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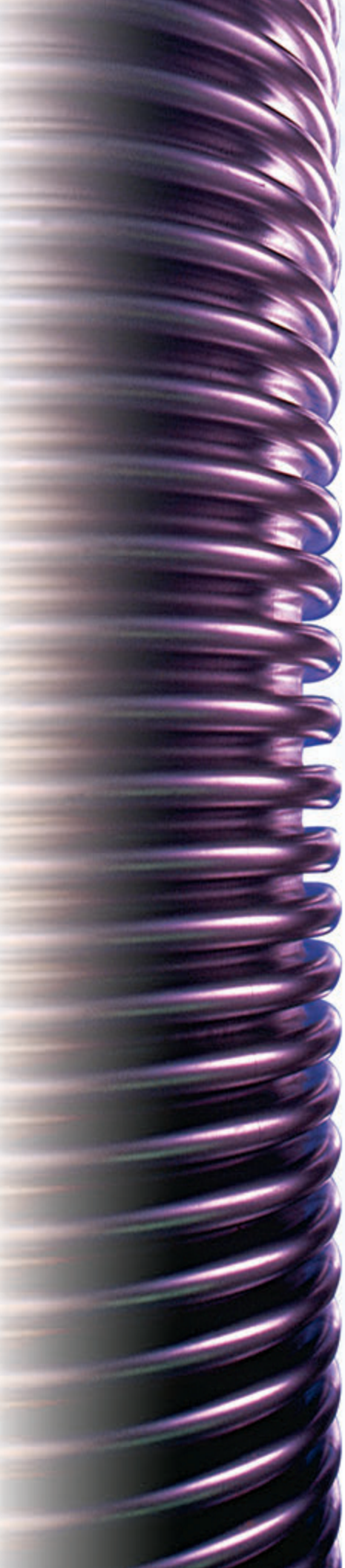
Flexonics

Canada



ENGINEERED SOLUTIONS

For Industrial & HVAC Applications



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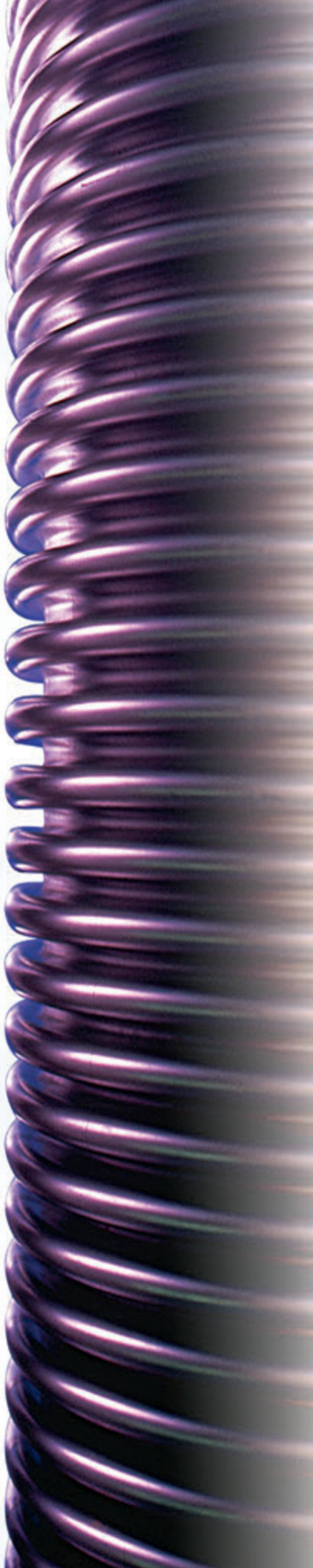
Introduction

With origins dating to 1902, Senior Flexonics is today recognized as the leader in the metal expansion joint industry. Our leadership has been earned through consistent application of solid engineering principles, stringent quality standards and product innovation to produce safe and reliable metal expansion joints and flexible connectors for both industrial and HVAC piping and ducting applications.

Senior Flexonics' Quality Assurance System has been certified to ISO 9001/14001. Our commitment to quality and engineering expertise is further reinforced by the design guidelines of CSA-B51, ASME code section VIII, DIV I, B31.1 and B31.3, and the Expansion Joint Manufacturers Association (EJMA). Detailed calculations used to design the expansion joints described in this catalogue are available to every Senior Flexonics customer.

This catalogue contains product performance data and physical descriptions for each of our light industrial and HVAC expansion joint, flexible connector, and pipe guide products. In addition, applications engineering information is included which describes the recommended practices for using these expansion joints in your piping system. Hopefully, you will find this catalogue to be a useful and informative technical reference manual that assists you in making an educated selection of the most suitable products for your application.

Notice: The information and technical data contained herein is believed to be accurate and the best information available to us at the time of printing this catalogue. All information and data contained herein is subject to change at any time, without notice. Because we have no control over the selection, installation or use of our products, we cannot be responsible for their improper application or misuse.



Glossary of Terms

External Cover - A device used to protect the bellows from foreign objects or mechanical damage. The cover may also act as a pressure containing device for externally pressurized expansion joints.

Internal Liner - Specified for all Expansion Joints, regardless of the metal of the bellows in the following cases: 1)Where it is necessary to hold friction losses to a minimum and smooth flow is desired; and 2)Where flow velocities are high and could produce resonant vibration of the bellows. Liners are recommended when flow velocities exceed the following values:

Air, Steam and other Gases

(1) up to 6" dia. - 4 ft/sec. per inch of dia.
(2) over 6" dia. - 25 ft/sec.

Water and other Liquids

(1) up to 6" dia. - 1-2/3 ft/sec. per inch of dia.
(2) over 6" dia. - 10 ft/sec.

Reinforcing Ring - Used on some bellows which fits closely in the root of the convolution. The primary purpose of these devices is to reinforce the bellows against applied pressure - internal pressure in the case of rings fitted in the roots of the convolutions.

Tie Rods - Devices, usually in the form of rods or bars, attached to the Expansion Joint assembly whose primary function is to continuously restrain the full bellows pressure thrust during normal operation while permitting only lateral deflection. Angular rotation can be accommodated only if two tie rods are used and located 90° opposed to the direction of rotation.

Limit Rods - Devices, usually in the form of rods or bars, attached to the expansion joint assembly whose primary function is to restrict the bellows movement range (axial, lateral and angular) during normal operation. In the event of a main anchor failure, they are designed to prevent bellows over-extension or over-compression while restraining the full pressure loading and dynamic forces generated by the anchor failure.

Weld Ends - The ends of a bellows unit equipped with pipe suitably beveled for welding to adjacent piping or equipment.

Flanged Ends - The ends of a bellows unit equipped with flanges for the purpose of bolting the unit to the mating flanges of adjacent piping or equipment.

Center Pipe - A common connection which joins two bellows.

Van Stoned Ends - In this type of construction, the flanges are slipped over the ends of the bellows and the bellows material is flared out or "Van Stoned" over the faces of the flanges. The bellows material prevents contact between the flanges and the medium flowing through the pipe. During installation, the Expansion Joint flanges can be rotated to match the bolt holes in the mating pipe line flanges. Although flat faced flanges are generally used for this type of construction, the Van Stoned portion of the bellows material overlapping the face of the flanges creates a condition which is, in effect, equivalent to a raised face.

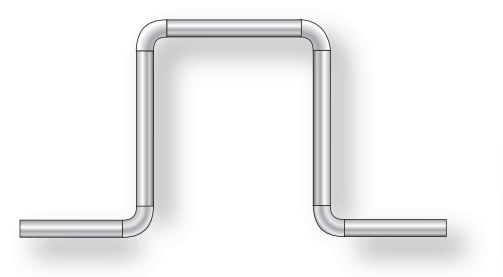
THERMAL EXPANSION COEFFICIENTS (IN./100 FT.)

Temperature (Deg F)	Carbon Steel Carbon-Moly Low-Chrome	Austenitic Stainless Steel	Copper
-25	-0.68	-0.98	-1.05
0	-0.49	-0.72	-0.79
25	-0.32	-0.46	-0.51
50	-0.14	-0.21	-0.22
70	0.00	0.00	0.00
100	0.23	0.34	0.34
125	0.42	0.62	0.62
150	0.61	0.90	0.90
175	0.80	1.18	1.18
200	0.99	1.46	1.48
225	1.21	1.75	1.77
250	1.40	2.03	2.05
275	1.61	2.32	2.34
300	1.82	2.61	2.62
325	2.04	2.90	2.91
350	2.26	3.20	3.19
375	2.48	3.50	3.48
400	2.70	3.80	3.88
425	2.93	4.10	4.17
450	3.16	4.41	4.47
475	3.39	4.71	4.76
500	3.62	5.01	5.06
525	3.86	5.31	5.35
550	4.11	5.62	5.64
575	4.35	5.93	-.--
600	4.60	6.24	-.--
625	4.86	6.55	-.--
650	5.11	6.87	-.--
675	5.37	7.18	-.--
700	5.63	7.50	-.--
725	5.90	7.82	-.--
750	6.16	8.15	-.--
775	6.43	8.47	-.--
800	6.70	8.80	-.--

Piping Flexibility

All materials expand and contract with thermal change. In the case of piping systems, this dimensional change can produce excessive stresses throughout the piping system and at fixed points such as vessels and rotating equipment, as well as within the piping itself.

Pipe loops may add the required flexibility to a piping system if space permits, however the initial cost of the additional pipe, elbows and supports must be considered. In addition, increased continuous operating costs due to pressure drop may result from the frictional resistance of the flowing media through additional elbows and pipe. In some cases, pipe diameter must be increased to compensate for losses due to pressure drop.





A practical and cost effective means of achieving piping system flexibility in a compact design is through the application of expansion joints. The most efficient piping system is the shortest and most directly routed system and expansion joints make this possible.

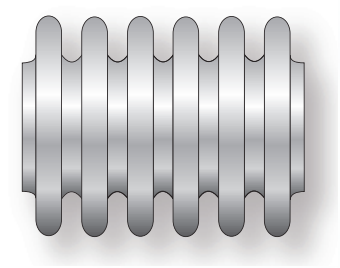
Expansion joints provide an excellent solution for isolation of settlement, seismic deflection, mechanical vibration and sound attenuation transmission produced by rotating equipment.

Design Basics

Metal bellows expansion joints consist of a flexible bellows element, appropriate end fittings such as flanges or butt-weld ends to allow connection to the adjacent piping or equipment, and other accessory items that may be required for a particular service application.

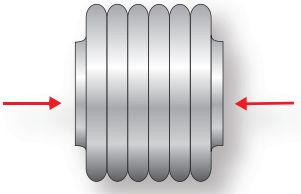
Bellows Design

Bellows are manufactured from relatively thin-walled tubing to form a corrugated cylinder. The corrugations, commonly referred to as convolutions, add the structural reinforcement necessary for the thin-wall material to contain system pressure. The bellows designer selects the thickness and convolution geometry to produce a bellows design that approaches, and often exceeds the capacity of the adjoining pipe to contain system pressure at the specified design temperature.

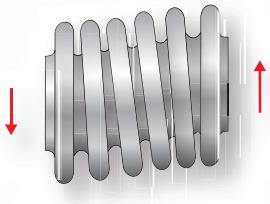


Flexibility of the bellows is achieved through bending of the convolution sidewalls, as well as flexing within their crest and root radii. In most cases, multiple convolutions are required to provide sufficient flexibility to accommodate the expected expansion and contraction of the piping system.

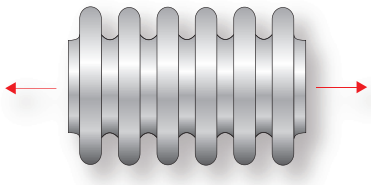
MOVEMENT CAPABILITIES



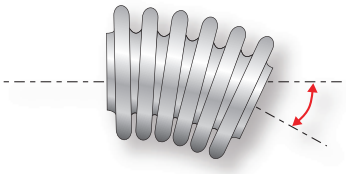
Axial Compression: Reduction of the bellows length due to piping expansion.



Lateral Offset: Transverse motion which is perpendicular to the plane of the pipe with the expansion joint ends remaining parallel.



Axial Extension: Increase of the bellows length due to pipe contraction.



Angular Rotation: Bending about the longitudinal centerline of the expansion joint.

Torsion: Twisting about the longitudinal axis of the expansion joint can reduce bellows life or cause expansion joint failure and should be avoided. Expansion joints should not be located at any point in a piping system that would impose torque to the expansion joint as a result of thermal change or settlement.

CYCLE LIFE

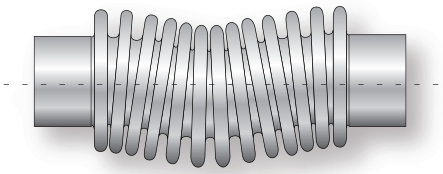
In most applications, design movements cause the individual convolutions to deflect beyond their elastic limits, producing fatigue due to plastic deformation, or yielding. One movement cycle occurs each time the expansion joint deflects from the installed length, to the operating temperature length, and then back again to the original installation length.

In the majority of applications, total shutdowns are infrequent, therefore a bellows with a predicted cycle life of one or two thousand cycles is usually sufficient to provide reliable fatigue life for decades of normal service. High cycle life designs may be desirable for service applications that include frequent start up/shut down cycles.

The bellows designer considers such design variables as material type, wall thickness, the number of convolutions and their geometry to produce a reliable design for the intended service with a suitable cycle life expectancy.

SQUIRM

An internally pressurized bellows behaves in a manner similar to that of a slender column under compressive load. At some critical end load, the column will buckle, and in a similar manner, at a sufficient pressure, an internally pressurized bellows that is installed between fixed points will also buckle, or squirm.





Bellows squirm is characterized by a gross lateral shift of the convolutions off of the longitudinal centerline. Bellows squirm can reduce cycle life, or in extreme cases, produce a catastrophic failure.

To avoid squirm, the bellows designer must limit movement capacity and flexibility to a level that insures that the bellows retains a conservative margin of column stability beyond the required design pressure.

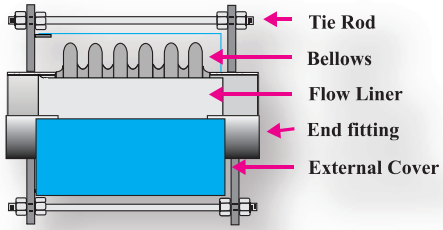
END FITTINGS

Expansion joints will include appropriate end fittings such as flanges or butt-weld ends that should match the dimensional requirements and materials of the adjoining pipe, or equipment. Small diameter compensators are available with threaded male ends, butt weld ends or copper sweat ends. Threaded flanges may be added to the threaded end compensators if a flanged connection is preferred.

ACCESSORIES

Flow liners are installed in the inlet bore of the expansion joint to protect the bellows from erosion damage due to an abrasive media or resonant vibration due to turbulent flow or velocities which exceed:

- For air, steam and other gases
  a) Up to 6" dia.- 4 ft./sec./inch of diameter
  b) Above 6" dia. -25 ft/sec
- For water and other liquids
  a) Up to 6" dia. - 2 ft./sec./inch of diameter
  b) Above 6" dia. -10 ft./sec.



Expansion joints that are installed within ten pipe diameters downstream of elbows, tees, valves or cyclonic devices should be considered to be subject to flow turbulence. The actual flow velocity should be multiplied by 4 to determine if a liner is required per the above guidelines. Actual or factored flow velocities should always be included with design data, particularly flow that exceeds 100 ft./sec. which require heavy gauge liners.

External Covers are mounted at one end of the expansion joint, providing a protective shield that spans the length of the bellows. Covers prevent direct contact with the bellows, offering personnel protection, as well as protection to the bellows from physical damage such as falling objects, weld splatter or arc strikes. Covers also provide a suitable base for external insulation to be added over an expansion joint. Some insulating materials, if wet, can leach chlorides or other substances that could damage a bellows.

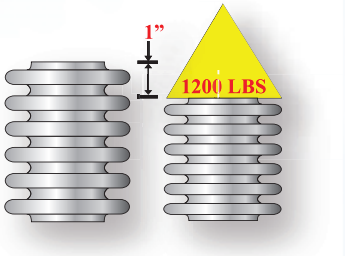
Tie rods eliminate pressure thrust and the need for main anchors required in an unrestrained piping system. Axial movement is prevented with the use of tie rods. Designs that have only two tie rods have the additional ability to accommodate angular rotation. Limit rods are similar, however they accommodate a specified axial capability.

Design Considerations

The addition of expansion joints in a piping system introduces reaction forces produced by the expansion joint that must be accommodated in the design of the piping system.

SPRING FORCE

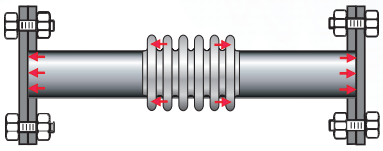
Expansion joints behave in a manner that is similar to a spring; as movement occurs, expansion joints produce a resistive force. This resistance is stated as spring rate and measured as the force required to deflect the bellows 1" in the axial or lateral direction; or inch-lbs./degree for angular rotation. Spring force is the spring rate times the deflection in inches.



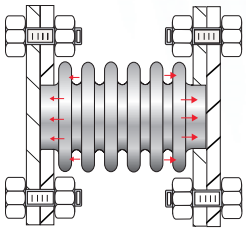


PRESSURE THRUST

If we consider a pipe section with blind flanges attached at each end, it is obvious that internal pressure produces a thrust force against the flange surfaces in opposing directions, however the longitudinal rigidity of the pipe prevents elongation.



If we add an expansion joint in the center of the pipe, this rigidity is lost and the thrust force may overcome the spring resistance of the bellows, producing elongation and possibly uncorrugating of the bellows.



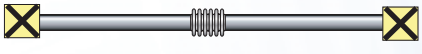
A pressurized bellows behaves like a hydraulic cylinder. Internal pressure bears against the walls of the convolutions, just as pressure bears against the face of a piston. This pressure produces a force that is equal to the internal pressure multiplied by the effective area of the bellows mean diameter ([ID + OD]/2) and will cause the flexible bellows to extend outward, unless it is restrained from doing so. In most pressure piping applications, pressure thrust is usually much greater than spring force.

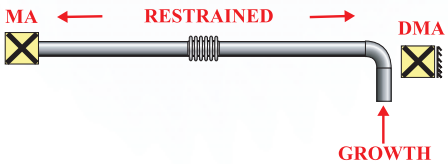
Pipe Anchors

By adding fixed points in the piping system, referred to as main anchors, the expansion joint is prevented from extending. Pressure thrust force is directed into the immovable main anchor. Now the expansion joint is forced to compress or extend axially, solely in response to dimensional changes in the pipe segment located between these main anchors.

Anchor design requires the consideration of forces due to pressure thrust at system test pressure, which is customarily 1 1/2 times the design pressure. In addition, bellows spring forces produced by deflection, friction force due to pipe movement across contact surfaces, forces and moments resulting from wind loading, bending and other influences must be considered in the design of anchors.

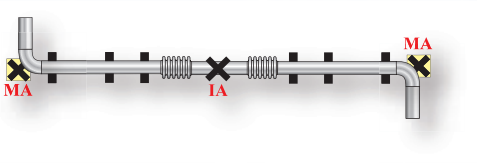
Main anchors are intended to anchor the pipe from motion in any direction.





Directional main anchors are, as the name implies, intended to anchor the piping system in one direction, while allowing movement to occur from a transverse direction.

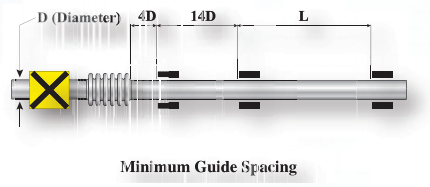
Intermediate anchors can isolate multiple expansion joints that are installed in series to accommodate large motions beyond the capability of a single expansion joint. This separation is required to insure that each expansion joint is able to function as intended and not be affected by the flexibility characteristics of adjoining units. Intermediate anchors react only to differences in spring force and are not exposed to pressure thrust.



PIPE GUIDES

With the addition of expansion joints and anchors, each pipe segment now behaves like a slender column under the compressive load of expansion joint pressure thrust and/or spring force bearing against the anchors. Bowing or buckling at the expansion joint may occur unless the pipe is properly guided.

Pipe guides are required to stabilize this slender column, preventing buckling and ensuring that pipe growth is directed into the expansion joint as axial movement.



Minimum Guide Spacing

The first pipe guide must be located within four pipe diameters of each side of the expansion joint and a second guide placed within 10-14 pipe diameters of the first guide. Additional guides may be required based on guide spacing tables that consider diameter and system pressure. A convenient intermediate guide spacing chart is provided on page 31.

