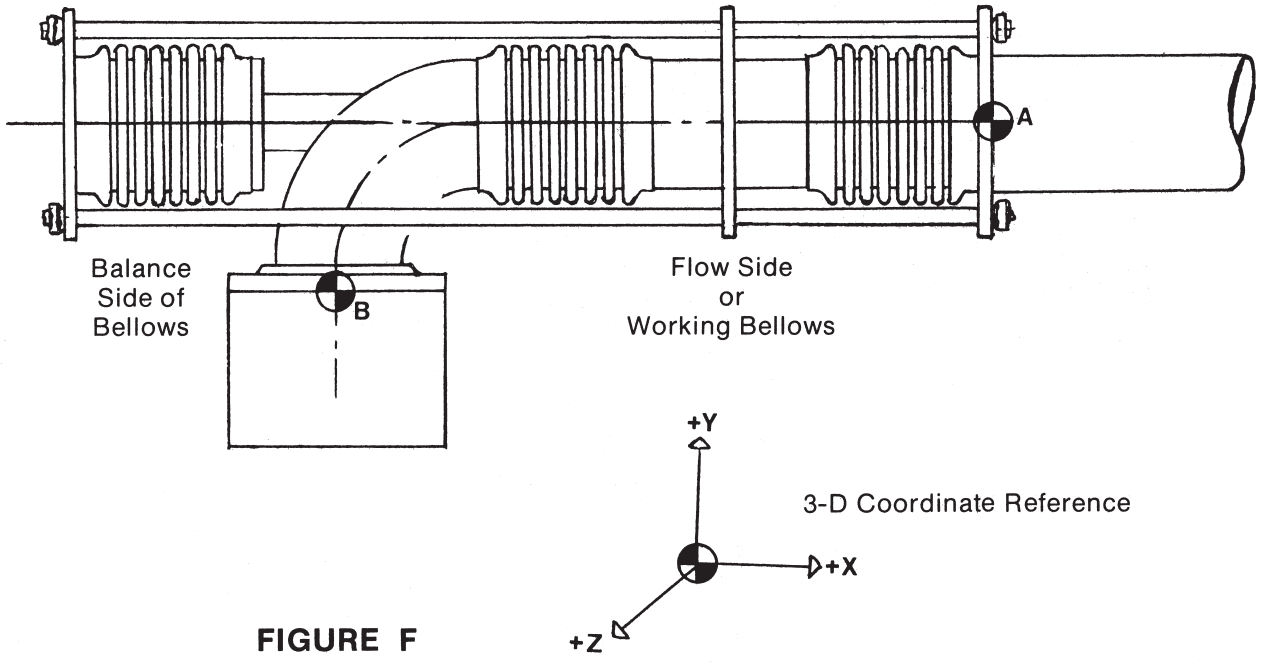


FIGURE F

Because of the design, the Pressure Balanced Expansion Joint eliminates pressure thrust loads on mating equipment and simplifies critical piping arrangements.

CYCLE LIFE • TESTING

CYCLE LIFE

The cycle life expectancy of an Expansion Joint is affected by various factors such as: (a) operating pressure, (b) operating temperature, (c) the material from which the bellows is made, (d) the movement per convolution, (e) the thickness of the bellows, (f) the convolution, pitch, (g) depth and shape of the convolution and (h) bellows heat treatment. Any change in these factors will result in a change in the life of the Expansion Joint. The work hardening of austenitic stainless steel, induced during the forming of convolutions, generally improves the fatigue life of an Expansion Joint, often to a marked degree; thus, it is not normally considered beneficial to heat treat. The necessity for heat treatment of other materials should be considered individually

The life expectancy can be defined as the total number of complete cycles which can be expected from the Expansion Joint based on data tabulated from tests performed at room temperature under simulated operating conditions. A cycle can be defined as one complete movement of an Expansion Joint from initial to extreme position and return.

Expansion Joints can be specially designed for very high cyclic life. However, when this is required, the Expansion Joint manufacturer must be advised of the estimated number of cycles required.

