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SENIOR FLEXONICS PATHWAY

ENGINEERED SOLUTIONS FOR LIGHT INDUSTRIAL & HVAC APPLICATIONS

senior

AVAILABLE
ON CD-ROM

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CERT. NO. 97-1091

SENIOR FLEXONICS PATHWAY

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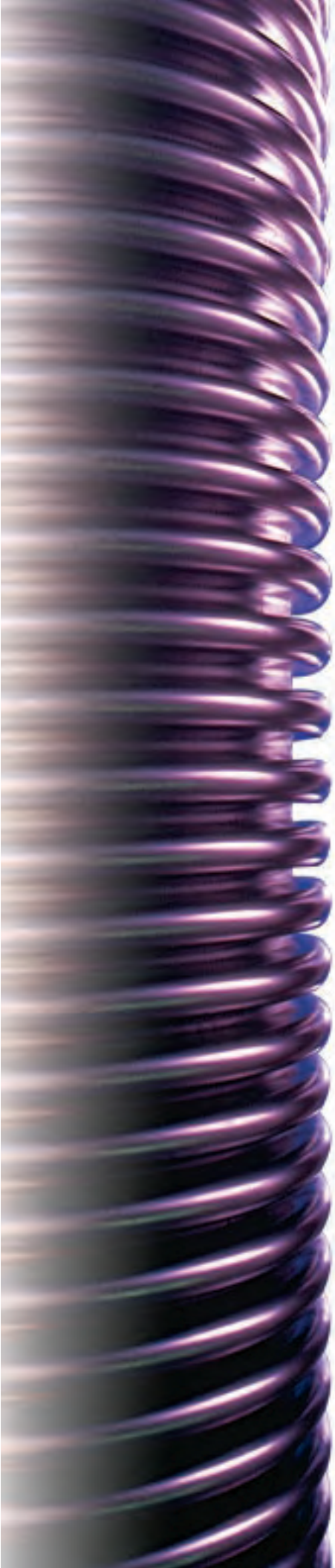


Contents

Introduction

With origins dating to 1902, Senior Flexonics Pathway 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.

This catalog contains product performance data and physical descriptions for each of our light industrial and HVAC expansion joint 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 catalog 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.

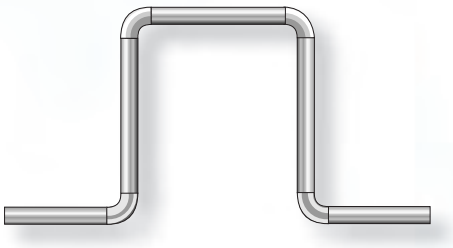
NOTICE: The information and technical data contained herein is believed to be accurate and the best information available to us at the time of printing this catalog. All information and data contained herein is subject to change at any time, without notice. Because we have no control over the selection,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

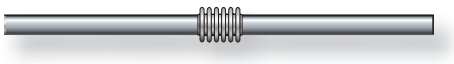
EXPANSION JOINT DESIGN BASICS

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.

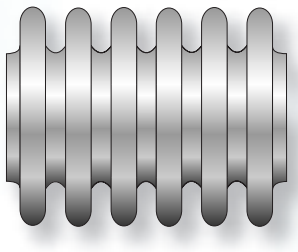
Expansion joints provide an excellent solution for isolation of settlement, seismic deflection, mechanical vibration and sound attenuation transmission produced by rotating equipment.

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.

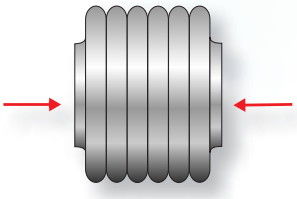
BELLOWS DESIGN

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.

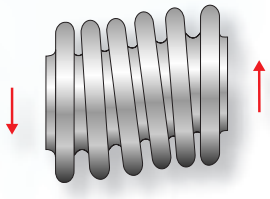


Flexibility of the bellows is achieved through bending of the convolution sidewalls, as well as flexing within their crest and root radii. In most cases, multiple convolutions are required to provide sufficient flexibility to accommodate the expected expansion and contraction of the piping system.

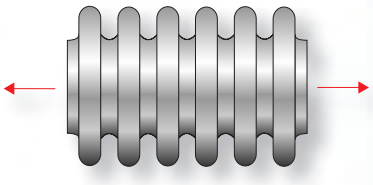
MOVEMENT CAPABILITIES



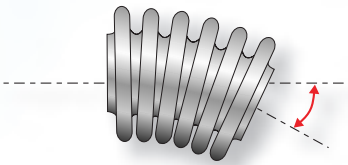
Axial Compression: Reduction of the bellows length due to piping expansion.



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

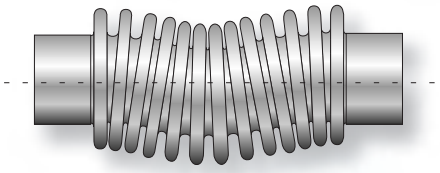
In most applications, design movements cause the individual convolutions to deflect beyond their elastic limits, producing fatigue due to plastic deformation, or yielding. One movement cycle occurs each time the expansion joint deflects from the installed length, to the operating temperature length,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

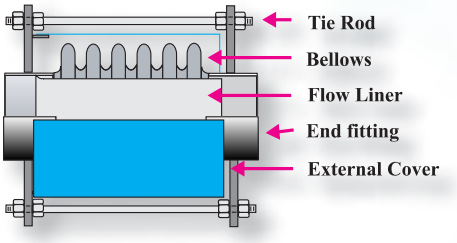
To avoid squirm, the bellows designer must limit movement capacity and flexibility to a level that insures that the bellows retains a conservative margin of column stability beyond the required design pressure.

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 include 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 leech chlorides or other substances which will could damage a bellows.

Tie rods eliminate pressure thrust and the need for main anchors required in 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.

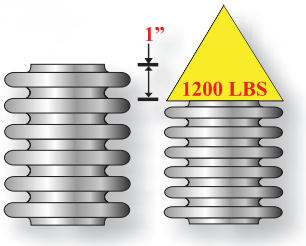
APPLICATIONS ENGINEERING

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

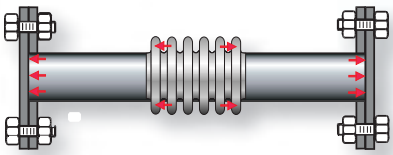
Expansion joints behave in a manner that is similar to a spring; as movement occurs, expansion joints produce a resistive force. This resistance is stated as spring rate and measured as the force required to deflect the bellows 1" in the axial or lateral direction; or inch-lbs./degree for angular rotation.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

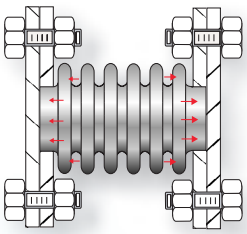


PRESSURE THRUST

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 the bellows.





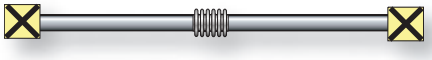
A pressurized bellows behaves like a hydraulic cylinder. Internal pressure bears against the walls of the convolutions, just as pressure bears against the face of a piston. This pressure produces a force that is equal to the internal pressure multiplied by the effective area of the bellows mean diameter ([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.

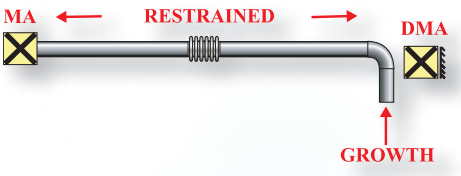
PIPE ANCHORS

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 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.

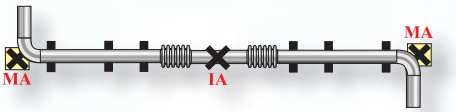
Main anchors are intended to anchor the pipe from motion in any direction.





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.

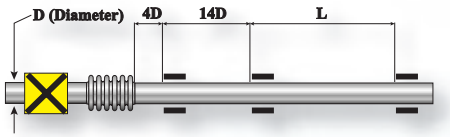
Intermediate anchors can isolate multiple expansion joints that are installed in series to accommodate large motions beyond the capability of a single joint. This separation is required to insure that each expansion is able to function as intended and not be affected by the flexibility characteristics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



PIPE GUIDES

With the addition of an 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 insuring 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 35.

The recommendations given for pipe guides represent the minimum requirements for controlling pipelines which contain expansion joints and are intended to protect the expansion joint 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 joint. If misalignment can not be avoided, contact one of our engineers for guidance.

CONCURRENT MOVEMENTS

Expansion joint movement capacity is listed in this catalog 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 may not exceed 100.

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

JOINT PRODUCT SELECTION GUIDE

Mid-Corr expansion joints (shown on pages 8-12) employ a standardized bellows design ideally suited for general industrial applications. Offered with flanges or butt weld ends from 2" to 24" nominal diameter for design pressures to 300 psig at 800° F. Large diameter available in our Metal Catalog.

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 bellows are available in two styles: Free-Flexing and Controlled-Flexing.

Free-Flexing expansion joints (shown on pages 13-14) 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 15-17) 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 18) 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 case and/or direct bured.

Expansion Compensators (shown on page 19) 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 chill water piping, this product is suitable for any small diameter axial expansion application.

Pressure Relief/Safety Valve Connectors (shown on pages 20-23) combine the design principles of the rugged externally pressurized expansion joint with a unique capability to also accommodate lateral and angular movements. Intended to replace devices such as drip pan elbows, this product enables pressure relief and safety relief valve discharge piping to be fully sealed.

Flexible Metal Pump Connectors (shown on pages 24-25) 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.

Non-Metallic Expansion Joints (shown on page 26-27) can also be used for similar applications as the Flexible Metal Pump Connector in a non-metallic construction.

Exhaust Flexible Connectors (shown on pages 28-29) are designed for low pressure applications such as stationary and marine gas turbine and diesel engine exhaust and low pressure ducting. Large motion capability, low spring forces and reduced weight make this product ideally suited to thin-wall duct systems.

Pipe Alignment Guides (shown on page 32) 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.

MID-CORR EXPANSION JOINTS

Mid-Corr expansion joints employ a standardized bellows design ideally suited for general industrial applications. Offered with flanges or butt weld ends from 2" to 24" nominal diameter for design pressures to 300 psig at 800° F. Large diameter available in our Metal Catalog.