The recommendations given for pipe guides represent the minimum requirements for controlling pipelines which contain expansion joints and are intended to protect the expansion joints and pipe system from undefined external forces which could cause system failure.

INSTALLATION MISALIGNMENT

Installation misalignment reduces the total movement capacity of the expansion joint. Correction of misalignment should be completed prior to installation of the expansion joints. If misalignment can not be avoided, contact one of our engineers for guidance.

CONCURRENT MOVEMENTS

Expansion joint movement capacity is listed in this catalogue as the non-concurrent capacity for each type of movement. Axial, lateral and angular movements usually occur simultaneously, therefore it is essential that the concurrent movement capacity of the expansion joint be determined. This may be calculated by determining the required percentage of non-concurrent capacity required to meet each type of specified motion. The sum of these percentage values should be equal to or less than 1.0.

$$\frac{\text{Required Axial Movement}}{\text{Catalogue Rated Axial}} + \frac{\text{Required Lateral Movement}}{\text{Catalogue Rated Lateral}} + \frac{\text{Required Angular Movement}}{\text{Catalogue Rated Angular}} < 1$$

EXPANSION JOINT PRODUCT SELECTION GUIDE

Normal Corr expansion joints (shown on pages 13-21) employ a standardized bellows design ideally suited for general industrial applications. Offered with flanges or butt weld ends from 3″ to 48″ nominal diameter for design pressures to 300 psig at 650°F.
(Consult factory for larger sizes)

High Corr bellows are hydraulically formed to produce superior fatigue life and maximum strength for severe service applications. This product provides an excellent means of absorbing large pipe motions (up to 7 1/2″). High corr expansion joints are available in two styles: Free Flexing and Controlled Flexing.

Free Flexing expansion joints (shown on pages 22-23) are widely used in process and steam piping applications to 50 psig. In addition, the Free Flexing expansion joint is recommended for compressor connections, engine intake and exhaust piping, ventilation and pump suction or discharge lines.

Controlled Flexing expansion joints (shown on pages 24-26) combine the Free Flexing bellows design with mated neck rings and control rings between each convolution. This rugged construction reinforces the bellows for higher pressure applications. With an external cover this expansion joint provides a high degree of safety for the most severe operating conditions.

Externally Pressurized expansion joints (shown on page 28) have a heavy duty packless design that enables this product to accommodate large amounts of axial motion at high pressure without the risk of bellows squirm. Limited to axial movement only, the bellows is fully enclosed within an outer shell which is constructed of standard weight pipe, offering the highest degree of protection for the bellows and personnel. External insulation may be added directly over the outer shell. This expansion joint design also permits direct burial. Consult factory for additional information.

Expansion Compensators (shown on page 29) provide the inherent performance benefits and safety features of the externally pressurized expansion joint design in a compact package. Intended primarily for steam supply and condensate return lines, as well as hot and chilled water piping, this product is suitable for any small diameter axial expansion application.



Exhaust Flexible Connectors (shown on page 27) are designed for low pressure applications such as stationary and marine gas turbine, diesel engine exhaust, and low pressure ducting. Large motion capability, low spring forces and reduced weight make this product ideally suited for thin-wall duct systems.

Flexible Metal Pump Connectors (shown on pages 32-33) reduce stresses at piping connections to sensitive rotating equipment such as pumps and compressors. Capable of absorbing thermal growth, piping misalignment, vibration, and noise, pump connectors offer extended service life for all rotating equipment.

Rubber Expansion Joints (shown on page 34-37) can be used for similar applications as Flexible Metal Pump Connector in a non-metallic construction. They are ideally suited for noise reduction in piping systems.

Pipe Alignment Guides (shown on pages 30-31) are an essential component of any properly designed piping system that employs expansion joints. These guides permit axial motion, while restricting lateral, angular and bowing movements.

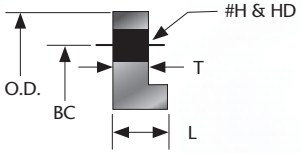
Specialty Products including Slip Pakt Expansion Joints, Non-Metallic Expansion Joints, and Pressure Relief Safety Valve Connectors are briefly described on pages 36-37 and more information and technical data may be obtained by consulting the factory.

[STANDARD FLANGE DATA]

This abbreviated flange data summary is to aid system designers in selecting the optimum pipe and duct flanges. The working pressure at temperature ratings were obtained from applicable flange specifications. Where elevated temperature data was not available, the rated working pressure at ambient was down rated in accordance with ASME code versus temperature correction factors.

Slip on Flanges

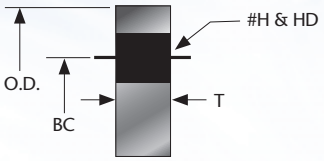
Slip on Flanges	Nominal I.D.	Working Pressure Rating (PSIG) at Temperature (Deg F)							
		(20) to 100	200	300	400	500	600	700	800
Class 125 L.W. Forged Steel	6" TO 12"	175	152	134	116	98	80	62	46
AWWA 125 L.W. C207-54T Class D Mat'l. A-105	14" TO 96"	150	131	115	99	83	67	51	38
Class 150 Forged Steel ANSI B16.5 Mat'l. A-105	1" TO 24"	285	260	230	200	170	140	110	80
Class 125 Forged Steel C207-54T Class E Mat'l. A-105	26" TO 96"	275	240	210	180	150	130	110	80
Class 300 Forged Steel ANSI B16.5 Mat'l. A-105	1" TO 24"	740	675	655	635	600	550	535	410
Class 400 Forged Steel ANSI B16.5 Mat'l. A-105	1" TO 24"	990	900	875	845	800	730	710	550



The dimensional data shown below has been consolidated from current standards for easy reference. All dimensions are in inches.

Nominal Size (in)	Class 125 LW							Class 150 B16.5							Class 300 B16.5							Nominal Size (in)
	OD	T	L	BC	#H	HD	WT (lb)	OD	T	L	BC	#H	HD	WT (lb)	OD	T	L	BC	#H	HD	WT (lb)	
1 1/2								5	11/16	7/8	3 7/8	4	5/8	3	6 1/8	13/16	1 3/16	4 1/2	4	7/8	6	1 1/2
2								6	3/4	1	4 3/4	4	3/4	5	6 1/2	7/8	1 5/16	5	8	3/4	7	2
2 1/2								7	7/8	1 1/8	5 1/2	4	3/4	7	7 1/2	1	1 1/2	5 7/8	8	7/8	10	2 1/2
3								7 1/2	15/16	1 3/16	6	4	3/4	8	8 1/4	1 1/8	1 11/16	6 5/8	8	7/8	13	3
3 1/2								8 1/2	15/16	1 1/4	7	8	3/4	11	9	1 3/16	1 3/4	7 1/4	8	7/8	17	3 1/2
4								9	15/16	1 5/16	7 1/2	8	3/4	13	10	1 1/4	1 7/8	7 7/8	8	7/8	22	4
5								10	15/16	1 7/16	8 1/2	8	7/8	15	11	1 3/8	2	9 1/4	8	7/8	28	5
6	11	9/16	1 1/4	9 1/2	8	7/8	13	11	1	1 9/16	9 1/2	8	7/8	19	12 1/2	1 7/16	2 1/16	10 5/8	12	7/8	39	6
8	13 1/2	9/16	1 1/4	11 3/4	8	7/8	18	13 1/2	1 1/8	1 3/4	11 3/4	8	7/8	30	15	1 5/8	2 7/16	13	12	1	58	8
10	16	11/16	1 1/4	14 1/4	12	1	26	16	1 3/16	1 15/16	14 1/4	12	1	43	17 1/2	1 7/8	2 5/8	15 1/4	16	1 1/8	81	10
12	19	11/16	1 1/4	17	12	1	42	19	1 1/4	2 3/16	17	12	1	64	20 1/2	2	2 7/8	17 3/4	16	1 1/4	115	12
14	21	3/4	1 1/4	18 3/4	12	1 1/8	44	21	1 3/8	2 1/4	18 3/4	12	1 1/8	90	23	2 1/8	3	20 1/4	20	1 1/4	165	14
16	23 1/2	3/4	1 1/4	21 1/4	16	1 1/8	58	23 1/2	1 7/16	2 1/2	21 1/4	16	1 1/8	98	25 1/2	2 1/4	3 1/4	22 1/2	20	1 3/8	190	16
18	25	3/4	1 1/4	22 3/4	16	1 1/4	59	25	1 9/16	2 11/16	22 3/4	16	1 1/4	130	28	2 3/8	3 1/2	24 3/4	24	1 3/8	250	18
20	27 1/2	3/4	1 1/4	25	20	1 1/4	69	27 1/2	1 11/16	2 7/8	25	20	1 1/4	165	30 1/2	2 1/2	3 3/4	27	24	1 3/8	315	20
22	29 1/2	1	1 3/4	27 1/4	20	1 3/8	76	29 1/2	1 13/16	3 1/8	27 1/4	20	1 3/8	185	33	2 5/8	4	29 1/4	24	1 5/8	370	22
24	32	1	1 3/4	29 1/2	20	1 3/8	115	32	1 7/8	3 1/4	29 1/2	20	1 3/8	220	36	2 3/4	4 3/16	32	24	1 5/8	475	24
26	34 1/4	1	1 3/4	31 3/4	24	1 3/8	125	Class 125														26
28	36 1/2	1	1 3/4	34	28	1 3/8	140	36 1/2	2 1/16	3 7/16	34	28	1 3/8	270								28
30	38 3/4	1	1 3/4	36	28	1 3/8	150	38 3/4	2 1/8	3 1/2	36	28	1 3/8	305								30
32	41 3/4	1 1/8	1 3/4	38 1/2	28	1 5/8	205															32
34	43 3/4	1 1/8	1 3/4	40 1/2	32	1 5/8	215															34
36	46	1 1/8	1 3/4	42 3/4	32	1 5/8	235	46	2 3/8	3 3/4	42 3/4	32	1 5/8	450								36
38	48 3/4	1 1/8	1 3/4	45 1/4	32	1 5/8	250															38
40	50 3/4	1 1/8	1 3/4	47 1/4	36	1 5/8	280															40
42	53	1 1/4	1 3/4	49 1/2	36	1 5/8	330	53	2 5/8	4	49 1/2	36	1 5/8	650								42
48	59 1/2	1 3/8	2 1/2	56	44	1 5/8	425	59 1/2	2 3/4	4 1/8	56	44	1 5/8	800								48
54	66 1/4	1 3/8	2 1/2	62 3/4	44	1 7/8	500	66 1/4	3	4 3/8	62 3/4	44	1 7/8	1025								54
60	73	1 1/2	2 3/4	69 1/4	52	1 7/8	640	73	3 1/8	4 1/2	69 1/4	52	1 7/8	1250								60
66	80	1 1/2	2 3/4	76	52	1 7/8	750	80	3 3/8	4 7/8	76	52	1 7/8	1175								66
72	86 1/2	1 1/2	2 3/4	82 1/2	60	1 7/8	850	86 1/2	3 1/2	5	82 1/2	60	1 7/8	1925								72
84	99 3/4	1 3/4	3	95 1/2	64	2 1/8	1000	99 3/4	3 7/8	5 3/8	95 1/2	64	2 1/8	2600								84
96	113 1/4	2	3 1/4	108 1/2	68	2 3/8	1650	113 1/4	4 1/4	5 3/4	108 1/2	68	2 3/8	3275								96

PLATE FLANGES



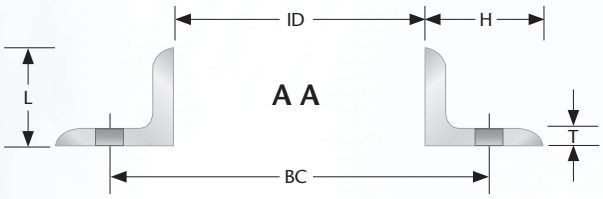
The dimensional data shown below has been consolidated from current standards for easy reference.

To Select the overall length of an assembly that uses plate flanges, use the FF (Flange by Flange) overall length from the data page and adjust the overall catalogue overall length by the amount shown in the column labelled FF OAL adjust.

Nominal Pipe Size	Plate Flange Dimensions						FF OAL Adjust	
	OD (in)	T (in)	BC (in)	#H	HD (in)	Wt. (lb)	Catalog Des. Pres. 50	150
2	6	5/8	4 3/4	4	3/4	4	-3/4	-3/4
2 1/2	7	5/8	5 1/2	4	3/4	5	-1	-3/4
3	7 1/2	5/8	6	4	3/4	6	-1 1/8	-1 1/8*
3 1/2	8 1/2	5/8	7	8	3/4	8	-1 1/4	-1 1/4
4	9	5/8	7 1/2	8	3/4	8	-1 3/8	-1 3/8
5	10	3/8	8 1/2	8	7/8	11	-1/2*	-1/2*
6	11	3/4	9 1/2	8	7/8	12	-3/8*	-3/8*
8	13 1/2	1	11 3/4	8	7/8	23	-1/4*	-1/4*
10	16	1	14 1/4	12	1	30	-1/8*	-1/8*
12	19	1	17	12	1	43	-5/8*	-5/8*
14	21	1 1/4	18 3/4	12	1 1/8	63	0	-2
16	23 1/2	1 1/4	21 1/4	16	1 1/8	76	0	-2 1/2
18	25	1 1/2	22 3/4	16	1 1/4	90	+1/2	5/8*
20	27 1/2	1 1/2	25	20	1 1/4	106	+1/2	-1*
22	29 1/2	1 1/2	27 1/4	20	1 3/8	120	-1/2	-1 1/2*
24	32	1 1/2	291/2	20	1 3/8	133	-1/2	-3 1/2
300 psig Flange Dimensions								
2	6 1/2	1	5	8	3/4	7	-5/8	
2 1/2	7 1/2	1	5 7/8	8	7/8	9	-1	
3	8 1/4	1	6 5/8	8	7/8	11	-1 3/8	
3 1/2	9	1 1/8	7 1/4	8	7/8	15	-1 1/4	
4	10	1 1/8	7 7/8	8	7/8	19	-1 1/2	
5	11	1 1/4	9 1/4	8	7/8	24	-1 1/2	
6	12 1/2	1 1/2	10 5/8	12	7/8	34	-1 11/8	
8	15	1 1/2	13	12	1	49	-1 7/8	
10	17 1/2	1 3/4	15 1/4	16	1 1/8	66	-1 3/4	
12	20 1/2	2	17 3/4	16	1 1/4	102	-1 3/4	
14	23	2	20 1/4	20	1 1/4	132	-2	
16	25 1/2	2 1/4	22 1/2	20	1 3/8	175	-2	
18	28	2 1/2	24 3/4	24	1 3/8	226	-2	
20	30 1/2	2 1/2	27	24	1 3/8	265	-2 1/2	
22	33	2 3/4	29 1/4	24	1 5/8	326	-2 1/2	
24	36	2 3/4	32	24	1 5/8	394	-2 7/8	

Notes:
Plate Flanges are designed for use with sheet gasket.
Flange gasket seating surface is a smooth mill finish.
Not recommended for use with spiral wound gaskets.
A36 material not recommended for use above 700F. or below 20F.
Not suggested for applications where ASME B31.3 or SectionVIII Pressure Vessel Code requirements apply.
Standard Catalog Flanges: 50 psig design/Class 125 L.W., 150 psig design/Class 150, 300 psig design/Class 300
* Length difference includes space required to avoide interference with bellows and flange nuts.

[ANGLE FLANGES - LOW PRESSURE]



5 PSIG MAX

- Economical flanges for low pressure service (<=5 PSIG)
- Can be added to single and universal expansion joints.
- Material: carbon steel.
- Other materials are available on request.
- Single overall length using angle flanges = WW OAL – 6 inches + 2*L.

Nominal Diameter (in)	Actual ID (in)	Angle Thickness T (in)	H	L	Approx. Weight (lb)	Bolt Holes		
						Bolt Circle (in)	Hole Size (in)	Number of Holes
14	14 3/16	3/16	1 1/2	1 1/2	7	15 13/16	13/32	12
16	16 1/4	3/16	1 3/4	1 3/4	9.5	18 1/8	13/32	16
18	18 1/4	3/16	1 3/4	1 3/4	10.5	20 1/8	13/32	16
20	20 1/4	3/16	1 3/4	1 3/4	11.6	22 1/8	13/32	20
22	22 1/4	3/16	1 3/4	1 3/4	12.8	24 1/8	9/16	20
24	24 1/4	3/16	1 3/4	1 3/4	14	26 1/8	9/16	20
26	26 1/4	3/16	2	2	17.3	28 1/2	9/16	24
28	28 1/4	3/16	2	2	18.5	30 1/2	9/16	24
30	30 1/4	3/16	2	2	20	32 1/2	9/16	28
32	32 1/4	3/16	2	2	21.3	34 1/2	9/16	28
34	34 1/4	3/16	2	2	22.5	36 1/2	9/16	32
36	36 1/4	3/16	2	2	23.5	38 1/2	9/16	32
38	38 1/4	3/16	2	2	24.6	40 1/2	9/16	36
40	40 1/4	3/16	2	2	26.2	42 1/2	9/16	36
42	42 1/4	3/16	2	2	27.5	44 1/2	9/16	40
44	44 1/4	3/16	2	2	28.8	46 1/2	9/16	40
46	46 1/4	3/16	2	2	30	48 1/2	9/16	44
48	48 1/4	3/16	2	2	31.5	50 1/2	9/16	44
50	50 1/4	1/4	3	3	54	53 1/2	11/16	48
52	52 1/4	1/4	3	3	57	55 1/2	11/16	48
54	54 1/4	1/4	3	3	59.7	57 1/2	11/16	52
60	60 1/4	1/4	3	3	68.2	63 1/2	11/16	56
66	66 1/4	1/4	3	3	76.7	69 1/2	11/16	60
72	72 5/16	3/8	3	3	119.3	75 1/2	11/16	68
84	84 5/16	3/8	3	3	141.9	87 1/2	13/16	76
96	96 5/16	3/8	3	3	164.5	99 1/2	13/16	88
108	108 3/8	3/8	3	3	187.3	111 1/2	13/16	100
120	120 3/8	3/8	3	3	209.9	123 1/2	13/16	108
132	132 3/8	3/8	3	3	232.5	135 1/2	13/16	120
144	144 3/8	3/8	3	3	255.1	147 1/2	13/16	132

MATERIALS - COMMON METALLURGICAL PROBLEMS

Failure Mode	Cause	Frequently Used Solution
Chloride Stress Corossion Crackling	Chlorides acting on highly stressed austentic stainless steel bellows (T304, T321, etc.)	Use a high nickel alloy like alloy 600 or alloy 625.
Carbide Precipitation	Chromium carbides from in unstabilized stainless steel (T304, T316 at high temperature (over 700 F) causing loss of corrosion resistance at the grain boundaries.	Use a stabilized stainless steel (T321) or T347) or low carbon stainless steel (T304L) or another high alloy material that is less affected by carbide precipitation.
Pitting Corrosion	Galvanic action causes holes to form in a bellows, usually from acids.	Use a bellows material containing molybdenum T316, Alloy 825, Alloy 625 or one of the specialty materials such as zirconium, tantalum or titanium.
Dew Point Corrosion	Liquid acid precipitates out of a sulfur rich flue gas stream in contact with the bellows element that operates just below the dew point for acid formation	Insulate the bellows to ensure it operates above dew point in service or install a "Hot Blanket" to maintain a constant bellows skin temperature that is above dew point.

Standard Material Specifications For Bellows Shown In This Catalog

ASTM Material Designation	Part Number Designation
A240 T304	304 (Catalog Standard)
A240 T304L	304L
A240 T309s	309s
A240 T316	316
A240 T316L	316L
A240 T317	317
A240 T317L	317L
A240 T321	321
A240 T347	347
B688 AL6XN	AL6XN
A240 7Mo plus	7Mo plus
A240 2205	2205
A625 904L	904L
B463 20CB	20Cb
A240 255	255
B536 330	330
A240 253MA	253 MA
B435 230	230
B162 200 (Nickel)	200
B162 201 (Nickel)	201
B127 Alloy 400 (Monel)	400
B168 600 (Inconel)	600
B433 617	617
B443 625 LCF	625 LCF
B409 800	800
B409 800H	800H
B424 825	825

BELLOWS MATERIAL DATA

Senior Flexonics engineers can form bellows from most ductile materials that can be welded by the automatic TIG butt welding process that results in a homogenious ductile weld structure. Companies specifying and purchasing bellows must give careful consideration to the selection of bellows material. When in doubt, consult with basic supplier mill Metallurgist. Senior Flexonics does not take responsibility for alloy selection.