Cycle life is dependent upon the maximum range of stress to which the bellows is subjected, the maximum stress amplitude being a far less significant factor. Accordingly, in most cases, cold springing an expansion joint in order to reduce the maximum stress amplitude would not result in a significant improvement in cycle life.

PRODUCTION TESTING

It is standard practice for Anaconda to test production assemblies. Test pressure and/or dye penetrant inspection is determined by size and configuration. Hydrostatic testing to 1.5 times working pressure as well as vacuum testing is also employed when specified.

CORROSION

The metal gauge of an Expansion Joint Bellows is generally the thinnest element of the entire piping system so attention must be given to the possible corrosive attack by the medium being conveyed. To merely increase the metal thickness of the bellows is not a satisfactory solution to the problem as reduced cycle life can be incurred by such an approach.

It is better to select a bellows alloy that is more resistant to the corrodent than the metal used in the overall piping system. This is one of the reasons Expansion Joints of stainless steel are normal in carbon steel piping. However, the use of alloy piping often may require a more compatible corrosion resistant bellows.

Although Anaconda's standard alloy is Type 321 stainless steel, Anaconda Expansion Joints are made of many other alloys, a few of which are shown in the following corrosion resistance reference tables. While every alloy is not practical for Expansion Joint manufacture, selection of alloy or alloys should be part of the engineering considerations when designing or specifying Expansion Joints.

CORROSION RESISTANCE REFERENCE TABLES

The following tables should be used only as a guide in the selection of the most suitable bellows and fitting material when conveying a given medium. The listed media are in general considered to be pure, at room temperature and, unless otherwise specified, dry. A change in any one of these conditions may change the rating. No attempt has been made to account for variations in service conditions since these variables are innumerable and complex.

Additional information on service life, etc. is keyed to the notes at the top of page 39. The numbers appear as superscripts to the upper right of the rating as: Acetic Acid, B^2, 321 Stainless Steel, Susceptible to intergranular corrosion.

When there is a question on this reference table or you have unusual service conditions or media, contact us before ordering.

CAUTION—certain chemicals and highly reactive materials normally require special cleaning which should only be performed in accordance with the hose manufacturer's established procedures.

FOR YOUR SAFETY and further details, you should write Anaconda Metal Hose, Box 2618, Waterbury, Connecticut, 06723.

CORROSION RESISTANCE REFERENCE TABLE

RATING CODE:

A—Suitable (normal conditions)
B—Limited Service
C—Unsuitable

NOTES:

1. Susceptible to intergranular corrosion
2. May cause explosive reaction
3. Susceptible to stress corrosion cracking
4. Susceptible to pitting type corrosion
5. Discolors
6. Concentration over 50% and/or temperature over 200°F, refer to our Engineering Dept.