MID-CORR DATA

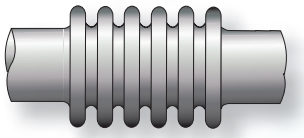
	SINGLE
Size Range	2" to 24"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 300 psi
Temperature Limits Stainless Steel Bellows	-20°F to 800°F. **
Axial Traverse	To 6.28". . . (depending on size)
Lateral Motion	Up to 2.51". . . (depending on size)

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

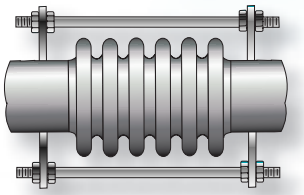
How to order:
Example P/N

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

STYLE

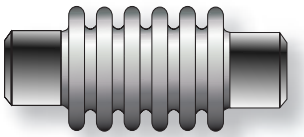


MCS SINGLE

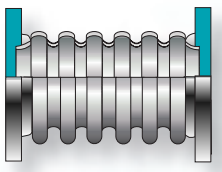


MCT TIED

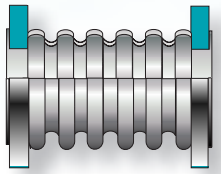
END CONNECTION



WW WELD END



FF FLANGED END



VV VANSTONE END

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: A36/A516-70 Plate (Std) A105 (Opt)
50 lb. Series: 150 lb. ANSI B16.5 F.F.S.O.
150 lb. Series: 150 lb. ANSI B16.5 F.F.S.O.
300 lb. Series: 300 lb. ANSI B16.5 F.F.S.O.

COVERS: Carbon Steel

TIE RODS: Carbon Steel

LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any one movement tabulated.
2. To combine axial, lateral movements, refer to page 6.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalog 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.

MID-CORR: STYLE HMCS

Nominal Diameter (In.)	Press (PSIG)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lb/Deg)	WW OAL (In.)	WW Wt. (Lbs.)	FF/VV OAL (In.)	FF/VV Wt. (Lbs.)	FW/VW OAL (In.)	FW/VW Wt. (Lbs.)
2″ Effective Area 5.7 in.²	50	4	0.32	0.05	10.0	598	4148	9	7 1/4	2	2 1/2	10	4 7/8	6
	50	8	0.64	0.20	10.0	299	518	5	8 1/2	2	3 3/4	11	6 1/8	6
	50	12	0.96	0.45	10.0	199	154	3	9 3/4	2	5	11	7 3/8	7
	50	16	1.28	0.79	*	150	65	2	11	2	6 1/4	12	8 5/8	7
2″ Effective Area 5.7 in.²	150	4	0.23	0.04	10.0	1168	8101	18	7 1/4	2	2 1/2	10	4 7/8	6
	150	8	0.47	0.15	10.0	584	1013	9	8 1/2	2	3 3/4	11	6 1/8	6
	150	12	0.70	0.33	10.0	389	300	6	9 3/4	2	5	12	7 3/8	7
	150	16	0.97	0.61	*	413	175	6	11	2	6 1/4	14	8 5/8	8
2″ Effective Area 5.7 in.²	300	4	0.18	0.03	7.7	2019	13999	32	7 1/4	2	3 1/4	14	5 1/4	8
	300	8	0.36	0.11	10.0	1009	1750	16	8 1/2	2	4 1/2	15	6 1/2	8
	300	12	0.54	0.25	10.0	673	518	11	9 3/4	2	5 3/4	16	7 3/4	9
	300	16	0.72	0.45	*	806	341	12	11	3	7	19	9	11
2.5″ Effective Area 8.3 in.²	50	4	0.42	0.05	10.0	419	4252	10	7 1/4	3	2 1/2	14	4 7/8	9
	50	8	0.84	0.21	10.0	210	531	5	8 1/2	3	3 3/4	15	6 1/8	9
	50	12	1.26	0.48	*	140	157	3	9 3/4	3	5	15	7 3/8	9
	50	16	1.63	0.83	*	210	133	5	11	4	6 1/4	19	8 5/8	12
2.5″ Effective Area 8.3 in.²	150	4	0.30	0.04	10.0	819	8304	19	7 1/4	3	2 1/2	14	4 7/8	9
	150	8	0.60	0.15	10.0	409	1038	9	8 1/2	3	3 3/4	15	6 1/8	9
	150	12	0.89	0.34	10.0	546	615	13	9 3/4	4	5	18	7 3/8	11
	150	16	1.18	0.61	*	409	259	9	11	4	6 1/4	21	8 5/8	12
2.5″ Effective Area 8.2 in.²	300	4	0.21	0.03	7.6	1612	16186	37	7 1/4	3	3 1/4	20	5 1/4	12
	300	8	0.43	0.11	10.0	806	2023	18	8 1/2	3	4 1/2	21	6 1/2	12
	300	12	0.63	0.25	10.0	1074	1199	25	9 3/4	4	5 3/4	24	7 3/4	14
	300	16	0.85	0.44	*	806	506	18	11	4	7	28	9	16
3″ Effective Area 12.4 in.²	50	4	0.46	0.07	10.0	881	6794	30	7 1/4	4	3 3/4	16	5 1/2	10
	50	8	0.92	0.27	10.0	440	849	15	8 1/2	4	5	17	6 3/4	11
	50	12	1.38	0.61	10.0	294	252	10	9 3/4	5	6 1/4	19	8	12
	50	16	1.85	1.09	*	220	106	8	11	5	7 1/2	21	9 1/4	13
	50	20	2.40	1.78	*	252	76	9	12 1/4	6	8 3/4	29	10 1/2	17
3″ Effective Area 12.4 in.²	150	4	0.24	0.04	6.9	4077	31455	140	7 1/4	4	3 3/4	17	5 1/2	10
	150	8	0.48	0.14	10.0	2039	3932	70	8 1/2	5	5	18	6 3/4	11
	150	12	0.72	0.32	10.0	1359	1165	47	9 3/4	5	6 1/4	21	8	13
	150	16	0.96	0.56	10.0	1019	491	35	11	6	7 1/2	24	9 1/4	15
	150	20	1.20	0.88	*	815	252	28	12 1/4	6	8 3/4	29	10 1/2	18
3″ Effective Area 12.2 in.²	300	4	0.21	0.03	6.0	5035	38232	170	7 1/4	4	3 1/4	27	5 1/4	15
	300	8	0.41	0.12	10.0	2517	4779	85	8 1/2	5	4 1/2	28	6 1/2	16
	300	12	0.62	0.28	10.0	1678	1416	57	9 3/4	5	5 3/4	31	7 3/4	18
	300	16	0.83	0.49	10.0	1259	597	43	11	6	7	34	9	20
	300	20	1.11	0.83	*	1293	387	43	12 1/4	7	8 1/4	45	10 1/4	26
3.5″ Effective Area 15.9 in.²	50	4	0.50	0.06	10.0	833	8258	37	7 3/4	4	3	22	5 3/8	13
	50	8	1.00	0.26	10.0	416	1032	18	9 1/2	4	4 3/4	23	7 1/8	14
	50	12	1.50	0.58	*	278	306	12	11 1/4	5	6 1/2	25	8 7/8	15
	50	16	2.00	1.04	*	208	129	9	13	5	8 1/4	27	10 5/8	16
	50	20	2.69	1.76	*	235	92	10	14 3/4	6	10	35	12 3/8	21
3.5″ Effective Area 15.9 in.²	150	4	0.26	0.03	6.7	3855	38232	170	7 3/4	4	3	23	5 3/8	13
	150	8	0.53	0.14	10.0	1927	4779	85	9 1/2	5	4 3/4	24	7 1/8	15
	150	12	0.79	0.31	10.0	1285	1416	57	11 1/4	5	6 1/2	27	8 7/8	16
	150	16	1.06	0.55	*	964	597	43	13	6	8 1/4	31	10 5/8	18
	150	20	1.32	0.86	*	771	306	34	14 3/4	7	10	36	12 3/8	21
3.5″ Effective Area 15.9 in.²	300	4	0.26	0.03	6.6	2967	28613	127	7 3/4	4	4	34	5 7/8	19
	300	8	0.51	0.14	10.0	1483	3577	64	9 1/2	5	5 3/4	36	7 5/8	20
	300	12	0.77	0.30	10.0	989	1060	42	11 1/4	5	7 1/2	38	9 3/8	21
	300	16	0.96	0.50	10.0	1927	1195	85	13	8	9 1/4	52	11 1/8	30
	300	20	1.19	0.77	*	1542	612	68	14 3/4	9	11	62	12 7/8	36

*Movements shown are nonconcurrent.

MID-CORR: STYLE HMCS (CONTINUED)