Use of these material codes as a suffix in the Catalogue part number will designate the bellows material that will be supplied by Senior Flexonics.

** ASME "SA" or "SB" materials are inventoried and are available upon request.*

All bellows material purchased by Senior Flexonics is "mill annealed" in accordance with ASTM or ASME specification. Senior Flexonics does not perform any other heat treating operations before welding, after welding before forming convolutions or after forming convolutions unless specified by purchaser. Heat treatment of bellows after forming convolutions can lower bellows spring rate "squirm" pressure, and cycle life. Senior Flexonics does not recommend heat treatment be performed unless the bellows is operating at high temperature where time dependent properties of creep and stress rupture become significant.

NCB EXPANSION JOINTS

Normal Corr expansion joints employ a standardized bellows design ideally suited for general industrial applications. Offered with flanges or butt weld ends from 3" to 48" nominal diameter for design pressures to 300 psig at 650°F. Larger diameters are available (consult factory).

How to order:
Example P/N

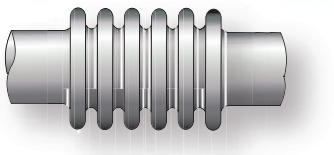
DIA	STYLE	ENDS	PRESSURE	CONS	LINER	COVER
8	NCB	FF	300	6	L	C

NORMAL CORR DATA

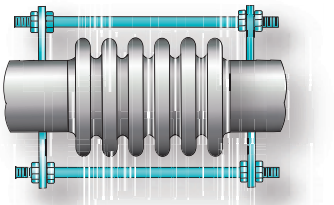
	SINGLE
Size Range	3" to 48" NPS *
Allowable Pressure Stainless Steel Bellows	Vacuum to 300 psig
Temperature Limits Stainless Steel Bellows	-20F to 650F. **
Axial Traverse	See Data Sheets
Lateral Motion	See Data Sheets

* For sizes larger than 48" consult factory for information.
** With special alloys, temperatures of minus 425°F. to plus 1600°F. can be handled.

STYLE



NCB SINGLE

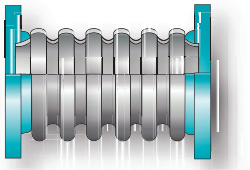


NCB TIED

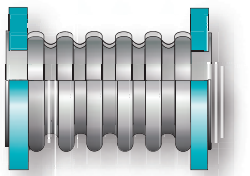
END CONNECTION



WW WELD END



FF FLANGED END



VV VANSTONE END

Please consult factory for floating flanges

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T316L (standard)
• Other materials available (see page 12)
PIPE: ASTM A53/A106
50 lb. Series: Sch. 40
150 lb. Series: Sch. 40
300 lb. Series: Sch. 40

FLANGES: A516-70 Plate & A105
50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS: Carbon Steel

LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 10th edition for any one movement tabulated.
2. To combine axial, lateral, and angular movements, refer to page 7.
3. Maximum axial extension movement is 10% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalogue pressure ratings are based upon a maximum bellows temperature of 650°F. Actual operating temperature should always be specified. Consult factory for higher temperature ratings. For special alloys see chart on page 12.
6. Maximum test pressure: 1 1/2 x maximum working pressure.

[NCB EXPANSION JOINTS]

Nominal Diameter (in)	Effective Area (in^2)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
3	12	50	5	0.45	0.08	10.00	1,338	6,503	45	7.19	4.08	4.56	16.92
			10	0.90	0.33	10.00	669	813	23	9.38	4.50	6.75	17.34
			15	1.35	0.75	10.00	446	241	15	11.56	4.92	8.94	17.76
			20	1.80	1.33	4.50	335	102	11	13.75	5.33	11.13	18.18
3	11.4	150	5	0.33	0.06	9.00	3,450	15,719	109	7.19	4.30	4.56	17.14
			10	0.65	0.25	10.00	1,725	1,965	55	9.38	4.68	6.75	17.53
			15	0.98	0.56	10.00	1,150	582	36	11.56	5.07	8.94	17.91
			20	1.31	1.00	1.00	862	246	27	13.75	5.45	11.13	18.29
3	12	300	5	0.26	0.05	6.50	4,480	21,773	152	7.19	4.54	5.56	27.38
			10	0.52	0.19	9.00	2,240	2,722	76	9.38	5.15	7.75	28.00
			15	0.69	0.39	7.50	1,845	981	61	11.56	5.59	9.94	28.43
			20	0.81	0.61	1.00	1,739	512	57	13.75	5.90	12.13	28.74
3.5	15.5	50	5	0.44	0.07	10.00	1,502	9,274	65	7.19	4.85	4.69	23.05
			10	0.88	0.29	10.00	751	1,159	32	9.38	5.33	6.88	23.53
			15	1.32	0.65	10.00	501	343	22	11.56	5.80	9.06	24.01
			20	1.75	1.15	6.50	376	145	16	13.75	6.28	11.25	24.48
3.5	15	150	5	0.28	0.05	6.50	3,548	21,443	149	7.19	4.97	4.69	23.18
			10	0.57	0.19	10.00	1,774	2,680	75	9.38	5.46	6.88	23.66
			15	0.85	0.42	10.00	1,183	794	50	11.56	5.94	9.06	24.15
			20	1.13	0.75	1.00	887	335	37	13.75	6.43	11.25	24.63
3.5	15	300	5	0.21	0.04	5.00	7,054	42,627	297	7.19	5.26	5.69	35.47
			10	0.43	0.14	7.50	3,527	5,328	148	9.38	5.86	7.88	36.07
			15	0.64	0.32	7.50	2,351	1,579	99	11.56	6.46	10.06	36.67
			20	0.85	0.57	1.00	1,764	666	74	13.75	7.06	12.25	37.27
4	20	50	5	0.539	0.079	10.00	1,144	8,963	62	7.19	5.79	4.81	27.29
			10	1.078	0.314	10.00	572	1,120	31	9.38	6.43	7.00	27.93
			15	1.617	0.708	10.00	381	332	21	11.56	7.07	9.19	28.57
			20	2.156	1.258	0.50	286	140	16	13.75	7.71	11.38	29.22
4	20	150	5	0.331	0.048	7.00	3,921	30,731	214	7.19	6.42	4.81	27.93
			10	0.662	0.193	10.00	1,961	3,841	107	9.38	7.37	7.00	28.88
			15	0.993	0.434	10.00	1,307	1,138	71	11.56	8.33	9.19	29.83
			20	1.324	0.772	3	980	480	53	13.75	9.28	11.38	30.78
4	20	300	5	0.263	0.038	5.50	6,932	54,327	378	7.19	6.80	5.69	36.31
			10	0.525	0.153	8.50	3,466	6,791	189	9.38	7.94	7.88	37.44
			15	0.788	0.345	8.5	2310	2,012	126	11.56	9.07	10.06	38.58
			20	1.050	0.613	0.5	1733	849	95	13.75	10.21	12.25	39.71

Materials:

Bellows --ASTM A240 - T316L. For alternate materials refer to page 12
Flanges: See pages 9,10,11
Pipe: ASTM A53/A106
Materials of construction may be changed to meet specific requirements (consult factory).
Test Pressure is 1.5 times operating pressure.
End Fittings are available in a variety of combinations and materials.
See Page 7 for calculations of concurrent movements.

Standard NCB Expansion Joints to operate at 650 deg F at pressures indicated.
Standard expansion joints are rated for 2000 cycles for non concurrent movements.
To obtain greater movement or cycle life contact the factory.
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NCB EXPANSION JOINTS

Nominal Diameter (in)	Effective Area (in^2)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
5	29	50	5	0.52	0.06	9.00	1,391	16,021	111	7.19	7.68	5.06	31.6
			10	1.05	0.25	10.00	695	2,003	56	9.38	8.48	7.25	32.4
			15	1.57	0.57	10.00	464	593	37	11.56	9.27	9.44	33.2
			20	2.09	1.01	3.50	348	250	28	13.75	10.06	11.63	34.0
5	29	150	5	0.33	0.04	5.50	4,834	55,686	388	7.2	8.5	5.1	32.4
			10	0.65	0.16	9.50	2,417	6,961	194	9.4	9.6	7.3	33.6
			15	0.98	0.35	10.00	1,611	2,062	129	11.6	10.8	9.4	34.7
			20	1.30	0.63	6.00	1,209	870	97	13.8	12.0	11.6	35.9
5	29	300	5	0.34	0.04	5.50	6,728	76,710	534	7.2	9.8	6.2	59.7
			10	0.68	0.16	9.50	3,364	9,589	267	9.4	11.5	8.4	61.4
			15	1.02	0.37	8.00	2,243	2,841	178	11.6	13.2	10.6	63.1
			20	1.36	0.66	0.00	1,682	1,199	133	13.8	15.0	12.8	64.9
6	41	50	5	0.72	0.10	10.00	1,572	12,637	179	9.1	17.1	7.3	85.6
			10	1.44	0.41	10.00	786	1,580	90	12.3	21.1	10.4	89.6
			15	2.15	0.93	9.50	524	468	60	15.4	25.2	13.5	93.7
			20	2.87	1.65	0.00	393	197	45	18.5	29.2	16.6	97.7
6	41	150	5	0.44	0.06	6.00	5,272	42,383	602	9.1	12.0	6.3	40.5
			10	0.87	0.25	10.00	2,636	5,298	301	12.3	13.3	9.4	41.8
			15	1.31	0.56	10.00	1,757	1,570	201	15.4	14.6	12.5	43.1
			20	1.74	1.00	1.50	1,318	662	150	18.5	15.9	15.6	44.4
6	41	300	5	0.41	0.06	6.00	11,570	93,415	1,327	9.1	13.2	6.3	41.7
			10	0.82	0.24	10.00	5,785	11,677	663	12.3	15.2	9.4	43.7
			15	1.24	0.53	10	3857	3460	442	15.4	17.1	12.5	45.6
			20	1.65	0.95	3.5	2893	1460	332	18.5	19.1	15.6	47.6
8	67	50	5	0.72	0.08	8.00	1,843	24,215	344	9.1	17.6	6.6	63.3
			10	1.43	0.32	10.00	921	3,027	172	12.3	19.4	9.8	65.1
			15	2.15	0.73	10.00	614	897	115	15.4	21.1	12.9	66.9
			20	2.87	1.29	2.00	461	378	86	18.5	22.9	16.0	68.6
8	66.7	150	5	0.62	0.07	7.50	4,747	61,964	880	9.1	20.7	6.6	66.4
			10	1.25	0.28	10.00	2,373	7,745	440	12.3	24.0	9.8	69.7
			15	1.87	0.63	10.00	1,582	2,295	293	15.4	27.2	12.9	73.0
			20	2.49	1.13	10.00	1,187	968	220	18.5	30.5	16.0	76.3
8	66.7	300	5	0.46	0.05	5	9622	125605	1784	9.1	22.2	8.0	124.0
			10	0.91	0.21	8.00	4,811	15,701	892	12.3	26.3	11.1	128.0
			15	1.37	0.46	7.5	3207	4652	595	15.4	30.4	14.3	132.1
			20	1.83	0.83	0.00	2,406	1,963	446	18.5	34.5	17.4	136.2

Materials:

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Flanges: See pages 9,10,11
Pipe: ASTM A53/A106
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[NCB EXPANSION JOINTS]

Nominal Diameter (in)	Effective Area (in^2)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
10	108	50	5	1.44	0.18	10.00	1,152	12,466	347	16.4	47.6	8.3	91.1
			10	2.89	0.72	7.50	576	1,558	174	17.3	48.6	9.1	92.1
			14	4.04	1.40	0.50	411	568	124	20.8	52.2	12.6	95.8
10	108	150	5	0.82	0.10	7.00	4,693	50,777	1,414	12.9	46.0	4.8	89.5
			10	1.65	0.41	10.00	2,347	6,347	707	16.4	51.8	8.3	95.4
			14	2.30	0.80	4.00	1,676	2,313	505	19.9	57.7	11.8	101.2
10	108	300	5	0.62	0.08	5	9348	101137	2816	24.25	65.03	16.13	108.55
			10	1.25	0.31	7.50	4,674	12,642	1,408	16.38	54.63	9.63	178.15
			14	1.75	0.61	4.00	3,338	4,607	1,006	20.75	63.72	14.00	187.24
12	151.26	50	4	1.12	0.09	8.50	2,073	48,870	871	15.5	59	7.5375	138
			8	2.25	0.38	10.00	1,037	6,109	435	19	65	11.0375	144
			12	3.37	0.85	7.50	691	1,810	290	22.5	71	14.5375	150
			16	4.49	1.51	1.50	518	764	218	26	78	18.0375	156
12	150.50	150	4	0.75	0.06	5.50	5,382	126,293	2,250	15.5	62	7.5375	141
			8	1.50	0.25	9.50	2,691	15,787	1,125	19	70	11.0375	148
			12	2.25	0.57	5.50	1,794	4,678	750	22.5	78	14.5375	156
			16	3.00	1.01	0.00	1,345	1,973	563	26	86	18.0375	164
12	150.60	300	4	0.57	0.05	4.00	10,704	251,194	4,475	15.5	65	9.25	246
			8	1.13	0.19	7.00	5,352	31,399	2,238	19	75	12.75	255
			12	1.70	0.43	5.50	3,568	9,303	1,492	22.5	85	16.25	265
			16	2.27	0.76	0.00	2,676	3,925	1,119	26	94	19.75	275
14	180	50	4	1.11	0.09	8.00	2,271	63,605	1,133	15.5	65	8	181
			8	2.23	0.34	10.00	1,135	7,951	567	19	72	11.5	187
			12	3.34	0.77	8.50	757	2,356	378	22.5	79	15	194
			16	4.46	1.37	2.50	568	994	283	26	85	18.5	201
14	180	150	4	0.78	0.06	5.50	5,447	152,578	2,718	15.5	69	8	184
			8	1.55	0.24	9.00	2,723	19,072	1,359	19	78	11.5	193
			12	2.33	0.54	5.00	1,816	5,651	906	22.5	86	15	202
			16	3.11	0.96	0.00	1,362	2,384	680	26	95	18.5	211
14	180	300	4	0.59	0.05	4.00	10,832	303,422	5,406	15.5	72	9.5	344
			8	1.17	0.18	6.50	5,416	37,928	2,703	19	83	13	355
			12	1.76	0.41	5.00	3,611	11,238	1,802	22.5	94	16.5	366
			16	2.35	0.72	0.00	2,708	4,741	1,352	26	105	20	377

Materials:

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NCB EXPANSION JOINTS

Nominal Diameter (in)	Effective Area (in^2)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
16	230.3	50	4	1.10	0.08	7.00	2,586	92,850	1,654	4	15.5	75	8.5
			8	2.20	0.30	10.00	1,293	11,606	827	8	19.0	82	12
			12	3.31	0.68	9.50	862	3,439	551	12	22.5	90	15.5
			16	4.41	1.20	3.50	646	1,451	414	16	26.0	98	19
16	230.3	150	4	0.77	0.05	4.50	6,210	223,005	3,973	4	15.5	79	8.5
			8	1.54	0.21	8.00	3,105	27,876	1,987	8	19.0	89	12
			12	2.31	0.47	6.00	2,070	8,259	1,324	12	22.5	99	15.5
			16	3.08	0.84	1.00	1,553	3,484	993	16	26.0	109	19
16	230.3	300	4	0.72	0.05	4.50	14,027	503,725	8,975	4	15.5	95	10
			8	1.44	0.20	7.50	7,014	62,966	4,487	8	19.0	115	13.5
			12	2.16	0.44	7.50	4,676	18,656	2,992	12	22.5	135	17
			16	2.88	0.78	2.50	3,507	7,871	2,244	16	26.0	156	20.5
18	286.4	50	4	1.25	0.08	7.00	1,808	80,727	1,438	15.5	81.2	8.875	251
			8	2.50	0.31	10.00	904	10,091	719	19	88.1	12.375	258
			12	3.75	0.69	4.00	603	2,990	479	22.5	95.0	15.875	265
			16	5.00	1.22	0.00	452	1,261	360	26	102.0	19.375	272
18	287.3	150	4	0.76	0.05	4.00	6,971	312,218	5,563	15.5	88.2	8.875	258
			8	1.53	0.19	7.50	3,486	39,027	2,781	19	99.6	12.375	270
			12	2.29	0.42	7.00	2,324	11,564	1,854	22.5	111.0	15.875	281
			16	3.05	0.74	2.00	1,743	4,878	1,391	26	122.4	19.375	292
18	287.3	300	4	0.71	0.04	4.00	15,746	705,221	12,565	15.5	106.3	10.5	596
			8	1.43	0.17	7.00	7,873	88,153	6,282	19	129.1	14	619
			12	2.14	0.39	8.50	5,249	26,119	4,188	22.5	152.0	17.5	642
			16	2.86	0.70	3.00	3,936	11,019	3,141	26	174.8	21	665
20	355	50	2	0.76	0.02	4.00	2,759	610,318	2,718	13.75	87.8	7.5	319
			6	2.29	0.19	10.00	920	22,604	906	17.25	97.0	11	328
			10	3.81	0.52	3.50	552	4,883	544	20.75	106.1	14.5	337
			14	5.33	1.02	0	394	1,779	388	24.25	115.2	18	347
20	355	150	2	0.44	0.01	2.00	11,483	2,539,661	11,312	13.75	93.3	7.5	325
			6	1.33	0.11	6.00	3,828	94,062	3,771	17.25	107.8	11	339
			10	2.22	0.31	7.00	2,297	20,317	2,262	20.75	122.3	14.5	354
			14	3.11	0.60	2.00	1,640	7,404	1,616	24.25	136.7	18	368
20	355	300	2	0.42	0.01	2.00	25,623	5,667,216	25,243	13.75	108.1	9.25	679
			6	1.26	0.10	6.00	8,541	209,897	8,414	17.25	137.0	12.75	708
			10	2.10	0.29	8.00	5,125	45,338	5,049	20.75	165.9	16.25	737
			14	2.94	0.56	3.00	3,660	16,522	3,606	24.25	194.9	19.75	766

Materials:

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[NCB EXPANSION JOINTS]

Nominal Diameter (in)	Effective Area (in²)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
22	425	50	4	1.51	0.08	6.50	1,514	100,197	1,785	15.5	105	9.75	333
			8	3.03	0.30	7.00	757	12,525	893	19	115	13.25	343
			12	4.54	0.68	2.00	505	3,711	595	22.5	125	16.75	353
			14	5.30	0.93	0.50	432	2,337	510	24.25	130	18.5	358
22	425	150	4	0.89	0.04	4.00	6,302	417,138	7,432	15.5	114	9.75	342
			8	1.77	0.18	7.00	3,151	52,142	3,716	19	130	13.25	358
			12	2.66	0.40	4.50	2,101	15,450	2,477	22.5	146	16.75	374
			14	3.10	0.54	2.50	1,801	9,729	2,123	24.25	154	18.5	382
22	425	300	4	0.84	0.04	3.50	14,062	930,780	16,584	15.5	138	11.5	914
			8	1.67	0.17	6.50	7,031	116,347	8,292	19	170	15	946
			12	2.51	0.38	5.50	4,687	34,473	5,528	22.5	202	18.5	978
			14	2.93	0.51	3.50	4,018	21,709	4,738	24.25	218	20.25	994
24	501	50	4	1.50	0.07	6.00	1,647	128,616	2,292	15.5	111	10.5	437
			8	3.01	0.28	7.50	824	16,077	1,146	19	122	14	447
			12	4.51	0.63	2.50	549	4,764	764	22.5	133	17.5	458
			14	5.26	0.85	1.00	471	3,000	655	24.25	139	19.25	464
24	501	150	4	0.88	0.04	3.50	6,861	535,667	9,544	15.5	121	10.5	446
			8	1.77	0.16	6.50	3,431	66,958	4,772	19	138	14	464
			12	2.65	0.37	5.00	2,287	19,840	3,181	22.5	156	17.5	481
			14	3.09	0.50	3.00	1,960	12,494	2,727	24.25	164	19.25	490
24	501	300	4	0.83	0.04	3.50	15,309	1,195,194	21,295	15.5	147	11.875	1037
			8	1.67	0.15	6.00	7,655	149,399	10,647	19	182	15.375	1071
			12	2.50	0.35	6.00	5,103	44,266	7,098	22.5	217	18.875	1106
			14	2.92	0.47	4.00	4,374	27,876	6,084	24.25	234	20.625	1123
30	773.4	50	3	1.16	0.04	4.00	3,531	579,236	7,582	15	446	8.88	822
			6	2.31	0.15	7.50	1,765	72,404	3,791	18	459	11.88	835
			9	3.47	0.33	9.00	1,177	21,453	2,527	21	472.94	14.88	849
			12	4.62	0.59	4.50	883	9,051	1,896	24	486.34	17.88	862
30	773.4	150	3	0.66	0.02	2.00	16,736	2,745,801	35,942	15	460.63	8.88	837
			6	1.32	0.08	4.00	8,368	343,225	17,971	18	482.73	11.88	859
			9	1.98	0.19	6.00	5,579	101,696	11,981	21	504.83	14.88	881
			12	2.63	0.34	7.00	4,184	42,903	8,986	24	526.93	17.88	903
30	773.1	225	3	0.78	0.02	2.5	18656	3060837	40066	15	482.71	10.24	1799
			6	1.57	0.10	5	9328	382605	20033	18	518.25	13.24	1834
			9	2.35	0.22	7	6219	113364	13355	21	553.79	16.24	1870
			12	3.14	0.40	6	4664	47826	10017	24	589.34	19.24	1905