	CUPRO NICKEL 706	MONEL 400	INCONEL 625	321 STAINLESS	316 STAINLESS
Acetaldehyde	A	A	A	A	A
Acetanilide	B	B	B	B	B
Acetic Acid	B	B	A	B[1]	A[1]
Acetic Anhydride	B	B	A	B	B
Acetone	A	A	A	B	B
Acetophenone	A	A	A	B	B
Acetylene	C	A	A	A	A
Acrylates	B	B	B	B	B
Acrylic Acid	B	B	A	B	B
Acrylonitrile	A	A	A	A	A
Alcohols	A	A	A	A	A
Alum	B	B	A	B	B
Alumina	A	A	A	A	A
Aluminum Acetate	B	B	B	B	B
Aluminum Chloride (Dry)	B	A	A	A	A
Aluminum Chloride (Moist)	C	B	A	C[3,4]	C[3]
Aluminum Fluoride	B	B	C	C	C
Aluminum Hydroxide	A	B	B	B	B
Aluminum Sulfate	B	B	B	B[1,3]	A[3]
Ammonia - Dry	A	A	A	A	A
Ammonia - Moist	C	C	B	A	A
Ammonium Acetate	B	A	A	A	A
Ammonium Bromide	C	B	B	C[4]	C[4]
Ammonium Chloride - Dry	C	A	A	A	A
Ammonium Chloride - Moist	C	B	B	C[3,4]	C[3]
Ammonium Hydroxide	C	A	A	B	B
Ammonium Nitrate	C	C[2]	B	B[3]	B[3]
Ammonium Sulfate	C	B	C	C[1]	B
Amyl Acetate	A	A	A	A	A
Amyl Alcohol	A	A	A	A	A
Amyl Chloride - Dry	C	A	A	A	A
Amyl Chloride - Moist	C	B	C	C[3,4]	C[3]
Aniline	C	A	B	B	B
Aniline Dyes	C	A	B	B	B
Asphalt	A	A	A	A	A
Atmosphere - Industrial	A	A	A	B[4]	A[4]
Atmosphere - Marine	A	A	A	B[4]	B[4]
Atmosphere - Rural	A	A	A	A	A
Barium Carbonate	A	B	B	B	B
Barium Chloride - Dry	B	A	A	A	A
Barium Chloride - Moist	C	B	C	C[3,4]	C[3]
Barium Hydroxide	A	B	B	B	A
Barium Sulfate	B	B	B	B	B
Barium Sulfide	C	C	B	B	B
Beer	A	A	A	A	A
Beet Sugar Syrups	A	A	A	A	A
Benzaldehyde	A	B	B	B	B
Benzene (Benzol)	A	A	A	A	A
Benzoic Acid	A	B	A	A	A
Benzylamine	C	B	B	B	B
Benzyl Chloride - Dry	A	A	A	A	A
Benzyl Chloride - Moist	B	B	B	C[3,4]	C[3]
Black Liquor, Sulfate Process	C	A	B	B	B
Bleaching Powder - Dry	A	A	A	A	A
Bleaching Powder - Moist	B	B	B	C[1,3,4]	C[3,4]
Borax	A	A	A	A	A
Bordeaux Mixture	A	A	A	A	A
Boric Acid	A	B	A	A	A
Boron Trichloride - Dry	B	B	B	B	B
Boron Trichloride - Moist	B	B	C	C[3,4]	C[3]
Boron Trifluoride - Dry	A	B	A	B	B
Brines	A	B	B	C[3,4]	C[3]
Bromic Acid	C	C	C	C	C
Bromine, Dry	A	A	A	B	B
Bromine, Moist	B	B	B	C	C
Butadiene	A	A	A	A	A
Butane	A	A	A	A	A
Butanol (Butyl Alcohol)	A	A	A	A	A
Butyl Phenols	B	A	B	B	B
Butylamine	B	A	A	A	A
Butyric Acid	A	B	A	B	B
Cadmium Chloride - Moist	B	B	B	C[3,4]	C[3]
Cadmium Chloride - Dry	A	A	A	A	A
Cadmium Sulfate	A	A	A	A	A
Calcium Bisulfite	B	B	B	B[1]	B
Calcium Bromide	A	B	A	C[3]	C[3]
Calcium Chloride - Moist	A	B	A	C[3,4]	C[3]
Calcium Chloride - Dry	A	A	A	A	A
Calcium Fluoride	B	B	B	C	C
Calcium Hydroxide	A	B	A	B	B
Calcium Hypochlorite - Moist	B	B	B	C[3,4]	C[3,4]
Calcium Hypochlorite - Dry	A	A	A	A	A
Calcium Nitrate	B	B	A	B[1]	B
Calcium Oxide	A	A	A	A	A
Cane Sugar Syrups	A	A	A	A	A
Carbolic Acid (Phenol)	B	B	B	B	B
Carbon Dioxide - Dry	A	A	A	A	A
Carbon Dioxide - Moist	B	A	A	A	A
Carbonated Beverages	B	A	A	A	A
Carbonated Water	B	A	A	A	A
Carbon Disulfide	B	B	B	B	B
Carbon Tetrachloride - Dry	A	A	A	A	A
Carbon Tetrachloride - Moist	B	B	B	C[3,4]	C[4]
Castor Oil	A	A	A	A	A
Chlorine - Dry	A	A	A	A	A
Chlorine - Moist	C	B	C	C[3,4]	C[3]