Nominal Diameter (In.)	Press (PSIG)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lb/Deg)	WW OAL (In.)	WW Wt. (Lbs.)	FF/VV OAL (In.)	FF/VV Wt. (Lbs.)	FW/VW OAL (In.)	FW/VW Wt. (Lbs.)
4″ Effective Area 19.1 in.²	50	4	0.39	0.05	9.0	1416	16905	75	7 3/4	6	3	26	5 3/8	16
	50	8	0.78	0.18	10.0	708	2113	38	9 1/2	6	4 3/4	27	7 1/8	17
	50	12	1.17	0.41	10.0	472	626	25	11 1/4	6	6 1/2	29	8 7/8	18
	50	16	1.55	0.73	*	354	264	19	13	7	8 1/4	31	10 5/8	19
	50	20	1.94	1.15	*	283	135	15	14 3/4	7	10	34	12 3/8	20
4″ Effective Area 20.1 in.²	150	4	0.32	0.04	7.2	3046	38232	170	7 3/4	6	3	27	5 3/8	16
	150	8	0.64	0.15	10.0	1523	4779	85	9 1/2	7	4 3/4	28	7 1/8	18
	150	12	0.96	0.33	10.0	1015	1416	57	11 1/4	7	6 1/2	32	8 7/8	19
	150	16	1.28	0.59	*	761	597	43	13	8	8 1/4	36	10 5/8	22
	150	20	1.75	1.02	*	743	368	41	14 3/4	11	10	49	12 3/8	30
4″ Effective Area 20.1 in.²	300	4	0.25	0.03	5.7	5263	66065	294	7 3/4	6	4	45	5 7/8	25
	300	8	0.50	0.12	10.0	2631	8258	147	9 1/2	7	5 3/4	47	7 5/8	27
	300	12	0.76	0.26	10.0	1754	2447	98	11 1/4	8	7 1/2	51	9 3/8	29
	300	16	1.01	0.47	10.0	1316	1032	74	13	9	9 1/4	56	11 1/8	32
	300	20	1.32	0.76	*	1451	719	80	14 3/4	12	11	73	12 7/8	43
5″ Effective Area 30.4 in.²	50	4	0.54	0.05	10.0	1218	23065	103	7 3/4	8	5 7/8	31	6 7/8	19
	50	8	1.08	0.20	10.0	609	2883	51	9 1/2	9	7 5/8	32	8 5/8	21
	50	12	1.62	0.46	10.0	406	854	34	11 1/4	10	9 3/8	35	10 3/8	22
	50	16	2.17	0.81	*	304	360	26	13	10	11 1/8	39	12 1/8	25
	50	20	2.71	1.27	*	244	185	21	14 3/4	11	12 7/8	44	13 7/8	28
5″ Effective Area 29.5 in.²	150	4	0.31	0.03	5.9	3805	69923	311	7 3/4	8	5 7/8	31	6 7/8	19
	150	8	0.63	0.12	10.0	1903	8740	156	9 1/2	9	7 5/8	32	8 5/8	21
	150	12	0.94	0.27	10.0	1268	2590	104	11 1/4	10	9 3/8	36	10 3/8	23
	150	16	1.25	0.48	10.0	951	1093	78	13	11	11 1/8	40	12 1/8	25
	150	20	1.57	0.75	*	761	559	62	14 3/4	12	12 7/8	45	13 7/8	28
5″ Effective Area 29.2 in.²	300	4	0.27	0.03	5.1	4529	82368	367	7 3/4	8	4 1/4	57	6	32
	300	8	0.54	0.10	10.0	2264	10296	183	9 1/2	9	6	58	7 3/4	34
	300	12	0.81	0.23	10.0	1510	3051	122	11 1/4	10	7 3/4	61	9 1/2	36
	300	16	1.08	0.42	10.0	1696	1889	135	13	12	9 1/2	70	11 1/4	41
	300	20	1.35	0.65	10.0	1357	967	108	14 3/4	13	11 1/4	77	13	45
6″ Effective Area 43 in.²	50	4	0.62	0.07	9.7	1902	24823	226	8 1/2	11	6 1/2	39	7 1/2	25
	50	8	1.25	0.28	10.0	951	3103	113	11	12	9	41	10	27
	50	12	1.87	0.63	10.0	634	919	75	13 1/2	14	11 1/2	45	12 1/2	30
	50	16	2.50	1.13	*	475	388	56	16	15	14	51	15	33
	50	20	3.12	1.76	*	380	199	45	18 1/2	16	16 1/2	59	17 1/2	38
6″ Effective Area 43 in.²	150	4	0.48	0.05	7.5	3286	42895	390	8 1/2	11	6 1/2	39	7 1/2	25
	150	8	0.97	0.22	10.0	1643	5362	195	11	13	9	42	10	27
	150	12	1.45	0.49	10.0	1095	1589	130	13 1/2	14	11 1/2	47	12 1/2	31
	150	16	1.98	0.90	*	1240	994	145	16	20	14	63	15	41
	150	20	2.47	1.41	*	992	509	116	18 1/2	22	16 1/2	77	17 1/2	49
6″ Effective Area 42 in.²	300	4	0.32	0.04	5.0	6694	83720	761	8 1/2	11	5 1/2	79	7	45
	300	8	0.64	0.15	10.0	3347	10465	381	11	12	8	81	9 1/2	47
	300	12	0.95	0.33	10.0	2231	3101	254	13 1/2	14	10 1/2	85	12	50
	300	16	1.20	0.55	10.0	2539	2036	296	16	18	13	98	14 1/2	58
	300	20	1.50	0.85	10.0	2031	1043	237	18 1/2	20	15 1/2	109	17	64
8″ Effective Area 70 in.²	50	4	0.69	0.06	8.4	1964	41983	382	8 1/2	16	7	61	7 3/4	39
	50	8	1.38	0.24	10.0	982	5248	191	11	18	9 1/2	64	10 1/4	41
	50	12	2.07	0.55	10.0	655	1555	127	13 1/2	20	12	68	12 3/4	44
	50	16	2.77	0.98	*	491	656	95	16	22	14 1/2	74	15 1/4	48
	50	20	3.46	1.53	*	393	336	76	18 1/2	24	17	82	17 3/4	53
8″ Effective Area 69 in.²	150	4	0.47	0.04	5.8	4329	91322	830	8 1/2	16	7	61	7 3/4	39
	150	8	0.95	0.17	10.0	2165	11415	415	11	19	9 1/2	64	10 1/4	41
	150	12	1.42	0.38	10.0	1443	3382	277	13 1/2	21	12	69	12 3/4	45
	150	16	1.90	0.67	10.0	1082	1427	208	16	23	14 1/2	76	15 1/4	49
	150	20	2.39	1.07	*	1305	1087	247	18 1/2	31	17	99	17 3/4	65
8″ Effective Area 69 in.²	300	4	0.34	0.03	4.1	10262	216468	1968	8 1/2	17	5 1/2	117	7	67
	300	8	0.68	0.12	8.3	5131	27058	984	11	20	8	121	9 1/2	71
	300	12	1.01	0.27	10.0	3421	8017	656	13 1/2	23	10 1/2	128	12	75
	300	16	1.35	0.48	10.0	2566	3382	492	16	26	13	137	14 1/2	81
	300	20	1.69	0.75	10.0	2052	1732	394	18 1/2	29	15 1/2	149	17	89

*Movements shown are nonconcurrent.

MID-CORR: STYLE HMCS (CONTINUED)

Nominal Diameter (In.)	Press (PSIG)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lb/Deg)	WW OAL (In.)	WW Wt. (Lbs.)	FF/VV OAL (In.)	FF/VV Wt. (Lbs.)	FW/VW OAL (In.)	FW/VW Wt. (Lbs.)
10″ Effective Area 109 in.²	50	4	0.98	0.10	9.6	2067	35133	626	9 1/2	24	9	87	9 1/4	56
	50	8	1.97	0.39	10.0	1034	4392	313	13	28	12 1/2	91	12 3/4	60
	50	12	2.95	0.88	10.0	689	1301	209	16 1/2	31	16	98	16 1/4	65
	50	16	3.94	1.56	*	517	549	156	20	35	19 1/2	108	19 3/4	71
	50	20	5.04	2.51	10.0	639	428	191	23 1/2	49	23	139	23 1/4	94
10″ Effective Area 110 in.²	150	4	0.62	0.06	6.1	5927	99661	1776	9 1/2	25	9	88	9 1/4	56
	150	8	1.24	0.25	10.0	2963	12458	888	13	30	12 1/2	93	12 3/4	61
	150	12	1.86	0.55	10.0	1976	3691	592	16 1/2	34	16	102	16 1/4	68
	150	16	2.48	0.99	10.0	1482	1557	444	20	39	19 1/2	114	19 3/4	76
	150	20	3.00	1.48	*	1600	1099	490	23 1/2	52	23	146	23 1/4	99
10″ Effective Area 108 in.²	300	4	0.49	0.05	4.8	10510	177675	3166	9 1/2	26	7	164	8 1/4	95
	300	8	0.99	0.20	9.6	5255	22209	1583	13	32	10 1/2	171	11 3/4	102
	300	12	1.48	0.44	10.0	3503	6581	1055	16 1/2	38	14	182	15 1/4	110
	300	16	1.97	0.78	10.0	2627	2776	791	20	44	17 1/2	198	18 3/4	121
	300	20	2.70	1.35	10.0	2619	1752	781	23 1/2	66	21	247	22 1/4	156
12″ Effective Area 154 in.²	50	4	0.98	0.08	8.0	3260	78244	1394	9 1/2	33	9	130	9 1/4	81
	50	8	1.97	0.33	10.0	1630	9781	697	13	40	12 1/2	137	12 3/4	88
	50	12	2.95	0.74	10.0	1087	2898	465	16 1/2	46	16	147	16 1/4	97
	50	16	3.93	1.31	*	815	1223	349	20	53	19 1/2	162	19 3/4	108
	50	20	4.91	2.05	*	652	626	279	23 1/2	60	23	182	23 1/4	121
12″ Effective Area 153 in.²	150	4	0.68	0.06	5.6	7443	177051	3154	9 1/2	34	9	131	9 1/4	82
	150	8	1.36	0.23	10.0	3722	22131	1577	13	42	12 1/2	138	12 3/4	90
	150	12	2.03	0.51	10.0	2481	6557	1051	16 1/2	50	16	151	16 1/4	101
	150	16	2.71	0.91	10.0	1861	2766	789	20	59	19 1/2	169	19 3/4	114
	150	20	3.39	1.42	*	1489	1416	631	23 1/2	67	23	192	23 1/4	129
12″ Effective Area 151 in.²	300	4	0.56	0.05	4.6	9558	224309	3996	9 1/2	34	7 1/2	232	8 1/2	133
	300	8	1.12	0.19	9.3	4779	28039	1998	13	41	11	240	12	140
	300	12	1.68	0.43	10.0	3186	8308	1332	16 1/2	49	14 1/2	252	15 1/2	150
	300	16	2.38	0.81	10.0	3213	4648	1325	20	71	18	287	19	179
	300	20	2.98	1.26	10.0	2570	2380	1060	23 1/2	83	21 1/2	319	22 1/2	201
14″ Effective Area 177 in.²	50	4	0.95	0.07	7.3	2720	75249	1341	9 1/2	36	6	89	7 3/4	63
	50	8	1.91	0.30	10.0	1360	9406	670	13	41	9 1/2	93	11 1/4	67
	50	12	2.86	0.67	10.0	907	2787	447	16 1/2	46	13	100	14 3/4	73
	50	16	3.81	1.18	*	680	1176	335	20	51	16 1/2	110	18 1/4	80
	50	20	4.77	1.85	*	544	602	268	23 1/2	55	20	122	21 3/4	89
14″ Effective Area 182 in.²	150	4	0.70	0.05	5.3	7582	215017	3831	9 1/2	41	6	183	7 3/4	112
	150	8	1.41	0.22	10.0	3791	26877	1915	13	50	9 1/2	190	11 1/4	120
	150	12	2.11	0.49	10.0	2527	7964	1277	16 1/2	60	13	204	14 3/4	132
	150	16	2.81	0.86	10.0	1895	3360	958	20	69	16 1/2	222	18 1/4	145
	150	20	3.52	1.35	*	1516	1720	766	23 1/2	78	20	246	21 3/4	162
14″ Effective Area 180 in.²	300	4	0.58	0.04	4.4	9669	270853	4826	9 1/2	40	7 1/2	332	8 1/2	186
	300	8	1.16	0.18	8.8	4835	33857	2413	13	49	11	340	12	194
	300	12	1.74	0.40	10.0	3223	10032	1609	16 1/2	58	14 1/2	352	15 1/2	205
	300	16	2.49	0.77	10.0	3224	5574	1589	20	83	18	389	19	236
	300	20	3.11	1.21	10.0	2579	2854	1271	23 1/2	95	21 1/2	421	22 1/2	258
16″ Effective Area 229 in.²	50	4	1.04	0.07	7.0	2612	93453	1665	9 1/2	41	6	117	7 3/4	79
	50	8	2.08	0.28	10.0	1306	11682	833	13	47	9 1/2	122	11 1/4	84
	50	12	3.12	0.64	10.0	871	3461	555	16 1/2	53	13	129	14 3/4	91
	50	16	4.16	1.13	*	653	1460	416	20	59	16 1/2	139	18 1/4	99
	50	20	5.20	1.77	*	522	748	333	23 1/2	64	20	152	21 3/4	108
16″ Effective Area 234 in.²	150	4	0.73	0.05	4.8	8064	293825	5235	9 1/2	47	6	199	7 3/4	123
	150	8	1.45	0.20	9.6	4032	36728	2618	13	58	9 1/2	207	11 1/4	132
	150	12	2.18	0.44	10.0	2688	10882	1745	16 1/2	68	13	220	14 3/4	144
	150	16	2.90	0.79	10.0	2016	4591	1309	20	79	16 1/2	239	18 1/4	159
	150	20	3.63	1.23	10.0	1613	2351	1047	23 1/2	90	20	263	21 3/4	176
16″ Effective Area 231 in.²	300	4	0.60	0.04	4.0	10217	368226	6561	9 1/2	46	8	383	8 3/4	214
	300	8	1.20	0.16	8.0	5108	46028	3280	13	56	11 1/2	390	12 1/4	223
	300	12	1.80	0.37	10.0	3406	13638	2187	16 1/2	66	16	403	15 3/4	234
	300	16	2.59	0.71	10.0	3380	7531	2147	20	95	18 1/2	440	19 1/4	268
	300	20	3.24	1.11	10.0	2704	3856	1717	23 1/2	110	22	474	22 3/4	292

*Movements shown are nonconcurrent.