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				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
32	873.6	50	3	1.31	0.04	4.00	2,312	428,460	5,609	15	472	9.38	1029
			6	2.62	0.16	7.50	1,156	53,557	2,804	18	483	12.38	1041
			9	3.93	0.35	4.50	771	15,869	1,870	21	495	15.38	1052
			12	5.24	0.63	1.50	578	6,695	1,402	24	506	18.38	1064
32	874.8	150	3	1.06	0.03	3.50	8,090	1,501,816	19,659	15	499	9.38	1057
			6	2.13	0.13	6.00	4,045	187,727	9,829	18	528	12.38	1086
			9	3.19	0.29	5.50	2,697	55,623	6,553	21	557	15.38	1114
			12	4.25	0.51	2.50	2,022	23,466	4,915	24	585	18.38	1143
32	874.8	225	3	0.78	0.02	2.50	19,865	3,687,815	48,273	15	515	10.76	2072
			6	1.56	0.09	4.50	9,932	460,977	24,137	18	553	13.76	2110
			9	2.35	0.21	6.50	6,622	136,586	16,091	21	591	16.76	2148
			12	3.13	0.38	6.50	4,966	57,622	12,068	24	629	19.76	2186
34	980.6	50	3	1.28	0.04	4.00	2,533	526,810	6,896	15	501	9.5	1100
			6	2.57	0.15	7.00	1,266	65,851	3,448	18	513	12.5	1112
			9	3.85	0.33	4.50	844	19,511	2,299	21	525	15.5	1125
			12	5.13	0.58	2.00	633	8,231	1,724	24	537	18.5	1137
34	980.6	150	3	1.01	0.03	3.00	9,472	1,970,301	25,791	15	529	9.5	1129
			6	2.01	0.11	5.50	4,736	246,288	12,896	18	558	12.5	1158
			9	3.02	0.26	6.50	3,157	72,974	8,597	21	587	15.5	1187
			12	4.02	0.46	3.50	2,368	30,786	6,448	24	617	18.5	1216
34	983.2	225	3	0.62	0.02	2.00	42,857	8,938,511	117,005	15	563	11	2373
			6	1.25	0.07	3.50	21,429	1,117,314	58,502	18	614	14	2423
			9	1.87	0.16	5.50	14,286	331,056	39,002	21	664	17	2473
			12	2.50	0.28	6.50	10,714	139,664	29,251	24	714	20	2523
36	1097	50	3	1.14	0.03	3.00	4,216	981,441	12,847	15	501	9.5	1100
			6	2.29	0.12	6.00	2,108	122,680	6,424	18	513	12.5	1112
			9	3.43	0.28	8.50	1,405	36,350	4,282	21	525	15.5	1125
			12	4.57	0.49	5.50	1,054	15,335	3,212	24	537	18.5	1137
36	1097	150	3	1.06	0.03	3.00	9,071	2,111,790	27,643	15	529	9.5	1129
			6	2.11	0.11	5.50	4,535	263,974	13,822	18	558	12.5	1158
			9	3.17	0.25	6.00	3,024	78,214	9,214	21	587	15.5	1187
			12	4.22	0.45	3.00	2,268	32,997	6,911	24	617	18.5	1216
36	1097	225	3	0.62	0.02	1.50	45,321	10,551,454	138,118	15	563	11	2909
			6	1.25	0.07	3.50	22,661	1,318,932	69,059	18	614	14	3000
			9	1.87	0.15	5.00	15,107	390,795	46,039	21	664	17	3090
			12	2.49	0.27	6.50	11,330	164,866	34,530	24	714	20	3180

Materials:

Bellows --ASTM A240 - T316L. For alternate materials refer to page 12
Flanges: See pages 9,10,11
Pipe: ASTM A53/A106
Materials of construction may be changed to meet specific requirements (consult factory).
Test Pressure is 1.5 times operating pressure.
End Fittings are available in a variety of combinations and materials.
See Page 7 for calculations of concurrent movements.

Standard NCB Expansion Joints to operate at 650 deg F at pressures indicated.
Standard expansion joints are rated for 2000 cycles for non concurrent movements.
To obtain greater movement or cycle life contact the factory.
Larger diameter, higher pressure and temperature expansion joints are available (consult factory).

[NCB EXPANSION JOINTS]

Nominal Diameter (in)	Effective Area (in²)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
38	1218	50	3	1.14	0.03	3.00	4,442	1,147,719	15,024	15	565	9.88	1468
			6	2.28	0.12	6.00	2,221	143,465	7,512	18	582	12.88	1485
			9	3.43	0.26	8.00	1,481	42,508	5,008	21	599	15.88	1502
			12	4.57	0.46	5.50	1,110	17,933	3,756	24	616	18.88	1519
38	1218	150	3	1.05	0.03	2.50	9,557	2,469,515	32,326	15	593	9.88	1496
			6	2.11	0.11	5.50	4,779	308,689	16,163	18	627	12.88	1530
			9	3.16	0.24	6.00	3,186	91,464	10,775	21	661	15.88	1564
			12	4.22	0.43	3.00	2,389	38,586	8,081	24	695	18.88	1598
38	1218	225	3	0.62	0.02	1.50	47,783	12,346,947	161,621	15	630	11.5	1482
			6	1.25	0.06	3.00	23,891	1,543,368	80,811	18	686	14.5	1538
			9	1.87	0.14	4.50	15,928	457,294	53,874	21	742	17.5	1594
			12	2.49	0.25	6.00	11,946	192,921	40,405	24	798	20.5	1650
40	1345	50	3	1.20	0.03	3.00	4,546	1,024,849	16,979	15.375	595	10.495	1579
			6	2.40	0.13	6.00	2,273	128,106	8,489	18.75	612	13.87	1596
			9	3.60	0.29	8.00	1,515	37,957	5,660	22.125	629	17.245	1614
			12	4.80	0.52	5.00	1,137	16,013	4,245	25.5	647	20.62	1631
40	1345	150	3	0.84	0.02	2.00	23,987	5,407,477	89,586	15.375	643	10.495	1627
			6	1.68	0.09	4.00	11,993	675,935	44,793	18.75	689	13.87	1673
			9	2.52	0.21	6.00	7,996	200,277	29,862	22.125	735	17.245	1720
			12	3.37	0.37	7.50	5,997	84,492	22,396	25.5	781	20.62	1766
40	1345	225	3	0.51	0.01	1.00	100,472	22,649,711	375,238	15.375	686	12.375	1800
			6	1.02	0.06	2.50	50,236	2,831,214	187,619	18.75	757	15.75	1871
			9	1.53	0.12	4.00	33,491	838,878	125,079	22.125	828	19.125	1942
			12	2.04	0.22	5.00	25,118	353,902	93,809	25.5	899	22.5	2013
42	1482	50	3	1.32	0.03	3.00	3,125	771,970	12,789	15.375	618	10.995	1805
			6	2.63	0.14	6.00	1,562	96,496	6,395	18.75	633	14.37	1819
			9	3.95	0.31	5.00	1,042	28,591	4,263	22.125	647	17.745	1833
			12	5.27	0.55	2.00	781	12,062	3,197	25.5	661	21.12	1848
42	1482	150	3	0.90	0.02	2.00	22,135	5,499,780	91,115	15.375	678	10.995	1864
			6	1.81	0.09	4.50	11,067	687,473	45,557	18.75	729	14.37	1915
			9	2.71	0.21	6.00	7,378	203,696	30,372	22.125	780	17.745	1966
			12	3.61	0.37	7.50	5,534	85,934	22,779	25.5	831	21.12	2018
42	1482	225	3	0.55	0.01	1.00	92,334	22,942,087	380,081	15.375	724	12.755	2031
			6	1.10	0.06	2.50	46,167	2,867,761	190,041	18.75	803	16.13	2110
			9	1.65	0.13	4.00	30,778	849,707	126,694	22.125	882	19.505	2189
			12	2.20	0.23	5.00	23,083	358,470	95,020	25.5	961	22.88	2268

Materials:

Bellows --ASTM A240 - T316L. For alternate materials refer to page 12
Flanges: See pages 9,10,11
Pipe: ASTM A53/A106
Materials of construction may be changed to meet specific requirements (consult factory).
Test Pressure is 1.5 times operating pressure.
End Fittings are available in a variety of combinations and materials.
See Page 7 for calculations of concurrent movements.

Standard NCB Expansion Joints to operate at 650 deg F at pressures indicated.
Standard expansion joints are rated for 2000 cycles for non concurrent movements.
To obtain greater movement or cycle life contact the factory.
Larger diameter, higher pressure and temperature expansion joints are available (consult factory).

NCB EXPANSION JOINTS

Nominal Diameter (in)	Effective Area (in²)	Max WP (psig)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends WW		Ends FF	
				Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
44	1622	50	3	1.28	0.03	3.00	4,410	1,199,089	19,865	15.375	655	11.375	2013
			6	2.55	0.13	5.50	2,205	149,886	9,933	18.75	675	14.75	2033
			9	3.83	0.28	7.50	1,470	44,411	6,622	22.125	696	18.125	2054
			12	5.10	0.51	4.50	1,103	18,736	4,966	25.5	716	21.5	2074
44	1622	150	3	0.90	0.02	2.00	23,154	6,295,162	104,292	15.375	710	11.375	2068
			6	1.80	0.09	4.00	11,577	786,895	52,146	18.75	764	14.75	2122
			9	2.71	0.20	6.00	7,718	233,154	34,764	22.125	817	18.125	2175
			12	3.61	0.36	7.00	5,789	98,362	26,073	25.5	871	21.5	2229
44	1622	225	3	0.55	0.01	1.00	96,632	26,271,999	435,248	15.375	759	13.135	2247
			6	1.10	0.05	2.50	48,316	3,284,000	217,624	18.75	842	16.51	2330
			9	1.65	0.12	3.50	32,211	973,037	145,083	22.125	924	19.885	2412
			12	2.20	0.22	5.00	24,158	410,500	108,812	25.5	1007	23.26	2495
46	1767	50	3	1.27	0.03	3.00	4,604	1,364,233	22,601	15.375	685	11.495	2155
			6	2.55	0.12	5.50	2,302	170,529	11,301	18.75	706	14.87	2176
			9	3.82	0.27	7.50	1,535	50,527	7,534	22.125	727	18.245	2197
			12	5.10	0.48	4.50	1,151	21,316	5,650	25.5	748	21.62	2218
46	1767	150	3	0.90	0.02	2.00	24,173	7,163,455	118,677	15.375	742	11.495	2212
			6	1.80	0.09	4.00	12,087	895,432	59,338	18.75	798	14.87	2268
			9	2.70	0.19	5.50	8,058	265,313	39,559	22.125	854	18.245	2324
			12	3.61	0.34	7.00	6,043	111,929	29,669	25.5	911	21.62	2380
46	1767	225	3	0.55	0.01	1.00	100,927	29,908,442	495,493	15.375	793	13.495	2613
			6	1.10	0.05	2.50	50,463	3,738,555	247,746	18.75	880	16.87	2700
			9	1.65	0.12	3.50	33,642	1,107,720	165,164	22.125	966	20.245	2786
			12	2.20	0.21	4.50	25,232	467,319	123,873	25.5	1053	23.62	2873
48	1920	50	3	1.27	0.03	2.50	4,796	1,543,616	25,573	15.375	715	11.875	2406
			6	2.55	0.12	5.00	2,398	192,952	12,787	18.75	737	15.25	2428
			9	3.82	0.26	7.00	1,599	57,171	8,524	22.125	759	18.625	2450
			12	5.09	0.46	4.50	1,199	24,119	6,393	25.5	781	22	2472
48	1920	150	3	0.71	0.02	1.5	51121.8	16453703.78	272588	15.375	798	11.875	2490
			6	1.43	0.06	3	25560.9	2056712.972	136294	18.75	871	15.25	2563
			9	2.14	0.15	4.5	17040.6	609396.4361	90863	22.125	944	18.625	2635
			12	2.85	0.26	5.5	12780.4	257089.1215	68147	25.5	1016	22	2708
48	1920	225	3	0.55	0.01	1	105218.4	33864810.4	561038	15.375	828	13.875	2909
			6	1.10	0.05	2	52609.2	4233101.3	280519	18.75	918	17.25	3000
			9	1.65	0.11	3.5	35072.8	1254252.237	187013	22.125	1008	20.625	3090
			12	2.19	0.20	4.5	26304.6	529137.6625	140260	25.5	1099	24	3180

Materials:

Bellows --ASTM A240 - T316L. For alternate materials refer to page 12
Flanges: See pages 9,10,11
Pipe: ASTM A53/A106
Materials of construction may be changed to meet specific requirements (consult factory).
Test Pressure is 1.5 times operating pressure.
End Fittings are available in a variety of combinations and materials.
See Page 7 for calculations of concurrent movements.

Standard NCB Expansion Joints to operate at 650 deg F at pressures indicated.
Standard expansion joints are rated for 2000 cycles for non concurrent movements.
To obtain greater movement or cycle life contact the factory.
Larger diameter, higher pressure and temperature expansion joints are available (consult factory).

FREE FLEXING EXPANSION JOINTS

Senior Flexonics low pressure (50 psi), Free Flexing Expansion Joints absorb pipe movement under pressure. Widely used in such applications as process and steam lines, ventilating lines, pump suction and discharge lines, turbine-to-condenser connections, fuel supply lines and bulkhead seals. Available with either Van Stoned flanges (FSF) or butt-weld ends (FSW) attached.

Dual expansion joints are available for applications where movement is greater than can be absorbed by a single unit. Contact factory for design information.

FREE FLEXING DATA

	SINGLE
Size Range	3" to 12"*
Allowable Pressure Stainless Steel Bellows	Vacuum to 50 psig
Temperature Limits Stainless Steel Bellows	-20F to 800F. **
Axial Traverse	To 7 1/2". . . (depending on size)
Lateral Motion	Up to 1 3/4". . . (depending on size)

* For sizes larger than 12" consult factory for information.

** With special alloys, temperatures of minus 300°F. to plus 1600°F. can be handled.

How to order: Example P/N

Diameter	Style	Ends	Pressure	Convolutions	Liner	Cover
6	FSF	VV	50	8	L	C
8	FSW	WW	50	4	L	C



MATERIALS OF CONSTRUCTION

- BELLOWS: ASTM A240 T304
- PIPE: ASTM A53/A106
  50 lb. Series: Sch. 40
  150 lb. Series: Sch. 40
  300 lb. Series: Sch. 40
- FLANGES: A516-70 Plate (Std)
  ASTM A105 (Opt)
  50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
  150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
  300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.
- COVERS: Carbon Steel
- TIE RODS: Carbon Steel
- LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 10th edition for any one movement tabulated.
2. To combine axial, lateral and angular movements, refer to page 7.
3. Maximum axial extension movement is 10% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalogue pressure ratings are based upon a maximum bellows temperature of 800°F. Actual operating temperature should always be specified.
6. Maximum test pressure: 1 1/2 x maximum working pressure.

50 PSIG FREE FLEXING: STYLE FSF OR FSW

Nominal Diameter (in)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends VV		Ends WW	
		Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
3" Effective Area 17.5 in.²	2	.59	.05	10	612	4096	30	6	14	8 7/8	5
	4	1.18	.19	10	306	512	15	8 1/4	15	11 1/8	5
	6	1.67	.40	10	354	263	17	10 1/2	15	13 3/8	6
	8	1.92	.61	10	630	263	31	12 3/4	16	15 5/8	6
	10	2.41	.95	10	504	134	24	15	17	17 1/8	6
4" Effective Area 23.6 in.²	2	.71	.05	10	608	5043	45	6 1/2	29	11 1/2	9
	4	1.41	.20	10	304	630	22	9	31	14	10
	6	1.99	.42	10	324	267	21	11 1/2	33	16 1/2	11
	8	2.31	.66	10	577	267	38	14	35	19	12
	10	2.53	.90	10	461	136	31	16 1/2	37	21 1/2	13

50 PSIG FREE FLEXING: STYLE FSF OR FSW

Nominal Diameter (in)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends VV		Ends WW	
		Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
5″ Effective Area 33.2 in.²	2	.76	.05	10	769	8882	80	6 3/4	34	13 1/2	15
	4	1.52	.18	10	384	1110	40	9 1/4	36	16	16
	6	2.11	.38	10	414	478	39	11 3/4	38	18 1/2	17
	8	2.41	.58	10	736	478	69	14 1/4	40	21	19
	10	2.52	.76	10	1123	467	106	16 3/4	42	23 1/2	20
6″ Effective Area 53.8 in.²	2	1.12	.07	10	856	7353	131	7 3/4	43	16 1/2	24
	4	2.23	.30	10	428	919	65	11 1/4	47	20	27
	6	3.35	.67	10	285	272	43	14 3/4	51	23 1/2	30
	8	4.05	1.08	10	408	219	62	18 1/4	54	27	33
	10	5.07	1.69	10	326	112	49	21 3/4	58	30 1/2	36
8″ Effective Area 85.0 in.²	2	1.16	.08	10	1218	10673	314	9 3/4	69	17 1/2	26
	4	2.32	.32	10	609	1334	157	14 1/4	72	22	30
	6	3.48	.72	10	406	395	104	18 3/4	76	26 1/2	35
	8	4.34	1.20	10	580	317	149	23 1/4	81	31	39
	10	5.42	1.87	10	464	162	119	27 3/4	85	35 1/2	44
10″ Effective Area 121 in.²	2	1.10	.10	10	687	10583	235	10 3/8	62	17 1/2	48
	4	2.53	.29	10	738	2147	252	14 7/8	99	22	54
	6	3.80	.66	10	492	636	168	19 3/8	104	26 1/2	60
	8	4.67	1.08	10	704	551	241	23 7/8	110	31	66
	10	5.83	1.68	10	563	262	192	28 3/8	116	35 1/2	72
12″ Effective Area 175 in.²	2	1.56	.08	10	1174	19003	559	10 3/4	136	17 1/2	61
	4	3.11	.31	10	587	7375	279	15 1/4	143	22	70
	6	4.67	.69	10	391	703	186	19 3/4	150	26 1/2	78
	8	5.71	1.12	10	559	566	266	24 1/4	158	31	86
	10	7.13	1.75	10	447	289	213	28 3/4	165	35 1/2	94

[CONTROLLED FLEXING EXPANSION JOINTS]

Senior Flexonics Controlled Flexing Expansion Joints combine a corrugated pressure carrier with closely mated neck rings and reinforcing or control rings. This construction permits their use with higher pressures (150 psig and 300 psig) in applications where large amounts of axial movement are required.

Dual expansion joints are available for applications where movement is greater than can be absorbed by a single unit. Contact factory for design information.

CONTROLLED FLEXING DATA

	SINGLE
Size Range	3" to 12"*
Allowable Pressure Stainless Steel Bellows	Vacuum to 300 psig
Temperature Limits Stainless Steel Bellows	-20F to 800F. **
Axial Traverse	To 7 1/2". . . (depending on size)
Lateral Motion	Up to 1 1/2". . . (depending on size)

* For sizes larger than 12" consult factory for information.

** With special alloys, temperatures of minus 425°F. to plus 1600°F. can be handled.

How to order: Example P/N

Diameter	Style	Ends	Pressure	Convolutions	Liner	Cover
8	CSF	FF	300	6	L	C
6	CSW	WW	150	10	L	C
12	CSF	VV	300	2	L	C



MATERIALS OF CONSTRUCTION

- BELLOWS: ASTM A240 T304
- PIPE: ASTM A53/A106
  50 lb. Series: Sch. 40
  150 lb. Series: Sch. 40
  300 lb. Series: Sch. 40
- FLANGES: A516-70 Plate (Std)
  ASTM A105 (Opt)
  50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
  150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
  300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.
- COVERS: Carbon Steel
- TIE RODS: Carbon Steel
- LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 10th edition for any one movement tabulated.
2. To combine axial, lateral & angular movements, refer to page 7.
3. Maximum axial extension movement is 10% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalogue pressure ratings are based upon a maximum bellows temperature of 800°F. Actual operating temperature should always be specified.
6. Maximum test pressure: 1 1/2 x maximum working pressure.