CORROSION RESISTANCE REFERENCE TABLE (cont'd)

	CUPRO NICKEL 706	MONEL 400	INCONEL 625	321 STAINLESS	316 STAINLESS
Chloroacetic Acid	B	B	B	C[3,4]	C[3]
Chloric Acid	C	C	C	C[3]	C[3]
Chlorine Dioxide - Moist	C	B	B	C[3,4]	C[3]
Chlorine Dioxide - Dry	B	A	A	A	A
Chloroform - Dry	A	A	A	A	A
Chloroform - Moist	B	B	B	C[3,4]	C[3]
Chromic Acid	C	C	B	C[1,4]	C
Chromic Fluoride	C	B	B	C	C
Chromic Hydroxide	B	B	B	B	B
Chromium Sulfate	B	B	B	B	B
Cider	A	A	A	A	A
Citric Acid	A	B	A	B	B
Coffee	A	A	A	A	A
Copper Chloride - Dry	A	A	A	A	A
Copper Chloride - Moist	C	B	C	C[3,4]	C[3]
Copper Nitrate	C	C	B	A	A
Copper Sulfate	B	B	B	B[1]	B
Corn Oil	A	A	A	A	A
Cottonseed Oil	A	A	A	A	A
Creosote	A	A	A	A	A
Crude Oil	B	A	A	C[1]	B
Cyclohexane	B	B	B	B	B
DDT	B	B[4]	B	B	B
Dichloroethane - Dry	A	A	A	A	A
Dichloroethane - Wet	B	B	B	C[4]	C[4]
Dichloroethylene - Dry	A	A	A	A	A
Dichloroethylene - Moist	B	B	B	C[4]	C[4]
Dichlorophenol	B	B	B	B[3]	B[3]
Diisocyanate	A	A	A	A	A
Dimethyl Sulfate	B	B	A	B	B
Epichlorohydrin - Dry	A	A	A	A	A
Epichlorohydrin - Moist	B	B	B	C[3,4]	C[3]
Ethane	A	A	A	A	A
Ethers	A	A	A	A	A
Ethyl Acetate	A	B	A	B	B
Ethyl Alcohol	A	A	A	A	A
Ethyl Benzene	B	B	A	B[3]	B
Ethyl Chloride - Moist	B	B	B	C[3,4]	C[3]
Ethyl Chloride - Dry	A	A	A	A	A
Ethylene	A	A	A	A	A
Ethylene Chlorohydrin - Dry	A	A	A	A	A
Ethylene Chlorohydrin - Moist	B	B	B	C[4]	C[4]
Ethylene Diamine	B	B	A	B	B
Ethylene Glycol	A	A	A	A	A
Ethylene Oxide	C	B	B	B	B
Fatty Acids	B	B	B	B[1,4]	A
Ferric Chloride - Moist	C	B	B	C[1,3,4]	C[3,4]
Ferric Chloride - Dry	A	A	A	A	A
Ferric Nitrate	C	C	B	B	B
Ferric Sulfate	C	C	B	B[1]	A
Ferrous Chloride - Moist	C	B	B	C[3,4]	C[3]
Ferrous Chloride - Dry	A	A	A	A	A
Ferrous Sulfate	B	A	B	B[4]	B
Fluorine, Dry	A	A	A	A	A