MID-CORR: STYLE HMCS (CONTINUED)

Nominal Diameter (In.)	Press (PSIG)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lb/Deg)	WW OAL (In.)	WW Wt. (Lbs.)	FF/VV OAL (In.)	FF/VV Wt. (Lbs.)	FW/VW OAL (In.)	FW/VW Wt. (Lbs.)
18″ Effective Area 287 in.²	50	4	1.08	0.07	6.5	2708	121273	2161	9 1/2	46	6 1/2	119	8	83
	50	8	2.16	0.26	10.0	1354	15159	1080	13	53	10	124	11 1/2	88
	50	12	3.24	0.59	10.0	903	4492	720	16 1/2	60	13 1/2	131	15	95
	50	16	4.32	1.05	10.0	677	1895	540	20	66	17	142	18 1/2	104
	50	20	5.40	1.65	*	542	970	432	23 1/2	73	20 1/2	155	22	114
18″ Effective Area 294 in.²	150	4	0.81	0.05	4.8	7314	335135	5971	9 1/2	53	10	263	9 3/4	158
	150	8	1.63	0.20	9.6	3657	41892	2986	13	66	13 1/2	273	13 1/4	170
	150	12	2.44	0.44	10.0	2438	12412	1990	16 1/2	79	17	290	16 3/4	184
	150	16	3.25	0.78	10.0	1829	5236	1493	20	92	20 1/2	312	20 1/4	202
	150	20	4.07	1.23	10.0	1463	2681	1194	23 1/2	105	24	339	23 3/4	222
18″ Effective Area 295 in.²	300	4	0.79	0.05	4.6	13643	627118	11173	9 1/2	67	8 1/2	506	9	286
	300	8	1.57	0.19	9.3	6822	78390	5587	13	93	12	523	12 1/2	308
	300	12	2.36	0.43	10.0	4548	23227	3724	16 1/2	119	15 1/2	552	16	336
	300	16	3.14	0.76	10.0	3411	9799	2793	20	145	19	593	19 1/2	369
	300	20	3.93	1.18	10.0	2729	5017	2235	23 1/2	171	22 1/2	645	23	408
20″ Effective Area 352 in.²	50	4	1.12	0.06	6.1	2777	152215	2712	9 1/2	51	6 1/2	140	8	95
	50	8	2.24	0.25	10.0	1389	19027	1356	13	59	10	144	11 1/2	101
	50	12	3.36	0.56	10.0	926	5638	904	16 1/2	66	13 1/2	152	15	109
	50	16	4.49	0.99	10.0	694	2378	678	20	74	17	162	18 1/2	118
	50	20	5.61	1.55	*	555	1218	542	23 1/2	82	20 1/2	176	22	129
20″ Effective Area 359 in.²	150	4	0.84	0.05	4.5	7606	425551	7582	9 1/2	59	10	333	9 3/4	196
	150	8	1.68	0.18	9.0	3803	53194	3791	13	74	13 1/2	342	13 1/4	208
	150	12	2.52	0.41	10.0	2535	15761	2527	16 1/2	88	17	356	16 3/4	222
	150	16	3.36	0.73	10.0	1902	6649	1896	20	103	20 1/2	376	20 1/4	240
	150	20	4.20	1.15	10.0	1521	3404	1516	23 1/2	117	24	403	23 3/4	260
20″ Effective Area 361 in.²	300	4	0.84	0.05	4.5	13294	748115	13329	9 1/2	90	8 1/2	636	9	363
	300	8	1.69	0.18	9.0	6647	93514	6665	13	120	12	654	12 1/2	387
	300	12	2.53	0.41	10.0	4431	27708	4443	16 1/2	150	15 1/2	684	16	417
	300	16	3.38	0.73	10.0	3324	11689	3332	20	180	19	726	19 1/2	453
	300	20	4.22	1.15	10.0	2659	5985	2666	23 1/2	210	22 1/2	781	23	495
22″ Effective Area 422 in.²	50	4	1.16	0.06	5.7	2825	186005	3314	9 1/2	56	6 1/2	154	8	105
	50	8	2.32	0.23	10.0	1413	23251	1657	13	65	10	158	11 1/2	112
	50	12	3.48	0.53	10.0	942	6889	1105	16 1/2	73	13 1/2	166	15	120
	50	16	4.64	0.93	10.0	706	2906	829	20	82	17	177	18 1/2	129
	50	20	5.80	1.46	*	565	1488	663	23 1/2	90	20 1/2	190	22	140
22″ Effective Area 429 in.²	150	4	0.84	0.04	4.1	8392	561448	10003	9 1/2	65	10	373	9 3/4	219
	150	8	1.67	0.17	8.2	4196	70181	5002	13	81	13 1/2	382	13 1/4	231
	150	12	2.51	0.38	10.0	2797	20794	3334	16 1/2	97	17	396	16 3/4	246
	150	16	3.34	0.67	10.0	2098	8773	2501	20	113	20 1/2	416	20 1/4	264
	150	20	4.18	1.04	10.0	1678	4492	2001	23 1/2	129	24	443	23 3/4	286
22″ Effective Area 431 in.²	300	4	0.84	0.04	4.1	14668	986650	17579	9 1/2	98	9	746	9 1/4	422
	300	8	1.68	0.17	8.2	7334	123331	8790	13	131	12 1/2	764	12 3/4	448
	300	12	2.52	0.38	10.0	4889	36543	5860	16 1/2	164	16	794	16 1/4	479
	300	16	3.36	0.67	10.0	3667	15416	4395	20	198	19 1/2	836	19 3/4	517
	300	20	4.20	1.04	10.0	2934	7893	3516	23 1/2	231	23	891	23 1/4	561
24″ Effective Area 501 in.²	50	4	1.26	0.06	5.7	2645	206485	3679	9 1/2	62	6 1/2	232	8	147
	50	8	2.51	0.23	10.0	1322	25811	1839	13	72	10	236	11 1/2	154
	50	12	3.77	0.52	10.0	882	7648	1226	16 1/2	81	13 1/2	244	15	163
	50	16	5.02	0.93	10.0	661	3226	920	20	91	17	256	18 1/2	173
	50	20	6.28	1.45	*	529	1652	736	23 1/2	100	20 1/2	270	22	185
24″ Effective Area 506 in.²	150	4	0.83	0.04	3.8	9177	723559	12892	9 1/2	70	6 1/2	443	8	257
	150	8	1.66	0.15	7.5	4589	90445	6446	13	88	10	452	11 1/2	270
	150	12	2.50	0.34	10.0	3059	26798	4297	16 1/2	105	13 1/2	466	15	286
	150	16	3.33	0.61	10.0	2294	11306	3223	20	122	17	486	18 1/2	304
	150	20	4.16	0.96	10.0	1835	5788	2578	23 1/2	140	20 1/2	513	22	326
24″ Effective Area 508 in.²	300	4	0.84	0.04	3.8	16043	1271132	22648	9 1/2	106	9	956	9 1/4	531
	300	8	1.67	0.15	7.5	8022	158892	11324	13	143	12 1/2	974	12 3/4	558
	300	12	2.51	0.34	10.0	5348	47079	7549	16 1/2	179	16	1004	16 1/4	592
	300	16	3.34	0.61	10.0	4011	19861	5662	20	215	19 1/2	1046	19 3/4	631
	300	20	4.18	0.96	10.0	3209	10169	4530	23 1/2	251	23	1101	23 1/4	676

*Movements shown are nonconcurrent.

FREE FLEXING EXPANSION JOINTS

Senior Flexonics Pathway 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 vanstone flanges or welding ends attached.

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

How to order:
Example P/N

DIA	STYLE	ENDS	PRESSURE	CONS	LINER	COVER
6	HFF	VV	50	8	L	C

FREE FLEXING DATA

	SINGLE
Size Range	3" to 16"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 50 psi
Temperature Limits Stainless Steel Bellows	-20°F to 800°F. **
Axial Traverse	To 7 1/2". . . (depending on size)
Lateral Motion	Up to 1 3/4". . . (depending on size)

*For sizes larger than 16" 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 T304
- PIPE: ASTM A53/A106
  50 lb. Series: Sch. 40
  150 lb. Series: Sch. 40
  300 lb. Series: Sch. 40
- FLANGES: A36/A516-70 Plate (Std)
  ASTM A105 (Opt)
  50 lb. Series: 150 lb. ANSI B16.5 F.F.S.O.
  150 lb. Series: 150 lb. ANSI B16.5 F.F.S.O.
  300 lb. Series: 300 lb. ANSI B16.5 F.F.S.O.
- COVERS: Carbon Steel
- TIE RODS: Carbon Steel
- LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any one movement tabulated.
2. To combine axial, lateral movements, refer to page 6.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalog 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 HFF

Nominal Diameter (In.)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lb/Deg.)	VV OAL in.	VV Wt. #	WW OAL in.	WW Wt. #
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

*Movements shown are nonconcurrent.

50 PSIG FREE FLEXING: STYLE HFF (CONTINUED)

Nominal Diameter (In.)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lb/Deg.)	VV OAL in.	VV Wt. #	WW OAL in.	WW Wt. #
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
14″ Effective Area 206 in.²	2	1.60	.07	10	1352	27285	803	11	189	17 1/2	65
	4	3.20	.29	10	676	3410	401	15 1/2	196	22	74
	6	4.80	.65	10	451	1010	267	20	204	26 1/2	84
	8	5.84	1.06	10	644	812	383	24 1/2	212	31	93
	10	7.30	1.66	10	515	416	306	29	220	35 1/2	102
16″ Effective Area 261 in.²	2	1.66	.07	10	1561	39578	1165	11 1/2	206	17 1/2	76
	4	3.32	.27	10	780	4947	582	16	213	22	87
	6	4.98	.61	10	520	1465	388	20 1/2	223	26 1/2	97
	8	5.98	.97	10	744	1179	555	25	234	31	107
	10	7.48	1.52	10	595	603	444	29 1/2	240	35 1/2	118
18″ Effective Area 322 in.²	2	1.71	.06	9.59	1769	55088	1622	12	271	17 1/2	86
	4	3.42	.25	10	884	6886	811	16 1/2	281	22	98
	6	5.13	.56	10	589	2040	540	21	291	26 1/2	110
	8	6.00	.88	10	843	1641	773	25 1/2	301	31	122
	10	7.50	1.37	10	674	840	618	30	311	35 1/2	134

*Movements shown are nonconcurrent.