150 PSIG CONTROLLED FLEXING: STYLE CSF OR CSW

Nominal Diameter (in)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends VV		Ends FF		Ends WW	
		Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
3" Effective Area 17.5 in.²	2	.875	.05	10	1383	5307	69	7 1/4	30	8 7/16	35	11 7/16	21
	4	1.75	.18	10	691	663	34	10 1/4	41	11 7/16	46	14 7/16	32
	6	2.625	.41	10	800	341	40	13 1/4	52	14 7/16	57	17 7/16	43
	8	3.50	.72	10	1423	341	71	16 1/4	63	17 7/16	68	20 7/16	54
	10	4.375	1.13	10	1139	174	57	19 1/4	74	20 7/16	79	23 7/16	65
4" Effective Area 23.6 in.²	2	.875	.04	10	1204	5283	81	8 3/8	48	9 13/16	60	15 1/16	40
	4	1.75	.17	10	602	660	40	11 5/8	67	13 1/16	79	18 5/16	58
	6	2.625	.38	10	697	339	46	14 7/8	86	16 5/16	97	21 9/16	77
	8	3.50	.67	10	1239	339	83	18 1/8	104	19 9/16	116	24 13/16	95
	10	4.375	1.05	10	1890	331	127	21 3/8	123	22 13/16	134	28 1/16	114

150 PSIG CONTROLLED FLEXING: STYLE CSF OR CSW (CONTINUED)

Nominal Diameter (in)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends VV		Ends FF		Ends WW	
		Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
5″ Effective Area 33.2 in.²	2	.875	.04	10	1537	9458	145	8 5/8	60	10 1/16	71	17 1/16	50
	4	1.75	.14	10	768	1182	72	11 7/8	80	13 5/16	91	20 5/16	70
	6	2.625	.32	10	890	608	84	15 1/8	101	16 9/16	112	23 9/16	91
	8	3.50	.57	10	1582	608	149	18 3/8	121	19 13/16	132	26 13/16	111
	10	4.375	.89	10	2413	593	228	21 5/8	142	23 1/16	153	30 1/16	132
6″ Effective Area 53.8 in.²	2	1.50	.06	10	1536	8959	235	10 1/2	82	12 1/8	99	20 7/8	76
	4	3.00	.25	10	768	1119	117	14 3/4	116	16 3/8	133	25 1/8	110
	6	4.50	.56	10	512	331	78	19	150	20 5/8	167	29 3/8	144
	8	6.00	1.00	10	732	266	112	23 1/4	184	24 7/8	201	33 5/8	178
	10	7.50	1.57	10	585	136	89	27 1/2	218	29 1/8	235	37 7/8	212
8″ Effective Area 85.0 in.²	2	1.50	.06	10	2061	13651	496	11 3/8	136	12 7/8	159	21 1/4	121
	4	3.00	.24	10	1030	1706	248	16 3/8	192	17 7/8	216	26 1/4	177
	6	4.50	.53	10	687	505	165	21 3/8	249	22 7/8	272	31 1/4	234
	8	6.00	.94	10	982	406	236	26 3/8	306	27 7/8	329	36 1/4	290
	10	7.50	1.47	10	786	208	189	31 3/8	362	32 7/8	386	41 1/4	347
10″ Effective Area 121 in.²	2	1.50	.05	10	2623	24731	899	12	188	13 7/8	222	21 7/8	145
	4	3.00	.20	10	1311	3091	449	17	267	18 7/8	300	26 7/8	223
	6	4.50	.45	10	874	915	299	22	346	23 7/8	379	31 7/8	302
	8	6.00	.79	10	1250	736	428	27	424	28 7/8	458	36 7/8	380
	10	7.50	1.24	10	1000	377	342	32	503	33 7/8	536	41 7/8	459
12″ Effective Area 175 in.²	2	1.50	.04	9.10	3180	40314	1465	11 1/4	251	13 5/8	300	21 1/8	210
	4	3.00	.17	10	1590	5039	732	16 1/4	367	18 5/8	416	26 1/8	326
	6	4.50	.38	10	1060	1493	488	21 1/4	483	23 5/8	532	31 1/8	442
	8	6.00	.68	10	1516	1201	698	26 1/4	599	28 5/8	648	36 1/8	558
	10	7.50	1.07	10	1212	614	558	31 1/4	715	33 5/8	764	41 1/8	674

300 PSIG CONTROLLED FLEXING: STYLE CSF OR CSW

Nominal Diameter (in)	No. of Conv.	Non-Concurrent Movement			Spring Rate			Ends VV		Ends FF		Ends WW	
		Axial (in)	Lateral (in)	Angular (deg)	Axial (lb/in)	Lateral (lb/in)	Angular (in-lb/deg)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)	OAL (in)	Weight (lb)
3″ Effective Area 17.5 in.²	2	.875	.05	10	1383	5307	69	8	40	9 7/16	45	11 7/16	21
	4	1.75	.18	10	691	663	34	11	51	12 7/16	56	14 7/16	32
	6	2.625	.41	10	800	341	40	14	62	15 7/16	67	17 7/16	43
	8	3.50	.72	10	1423	341	71	17	73	18 7/16	78	20 7/16	54
	10	4.375	1.13	10	1139	174	57	20	84	21 7/16	89	23 7/16	65
4″ Effective Area 23.6 in.²	2	.875	.04	10	1204	5283	81	9 3/8	71	10 15/16	78	15 1/16	40
	4	1.75	.17	10	602	660	40	12 5/8	90	14 3/16	97	18 5/16	58
	6	2.625	.38	10	697	339	46	15 7/8	109	17 7/16	115	21 9/16	77
	8	3.50	.67	10	1239	339	83	19 1/8	127	20 11/16	134	24 13/16	95
	10	4.375	1.05	10	1890	331	127	22 3/8	146	23 15/16	153	28 1/16	114
5″ Effective Area 33.2 in.²	2	.875	.04	10	1537	9458	145	9 5/8	88	11 3/16	98	17 1/16	50
	4	1.75	.14	10	768	1182	72	12 7/8	108	14 7/16	118	20 5/16	70
	6	2.625	.32	10	890	608	84	16 1/8	129	17 11/16	138	23 9/16	91
	8	3.50	.57	10	1582	608	149	19 3/8	149	20 15/16	159	26 13/16	111
	10	4.375	.89	10	2413	593	228	22 5/8	169	24 3/16	179	30 1/16	132
6″ Effective Area 53.8 in.²	2	1.50	.06	10	4854	53492	743	12	132	13 1/8	142	20 7/8	76
	4	3.00	.25	10	2427	4629	371	16 1/4	166	17 3/8	176	25 1/8	110
	6	4.50	.56	10	1631	1253	249	20 1/2	200	21 5/8	210	29 3/8	144
	8	6.00	1.00	10	2193	906	336	24 3/4	234	25 7/8	244	33 5/8	178
	10	7.50	1.57	10	2830	728	433	29	267	30 1/8	278	37 7/8	212
8″ Effective Area 85.0 in.²	2	1.50	.06	10	6889	57029	1658	12 3/8	195	14 1/4	218	21 1/4	121
	4	3.00	.24	10	3764	6924	906	17 3/8	251	19 1/4	274	26 1/4	177
	6	4.50	.53	10	2713	2139	653	22 3/8	308	24 1/4	331	31 1/4	234
	8	6.00	.94	10	3466	1510	834	27 3/8	364	29 1/4	388	36 1/4	290
	10	7.50	1.47	10	4300	1186	1035	32 3/8	421	34 1/4	444	41 1/4	347
10″ Effective Area 121 in.²	2	1.50	.05	10	7497	88345	2569	13 1/2	272	15 1/4	298	21 7/8	145
	4	3.00	.20	10	4172	10924	1429	18 1/2	350	20 1/4	377	26 7/8	223
	6	4.50	.45	10	2982	3347	1022	23 1/2	429	25 1/4	455	31 7/8	302
	8	6.00	.79	10	3829	2375	1312	28 1/2	507	30 1/4	534	36 7/8	380
	10	7.50	1.24	10	5681	2231	1947	33 1/2	586	35 1/4	612	41 7/8	459
12″ Effective Area 175 in.²	2	1.50	.04	9.10	4983	81695	2376	13 1/4	391	15	403	21 1/8	210
	4	3.00	.17	10	2900	10565	1383	18 1/4	507	20	519	26 1/8	326
	6	4.50	.38	10	2028	3166	967	23 1/4	623	25	635	31 1/8	442
	8	6.00	.68	10	3152	2780	1503	28 1/4	739	30	751	36 1/8	558
	10	7.50	1.07	10	3953	2160	1885	33 1/4	855	35	867	41 1/8	674

EXHAUST FLEXIBLE CONNECTORS*

Senior Flexonics exhaust flexible connectors are specifically designed for low pressure (15 psig) applications that require a high degree of flexibility.

Designed to produce low spring forces with a reduced assembly weight, our exhaust flexible connectors are an ideal solution for vibration and corrosive gas applications such as marine and stationary diesel engines, gas turbines and forced air ducting applications.

Available with plate flanges, angle flanges or weld ends. (Consult factory for larger sizes)

EXHAUST CONNECTOR DATA

	SINGLE
Size Range	2" to 48"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 15 psig
Temperature Limits Stainless Steel Bellows	-20F to 1500F. **
Axial Traverse	To 4.5". . . (depending on size)
Lateral Motion	Up to 1.0". . . (depending on size)

* For sizes larger than 24" consult factory for information.

** With special alloys, temperatures of minus 300°F. to plus 1600°F. can be handled.



MATERIALS OF CONSTRUCTION

- **BELLOWS:** ASTM A240 T321-Multi-Ply
- **PIPE:** Carbon Steel/Stainless Steel
- **FLANGES:** Carbon Steel/Stainless Steel
- **LINERS:** 300 Series Stainless Steel
- **COVERS:** Carbon Steel

STYLE DEJ DIESEL EXHAUST EXPANSION JOINTS

Nominal Diameter (in)	Model Number	Non-Concurrent		Spring Rate		Overall Length (in)		Approx. Weight (lb)	
		Axial (in)	Lateral (in)	Axial (lb/in)	Lateral (lb/in)	Flanged End	Weld End	Flanged End	Weld End
3	DEJ-048-S	2.0	0.63	183	87	8.0	11.0	9	5
	DEJ-048-L	3.5	1.00	107	17	13.0	16.0	10	6
4	DEJ-064-S	2.0	0.63	136	106	8.0	11.0	12	7
	DEJ-064-L	3.5	1.00	79	21	13.0	16.0	14	9
5	DEJ-080-S	2.0	0.63	144	159	8.0	11.0	14	8
	DEJ-080-L	3.5	1.00	86	34	13.0	16.0	16	10
6	DEJ-096-S	2.5	0.63	165	249	8.0	11.0	16	11
	DEJ-096-L	4.0	1.00	99	53	13.0	16.0	19	13
8	DEJ-128-S	2.5	0.63	206	505	8.0	11.0	28	15
	DEJ-128-L	4.0	1.00	123	109	13.0	16.0	31	19
10	DEJ-160-S	3.0	0.50	115	454	8.0	11.0	35	21
	DEJ-160-L	4.5	0.88	70	103	13.0	16.0	40	25
12	DEJ-192-S	3.0	0.50	132	717	8.0	12.0	50	25
	DEJ-192-L	4.5	0.88	80	163	13.0	17.0	55	31
14	DEJ-224-S	3.0	0.50	108	751	8.0	12.0	59	25
	DEJ-224-L	4.5	0.88	64	162	13.0	17.0	66	33
16	DEJ-256-L	3.0	0.50	121	1078	9.0	12.0	101	28
	DEJ-256-S	4.5	0.88	72	232	14.0	17.0	108	35
18	DEJ-288-S	3.0	0.50	131	1355	9.0	12.0	102	32
	DEJ-288-L	4.5	0.88	78	314	14.0	17.0	110	40
20	DEJ-320-S	3.0	0.38	141	1916	9.0	12.0	114	35
	DEJ-320-L	4.5	0.50	84	414	14.0	17.0	122	44
22	DEJ-352-S	3.0	0.38	157	2548	9.0	12.0	129	39
	DEJ-352-L	4.5	0.50	94	550	14.0	17.0	138	48
24	DEJ-384-S	3.0	0.30	168	3225	9.0	12.0	150	42
	DEJ-384-L	4.5	0.50	101	696	14.0	17.0	161	53

* Exhaust Flexible Connectors are not CRN registered.

SINGLE & DUAL EXTERNALLY PRESSURIZED EXPANSION JOINTS

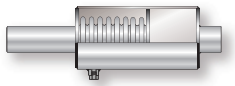
Externally pressurized expansion joints are designed for use in straight pipe runs to accommodate high pressure and large amounts of thermal expansion and contraction. Pressure is applied to the bellows external surface via a gap between the inner guide ring and outer pipe shell. The stabilizing effect of external pressure permits use of a longer bellows with larger movement capability than a comparable internally pressurized design.

This rugged construction fully encases the bellows, assuring a high level of safety and durability. A convenient drain port is included that allows removal of condensate and sediment in steam service applications.

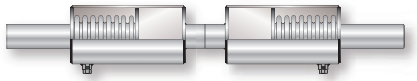
SX AND DX DATA

	SINGLE
Size Range	2" to 12"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 300 psig
Temperature Limits Stainless Steel Bellows	-20F to 800F. **
Axial Traverse	To 8" (SX). . . To 16" (DX)

* For sizes larger than 12" consult factory for information.
** With special alloys, temperatures of minus 300°F. to plus 1600°F. can be handled.



SINGLE SX-WW (weld ends)
also available as SX-FF (flanged ends)



Dual with Anchor Base DX-WW (weld ends)
also available as DX-FF (flanged ends)

How to order:
Example P/N

Diameter	Style	Ends	Pressure	Travel
6	SX	FF	150	8
8	SX	WW	300	4
3	DX	FF	150	4
10	DX	WW	300	8

150 AND 300 PSIG DESIGNS AVAILABLE

Nominal Diameter (in)	Single (SERIES SX)					Dual (SERIES DX)					Axial Sp. Rate (lb/in)	Effective Area (in^2)	Shell OD (in)
	Axial (in)	FF OAL (in)	FF Wt. (lb)	WW OAL (in)	WW Wt. (lb)	Axial (in)	FF OAL (in)	FF Wt. (lb)	WW OAL (in)	WW Wt. (lb)			
2	4	27	39	26	29	8	53	73	52	63	570	19	6 5/8
2 1/2	4	27	47	26	33	8	53	85	52	71	570		
	8	47	103	46	89	16	93	157	92	185	285	19	6 5/8
3	4	27	65	26	49	8	53	119	52	105	570		
	8	47	113	46	97	16	93	200	92	200	285	19	6 5/8
4	4	27	112	26	86	8	53	208	52	180	792		
	8	47	170	46	144	16	93	230	92	300	396	35	8 5/8
5	4	27	140	26	110	8	53	265	52	230	792		
	8	47	214	46	184	16	93	333	92	378	396	35	8 5/8
6	4	27	176	26	138	8	53	330	52	285	890		
	8	47	262	46	224	16	93	505	92	455	445	54	10 3/4
8	4	29	250	28	190	8	57	460	56	390	1296		
	8	49	342	48	282	16	97	644	96	574	649	88	12 3/4
10	4	29	312	28	226	8	57	563	56	462	1434		
	8	49	462	48	376	16	97	863	96	762	717	118	14 1/2
12	4	29	387	28	259	8	57	676	56	530	1105		
	8	49	563	48	435	16	97	1028	96	882	553	163	16 3/4

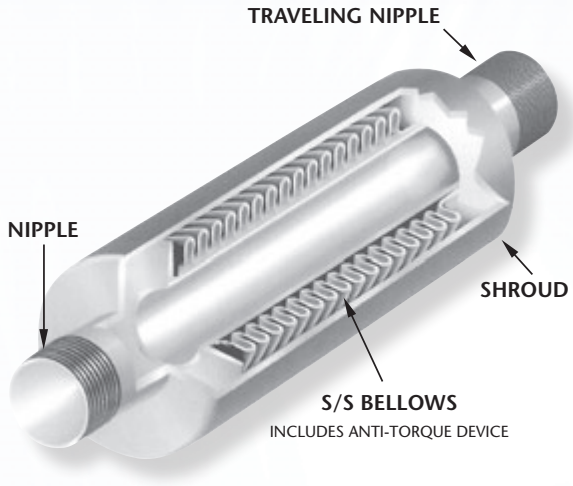
MATERIALS OF CONSTRUCTION

- **BELLOWS**
  A 240-304
  Other Materials Available
- **FLANGES**
  A-105/A516-70
  2" thru 12" 150 lb. & 300 lb.
  R.F.S.O. B16.5
- **PIPE/SHELL**
  A53/106 Gr. B
  or A516-70
  2" thru 10" Sch. 40
  12" Std. Wall .375" thk.
- **RINGS**
  A285 GR. C or A516-70
- **ANCHOR BASE**
  Carbon Steel
  (Standard on NDX)
- **DRAIN, VENT PORTS**
  Carbon Steel

EXPANSION COMPENSATORS

Here's the perfect way to absorb pipe motion in small diameter systems. Series H2 high pressure types permit 2" stroke — 1 3/4" compression and 1/4" extension. Series H3 high pressure types permit 3" stroke — 2 3/4" compression and 1/4" extension. Senior Flexonics expansion compensators provide the lowest cost method to take up thermal growth.

Senior Flexonics compensators are externally pressurized as opposed to the standard internally pressurized models. The external pressurization principle eliminates the possibility of the bellows buckling, which is one of the major causes of compensator failure.



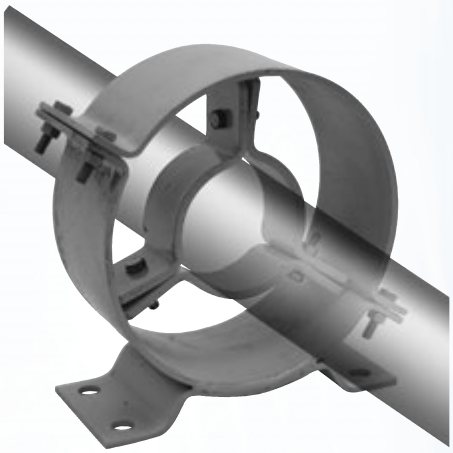
SPECIFICATIONS: SERIES H2&H3

High Pressure	Nominal Diameter (in)	Model Number	Max. WP (psig)	Test Pressure (psig)	Overall Length (in)	Outside Diameter (in)	Axial Sp. Rate (lb/in)	Effective Area (in^2)	Weight (lb)
Steel Piping Systems- MODEL H2 Stroke-1 3/4" compression; 1/4" extension (Total stroke 2") Maximum Operating Temperature - 750° F. Maximum Working Pressure - 200 psig Maximum Test Pressure - 300 psig Fittings-Weld Ends (WE) Fittings-Male Thread Ends (MMT) Stainless steel bellows, Steel shroud and fitting	3/4	CM-H2-MT-012	200	300	12 1/8	3	141	2.20	5.5
	3/4	CM-H3K-MT-012	200	300	16 3/4	3	126	2.20	6.6
	1	CM-H2-MT-016	200	300	12 1/8	3 1/2	171	3.50	7.1
	1	CM-H3K-MT-016	200	300	16 3/4	3 1/2	165	3.50	8.4
	1 1/4	CM-H2-MT-020	200	300	14 1/8	4	162	4.84	10.2
	1 1/4	CM-H3K-MT-020	200	300	16 1/8	4	167	4.84	10.8
	1 1/2	CM-H2-MT-024	200	300	14 1/8	4 1/2	262	6.50	12.3
	1 1/2	CM-H3K-MT-024	200	300	16 1/8	4 1/2	262	6.50	13
	2	CM-H2-MT-032	200	300	14 1/8	4 1/2	269	7.60	13.2
	2	CM-H3K-MT-032	200	300	15 7/8	4 1/2	269	7.60	13.9
Steel Piping Systems- MODEL H3 Stroke-2 3/4" compression; 1/4" extension (Total stroke 3") Maximum Operating Temperature - 750° F. Maximum Working Pressure - 200 psig Maximum Test Pressure - 300 psig Fittings-Weld Ends (HWE), Male Thread Ends (MMT), Flanged Ends (FF) Stainless steel bellows, Steel shroud and fittings	2 1/2	CM-H2-MT-040	200	300	15 1/2	5 1/2	362	12.9	19.6
	2 1/2	CM-H2-WE-040	200	300	15 1/2	5 1/2	362	12.9	19.6
	2 1/2	CM-H2-FF-040	200	300	16 1/2	7	362	12.9	34
	2 1/2	CM-H3K-MT-040	200	300	16 1/2	5 1/2	362	12.9	19.8
	2 1/2	CM-H3K-WE-040	200	300	16 1/2	5 1/2	362	12.9	19.8
	2 1/2	CM-H3K-FF-040	200	300	17	7	362	12.9	34
	3	CM-H2-MT-048	200	300	15 3/16	6 1/2	413	16.1	24.2
	3	CM-H2-WE-048	200	300	15 3/16	6 1/2	413	16.1	24.2
	3	CM-H2-FF-048	200	300	16 3/16	7 1/2	413	16.1	40
	3	CM-H3K-MT-048	200	300	21	6 1/2	413	16.1	36.3
	3	CM-H3K-WE-048	200	300	21	6 1/2	413	16.1	36.3
	3	CM-H3K-FF-048	200	300	22	7 1/2	413	16.1	52
	4	CM-H2-WE-064	200	300	15 3/16	7	499	24.2	27.6
	4	CM-H3K-WE-064	200	300	21	7	499	24.2	40
	4	CM-H3K-FF-064	200	300	22	9	499	24.2	66

CAUTION: Manufacturing process utilizes silver brazing. Do not exceed 1,000°F. during installation.
NOTE: (1) H2 & H3 Compensators are available with Flanged Ends. Consult factory for details.
(2) Stainless steel components should not be used in systems containing excessive chlorides. Premature failure may result.