	CUPRO NICKEL 706	MONEL 400	INCONEL 625	321 STAINLESS	316 STAINLESS
Fluorine, Moist	C	B	C	C	C
Formaldehyde	A	A[5]	B	B	B
Formic Acid	A	B	A	B[1]	A
Freon	A	A	A	A	A
Fruit Juices	B	A	A	A	A
Fuel Oil	A	A	A	A	A
Furfural	A	A	B	A	A
Gasoline	A	A	A	A	A
Gelatine	A	A	A	A	A
Glucose	A	A	A	A	A
Glue	A	A	A	A	A
Glutamic Acid	B	B	A	B[3,4]	B[3,4]
Glycerin (Glycerol)	A	A	A	A	A
Heptane	A	A	A	A	A
Hexachloroethane - Dry	A	A	A	A	A
Hexachloroethane - Moist	B	B	B	C[4]	C[4]
Hydrazine	C	C	A	A	A
Hydrobromic Acid	C	C	B	C[4]	C
Hydrocarbons, Pure	A	A	A	A	A
Hydrochloric Acid	C	B	C	C[4]	C[4]
Hydrocyanic Acid	C	B	B	B[1]	B
Hydrofluoric Acid	C	B	B	C[1,3]	C
Hudrofluorsilicic Acid	B	B	B	C	C
Hydrogen	A	A	A	A	A
Hydrogen Chloride - Dry	A	A	A	A	A
Hydrogen Chloride - Wet	C	B	C	C[4]	C[4]
Hydrogen Peroxide	B	B	A	A	A
Hydrogen Sulfide - Dry	A	A	A	A	A
Hydrogen Sulfide - Moist	C	B	B	B[4]	A
Hydroquinone	B	B	B	B	B
Kerosine (Kerosene)	A	A	A	A	A
Lacquers	A	A	A	A	A
Lacquer Solvents	A	A	A	A	A
Lactic Acid	A	B	B	B[1,4]	B[1]
Lime	A	A	A	A	A
Lime - Sulfur	C	B	B	B	B
Linseed Oil	B	A	A	A	A
Lithium Chloride - Moist	C	B	B	C[3,4]	C[3]
Lithium Chloride - Dry	A	A	A	A	A
Lithium Hydroxide	B	B	B	B	B
Magnesium Chloride - Moist	B	B	B	C[3,4]	C[3]
Magnesium Chloride - Dry	A	A	A	A	A
Magnesium Hydroxide	A	A	A	A	A
Magnesium Sulfate	A	A	A	B	A
Maleic Acid	C	B	B	B[1]	B
Mercuric Chloride - Moist	C	B	A	C[3,4]	C[3]
Mercuric Chloride - Dry	C	A	A	A	A
Mercurous Nitrate	C	B[3]	B	B	B
Mercury	C	B[3]	B	B	B
Methyl Alcohol	A	A	A	A	A
Methane	A	A	A	A	A
Methyl Chloride - Dry	A	A	A	A	A
Methyl Chloride - Moist	B	B	B	C[3,4]	C[3]
Methyl Ethyl Ketone	A	B	A	B	B

CORROSION RESISTANCE REFERENCE TABLE (cont'd)

	CUPRO NICKEL 706	MONEL 400	INCONEL 625	321 STAINLESS	316 STAINLESS
Milk	A	A	A	A	A
Mine Water	C	B	A	B	B
Naphthalene	B	B	A	A	A
Natural Gas	A	A	A	A	A
Nickel Chloride - Moist	B	B	B	C[3,4]	C[3]
Nickel Chloride - Dry	A	A	A	A	A
Nitric Acid	C	C	B	A	A
Nitrotoluene	B	B	B	B	B
Nitrogene	A	A	A	A	A
Oleic Acid	B	A	B	B[4]	B
Oleum (Fuming H2SO4)	C	C	B	B	B
Oxalic Acid	A	B	B	C[1]	B[1]
Oxygen	A	A	A	A	A
Palmitic Acid	B	A	A	A	A
Parafin	A	A	A	A	A
Pentane	B	B	B	B	B
Phosphoric Acid	B	B	B	C[1]	B[1]
Phthalic Acid	B	B	B	B[1]	B
Picric Acid	C	C	B	B	B
Potassium Bromide	A	B	B	C	C
Potassium Carbonate	A	A	A	A	A
Potassium Chloride - Moist	B	B	B	C[3,4]	C[3]
Potassium Chloride - Dry	A	A	A	A	A
Potassium Chromate	A	B	A	B	B
Potassium Cyanide	C	B	B	B	B
Potassium Dichromate	C	A	A	A	A
Potassium Fluoride	C	B	B	C	C
Potassium Hydroxide	B	B[3]	A	B[3]	B[3]
Potassium Nitrate	A	B	A	B	A
Potassium Permanganate	B	B	B	B	B
Potassium Sulfate	A	B	A	B	B
Propane	A	A	A	A	A
Propylene	A	A	A	A	A
Propylene Dichloride - Dry	A	A	A	A	A
Propylene Dichloride - Moist	B	B	B	C[4]	C[4]
Pyridine	B	B	B	B	B
Pyrrolidine	B	B	A	B	A
Quinine	B	B	A	B	B
Rosin	A	A	A	A	A
Sea Water	A	B	A	C[3,4]	C[3]
Sewage	A	A	A	A	A
Silver Salts	C	A	A	B	B
Silver Nitrate	C	C	A	B	B
Soap Solutions	A	A	A	A	A
Sodium	A	A	A	A	A
Sodium Acetate	B	B	B	B[4]	B
Sodium Bicarbonate	A	A	A	A	A
Sodium Bisulfate	B	B	B	B[1,4]	B
Sodium Bisulfite	B	B[4]	B	B	B
Sodium Bromide	C	B	B	C	C
Sodium Carbonate	A	A	A	A	A
Sodium Chlorate - Moist	B	B	B	C[3,4]	C[3]
Sodium Chlorate - Dry	A	A	A	A	A
Sodium Chloride - Moist	A	B	A	C[3,4]	C[3]
Sodium Chloride - Dry	A	A	A	A	A
Sodium Chromate	B	B	B	B	B
Sodium Citrate	B	B	B	B	B