CONTROL FLEXING EXPANSION JOINTS

Senior Flexonics Pathway Control 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 pressure (150 psi).

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

CONTROLLED-FLEXING DATA

	SINGLE
Size Range	3" to 16"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 300 psi
Temperature Limits Stainless Steel Bellows	-20°F to 800°F. **
Axial Traverse	To 7 1/2". . . (depending on size)
Lateral Motion	Up to 1 1/2". . . (depending on size)

*For sizes larger than 16" 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

DIA	STYLE	ENDS	PRESSURE	CONS	LINER	COVER
8	HCF	FF	300	6	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: A36/A516-70 Plate (Std)
  ASTM A105 (Opt)
  50 lb. Series: 150 lb. ANSI B16.5 F.F.S.O.
  150 lb. Series: 150 lb. ANSI B16.5 F.F.S.O.
  300 lb. Series: 300 lb. ANSI B16.5 F.F.S.O.
- COVERS: Carbon Steel
- TIE RODS: Carbon Steel
- LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any one movement tabulated.
2. To combine axial, lateral movements, refer to page 6.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalog 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 HCF

Nominal Diameter (In.)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lbs/Deg.)	VV OAL in.	VV Wt. #	FF OAL in.	FF Wt. #	WW OAL in.	WW Wt. #
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

*Movements shown are nonconcurrent.

150 PSIG CONTROLLED-FLEXING: STYLE HCF (CONTINUED)

Nominal Diameter (In.)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lbs/Deg.)	VV OAL in.	VV Wt. #	FF OAL in.	FF Wt. #	WW OAL in.	WW Wt. #
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
14″ Effective Area 206 in.²	2	1.50	.04	8.19	3727	60809	2211	12	302	14	366	21 3/8	231
	4	3.00	.15	10	1863	7601	1105	17	432	19	496	26 3/8	361
	6	4.50	.34	10	1242	2252	737	22	562	24	626	31 3/8	491
	8	6.00	.61	10	1776	1811	1053	27	692	29	756	36 3/8	621
	10	7.50	.96	10	1421	927	843	32	822	34	885	41 3/8	751
16″ Effective Area 261 in.²	2	1.50	.03	7.24	4286	87934	3197	11 3/4	376	14 1/4	416	21 1/8	272
	4	3.00	.14	10	2143	10991	1598	16 3/4	528	19 1/4	568	26 1/8	424
	6	4.50	.31	10	1428	3256	1065	21 3/4	680	24 1/4	720	31 1/8	576
	8	6.00	.54	10	2043	2619	1524	26 3/4	832	29 1/4	872	36 1/8	728
	10	7.50	.85	10	1634	1341	1219	31 3/4	984	34 1/4	1024	41 1/8	880
18″ Effective Area 322 in.²	2	1.50	.03	6.81	4847	122102	4439	12 3/8	449	14 3/4	514	21 1/4	338
	4	3.00	.12	10	2423	15262	2219	17 3/8	617	19 3/4	682	26 1/4	506
	6	4.50	.28	10	1615	4522	1479	22 3/8	785	24 3/4	850	31 1/4	674
	8	6.00	.49	10	2310	3637	2116	27 3/8	953	29 3/4	1018	36 1/4	842
	10	7.50	.77	10	1848	1862	1692	32 3/8	1121	34 3/4	1186	41 1/4	1010

*Movements shown are nonconcurrent.

300 PSIG CONTROLLED-FLEXING: STYLE HCF (CONTINUED)

Nominal Diameter (In.)	Con. Count	Axial (In.)	Lateral (In.)	Angular (Deg.)	Axial Sp Rate (Lbs/In.)	Lateral Sp Rate (Lbs/In.)	Angular Sp Rate (In.-Lbs/Deg.)	VV OAL in.	VV Wt. #	FF OAL in.	FF Wt. #	WW OAL in.	WW Wt. #
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

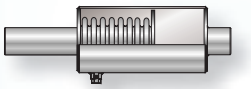
*Movements shown are nonconcurrent.

SINGLE & DOUBLE EXTERNALLY PRESSURIZED EXPANSION JOINTS

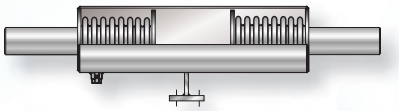
Externally pressurized expansion joints are ideal for large axial movement applications.

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.

The 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.



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)

SX AND DX DATA

	SINGLE
Size Range	2" to 12"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 300 psi
Temperature Limits Stainless Steel Bellows	-20°F to 800°F. **
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.

How to order:
Example P/N

DIA	STYLE	ENDS	PRESSURE	TRAVEL
2	HSX	FF	150	4

150 AND 300 PSIG DESIGNS AVAILABLE

SIZE	Single (SERIES SX)					Double (Series NDX)					Effective Area in.²	Shell O.D. in.	Anchor Hgt. in.
	Axial Move	FF OAL	Wt.	WW OAL	Wt.	Axial Move	FF OAL	Wt.	WW OAL	Wt.			
2	4	27	75	26	65	8	53	142	52	135	16	6 5/8	7 5/16
2 1/2	4	27	86	26	72	8	53	164	52	149	16	6 5/8	7 5/16
	8	47	106	46	92	16	93	198	92	184			
3	4	27	96	26	80	8	53	184	52	165	16	6 5/8	7 5/16
	8	47	109	46	93	16	93	202	92	186			
4	4	27	160	26	134	8	53	284	52	277	35	8 5/8	8 5/16
	8	47	236	46	210	16	93	417	92	434			
5	4	27	173	26	143	8	53	306	52	296	35	10 3/4	9 3/8
	8	47	260	46	230	16	93	459	92	474			
6	4	27	194	26	154	8	53	343	52	319	54	10 3/4	9 3/8
	8	47	277	46	237	16	93	491	92	490			
8	4	29	345	28	285	8	57	611	56	588	88	12 3/4	10 3/8
	8	49	498	48	438	16	97	882	96	905			
10	4	29	395	28	307	8	57	699	56	634	118	14	11
	8	49	558	48	472	16	97	987	96	974			
12	4	29	508	28	380	8	57	900	56	784	163	16	12
	8	49	702	48	574	16	97	1242	96	1185			

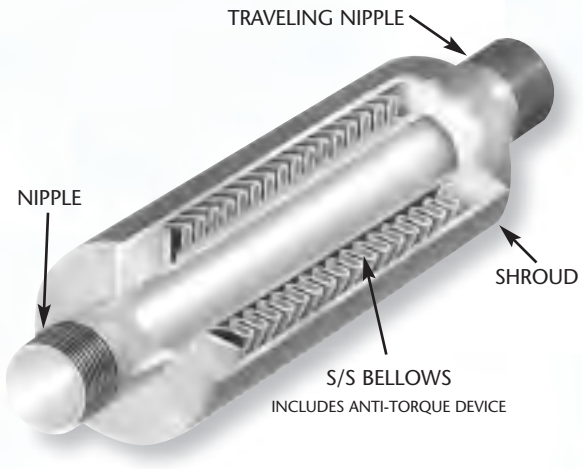
MATERIALS OF CONSTRUCTION

- 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 HDX)
- DRAIN, VENT PORTS
  Carbon Steel

EXPANSION COMPENSATORS

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

Senior Flexonics Pathway 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.



How to order:
Example P/N

DIA	STYLE
1.25	HMT

SPECIFICATIONS: SERIES H

High pressure	Pipe Size	Style	Pressure Max. Wkg.	Pressure Test	Overall Length	Outside Diameter	Axial Sp Rate (lbs./in.)	Effective Area in.^{2}	Weight lbs.
STEEL PIPING SYSTEMS	3/4	HWE	200	300	12 1/8	3	112	2.2	5.5
Stroke-1 3/4" compression; 1/4" extension (Total stroke 2")	3/4	HMT	200	300	12 1/8	3	112	2.2	5.5
Maximum Operating Temperature - 750° F.	1	HWE	200	300	12 1/8	3 1/2	148	3.5	7.0
Maximum Working Pressure - 200 p.s.i.	1	HMT	200	300	12 1/8	3 1/2	148	3.5	7.0
Maximum Test Pressure - 300 p.s.i.	1 1/4	HWE	200	300	14 1/8	4	165	4.8	10.2
Fittings-Weld Ends (WE)	1 1/4	HMT	200	300	14 1/8	4	165	4.8	10.2
Fittings-Male Thread Ends (MT)	1 1/2	HMT	200	300	14 1/8	4 1/2	259	6.5	12.3
Stainless steel bellows,	1 1/2	HWE	200	300	14 1/8	4 1/2	259	6.5	12.3
Steel shroud and fittings	2	HWE	200	300	14 1/8	4 1/2	266	7.6	13.2
	2	HMT	200	300	14 1/8	4 1/2	266	7.6	13.2
	2 1/2	HWE	200	300	15 1/2	5 1/2	358	12.9	19.6
	2 1/2	HMT	200	300	15 1/2	5 1/2	358	12.9	19.6
	3	HWE	200	300	15 3/16	6 1/2	409	16.1	24.4
	3	HMT	200	300	15 3/16	6 1/2	409	16.1	24.4
	4	HWE	200	300	15 3/16	7 3/32	494	24.2	27.5
	4	HMT	200	300	15 3/16	7 3/32	494	24.2	27.5
COPPER PIPING SYSTEMS	3/4	HFS	200	300	12 1/2	2 3/8	122	2.2	2.2
Stroke-1 3/4" compression; 1/4" extension (Total stroke 2")	1	HFS	200	300	12 1/2	2 3/8	122	2.2	2.4
Maximum Operating Temperature - 400° F.	1 1/4	HFS	200	300	13 13/16	2 3/4	161	3.5	3.1
Maximum Working Pressure - 200 p.s.i.	1 1/2	HFS	200	300	13 13/16	2 3/4	161	3.5	3.3
Maximum Test Pressure - 300 p.s.i.	2	HFS	200	300	13 13/16	3 3/4	270	6.5	5.5
Fittings-Copper Female Sweat Ends (FS)	2 1/2	HFS	200	300	14 7/16	4 3/8	348	9.6	7.5
Stainless steel bellows and shroud	3	HFS	200	300	14 7/16	5	399	12.9	10.0

CAUTION: Manufacturing process utilizes silver brazing. Do not exceed 1,000°F. during installation.
*The three-letter suffix HMT indicates Male Pipe Thread Ends. For other end fittings, substitute the following: Female Sweat Ends, HFS; Weld Ends, HWE.
NOTE: Stainless steel components should not be used in systems containing excessive chlorides. Premature failure may result.

PR/SVC ENGINEERING & INSTALLATION DATA

Steam, particularly under pressure, is one of our most useful tools. To help keep it under control — to prevent overpressurization and potential serious accidents and costly damage — there are many respected pressure relief valves available in today's marketplace. But, after the relief valve operates, what of the pressurized steam as venting occurs?