[PIPE ALIGNMENT GUIDES]

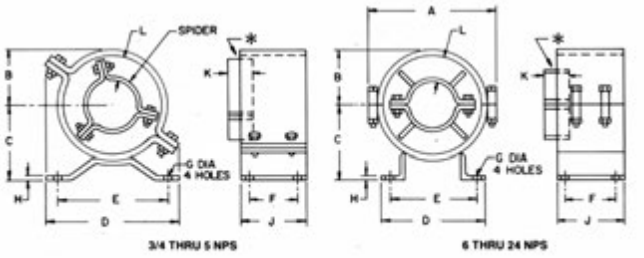
Proper pipe alignment is vital to maximize service from expansion joints. Senior Flexonics' improved, easy-to-install pipe alignment guides are your ideal solution. These pipe alignment guides permit free axial movement of the pipe while restricting lateral and angular movement. U-bolts, hangers and rollers only support; Senior Flexonics pipe alignment guides protect.



LOCATION OF PIPE ALIGNMENT GUIDES

Whenever possible, install the expansion joint close to an anchor. Locate the anchor or first pipe alignment guide no more than 4 pipe diameters from the expansion joint. The second guide should be located no more than 14 pipe diameters from the first guide.

The chart on page 31 gives the recommended pipe alignment guide spacing along the balance of the line. For any pipe size and pressure, the recommended pipe alignment guide spacing can be readily determined. Find the pressure on the bottom scale; extend a vertical line from this point until it intersects the sloping line representing the pipe size involved; from this intersection extend a horizontal line to find pipe alignment guide spacing in feet on the left-hand scale.



* For maximum movement, install spider with half its length extended.

SPECIFICATIONS: SERIES PGT

Nominal Diameter (in)	Model Number	General Dimensions - (Inches)											Maximum Insulation Thickness (in)	Max. Allow Move. (in)	Spider Fits Into Std. Pipe	Wt. (lb)
		A	B	C	D	E	F	G	H	J	K	L				
3/4	PG-CS-012-022-03	6 3/8	2 1/4	3 1/8	6 1/4	4 3/4	1 1/2	5/8	3/16	3	1 1/2	1 3/8	1 3/8	3	4	5
1	PG-CS-016-020-03	6 3/8	2 1/4	3 1/8	6 1/4	4 3/4	1 1/2	5/8	3/16	3	1 1/2	1 1/4	1 1/4	3	4	5
1 1/4	PG-CS-020-018-03	6 3/8	2 1/4	3 1/8	6 1/4	4 3/4	1 1/2	5/8	3/16	3	1 1/2	1 1/8	1 1/8	3	4	5
1 1/2	PG-CS-024-024-03	7 3/8	2 3/4	3 1/2	7	5 1/2	2 1/2	5/8	3/16	3	1 1/2	1 1/2	1 1/2	3	5	6
2	PG-CS-032-020-03	7 3/8	2 3/4	3 1/2	7	5 1/2	2 1/2	5/8	3/16	3	1 1/2	1 1/4	1 1/4	3	5	6
2 1/2	PG-CS-040-040-04	10 5/8	4 1/4	4 7/8	8 1/2	7	2 1/2	5/8	3/16	4	2	2 1/2	2 1/2	4	8	12
3	PG-CS-048-034-04	10 5/8	4 1/4	4 7/8	8 1/2	7	2 1/2	5/8	3/16	4	2	2 1/8	2 1/8	4	8	12
3 1/2	PG-CS-056-048-04	12 5/8	5 1/4	5 1/2	10 1/2	9	2 1/2	5/8	3/16	4	2	3	3	4	10	15
4	PG-CS-064-040-04	12 5/8	5 1/4	5 1/2	10 1/2	9	2 1/2	5/8	3/16	4	2	2 1/2	2 1/2	4	10	15
5	PG-CS-080-034-04	12 5/8	5 1/4	5 1/2	10 1/2	9	2 1/2	5/8	3/16	4	2	2 1/8	2 1/8	4	10	15
6	PG-CS-096-024-04	12 1/2	5 3/8	6 1/4	9 1/4	7 1/4	2 3/4	5/8	1/4	4	4	1 1/2	1 1/2	4	12	20
8	PG-CS-128-024-04	14 1/2	6 3/8	7 1/4	10 1/4	8 1/4	2 3/4	5/8	1/4	4	4	1 1/2	1 1/2	4	16	25
10	PG-CS-160-032-06	17 3/4	8	9	13	11	4	3/4	1/4	6	6	2	2	6	16	45
12	PG-CS-196-032-06	20 1/8	9	9 3/4	14	12	4	3/4	1/4	6	6	2	2	6	20	55
14	PG-CS-224-040-06	22 1/8	10	11 1/8	15 1/2	13 1/2	4	3/4	3/8	6	6	2 1/2	2 1/2	6	22	65
16	PG-CS-256-040-08	24 1/8	11	12 1/8	16 1/2	14 1/2	6	7/8	3/8	8	8	2 1/2	2 1/2	8	24	95
18	PG-CS-288-040-08	26 5/8	12	13	17 1/2	15 1/2	6	7/8	3/8	8	8	2 1/2	2 1/2	8	26	115
20	PG-CS-320-040-08	28 5/8	13	14 3/4	19 1/2	17 1/2	6	1 1/8	3/8	8	8	2 1/2	2 1/2	8	30	135

NOTE: Additional pipe supports are usually required in accordance with standard practice.
Additional sizes, insulation thickness, and motion options are available. Please consult factory for pricing and availability.

INTERMEDIATE PIPE ALIGNMENT GUIDE SPACING CHART

FIGURE NO. 1: EXPANSION JOINTS

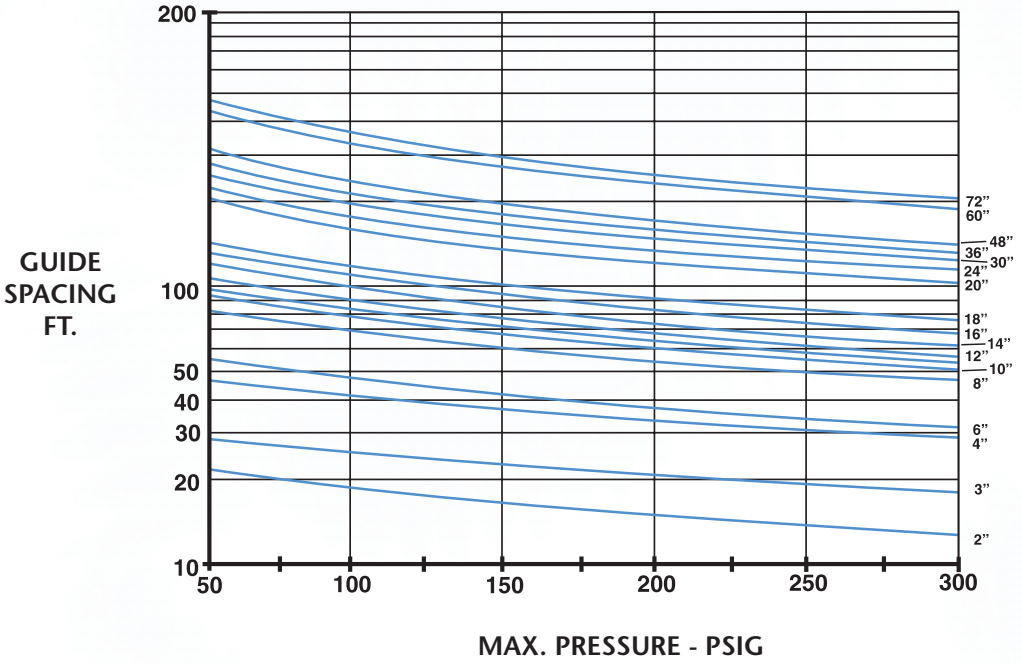


Chart is based upon sch. 40 pipe.

FIGURE NO. 2: MODEL H2, H3, & HB COMPENSATORS

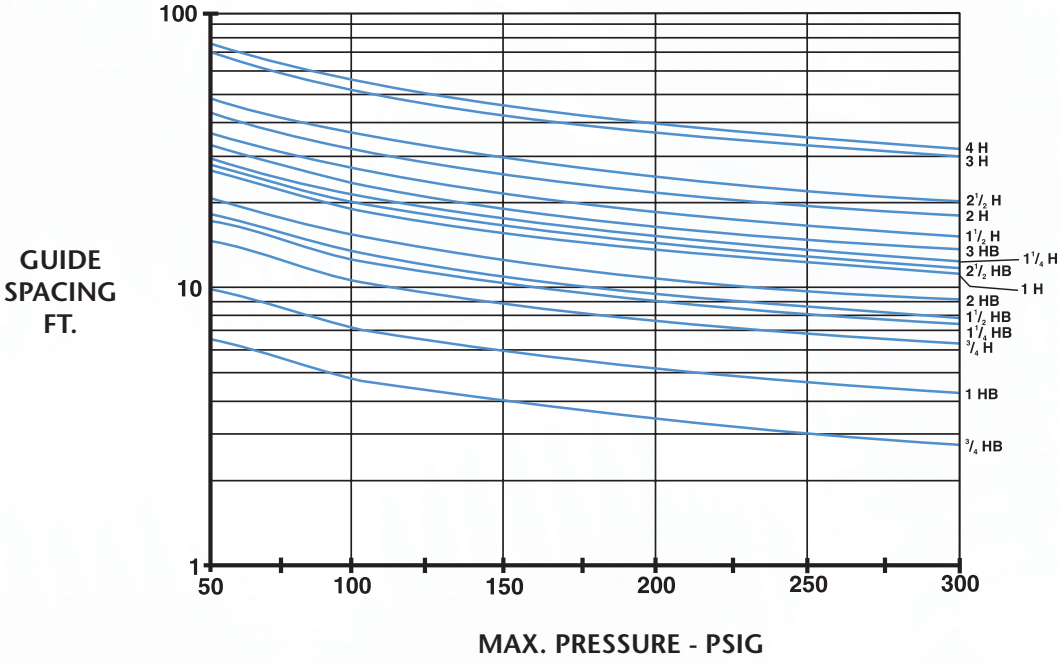


Chart is based upon sch. 40 pipe and type K copper tubing.

FLEXIBLE METAL PUMP CONNECTORS

Why use Senior Flexonics Pump Connectors?

The basic function of pump connectors is to provide piping systems with the flexibility needed to absorb noise and vibration, compensate for thermal growth, or permit motion of other piping elements.

Senior Flexonics pump connectors are a perfect match of style, wall thickness and design to minimize the forces and stress within piping systems. These pump connectors are factory engineered, manufactured and tested to effectively minimize the stress on pump and compressor housings and to isolate vibrations transmitted by mechanical equipment. Senior Flexonics can help you comply with noise level requirements by reducing pipe vibration throughout a structure.

FEATURES:

- **ABSORBS THERMAL GROWTH MOTION**
  Excellent protection to adjacent piping and equipment.
- **COMPENSATES FOR MISALIGNMENT**
  Reduces stresses.
- **CONTROLS VIBRATION**
  Normal mechanical equipment vibrations are reduced at the connector.
- **REDUCES NOISE**
  High pipe vibration noise is greatly reduced . . . often eliminated.
- **ALL METAL CONSTRUCTION**
  Eliminates shelf life problems and allows operation at elevated temperature.

BSN STAINLESS STEEL CONNECTORS

Nominal Diameter (in)	Model Number	Overall Length (in)	Live Length (in)	Design Data		
				Approx. Wt. (lb)	Working Pressure	
					@ 70°F	@ 250°F
1/2	SA-BSN-008-12	12	8	3/8	1225	1078
3/4	SA-BSN-012-12	12	6 3/4	3/4	1034	910
1	SA-BSN-016-12	12	6 1/2	1	796	700
1 1/4	SA-BSN-020-12	12	6 1/4	1 1/4	600	528
1 1/2	SA-BSN-024-12	12	6 1/4	1 1/2	557	490
2	SA-BSN-032-12	12	5	2	570	502
2 1/2	SA-BSN-040-14	14	6	4	387	341
3	SA-BSN-048-14	14	6 3/4	5	316	278
4	SA-BSN-064-18	18	8 1/2	8 1/2	232	204



NOTE: Also available from 18", 24", 36" and 48" overall in sizes ½" – 2"
Optional • SCH 80 fittings • Stainless Steel Fittings
• HEX Male Nipples • Double Braid for higher pressure

BRC BRONZE CONNECTORS

Nominal Diameter (in)	Model Number	Overall Length (in)	Live Length (in)	Design Data		
				Approx. Wt. (lb)	Working Pressure	
					@ 70°F	@ 250°F
1/2	SA-BRC-008-12	12	8	1/2	706	607
3/4	SA-BRC-012-12	12	7 1/2	1	577	496
1	SA-BRC-016-12	12	6 3/4	1 1/4	470	404
1-1/4	SA-BRC-020-12	12	5 3/4	1 3/4	361	310
1-1/2	SA-BRC-024-12	12	5 3/4	2	329	282
2	SA-BRC-032-12	12	4 3/4	2 1/2	317	272



• For use in copper piping systems
• BRC Bronze Connectors are not CRN registered. Consult factory for more information.

FLEXIBLE METAL PUMP CONNECTORS

DESIGN CHARACTERISTICS

BSN Conectors: Stainless Steel hose and braid, SCH 40 carbon steel NPT nipples.

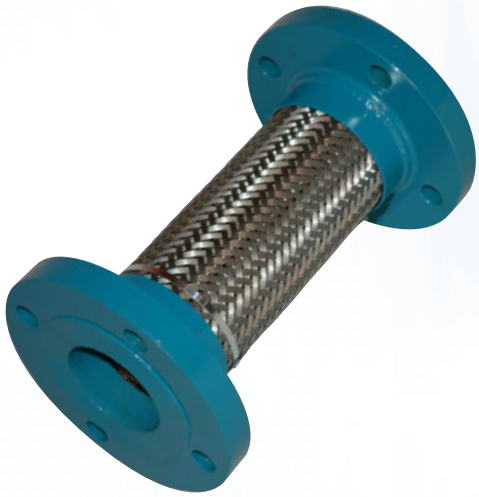
BRC Connectors: Bronze hose and braid, copper female sweat ends. For use in copper piping systems.

BSFS Connectors: Stainless Steel hose and braid, 150lb. raised face forged steel Slip On flanges.

TCS-R Connectors: Multi-Ply Stainless Steel bellows, carbon steel 150lb. flat faced flanges.

BSFS STAINLESS STEEL CONNECTORS

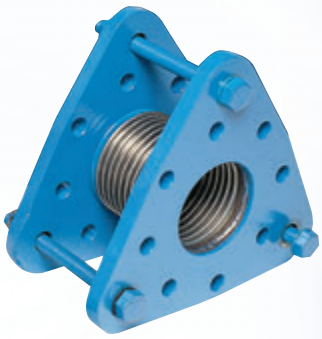
Nominal Diameter (in)	Model Number	Overall Length (in)	Live Length (in)	Design Data		
				Approx. Wt. (lb)	Working Pressure	
					@ 70°F	@ 250°F
2	SA-BSFS-032-12	12	8	11	285	245
2 1/2	SA-BSFS-040-12	12	7 3/4	15	285	245
3	SA-BSFS-048-12	12	7 5/8	21	285	245
	SA-BSFS-048-18	18	13 5/8	22	285	245
4	SA-BSFS-064-12	12	7 3/8	28	232	204
	SA-BSFS-064-18	18	13 3/8	29	232	204
5	SA-BSFS-080-12	12	6 1/4	33	191	168
	SA-BSFS-080-18	18	12 1/4	36	191	168
6	SA-BSFS-096-12	12	6	41	165	145
	SA-BSFS-096-18	18	12	43	165	145
8	SA-BSFS-128-12	12	5 5/8	63	234	206
	SA-BSFS-128-18	18	11 5/8	66	234	206
10	SA-BSFS-160-18	18	11 1/4	90	230	202
12	SA-BSFS-192-18	18	10 3/4	135	161	142



Optional:
- Stainless Steel Flanges
- 300 Lb Flanges

TCS-R STAINLESS STEEL CONNECTORS

Nominal Diameter (in)	Model Number	Overall Length (in)	Live Length (in)	Fitting Length (in)	Design Data			Effective Area (in^2)
					Approx. Wt. (lb)	Working Pressure		
						@ 70°F	@ 250°F	
2	TCSR-FLG-032	6	4 3/4	5/8	20 1/2	225	210	6.9
2 1/2	TCSR-FLG-040	6	4 3/4	5/8	24	225	210	6.9
3	TCSR-FLG-048	6	4 3/4	5/8	25	225	210	8.8
4	TCSR-FLG-064	6	4 1/2	3/4	35	225	210	15.1
5	TCSR-FLG-080	6	4 1/2	3/4	38	225	210	23.5
6	TCSR-FLG-096	6	4 1/2	3/4	41 1/2	225	210	33.2
8	TCSR-FLG-128	6	4	1	68	225	210	59.3
10	TCSR-FLG-160	8	6	1	118	225	210	93.5
12	TCSR-FLG-192	8	6	1	147	225	210	134.0
14	TCSR-FLG-224	8	5 1/2	1 1/4	205	225	210	171.0



NOTE
- Model TCS-R rated for 1" compression, 3/8" extension, 1/8" -5/16" lateral and pump vibration. (Depending on size)
- Movements shown are non-concurrent
- Larger sizes available upon request.

RUBBER EXPANSION JOINTS*

Senior Flexonics stocks and distributes a comprehensive range of rubber expansion joints for use in many tough, demanding industrial applications such as air conditioning, heating and ventilation systems, petrochemical, industrial process piping systems, power generation, marine services, paper, water and sewerage systems.

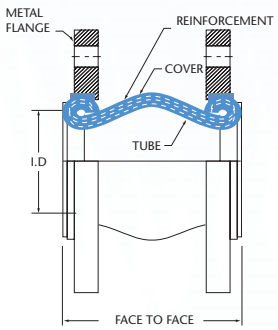
Senior Flexonics standard rubber expansion joints feature an engineered sphere design bellows which is inherently stronger than the hand fabricated older standard cylindrical shapes. Internal pressure within a sphere is exerted in all directions distributing forces evenly over a large area.

The spherical design "flowing arch" reduces turbulence, sediment build-up, thrust area and the effects of thrust on the piping system equipment when compared to the "high arch" design.

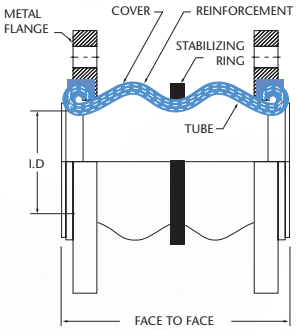
Standard stock units in styles 101 and 102 are constructed from EPDM rubber inner liner and outer cover, with an embedded nylon cord reinforcement and wire reinforced flange collars. Floating flanges allow for easy installation and alignment of bolt holes.