	CUPRO NICKEL 706	MONEL 400	INCONEL 625	321 STAINLESS	316 STAINLESS
Sodium Cyanide	C	B	B	B	B
Sodium Dichromate	C	B	B	B	B
Sodium Fluoride	B	B	B	C[4]	C
Sodium Hydroxide	B[3]	B[3]	A	B[3]	B[3]
Sodium Hypochlorite - Moist	C	B	B	C[1,4]	C[4]
Sodium Hypochlorite - Dry	A	A	A	A	A
Sodium Metasilicate	A	A	A	A	A
Sodium Nitrate	A	A	A	A	A
Sodium Nitrite	B	B	B	B	B
Sodium Peroxide	B	B	B	B	B
Sodium Phosphate	A	A	B	B	B
Sodium Silicate	A	A	A	A	A
Sodium Sulfate	A	A	A	B[3]	B
Sodium Sulfide	C	B	B	B[4]	B
Sodium Sulfite	B	B	B	B	B
Sodium Thiosulfate	C	B	B	B	B
Stannic Chloride - Moist	C	B	B	C[3,4]	C[3]
Stannic Chloride - Dry	A	A	A	A	A
Stannous Chloride - Moist	C	B	B	C[3,4]	C[3]
Stannous Chloride - Dry	A	A	A	A	A
Steam	A	A[3]	A	A	A
Stearic Acid	B	B	B	B	B
Strontium Nitrate	B	B	B	B	B
Sulfate Black Liquor	B	B	B	B	B
Sulfate Green Liquor	B	B	B	B[3]	B[3]
Sugar Solutions	A	A	A	A	A
Sulfur - Dry	B	A	A	A	A
Sulfur - Molten	C	B	A	A	A
Sulfur Chloride - Dry	A	A	A	A	A
Sulfur Chloride - Wet	B	B	B	C[3,4]	C[3]
Sulfur Dioxide - Dry	B	B	B	C[1]	B
Sulfur Dioxide - Moist	C	C	C	C[1]	B
Sulfur Trioxide - Dry	A	A	A	A	A
Sulfuric Acid, 95-100%	B	B	A	A	A
Sulfuric Acid, 80-95%	B	B	B	B	B
Sulfuric Acid, 40-80%	C	C	B	C[1]	C[1]
Sulfuric Acid, 40%	B	C	B	C[1]	C[1]
Sulfurous Acid	C	B	B	C[1,4]	C[1,4]
Tall Oil	B	B	B	B	B
Tannic Acid	B	B	B	B	B
Tar	A	A	A	A	A
Tartaric Acid	B	B	B	B	B
Tetraphosphoric Acid	C	C	B	B	B
Toluene	A	A	A	A	A
Trichloroacetic Acid	B	B	B	C[3,4]	C[4]
Trichloroethane - Dry	A	A	A	A	A
Trichloroethane - Moist	B	B	B	C[4]	C[4]
Trichloroethylene - Dry	A	A	A	A	A
Trichloroethylene - Moist	B	B	B	C[4]	C[4]
Turpentine	A	A	A	A	A
Varnish	A	A	A	A	A
Vinegar	B	B	B	B	B
Water, Potable	A	A	A	A	A
Xylene	A	A	A	A	A
Zinc Chloride - Moist	C	B	B	C[3,4]	C[3]
Zinc Chloride - Dry	A	A	A	A	A
Zinc Sulfate	B	B	B	B	A