This is where our pressure relief/safety valve connectors offer you an efficient, reliable answer... 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.

Wide Choice ... Easy To Order

The Senior Flexonics Pathway pressure relief/safety valve connectors are available in 164 different models and may be ordered for quick delivery by catalog model number. 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 also be supplied as required.)

Design Motions

Senior Flexonics Pathway pressure relief/safety valve connectors have been designed to handle two types of motion, axial and lateral. The axial motion (Y axis, 1 1/2" to 6") is the total of the vertical downward vent stack growth and the vertical upward header/vessel growth. Lateral motion (X and Z axis, ± 3/4" to ± 2 1/2") is the resultant of anticipated horizontal movements from the true vertical centerline of the connector.

Pre-set To Increase Lateral Movement

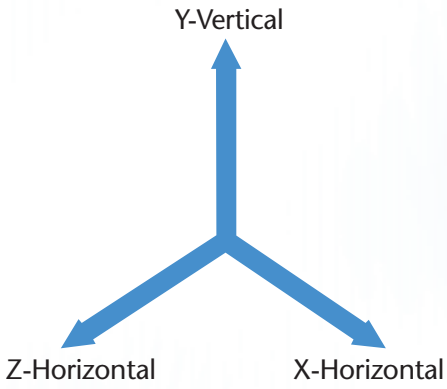
If the resultant horizontal movements exceed those indicated (in parentheses, above), Senior Flexonics Pathway connectors can be pre-set up to 100 percent of the rated movement to increase lateral movement capability. For example, connectors having ± 1" lateral motion and pre-set 1/2", will provide units with a motion range from minus 1/2" to plus 1 1/2". Axial and lateral spring forces can also be calculated from the design data given on pages 10 through 32. It is determined as follows:

Example: SVC-0612-100-600

Axial Motion	(Y axis)	-3.125"
Lateral Motion	(X axis)	-1.75"
	(Z axis)	-.625"

X plus Z Resultant — 1.858" Formula: $\sqrt{X^2 + Z^2}$

Axial Force:	Y Axis:	58 lb/in x 3.125 = 181.25 lbs.
Lateral Force	X Axis:	18 lb/in x 1.75 = 31.5 lbs.
	Z Axis:	18 lb/in x .625 = 11.25 lbs.
	(X + Z):	18 lbs/in x 1.858 = 33.4 lbs.

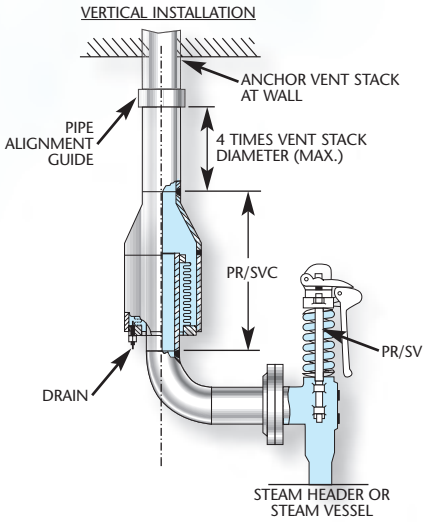


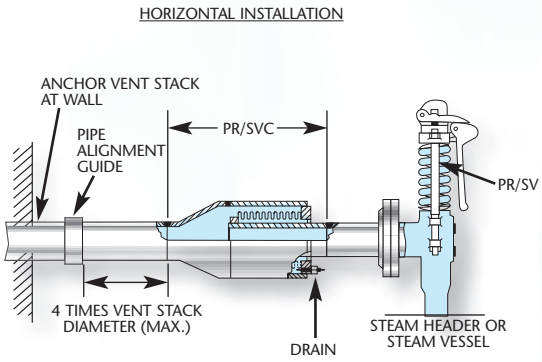
Installation and Anchoring

As shown on the next page, Senior Flexonics Pathway connectors are installed on top of the outlet elbow of the pressure relief/safety valve (base of the exhaust vent stack).

Many pipe-related failures involving connectors and expansion joints are caused by improper anchoring. If the vent stack should be anchored at the building roof or to a supporting structure the anchors must be designed to withstand the bellows-generated pressure thrust, spring forces and guiding friction forces. See Pressure Thrust page 5. Other sizes and pressures available.

PRESSURE RELIEF/ SAFETY VALVE CONNECTORS





DATA SHEETS: SERIES SVC

Nominal Diameter (In.)	Press (PSIG)	Part Number	Vent Stack Size	Motion Series	Overall Length in.	Weight lbs.	Max. O.D. in.	Axial Motion in.	Lateral Motion in.	Axial Sp Rate lbs./in.	Lateral Sp Rate lbs./in.	Effective Area in.^{2}
2″	100	SVC-0225-100-150	2 1/2	150	26.25	72	8.62	1 1/2	±3/4	78	14	19.0
		SVC-0225-100-400	2 1/2	400	48.25	240	14.00	4	±2	65	9	44.5
		SVC-0203-100-150	3	150	26.25	72	8.62	1 1/2	±3/4	78	14	19.0
		SVC-0203-100-400	3	400	48.25	240	14.00	4	±2	65	9	44.5
		SVC-0204-100-150	4	150	26.25	72	8.62	1 1/2	±3/4	78	14	19.0
		SVC-0204-100-400	4	400	48.25	240	14.00	4	±2	65	9	44.5
		SVC-0205-100-150	5	150	26.25	72	8.62	1 1/2	±3/4	78	14	19.0
		SVC-0205-100-400	5	400	48.25	240	14.00	4	±2	65	9	44.5
		SVC-0206-100-150	6	150	26.25	72	8.62	1 1/2	±3/4	78	14	19.0
		SVC-0206-100-400	6	400	48.25	240	14.00	4	±2	65	9	44.5
2 1/2″	100	SVC-2503-100-200	3	200	29.75	115	10.75	2	±1	84	19	29.0
		SVC-2503-100-600	3	600	59.75	350	16.00	6	±2 1/2	49	6	57.5
		SVC-2504-100-200	4	200	29.75	115	10.75	2	±1	84	19	29.0
		SVC-2504-100-600	4	600	59.75	350	16.00	6	±2 1/2	49	6	57.5
		SVC-2505-100-200	5	200	29.75	115	10.75	2	±1	84	19	29.0
		SVC-2505-100-600	5	600	59.75	350	16.00	6	±2 1/2	49	6	57.5
		SVC-2506-100-200	6	200	29.75	115	10.75	2	±1	84	19	29.0
		SVC-2506-100-600	6	600	59.75	350	16.00	6	±2 1/2	49	6	57.5
3″	100	SVC-0305-100-200	5	200	28.0	135	12.75	2	±1	63	26	41
		SVC-0305-100-600	5	600	61.0	400	18.00	6	±2 1/2	39	6	76
		SVC-0306-100-200	6	200	28.0	135	12.75	2	±1	63	26	41
		SVC-0306-100-600	6	600	61.0	400	18.00	6	±2 1/2	39	6	76
		SVC-0308-100-200	8	200	28.0	135	12.75	2	±1	63	26	41
		SVC-0308-100-600	8	600	61.0	400	18.00	6	±2 1/2	39	6	76
		SVC-0310-100-200	10	200	28.0	135	12.75	2	±1	63	26	41
		SVC-0310-100-600	10	600	61.0	400	18.00	6	±2 1/2	39	6	76

*Movements shown are nonconcurrent.

DATA SHEETS: SERIES SVC (CONTINUED)

Nominal Diameter (In.)	Press (PSIG)	Part Number	Vent Stack Size	Motion Series	Overall Length in.	Weight lbs.	Max. O.D. in.	Axial Motion in.	Lateral Motion in.	Axial Sp Rate lbs./in.	Lateral Sp Rate lbs./in.	Effective Area in.^{2}
4″	100	SVC-0406-100-200	6	200	33.5	170	14.0	2	±1	106	63	65
		SVC-0406-100-600	6	600	64.5	465	20.0	6	±2 1/2	35	8	105
		SVC-0408-100-200	8	200	33.5	170	14.0	2	±1	106	63	65
		SVC-0408-100-600	8	600	64.5	465	20.0	6	±2 1/2	35	8	105
		SVC-0410-100-200	10	200	33.5	170	14.0	2	±1	106	63	65
		SVC-0410-100-600	10	600	64.5	465	20.0	6	±2 1/2	35	8	105
		SVC-0412-100-200	12	200	33.5	170	14.0	2	±1	106	63	65
		SVC-0412-100-600	12	600	64.5	465	20.0	6	±2 1/2	35	8	105
		SVC-0414-100-200	14	200	34.5	200	16.0	2	±1	106	63	65
		SVC-0414-100-600	14	600	64.5	465	20.0	6	±2 1/2	35	8	105
6″	100	SVC-0610-100-200	10	200	35.50	235	16.0	2	±1	71	60	105
		SVC-0610-100-600	10	600	63.75	550	22.0	6	±2 1/2	58	18	143
		SVC-0612-100-200	12	200	35.50	235	16.0	2	±1	71	60	105
		SVC-0612-100-600	12	600	63.75	550	22.0	6	±2 1/2	58	18	143
		SVC-0614-100-200	14	200	35.50	235	16.0	2	±1	71	60	105
		SVC-0614-100-600	14	600	63.75	550	22.0	6	±2 1/2	58	18	143
		SVC-0616-100-200	16	200	36.50	265	18.0	2	±1	71	60	105
		SVC-0616-100-600	16	600	63.75	550	22.0	6	±2 1/2	58	18	143
8″	100	SVC-0812-100-200	12	200	35.75	275	18.0	2	±1	116	145	143
		SVC-0812-100-600	12	600	74.00	740	24.0	6	±2 1/2	74	17	195
		SVC-0814-100-200	14	200	35.75	275	18.0	2	±1	116	145	143
		SVC-0814-100-600	14	600	74.00	740	24.0	6	±2 1/2	74	17	195
		SVC-0816-100-200	16	200	35.75	275	18.0	2	±1	116	145	143
		SVC-0816-100-600	16	600	74.00	740	24.0	6	±2 1/2	74	17	195
		SVC-0818-100-200	18	200	40.75	335	20.0	2	±1	116	145	143
		SVC-0818-100-600	18	600	74.00	740	24.0	6	±2 1/2	74	17	195
		SVC-0820-100-200	20	200	40.75	365	22.0	2	±1	116	145	143
		SVC-0820-100-600	20	600	74.00	740	24.0	6	±2 1/2	74	17	195
10″	100	SVC-1014-100-200	14	200	44.0	400	20.0	2	±1	150	35	174
		SVC-1014-100-600	14	600	74.0	795	24.0	6	±2 1/2	53	14	224
		SVC-1016-100-200	16	200	44.0	400	20.0	2	±1	150	35	174
		SVC-1016-100-600	16	600	74.0	795	24.0	6	±2 1/2	53	14	224
		SVC-1018-100-200	18	200	44.0	400	20.0	2	±1	150	35	174
		SVC-1018-100-600	18	600	74.0	795	24.0	6	±2 1/2	53	14	224
		SVC-1020-100-200	20	200	44.0	435	22.0	2	±1	150	35	174
		SVC-1020-100-600	20	600	74.0	795	24.0	6	±2 1/2	53	14	224
		SVC-1024-100-200	24	200	48.0	540	26.0	2	±1	150	35	174
		SVC-1024-100-600	24	600	78.0	880	26.0	6	±2 1/2	53	14	224

*Movements shown are nonconcurrent.