Other materials and styles of rubber flexible joints are available on request or can be designed to meet customers' specific requirements.

STYLE 101 SINGLE SPHERE CONNECTORS
STYLE 102 DUAL SPHERE CONNECTORS



STYLE 101



STYLE 102

FEATURES:

- Precision molded design eliminates transmission of noise and vibration, cushions water hammer and smooths out pumping impulses and waterborne noises.
- Excellent for suction and discharge installations. The inherent design strength of the spherical arch allows for high operating pressure (up to 232 PSIG). The nylon reinforcement permits the use of SERIES 100 rubber expansion joints under vacuum conditions (up to 25 in. of Hg).
- Easy installation on piping due to the elastic spherical body and rotating flanges

* Rubber Expansion Joints are not CRN registered.

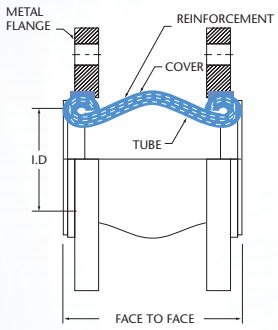
APPLICATIONS:

- Pulp and Paper
- Petrochemical
- Shipbuilding
- Pumps
- Circulating Water Lines
- Chemical
- Power Plants
- Waste Water Treatment
- Steel and Mining
- HVAC
- Compressors
- Turbine to Condenser
- Refrigeration
- Sewage

RUBBER EXPANSION JOINTS*

DESIGN DATA:

STYLE 101 SINGLE SPHERE CONNECTORS



STYLE 101

Temperature		Pressure			
		Diameter: 1″ ~ 12″ (32 mm ~300 mm)		Diameter: 14″ and up (350 mm and up)	
(° F)	(° C)	(PSI)	(bar)	(PSI)	(bar)
170	77	232	16	125	8
180	82	200	14	115	7.5
190	88	175	12	105	7
200	93	150	10	95	6
210	99	125	8	40	3
220	104	100	6	35	2
230	110	75	5	25	1

DIMENSIONS, MOVEMENTS AND OPERATING CONDITIONS

Diameter		Model Number	Allowable Movements									Pressure @ 70° F / 21°C		Approx. Weight
			Face to Face		Compression		Extension		Lateral		Angular			
(in)	(mm)		(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(deg)	(PSI)	(bar)	(lb)
1 1/2	40	RJ-101-EPDM-024	5.90	150	1/2	12	3/8	9	1/2	12	15°	**232**	**16**	**6**
2	50	RJ-101-EPDM-032	5.90	150	1/2	12	3/8	9	1/2	12	15°	**232**	**16**	**7**
2 1/2	65	RJ-101-EPDM-040	5.90	150	1/2	12	3/8	9	1/2	12	15°	**232**	**16**	**10**
3	80	RJ-101-EPDM-048	5.90	150	1/2	12	3/8	9	1/2	12	15°	**232**	**16**	**12**
4	100	RJ-101-EPDM-064	5.90	150	5/8	15	3/8	9	1/2	12	15°	**232**	**16**	**16**
5	125	RJ-101-EPDM-080	5.90	150	5/8	15	3/8	9	1/2	12	15°	**232**	**16**	**21**
6	150	RJ-101-EPDM-096	5.90	150	5/8	15	3/8	9	1/2	12	15°	**232**	**16**	**26**
8	200	RJ-101-EPDM-128	5.90	150	5/8	15	3/8	9	1/2	12	15°	**232**	**16**	**37**
10	250	RJ-101-EPDM-160	7.87	200	3/4	19	1/2	12	3/4	19	15°	**232**	**16**	**50**
12	300	RJ-101-EPDM-192	7.87	200	3/4	19	1/2	12	3/4	19	15°	**232**	**16**	**73**
14	350	RJ-101-EPDM-224	7.87	200	3/4	19	1/2	12	3/4	19	15°	**150**	**10**	**94**
16	400	RJ-101-EPDM-256	7.87	200	3/4	19	1/2	12	3/4	19	15°	**150**	**10**	**123**
18	450	RJ-101-EPDM-288	7.87	200	3/4	19	1/2	12	3/4	19	15°	**150**	**10**	**133**
20	500	RJ-101-EPDM-320	7.87	200	3/4	19	1/2	12	3/4	19	15°	**150**	**10**	**154**

Movements given are non-concurrent. Consult Senior Flexonics for concurrent movement capabilities.

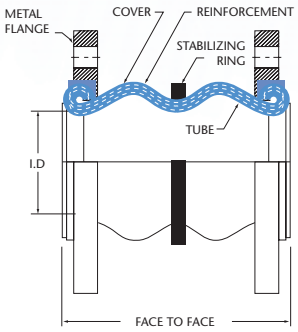
Pressure rating is based on °F operating temperature. Maximum operating temperature is 230°F.

At higher temperatures the pressure must be reduced as per chart.

Other sizes, styles and materials available upon request.

* Rubber Expansion Joints are not CRN registered.

DESIGN DATA:
STYLE 102 DUAL SPHERE CONNECTORS



STYLE 102

Temperature		Pressure			
		Diameter: 1″ ~ 12″ (32 mm ~300 mm)		Diameter: 14″ and up (350 mm and up)	
(° F)	(° C)	(PSI)	(bar)	(PSI)	(bar)
170	77	232	16	125	8
180	82	200	14	115	7.5
190	88	175	12	105	7
200	93	150	10	95	6
210	99	125	8	40	3
220	104	100	6	35	2
230	110	75	5	25	1

DIMENSIONS, MOVEMENTS AND OPERATING CONDITIONS

Diameter (in)	(mm)	Model Number	Allowable Movements										Pressure @ 70° F / 21°C (PSI)	(bar)	Approx. Weight (lb)
			Face to Face (in)	(mm)	Compression (in)	(mm)	Extension (in)	(mm)	Lateral (in)	(mm)	Angular (deg)				
1 1/2	40	RJ-102-EPDM-024	6.88	175	1.97	50	1.18	30	1.38	35	40°		**232**	**16**	**6**
2	50	RJ-102-EPDM-032	6.88	175	1.97	50	1.18	30	1.38	35	40°		**232**	**16**	**8**
2 1/2	65	RJ-102-EPDM-040	6.88	175	1.97	50	1.18	30	1.38	35	40°		**232**	**16**	**11**
3	80	RJ-102-EPDM-048	6.88	175	1.97	50	1.18	30	1.38	35	40°		**232**	**16**	**13**
4	100	RJ-102-EPDM-064	8.85	225	2.25	57	1.38	35	1.57	40	35°		**232**	**16**	**18**
5	125	RJ-102-EPDM-080	8.85	225	2.25	57	1.38	35	1.57	40	35°		**232**	**16**	**22**
6	150	RJ-102-EPDM-096	8.85	225	2.25	57	1.38	35	1.57	40	35°		**232**	**16**	**28**
8	200	RJ-102-EPDM-128	12.79	325	2.48	63	1.38	35	1.77	45	30°		**232**	**16**	**45**
10	250	RJ-102-EPDM-160	12.79	325	2.48	63	1.38	35	1.77	45	30°		**232**	**16**	**58**
12	300	RJ-102-EPDM-192	12.79	325	2.48	63	1.38	35	1.77	45	30°		**232**	**16**	**83**
14	350	RJ-102-EPDM-224	13.77	350	1.57	40	1.18	30	1.18	30	20°		**150**	**10**	**107**

Movements given are non-concurrent. Consult Senior Flexonics for concurrent movement capabilities.
Pressure rating is based on °F operating temperature. Maximum operating temperature is 230°F.
At higher temperatures the pressure must be reduced as per chart.
Other sizes, styles and materials available upon request.

* Rubber Expansion Joints are not CRN registered.

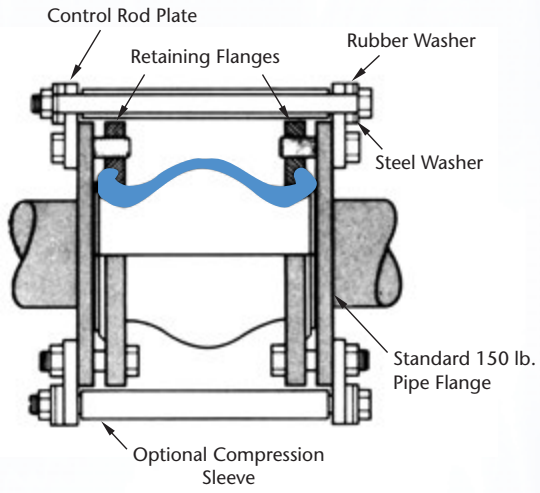
CONTROL UNITS

Control Rod/Units are designed to absorb static pressure thrust developed at the expansion joint. When used in this manner, control unit assemblies are an additional safety feature, minimizing possible failure of the expansion joint or damage to the equipment.

1. **Anchored Systems:** Control unit assemblies are not required in piping systems that are anchored on both sides of the expansion joint, providing piping movements are within the rated movements.

2. **Unanchored Systems:** Control Unit assemblies are always recommended in unanchored systems. Additionally, control unit assemblies must be used when the maximum pressure exceeds the limit shown in the table below, or the movement exceeds the rated movements.

3. **Spring Mounted Equipment:** Control unit assemblies are always recommended for spring mounted equipment. Control units must be used when the maximum pressure is higher than the ratings shown in the table below, or the movement exceeds the rated movements.



Control Rod Unit must be installed when pressure (test, surge, operating) exceeds the rating below.

SIZE (ins.)	STYLE 101 (PSIG)	STYLE 102 (PSIG)
1-4	150	150
5-10	135	135
12-14	90	90
16-24	45	45

Custom fabricated joints available in the following profiles:

Style	Profile
RJ-TU100	OPEN DOUBLE ARCH - THREADED UNIONS
RJ-101W	OPEN SINGLE WIDE ARCH
RJ-201	SINGLE OPEN ARCH
RJ-202	DOUBLE OPEN ARCH
RJ-203	TRIPLE OPEN ARCH
RJ-204	QUADRUPLE OPEN ARCH
RJ-201F	SINGLE FILLED ARCH
RJ-202F	DOUBLE FILLED ARCH
RJ-203F	TRIPLE FILLED ARCH
RJ-204F	QUADROUPLE FILLED ARCH
RJ-301W	SINGLE WIDE ARCH
RJ-302W	DOUBLE WIDE ARCH
RJ-303W	SINGLE WIDE OPEN ARCH
RJ-401LP	SINGLE LOW PROFILE OPEN ARCH HIGH PRESSURE
RJ-401SR	SINGLE LOW PROFILE OPEN ARCH HIGH PRESSURE
RJ-CJ-100	SINGLE ARCH CONCENTRIC REDUCER
RJ-CR-100	SINGLE ARCH LOW PRESSURE
RDC-01	A 1/4" THICK CIRCULAR RUBBER DUCT CONNECTOR (AVAILABLE AS CONCENTRIC OR ECCENTRIC REDUCING)
RPC-00	PUMP CONNECTOR - SMOOTHE BORE - NO ARCH (AVAILABLE AS CONCENTRIC OR ECCENTRIC REDUCING)

Fabricated joints available in the following materials:

Style	Profile
Neoprene	CR
Buna	NB
Natural Rubber	NR
Butyl	CI
Hypalon	CS
EPDM	EPDM
Viton	FK
PTFE	PTFE
Silicon	SI

Other sizes, styles and materials available upon request.

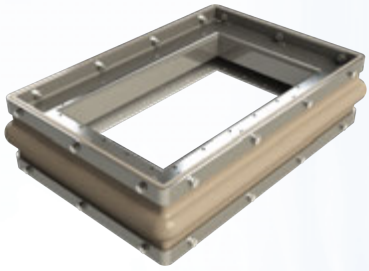
* Rubber Expansion Joints are not CRN registered.

[FABRIC EXPANSION JOINTS]*

ADVANTAGES OF FABRIC EXPANSION JOINTS



- Cost efficient for large ducting applications
  - Lower initial cost
  - Lower installed cost
  - Lower repair/replacement cost
- Can be installed over existing metal joints
- Negligible spring forces
- Large movement capacity



PRODUCTS, MARKETS & APPLICATIONS

Senior Flexonics pioneered the use of fabric expansion joints as an alternative to metal bellows through its FlowFlex division in 1964. We are continually striving to provide reliable cost-effective solutions to reducing or eliminating your thermal/mechanical movement problems.

Senior Flexonics' non-metallic expansion joints are produced in various configurations in order to meet virtually any application requirements and operating conditions. They can be engineered to fit into existing systems without major changes in duct work.

Fabric expansion joints are offered in either integral flange or belt-type geometry. They are designed not only for relieving stress due to thermal conditions but to eliminate transmission of vibration caused by fans and other equipment in ducting systems.

Senior Flexonics can produce round, rectangular and custom shapes for every application. In addition to our standard designs in this catalog, we can produce specially engineered designs to meet your specific requirements.

Our fabric expansion joints are used in, but not limited to, the following industries and applications:

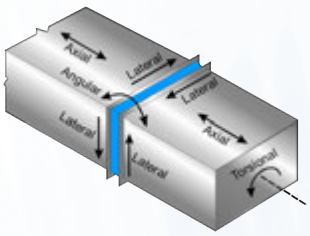
- Power generation
- Refineries
- Pulp and paper
- Metal fabrication
- Food processing
- Incineration
- Chemical processing

CUSTOM ENGINEERED PRODUCTS

In addition to our standard designs in this catalog, we can produce specially engineered designs to meet your specific requirements. Most solutions can be engineered to fit and improve existing systems with minor modifications. Our team of experts would be pleased to assist you with your custom designs.

MOVEMENT CAPABILITIES

The system thermal expansions are the differential expansion/contraction of operating and/or excursion temperatures and the minimum ambient temperature during installation and shutdowns.



The expansion joint engineer uses these movements and temperatures to select the proper material and design for each expansion joint. Fabric expansion joints frequently can handle combined axial, lateral, angular and torsional movements in a single assembly.
The expansion joint locations can often be optimized, reducing the total number required. Consideration should be given to accessibility and belt replacement.

SPLICING AND REPAIRABILITY



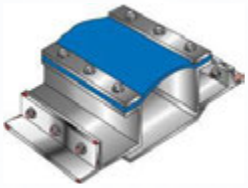
Senior Flexonics' Flexon and Ultrachem materials can be easily spliced in the field during expansion joint installation. These materials are easily repaired in the event of damage after installation. The "Thermowelding" characteristics of these materials provide splicing and repair material strength equal to or greater than the base material strength.

The ability to repair your expansion joint materials with plant personnel gives the plant more independence to solve its own problems. Expansion joint replacement and repairs can now be easily performed.

* Fabric Expansion Joints are not CRN registered.

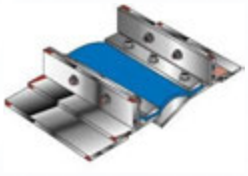
FABRIC EXPANSION JOINTS*

FRAME STYLES



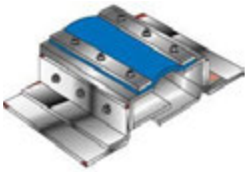
SERIES 2400

Design applications where the ductwork flanges are present and a complete frame assembly is preferred. This style works well for high temperature applications.



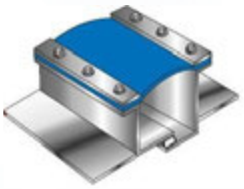
SERIES 2500

Complete drop-in assembly design which works well with low to moderate temperature applications with low levels of particulate accumulation.



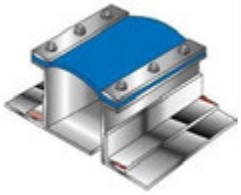
SERIES 2600

Similar to Series 2500, and is used where additional standoff is necessary or preferred. This design works well in low to moderate temperature applications with low levels of particulate accumulation.



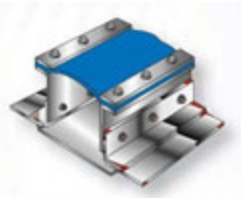
SERIES 2700

Used for low-to-high temperature applications with a cavity pillow, where high levels of particulate are present.



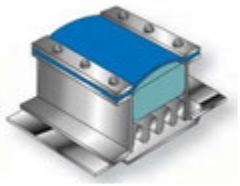
SERIES 2750

Similar to Series 2700, with the exception of a single integral flow liner. This design works well with lower particulate levels or vertical duct applications.



SERIES 2800

This style frame is well suited for installation with field assembly over existing expansion joints, and is utilized for all temperature ratings.



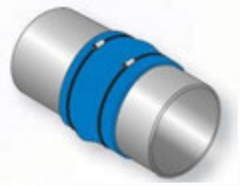
SERIES 2900

Best utilized where flanges are not present and field assembly is required or preferred.



SERIES U1000

The standard integrally flanged U-belt design is used for low to moderate temperature applications where duct flanges are present and particulate loading is minimal.



SLEEVES

Sleeves are primarily used for vibration in HVAC applications with minimal pressures.

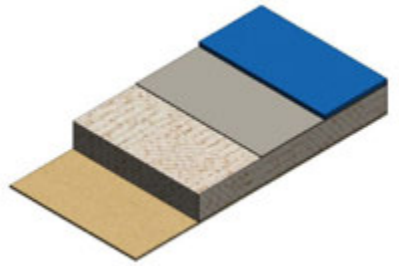
* Fabric Expansion Joints are not CRN registered.

[FABRIC EXPANSION JOINTS]*

BELT MATERIALS

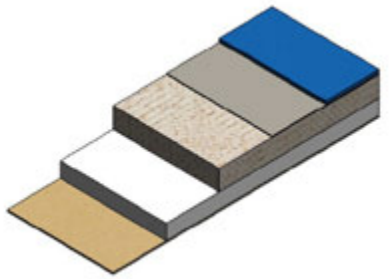
FLEXON-1000

A composite belt approximately 3/4" thick, rated for 1000°F (538°C) and consisting of layers of PTFE coated fiberglass fabric, PTFE film, non-woven fiberglass needle mat insulation, and fiberglass encasement (optional).



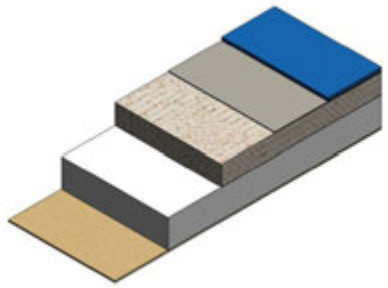
FLEXON-1200

A composite belt approximately 1-1/4" thick, rated for 1200°F (649°C) and consisting of layers of PTFE coated fiberglass fabric, PTFE film, non-woven fiberglass needle mat insulation, ceramic mat insulation, and silica cloth encasement.



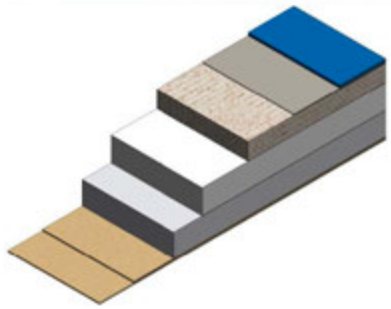
FLEXON-1500

A composite belt approximately 1-3/4" thick, rated for 1500°F (816°C) and consisting of layers of PTFE coated fiberglass fabric, PTFE film, non-woven fiberglass needle mat insulation, ceramic mat insulation, and silica cloth encasement.



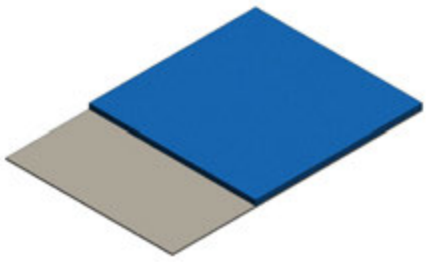
FLEXON-2000

A composite belt approximately 2-1/4" thick, rated for 2000°F (1093°C) and consisting of layers of PTFE coated fiberglass fabric, PTFE film, nonwoven fiberglass needle mat insulation, ceramic mat insulation, and silica cloth encasement.



ULTRACHEM SERIES

Three different belts are available, all rated for 600°F (316°C). Thicknesses range from .047" to .060". All belts have an outside layer of PTFE coated fiberglass fabric and various thicknesses of PTFE film on the gas side.

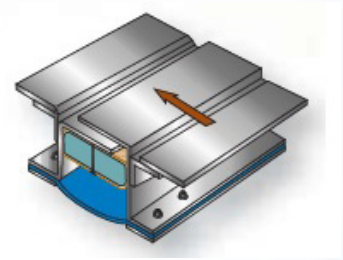


* Fabric Expansion Joints are not CRN registered.