THERMAL MOVEMENTS

Examples:

A 3" steel pipe line is 138 feet long. Maximum temperature the line will encounter is 450°F. Lowest temperature is 100°F.

Calculation:

From the chart - the expansion of steel pipe at:

450°F 3.16 inches per 100 feet of pipe

100°F .22 inches per 100 feet of pipe

Difference 2.94 inches per 100 feet of pipe

$\frac{138}{100}$ x 2.94 = 4.06" total change in length

A 4" stainless steel line is 50 feet long. Maximum temperature the line will encounter is 575°F. Lowest temperature is -175°F.

Calculation:

From the chart - the expansion of stainless steel pipe at:

575°F 5.93 inches per 100 feet pipe

-175°F 2.49 inches per 100 feet of pipe (contraction)

Total 8.42 inches per 100 feet of pipe

$\frac{50}{100}$ x 8.42 = 4.21" total change in length

Thermal expansion of pipe data by permission of Expansion Joint Manufacturers Association, Inc.

*Monel is a registered trademark of the International Nickel Co., Inc.—data by permission.

THERMAL MOVEMENTS

IN INCHES PER 100 FEET

Saturated Steam Pressure	Temp. Degrees F.	Carbon C Mo. 3Cr Mo Steel	Austen. Stainl. Steel	Monel	Inconel	25Cr 20Ni	Aluminum	Wrought Iron	70Cu 30Ni
	-325	-2.37	-3.85	-2.62		-3.00	-4.69	-2.70	-3.15
	-300	-2.24	-3.62	-2.50		-2.83	-4.43	-2.55	-2.98
	-275	-2.11	-3.40	-2.38		-2.66	-4.17	-2.41	-2.81
	-250	-1.98	-3.17	-2.26	-2.30	-2.49	-3.91	-2.26	-2.63
	-225	-1.84	-2.95	-2.14	-2.17	-2.32	-3.66	-2.11	-2.46
	-200	-1.71	-2.72	-2.03	-2.04	-2.15	-3.40	-1.96	-2.29
	-175	-1.58	-2.49	-1.91	-1.87	-1.98	-3.14	-1.82	-2.12
	-150	-1.45	-2.27	-1.79	-1.70	-1.81	-2.88	-1.67	-1.95
	-125	-1.30	-2.01	-1.59	-1.54	-1.60	-2.58	-1.49	-1.76
	-100	-1.15	-1.75	-1.38	-1.37	-1.39	-2.27	-1.32	-1.55
	-75	-1.00	-1.50	-1.18	-1.17	-1.19	-1.97	-1.14	-1.34
	-50	-0.84	-1.24	-0.98	-0.97	-0.98	-1.67	-0.96	-1.12
	-25	-0.67	-0.98	-0.77	-0.76	-0.76	-1.32	-0.77	-0.90
	0	-0.50	-0.72	-0.57	-0.56	-0.57	-0.97	-0.57	-0.67
	25	-0.32	-0.46	-0.37	-0.36	-0.37	-0.63	-0.37	-0.43
VACUUM, INCHES OF HG 29.53	50	-0.14	-0.21	-0.16	-0.16	-0.16	-0.28	0.17	-0.19
29.14	70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27.99	100	0.22	0.33	0.27	0.26	0.27	0.45	0.25	0.30
25.87	125	0.41	0.61	0.50	0.48	0.50	0.83	0.47	0.55
22.16	150	0.60	0.89	0.74	0.70	0.73	1.22	0.69	0.81
16.04	175	0.80	1.17	0.98	0.93	0.97	1.61	0.91	1.07
6.46	200	1.00	1.46	1.22	1.15	1.21	2.00	1.14	1.33