FLEXIBLE METAL PUMP CONNECTORS

WHY USE SENIOR FLEXONICS PATHWAY 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 Pathway pump connectors are a perfect match of style, wall thickness and design to minimize the forces and stress within piping systems. These 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 Pathway can help you comply with noise level requirements by reducing pipe vibration throughout a structure.

DESIGN CHARACTERISTICS:

HPC Connectors — Stainless Steel 300 Series Multiply Bellows with C-STL Flanges and Limit Rods
HPC-R Connectors — Stainless Steel 300 Series Multiply Bellows with C-STL Flanges and Limit Rods and Increased Movement Capacity
Flanges are carbon steel.

FEATURES:

- **Absorbs Thermal Growth Motion**
  Excellent protection to adjacent piping and equipment
- **Compensates for Misalignment**
  Eliminates 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.

SENIOR FLEXONICS PATHWAY PROTECTION MEANS:

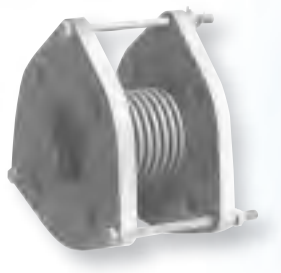
- **Multiply Construction for Improved Flexibility**
- **Longer Service Life**
- **Lower Overall Operating Costs**
- **Years of Trouble-Free Service**

How to order:
Example P/N

DIA	STYLE
2.5	HPC-R

STAINLESS STEEL PUMP CONNECTORS: SERIES HPC

Pipe Size	Style	OAL	Live Length	Fitting Length	Approx. Wt. (Lb.)	Design Data Working Pressure @70 F.	@360 F.	Effective Area in.²
2	HPC	4 3/8	3 1/8	5/8	10 1/2	225	210	6.9
2 1/2	HPC	4 3/8	3 1/8	5/8	14 1/2	225	210	6.9
3	HPC	4 3/8	3 1/8	5/8	16 1/2	225	210	8.8
4	HPC	4 5/8	3 1/8	3/4	26	225	210	15.1
5	HPC	4 7/8	3 3/8	3/4	32	225	210	23.5
6	HPC	5	3 1/2	3/4	37	225	210	33.2
8	HPC	5 7/8	3 7/8	1	65	225	210	59.3
10	HPC	6 1/4	4 1/4	1	86	225	210	93.5
12	HPC	6 5/8	4 5/8	1	112	225	210	134.0
14	HPC	9 1/2	7	1 1/4	183	225	210	171.0
16	HPC	10	7 1/2	1 1/4	217	225	210	220.0



STAINLESS STEEL PUMP CONNECTORS: SERIES HPC-R

Pipe Size	Style	OAL	Live Length	Fitting Length	Approx. Wt. (LB.)	Design Data Working Pressure @70 F.	@360 F.	Effective Area in.²
2	HPC-R	6	4 3/4	5/8	20 1/2	225	210	6.9
2 1/2	HPC-R	6	4 3/4	5/8	24	225	210	6.9
3	HPC-R	6	4 3/4	5/8	25	225	210	8.8
4	HPC-R	6	4 1/2	3/4	35	225	210	15.1
5	HPC-R	6	4 1/2	3/4	38	225	210	23.5
6	HPC-R	6	4 1/2	3/4	41 1/2	225	210	33.2
8	HPC-R	6	4	1	68	225	210	59.3
10	HPC-R	8	6	1	118	225	210	93.5
12	HPC-R	8	6	1	147	225	210	134.0
14	HPC-R	8	5 1/2	1 1/4	205	225	210	171.0
16	HPC-R	8	5 1/2	1 1/4	233	225	210	220.0
18	HPC-R	8	5 1/2	1 1/4	234	225	210	279.0
20	HPC-R	8	5	1 1/2	312	225	210	342.0
24	HPC-R	10	7	1 1/2	380	225	210	493.0

NOTE: Model HPC rated for 1/2" compression, 1/8" lateral & pump vibration.
Model HPC-R rated for 1" compression, 3/8" extension, 1/8" - 5/16" lateral and pump vibration.
(Depending on size.)

NON-METALLIC EXPANSION JOINTS

Specify Senior Flexonics Pathway:

Arch Type Connectors (RA): When compression, elongation, lateral or angular movements are a consideration of the installation.

U-Type Connectors (RU): When ONLY vibration or sound limiting characteristics are a consideration of the installation.

Series: RA-PVS Pressure/Vacuum Service. Senior Flexonics Pathway arch type for general service features steel body rings held in place with exclusive ring enveloper system. Can be specified for service in most applications. Also available in U-Type. Series: RU-PVS.

Series: RA-HPGS High Pressure/General Service. A modification of Series RA-PVS with additional body fabric plies for higher pressure service with full vacuum ratings.

Series: RA-HPS High Pressure Service. Engineered for high pressure service. Also available in U-Type. Series: RU-HPS.

Series: RA-VHP Very High Pressure. For extreme pressure applications. Not available in more than two arches. Tapers not available.

Series: RA-LPS Low Pressure Service. For pressures less than 25 PSIG and limited vacuum. Also available in U-Type. Series: RU-LPS

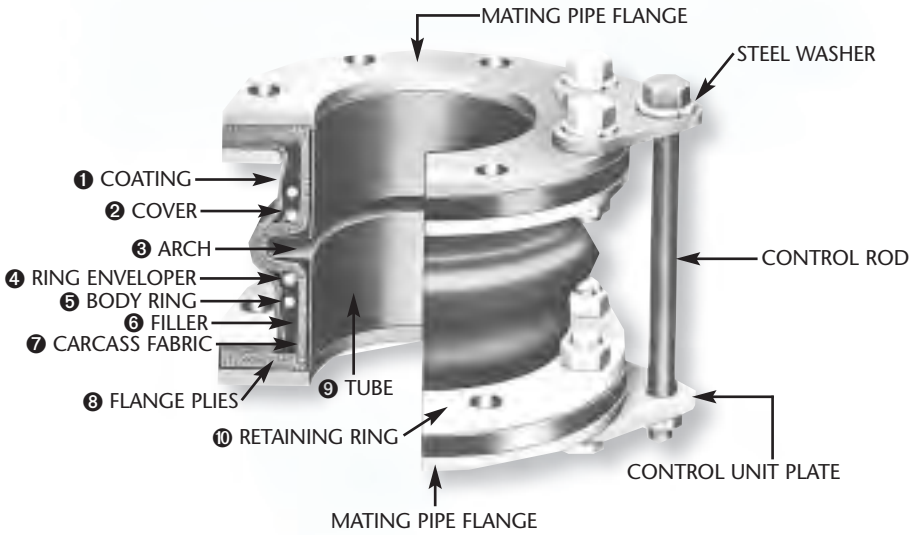
Series: RA-MST I Military Specification. Meets MIL-E-15330D, Class A, Type I and ASTM-F-1123.

Series: RU-MST III meets MIL-E-15330D, Class A, Type III.

ALL STYLES LISTED CONFORM TO U.S. COAST GUARD AND A.B.S. SPECIFICATIONS.

TABLE 1: PRESSURE/VACUUM RATINGS ARCH AND U-TYPE EXPANSION JOINTS.

Archtype / U-Type	RA-VHP / —		RA-HPS / RU-HPS		RA-HPGS / —		RA-PVS / RU-PVS		RA-LPS / RU-LPS	
NOM. Pipe Size - I.D. OF EXP. JT.	Pressure		Pressure		Pressure		Pressure		Pressure	
	Pos. PSG	Neg. HG	Pos. PSG	Neg. HG	Pos. PSG	Neg. HG	Pos. PSG	Neg. HG	Pos. PSG	Neg. HG
1/2 to 3	325	30°	250	30°	210	30°	180	30°	25	15°
3 1/2 to 4	300	30°	250	30°	210	30°	165	30°	25	15°
4 1/2 to 6	300	30°	215	30°	210	30°	155	30°	25	15°
6 1/2 to 10	275	30°	215	30°	210	30°	145	30°	25	15°
11 to 12	250	30°	215	30°	210	30°	140	30°	25	15°
13 to 14	225	15°	150	30°	130	30°	125	30°	25	15°
15 to 16	200	15°	120	30°	110	30°	75	30°	25	15°
17 to 18	200	15°	120	30°	110	30°	75	30°	25	15°
19 to 20	200	15°	120	30°	110	30°	75	30°	25	15°
21 to 24	150	15°	110	30°	110	30°	70	30°	25	15°
25 to 28	110	15°	100	30°	90	30°	60	30°	25	15°
29 to 40	110	15°	95	30°	90	30°	60	30°	25	15°
42 to 48	110	15°	85	15°	80	30°	60	30°	25	15°
50 to 66	100	15°	85	15°	80	30°	60	30°	15	15°
68 to 96	90	15°	75	15°	70	30°	50	30°	15	15°
98 to 108	80	15°	70	15°	70	30°	45	30°	15	15°



Extended Service Life

With Engineered Design, Quality Materials and Workmanship

1. **Cover Coating** of Hypalon for extra product protection against ozone, weather and environment.
2. **Elastomer Cover** selected for resistance to the atmosphere around the product. Choice of natural, neoprene, nitrile, butyl, Hypalon*, EPDM, Viton*, gum and SBR elastomers.
3. **Deep Wide Arch** engineered to give controlled resilience at the hinge point with maximum movement.
4. **Reinforcing Rings** of heavy-duty solid steel embedded in elastomer for maximum pressure service.
5. **Body Ring Enveloper** ties rings on one side of the arch to the other. Prevents ring migration during pressure surges and excessive movements. Extra fabric plies over the arch add to total pressure rating.
6. **Elastomer Filler** between reinforcing rings absorbs vibrations, sounds and electrolysis.
7. **Standard Body Fabric**, elastomer impregnated, is a high tensile polyester. Other fabrics are available. Engineered relationship of fabric plies to the body reinforcing rings determines positive/negative pressures of the product.
8. **Extra Flange Plies** built in for greater strength of the integral to the body retaining flange.
9. **Leak Free One-Piece Tube** selected for resistance against media pumped/piped. Wide choice of elastomers including Teflon*.
10. **Retaining Rings** for flanged products. Split steel; plated for corrosion resistance. Required for all installations.
11. **Control Unit Assemblies** prevent over extension of expansion joint. Recommended for most applications. Optional sleeve prevents over compression.