FABRIC EXPANSION JOINTS*

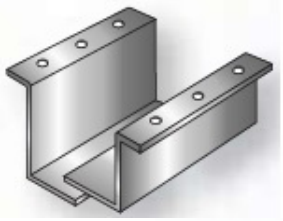
CAVITY PILLOW

Cavity pillows serve three purposes: retarding the intrusion of particulate, providing thermal protection, and resisting pressure pulsation. Our pillows are fabricated from selected insulation materials and wrapped with a high temperature fabric, designed for the operating conditions. Standard pillows are provided with "ears" or tabs that fasten under the belt and backup bars to hold the pillow in place. The ears are designed to provide a memory to the pillow such that it will return to an "as installed" uncompressed state after plant cool down, during outages.



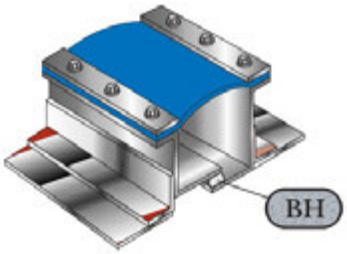
FLOW LINER

Flow liners (baffles) are metal shields designed to provide protection for the fabric element and/or cavity pillow from direct impingement of particulate or particulate accumulation. A liner is also used to reduce flutter of the fabric element caused by turbulence, to help control the accumulation of dust or ash in the expansion joint cavity, and to reduce the temperature of the flexible element. Flow liners can be supplied on a variety of materials and profiles (straight, airfoil, semi-airfoil or telescoping).



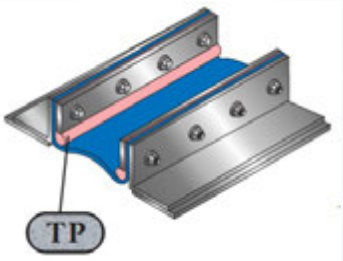
BRAIDED HOSE SEAL (BH)

Flexible stainless steel braided hose with enclosed ceramic insulation is often specified for expansion joints in areas of high particulate loading. The hose is secured between the flow liners to prevent particulate from entering the expansion joint cavity. This accessory along with a cavity pillow works well in cement plants.



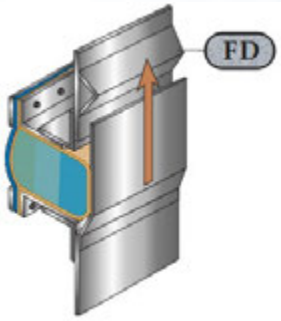
TADPOLE GASKET TAPE (TP)

When using integral flange-type expansion joints in duct systems with positive pressure operating conditions, Senior Flexonics recommends the use of tadpole gasketing between the flexible element flange and backup bars (as illustrated). This prevents the heads of the erection bolts from abrading the outside cover of the flexible element. This option also protects both flat and integrally flanged belts during large lateral or compression movements.



FLOW DEFLECTOR (FD)

In some expansion joint installations, an angle flow deflector is added to the design to increase the service life of the joint. A flow deflector is used to prevent moisture and particulate from sliding down vertical duct walls and being trapped in the expansion joint cavity by the flow liner.



* Fabric Expansion Joints are not CRN registered.

'SLIP PAKT' EXPANSION JOINTS*

PERFORMANCE DATA

Pressures and Temperatures

Senior Flexonics "Slip Pakt" Expansion Joints are designed for maximum working pressures of 150 psig or 300 psig. and to a maximum temperature of 500°F. Higher pressure and temperature units are available upon request.

Media

Senior Flexonics "Slip Pakt" Expansion Joints are suitable for use in pipelines containing Steam-Water-Oil-Air or Gas.

Sizes

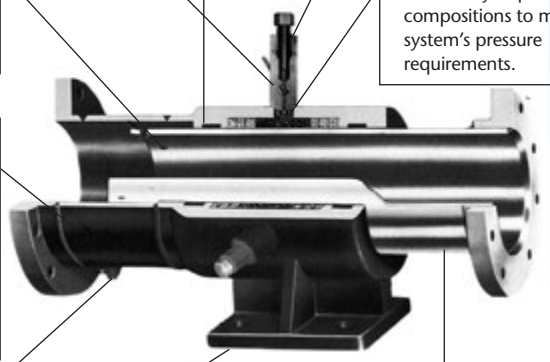
Senior Flexonics "Slip Pakt" Expansion Joints are available in Single or Dual units from 1 1/2" NPS through 24" NPS. Larger sizes available upon request.

Stroke or Traverse

4 inch, 8 inch and 12 inch strokes are standard in all single units. 8 inch, 16 inch and 24 inch strokes are standard in all dual units. Longer strokes in either Single or Dual "Slip Pakt" Expansion Joints are available for special applications.

Repacking

Senior Flexonics "Slip Pakt" Expansion Joints can be packed under full line pressure.



Shut-Off Valve 1/4 turn shut-off Valve prevents blowback of packing under full line pressure.

Integral Internal and External guides are of non ferrous material to insure close tolerance guiding without scratching or scoring the highly polished seamless carbon steel, double hard chrome plated slip.

Ram: The ram packing cylinders are carbon steel, welded in place and have internal acme thread in body and external acme thread on the ram and are designed for injection of semi-plastic self-lubricating packing under full line pressure.

Limit Stops, when engaging stuffing box end of gland, prevent slip from being pulled out of body. Limit stops are of stainless steel, designed for full line pressure thrust at 1 1/2 times design pressure.

Packing: Semi-plastic, self-lubricating packing available in a variety of packing compositions to meet your system's pressure requirements.

Body is carbon steel, fabricated to close tolerances. Body can be furnished with either a flanged or welding end. Flanged ends are faced and drilled in accordance with ANSI Standards.

Drip is furnished only when specified.

Bases for single joints are optional. Intermediate anchor bases are furnished on all double joints.

Slip of carbon steel, accurately machined and plated w/chrome over nickle as standard or with double hard chrome plating; .001" TK. hard chrome over .001" TK. crack-free hard chrome when specified.

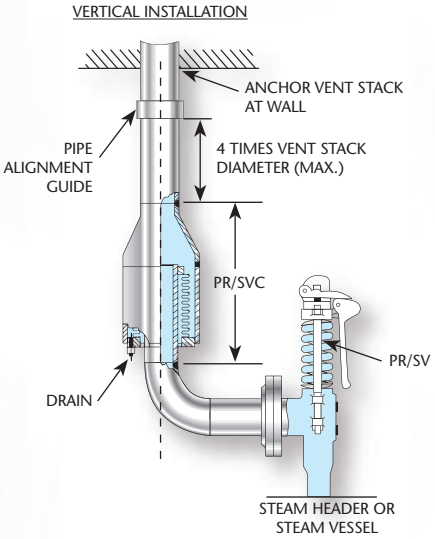
PRESSURE RELIEF/ SAFETY VALVE CONNECTORS

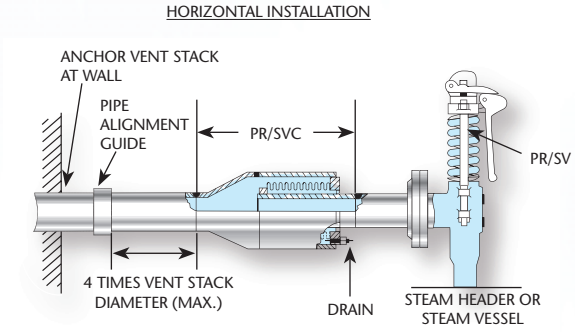
A modern answer for a 100 percent sealed vent system to replace such old-fashioned devices as drip pan elbows with their inherent safety hazards. These connectors, by eliminating steam blowback and by preventing drafting through the vent stack, provide increased protection for both plant personnel and expensive equipment.

The Senior Flexonics pressure relief/safety valve connectors are available in 164 different models and may be ordered for quick delivery.

Valve discharge sizes range from 1″ through 10″ and vent stack sizes range from 2″ through 24″ are available. The connectors come in both high and low pressure series with four standard motion capabilities. For smaller sizes there is 1 1/2″ axial deflection with ± 3/4″ lateral deflection, and 4″ axial with ± 2″ lateral; for larger sizes there is 2″ axial deflection with ± 1″ lateral deflection, and 6″ axial with ± 2 1/2″ lateral. (Special movements can be supplied as required.)

Consult factory for more information.





SENIOR FLEXONICS WARRANTY

The following warranty is given by Senior Flexonics Canada (SFC) to the purchaser only and to the exclusion of any other warranty or condition either expressed or implied.

All products/services provided by SFC are warranted for one (1) year after system startup or eighteen (18) months after shipment, whichever occurs first. The warranty covers defects in workmanship, material, and material non-conformance to specifications as demonstrated by the inspection and testing protocol in use by SFC. SFC at its sole option will either repair or replace any supplied defective products. The effects of corrosion, erosion, aging, normal wear, or negligence, incidental or consequential damages are specifically excluded from the warranty. All products must be installed in strict accordance with the installation instructions. Failure to comply with installation instructions will nullify the warranty.

Notwithstanding any discussions between the purchaser and SFC, SFC does not warrant the use of its products for any particular purpose and any reliance on SFC's skill or judgment is done at the sole risk of the purchaser.

Further, notwithstanding any usage of trade, SFC does not warrant its products as being fit for a particular purpose. All warranty claims must be made in writing. Claims made by phone must be confirmed in writing within 10 days.

All removal, reinstallation, and freight costs to and from SFC are excluded from warranty coverage.

The warranty on products repaired shall not be extended beyond the original warranty period.

The purchaser shall be responsible for the correct sizing, specifications, quantities, installation and suitability of all flex connectors, expansion joints, flanges, gaskets, bolting, victaulic clamps, anchors and pipe alignment guides so as to ensure the proper functioning of the products and to maintain full manufacturer's warranty.

Please refer to section 7 in our Terms and Conditions document on www.flexonics.com for the current version of our warranty.

EXPANSION JOINT SPECIFICATION SHEET

Company:			Date:		
Project:			Sheet of		
			Inquiry No.		
			Job No.		
Item No./EJ Tag No.					
1.	Quantity				
2.	Nominal Size/I.D./O.D. (in.)				
3.	Expansion Joint Type				
4a	Fluid Information		Medium Gas/Liquid		
4b			Velocity (Ft./Sec/)		
4c			Flow Direction		
5	Design Pressure, psig				
6	Test Pressure, psig				
7a	Temperature		Design (°F)		
7b			Max./Min. (°F)		
7c			Installation (°F)		
8a	Maximum Installation Movement		Axial Compression (in.)		
8b			Axial Extension (in.)		
8c			Lateral (in.)		
8d			Angular (in.)		
9a	Maximum Design Movements		Axial Compression (in.)		
9b			Axial Extension (in.)		
9c			Lateral (in.)		
9d			Angular (deg.)		
9e			No. of Cycles		
10a	Operating Fluctuations		Axial Compression (in.)		
10b			Axial Extension (in.)		
10c			Lateral (in.)		
10d			Angular (deg.)		
10e			No. of Cycles		
11a	Materials of Construction		Bellows		
11b			Liners		
11c			Cover		
11d			Pipe Specifications		
11e			Flange Specification		
12	Rods (Tie/Limit/Control)				
13	Pantographic Linkage				
14	Anchor Base (Main/Intermediate)				
15a	Dimensional Limitations		Overall Length (in.)		
15b			Outside Diameter (in.)		
15c			Inside Diameter (in.)		
16a	Spring Rate Limitations		Axial (lbs./in.)		
16b			Lateral (lbs./in)		
16c			Angular (in-lbs./deg.)		
17	Installation Position Horiz./Vert.				
18a	Quality Assurance Requirements		Bellows Long.	Seam	
18b			Weld NDE	Attach.	
18c			Pipe NDE		
18d			Design Code Reqrd.		
18e			Partial Data Reqrd.		
18f					
18g					
19	Vibration Amplitude/Frequency				
20	Purge Instrumentation Connection				
21a	Special Flange Design	Facing			
21b		O.D. (in.)			
21c		I.D. (in.)			
21d		Thickness (in.)			
21e		B.C. Diameter (in.)			
21f		No. Holes			
21g		Size Holes			
21h		Hole Orientation			

INSTALLATION INSTRUCTIONS*

Senior Flexonics Expansion Joints are fully inspected at the factory and are packaged to arrive at the job site in good condition. Please, immediately upon receipt at the job site, verify that there is no freight damage; i.e., dents, broken hardware, loose shipping bars, etc.

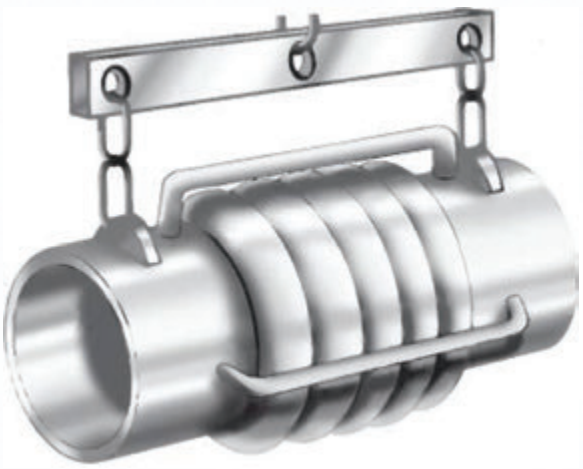
Because the bellows expansion joint is required to absorb thermal and /or mechanical movements, the bellows element must be constructed of a relatively thin gage material. This requires special installation precautions. The following steps should be taken prior to installation of the expansion joint into the pipeline or duct.

1. The opening into which the expansion joint will be installed should be examined to verify that the opening for which the expansion joint was designed does not exceed the installation toler ances designated by the designer and/or purchaser. If the opening exceeds the tolerance, notify Senior flexonics at once for a disposition.
2. The attachment edges of the pipe or duct should be smooth, clean, and parallel to each other.
3. The area around the expansion joint should be cleared of any sharp objects or protrusions. If not removable, the should be noted so that they can be avoided.
4. Expansion joints provided with lifting lugs should be lifted only by the designated lifting lugs. SHIPPING BARS (PAINTED YELLOW) ARE NOT DESIGNED TO BE LIFTING DEVICES DIRECTLY ON THE BELLOWS ELEMENT OR BELLOWS COVER. For expansion joints not provided with lifting lugs (i.e., less than 500 lbs.), the best lifting method should be evaluated at the time of installation.
5. The shipping bars are installed on an expansion joint to maintain shipping length and give the expansion joint stability during transit and installation. DO NOT REMOVE THE SHIPPING BARS UNTIL THE INSTALLATION IS COMPLETE.

Installation:

The following precautions must be taken when installing an expansion joint:

1. Remove any protective covering from the ends of expansion joint. Plywood covers may have been used to protect flanges or weld ends. Check inside expansion joint for dessicant bags or any other material.



2. When a flow liner is installed in the expansion joint, orient with FLOW ARROW POINTING IN DIRECTION OF FLOW.
3. Using lifting lugs, lift joint to desired location and position into pipeline or ducting.
4. Weld end expansion joints.
   (a) PRIOR TO WELDING, COVER THE BELLOWS ELEMENT WITH A CHLORIDE FREE FIRE RETARDANT CLOTH. This is to prevent arc strikes, weld splatter, etc. from damaging the bellows element.

(b) Using the proper electrode, weld the expansion joint to adjacent piping. DO NOT USE BELLOWS TO CORRECT FOR MISALIGNMENT OF PIPING UNLESS THIS HAS BEEN CONSIDERED IN THE DESIGN OF THE EXPANSION JOINT.

5. Flanged end expansion joints.

a) Orient expansion joints flanges so that the bolt holes are aligned with the mating flanges. DO NOT FORCE THE EXPANSION JOINT TO MATCH THE BOLT HOLES OF THE MATING FLANGE. This causes torsion on the bellows and will severely reduce the bellows capability during operation and may cause premature failure of the expansion joint. It is good practice to leave one pipe flange loose until the expansion joint is installed or to purchase an expansion joint with a flange that will rotate.

b) Install gaskets and bolt to the required torque recommended by the flange manufacturer.

c) Vanstone type flanges may be secured to the bellows with shipping straps. Remove these straps prior to installation.

*For complete and up-to-date installation instructions, please refer to our web site (www.flexonics.com)

After Installation BUT PRIOR TO HYDRO TEST

1. Inspect entire system to ensure that anchors, guides and pipe supports are installed in strict accordance with piping system drawings. A pipe guide spacing chart is provided below to aid in this check.
2. ANCHORS MUST BE DESIGNED FOR THE TEST PRESSURE THRUST LOADS. Expansion joints exert a force equal to the test pressure times the effective area of the bellows during hydro test. Pressure thrust at design pressure may be found on the individual drawings. Refer to EJMA Safety Recommendations.
3. If the system media is gaseous, check to determine if the piping and/or the expansion joint may require additional temporary supports due to the weight for water during testing.
4. REMOVE SHIPPING CARS (PAINTED YELLOW) PRI OR TO HYDROTESTING. Shipping bars are not designed for hydrostatic pressure thrust loads.
5. Hydrostatically test pipeline and expansion joint. ONLY CHLORIDE FREE WATER SHOULD BE USED FOR HYDROTEST. (Published reports indicate chloride attach of stainless steel bellows as low as 3 PPM). Water should not be left standing in the bellows.

General Precautions

1. Cleaning agents, soaps and solvents may contain chlorides, caustics, or sulfides and can cause stress corrosion which appears only after a bellows is put into service.
2. Wire brushes, steel wool and other abrasives should not be used on the bellows element.
3. Hydrostatic test pressure should not exceed 1 ½ times the rated working pressure unless the expansion joint was specifically designed for this test pressure.
4. Some types of insulation leach chlorides when wet. Only chloride free installation materials should be used for insulating an expansion joint.

SENIOR FLEXONICS' WARRANTY IS VOID UNLESS THE ABOVE INSTRUCTIONS ARE FOLLOWED

Pipe Guide Spacing Table

1. Senior Flexonics recommends that for Flexway™ Single Expansion Joints the first guide be located within four (4) pipe diameters from the expansion joint and the second guide be located within a distance of fourteen (14) pipe diameters from the first guide. The remaining guides are to be in accordance with the table below.
2. Senior Flexonics recommends that for X-Press Expansion Joints the first guide be located within twelve (12) pipe diameters from the expansion joint. The remaining guides are to be in accordance with the formula below.

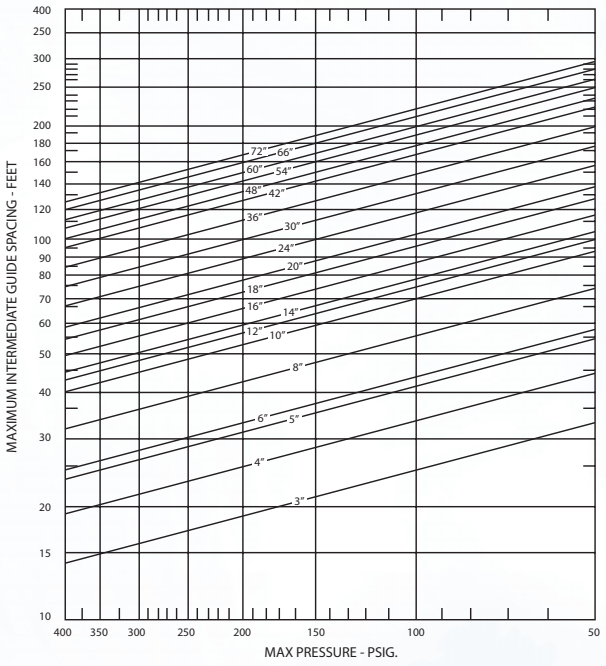
Maximum intermediate guide spacing for any pipe material or thickness may be calculated using the following formula:

$$L = 0.131 \sqrt{\frac{EI}{PA + {}_{A}Ra}}$$

Where
- L = Maximum intermediate guide Spacing (feet)
- E = Modules of elasticity of pipe material (psi).
- I = Moment of Inertia of Pipe (in^2)
- P = Design pressure (psig).
- A = Bellows effective area (in^2).
- ${}_{A}$ = Axial stroke of expansion joint (in).
- R_a = Axial spring rate of bellows (lbs/in.)

NOTES:
1. When bellows is compressed in operation use (+) ${}_{A}R_a$; when extended, use (-) ${}_{A}R_a$.
2. Dead weight of the pipe should also be considered for guide spacing.

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



Notes



TSSA CERTIFIED TO:

- ASME Sect. VIII, Div.I
- ASME B31.1
- ASME B31.3
- CSA B51
- EJMA Standards

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