4.2	225	1.20	1.74	1.47	1.39	1.45	2.42	1.37	1.60
15.1	250	1.40	2.03	1.71	1.63	1.69	2.83	1.60	1.86
30.7	275	1.61	2.32	1.96	1.86	1.94	3.25	1.83	2.13
52.3	300	1.82	2.61	2.21	2.10	2.19	3.67	2.06	2.40
81.5	325	2.04	2.91	2.47	2.34	2.44	4.09	2.30	2.68
119.9	350	2.25	3.20	2.72	2.57	2.69	4.52	2.54	2.96
169.6	375	2.48	3.50	2.98	2.81	2.94	4.95	2.77	3.24
232.2	400	2.70	3.80	3.25	3.05	3.20	5.39	3.01	3.52
311.3	425	2.93	4.10	3.51	3.30	3.46	5.83	3.25	
407.9	450	3.16	4.40	3.78	3.54	3.72	6.27	3.50	
525.3	475	3.39	4.70	4.06	3.79	3.98	6.72	3.74	
PRESSURE PSI GAUGE 666.0	500	3.62	5.01	4.33	4.03	4.24	7.17	3.99	
833.4	525	3.86	5.31	4.61	4.28	4.51	7.63	4.24	
1006	550	4.10	5.62	4.89	4.53	4.78	8.09	4.50	
1261	575	4.35	5.93	5.17	4.77	5.05	8.56	4.75	
1529	600	4.60	6.24	5.46	5.02	5.33	9.03	5.01	
1838	625	4.85	6.56	5.75	5.29	5.60		5.27	
2194	650	5.11	6.87	6.04	5.54	5.88		5.53	
2604	675	5.36	7.18	6.34	5.80	6.16		5.79	
3080	700	5.62	7.50	6.64	6.06	6.44		6.06	
	725	5.89	7.82	6.94	6.32	6.73		6.32	
	750	6.16	8.15	7.24	6.58	7.02		6.59	
	775	6.43	8.47	7.54	6.84	7.31		6.85	
	800	6.70	8.80	7.85	7.10	7.60		7.12	
	825	6.97	9.13	8.16	7.38	7.89		7.40	
	850	7.25	9.46	8.48	7.67	8.19		7.68	
	875	7.53	9.79	8.80	7.95	8.48		7.97	
	900	7.81	10.12	9.12	8.23	8.78		8.26	
	925	8.08	10.46	9.44	8.52	9.07		8.53	
	950	8.35	10.80	9.77	8.80	9.36		8.81	
	975	8.62	11.14	10.09	9.09	9.66		9.08	
	1000	8.89	11.48	10.42	9.37	9.95		9.36	

GUIDE FOR ORDERING
NON-STANDARD ANACONDA EXPANSION JOINTS

1. Item no. _____
2. Quantity _____
3. Size and schedule of mating pipe _____
4. Flow: Medium _____, velocity _____, direction _____
5. Design pressure, PSIG _____
6. Internal test pressure, PSIG _____
7. Temperature, °F maximum _____ minimum _____
8. Installation temperature, °F. _____
9. Axial compression, inches _____ Axial extension, inches _____
10. Lateral deflection, inches _____
11. Angular rotation, degrees _____
12. Bellows material _____
13. Pipe specification/material _____
14. Weld end preparation _____
15. Flange specification/material _____
16. Internal sleeves/materials _____
17. External covers/material _____
18. Anchor Base (main/intermediate) _____
19. Tie rods _____
20. Maximum outside diameter _____
21. Overall length _____
22. Installation position (horiz./vert.) _____

Customer _____ Date _____

_____ Proposal no. _____

Project _____ Inquiry, Job no. _____

_____ Sheet _____ of _____