Hypalon*, Viton*, Teflon*, trademarks of E.I. DuPont de Nemours & Co., Inc.

EXHAUST FLEXIBLE CONNECTORS

Senior Flexonics Pathway exhaust flexible connectors are specifically designated for low pressure (15 psi) 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.

EXHAUST CONNECTOR DATA

	SINGLE
Size Range	2" to 48"* NPS
Allowable Pressure Stainless Steel Bellows	Vacuum to 15 psi
Temperature Limits Stainless Steel Bellows	-20°F to 800°F. **
Axial Traverse	To 4.67". . . (depending on size)
Lateral Motion	Up to 0.82". . . (depending on size)

*For sizes larger than 48" 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

DIA	STYLE	ENDS	PRESSURE	CONS	LINER	COVER
6	HFF	VV	50	8	L	C

EXHAUST GAS EXPANSION JOINTS

Nom. Diam.	# of Cons	Max. Axial Mvmt (in.)	Max. Lateral Mvmt (in.)	Max. Angular Mvmt (deg.)	Axial Spring Rate (lbs/in.)	Lateral Spring Rate (lbs/in.)	Angular Spring Rate (in-lbs/deg)	WW		PP		AA		Natural Freq. Axial (Hz.)	Natural Freq. Lateral (Hz)
								OAL w/Weld Ends (in.)	Weight w/Weld Ends (lbs)	OAL w/Plate Flanges (in.)	Weight w/Plate Flanges (lbs)	OAL w/Angle Flanges (in.)	Weight w/Angle Flanges (lbs)		
2	14	.053	0.15	10	224	554	3.4	8.375	2	3.625	8	—	—	310	890
2	28	1.06	0.59	10	112	69	1.7	10.625	2	5.875	8	—	—	155	222
2.5	13	0.69	0.14	10	174	611	3.9	8.500	3	3.750	11	—	—	236	779
2.5	26	1.39	0.55	10	87	77	1.9	11.000	4	6.125	11	—	—	118	195
3	13	0.70	0.17	10	291	918	9.4	9.000	5	4.250	12	—	—	235	757
3	26	1.40	0.69	10	146	115	4.7	12.125	5	7.250	13	—	—	118	190
4	11	0.69	0.15	10	365	1693	18.9	9.125	6	4.375	16	5.125	3	243	955
4	22	1.39	0.59	10	182	212	9.4	12.375	7	7.500	17	8.250	3	121	239
5	10	1.15	0.16	10	201	1302	16.1	9.500	9	5.000	22	5.500	3	147	635
5	20	2.31	0.63	10	100	163	8.1	13.125	9	8.625	23	9.125	4	73	158
6	10	1.33	0.14	10	177	1653	19.9	9.625	11	5.125	25	6.125	5	120	604
6	20	2.66	0.56	10	88	207	10.0	13.250	12	8.750	26	9.750	6	60	150
8	10	1.14	0.11	10	298	4150	54.2	9.625	16	5.125	35	6.125	6	143	911
8	20	2.29	0.44	10	149	519	27.1	13.250	18	8.750	37	9.750	7	71	228
10	10	1.70	0.14	10	222	3305	64.1	10.625	24	6.125	46	7.000	9	84	532
10	20	3.39	0.56	10	111	413	32.1	15.250	27	10.750	49	11.625	12	42	133
12	10	1.70	0.12	10	266	5449	105.7	10.625	29	6.125	66	7.625	16	85	629
12	20	3.39	0.48	10	133	680	52.9	15.250	33	10.750	69	12.125	19	42	157

*Movements shown are nonconcurrent.

MATERIALS OF CONSTRUCTION

- BELLOWS: ASTM A240 T304
- PIPE: ASTM A53/A106/A516 GR70
- FLANGES: Steel A36/A516GR70 Plate Angle Carbon Steel
- LINERS: 300 Series Stainless Steel
- COVERS: Carbon Steel

EXHAUST GAS EXPANSION JOINTS (CONTINUED)

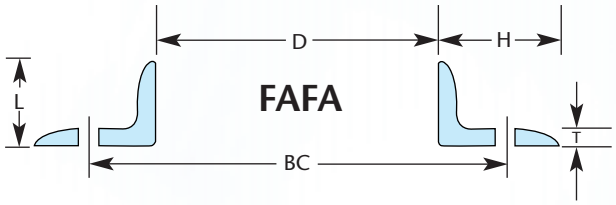
								WW		PP		AA			
Nom. Diam.	# of Cons	Max. Axial Mvmt (in.)	Max. Lateral Mvmt (in.)	Max. Angular Mvmt (deg.)	Axial Spring Rate (lbs/in.)	Lateral Spring Rate (lbs/in.)	Angular Spring Rate (in-lbs/deg)	OAL w/Weld Ends (in.)	Weight w/Weld Ends (lbs)	OAL w/Plate Flanges (in.)	Weight w/Plate Flanges (lbs)	OAL w/Angle Flanges (in.)	Weight w/Angle Flanges (lbs)	Natural Freq. Axial (Hz.)	Natural Freq. Lateral (Hz)
14	10	2.19	0.20	10	260	3412	123.4	12.250	32	7.750	81	9.250	18	78	467
14	20	4.38	0.82	10	130	427	61.7	18.500	36	13.875	85	15.375	22	39	117
16	10	2.17	0.18	10	295	4965	180.4	12.250	37	7.750	96	9.750	24	77	529
16	20	4.34	0.72	10	147	621	90.2	18.500	41	13.875	101	15.875	28	39	132
18	10	2.34	0.16	10	261	5802	202.0	12.250	42	7.750	97	9.750	27	66	508
18	20	4.67	0.64	10	131	725	101.0	18.500	47	13.875	103	15.875	32	33	127
20	8	2.32	0.14	10	210	6079	202.1	12.125	46	7.625	114	9.625	30	57	498
20	16	4.63	0.56	10	105	759	101.1	18.250	52	13.625	120	15.625	36	28	124
22	8	2.28	0.12	10	444	15324	515.0	12.125	53	8.125	164	9.625	35	67	639
22	16	4.56	0.50	10	222	1916	257.5	18.250	63	14.125	174	15.625	45	33	160
24	8	2.28	0.11	10	482	19647	660.2	12.125	58	8.125	192	9.625	38	66	693
24	16	4.56	0.46	10	241	2456	330.1	18.250	69	14.125	203	15.625	49	33	173
26	7	2.32	0.11	10	381	18191	616.6	12.125	64	8.125	212	10.125	46	56	630
26	14	4.63	0.43	10	190	2272	308.4	18.250	75	14.250	223	16.250	58	28	158
28	7	2.32	0.10	10	408	22473	761.8	12.125	68	8.125	232	10.125	50	56	675
28	14	4.63	0.40	10	204	2806	381.0	18.250	81	14.250	245	16.250	62	28	169
30	6	1.99	0.07	10	403	34806	866.4	11.250	72	7.250	256	9.250	53	56	841
30	12	3.97	0.28	10	202	4346	433.4	16.500	85	12.500	268	14.500	65	28	210
32	6	1.99	0.06	10	429	41888	1042.7	11.250	77	7.250	299	9.250	56	56	893
32	12	3.97	0.26	10	215	5230	521.5	16.500	91	12.500	313	14.500	69	28	223
34	6	1.99	0.06	10	455	49866	1241.3	11.250	82	7.250	313	9.250	59	55	946
34	12	3.97	0.24	10	227	6226	620.9	16.500	96	12.500	327	14.500	73	28	236
36	6	1.99	0.06	10	480	58792	1463.5	11.250	87	7.250	341	9.250	63	55	998
36	12	3.97	0.23	10	240	7340	732.0	16.500	102	12.500	356	14.500	78	28	250
38	4	2.30	0.07	10	684	73073	2359.4	12.000	93	8.000	393	10.000	67	61	1023
38	8	4.61	0.29	10	342	9143	1179.3	18.000	111	14.000	411	16.000	84	31	256
40	4	2.30	0.07	10	716	84286	2721.5	12.000	98	8.000	409	10.000	72	60	1071
40	8	4.61	0.28	10	358	10546	1360.3	18.000	117	14.000	427	16.000	90	30	268
42	4	2.30	0.07	10	747	96578	3118.4	12.000	103	8.000	440	10.000	75	60	1119
42	8	4.61	0.26	10	373	12084	1558.6	18.000	123	14.000	460	16.000	94	30	280
44	4	2.30	0.06	10	779	110100	3556.4	12.000	108	8.000	468	10.000	78	60	1168
44	8	4.61	0.25	10	389	13782	1777.5	18.000	129	14.000	489	16.000	99	30	292
46	4	2.30	0.06	10	811	124900	4034.1	12.000	113	8.000	489	10.000	81	60	1216
46	8	4.61	0.24	10	405	15633	2016.3	18.000	134	14.000	511	16.000	103	30	304
48	4	2.30	0.06	10	843	141000	4552.4	12.000	118	8.000	518	10.000	85	60	1265
48	8	4.61	0.23	10	421	17642	2275.4	18.000	140	14.000	541	16.000	108	30	316

*Movements shown are nonconcurrent.

ANGLE & PLATE FLANGES
LOW PRESSURE – 5 PSIG MAX

- Economical flanges for low pressure service <5.
- Can be added to single and universal expansion joints. See part number example below.

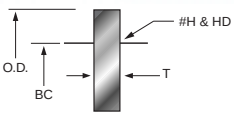
Material: carbon steel.
Other materials are available on request.
Single overall length using angle flanges = WW OAL – 6 Inches + 2L.



Nominal Diameter (Inch)	Actual ID (Inch)	Angle Thickness "T" (Inch)	"H"	"L"	Approx. Weight (Lbs.)	Bolt Circle (Inch)	Bolt Holes	
							Hole Size (Inch)	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	23.8	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

Nominal Pipe Size	150# Plate Flange Dimensions					
	OD (Inch)	T (Inch)	BC (Inch)	#H	HD (Inch)	Wt. (Lbs.)
2	6	5/8	4 3/4	4	3/4	4
2 1/2	7	5/8	5 1/2	4	3/4	5
3	7 1/2	5/8	6	4	3/4	6
3 1/2	8 1/2	5/8	7	8	3/4	8
4	9	5/8	7 1/2	8	3/4	8
5	10	3/4	8 1/2	8	7/8	11
6	11	3/4	9 1/2	8	7/8	12
8	13 1/2	1	11 3/4	8	7/8	23
10	16	1	14 1/4	12	1	30
12	19	1	17	12	1	43
14	21	1 1/4	18 3/4	12	1 1/8	63
16	23 1/2	1 1/4	21 1/4	16	1 1/8	76
18	25	1 1/2	22 3/4	16	1 1/4	90
20	27 1/2	1 1/2	25	20	1 1/4	106
22	29 1/2	1 1/2	27 1/4	20	1 3/8	120
24	32	1 1/2	29 1/2	20	1 3/8	133

Nominal Pipe Size	300# Plate Flange Dimensions					
	OD (Inch)	T (Inch)	BC (Inch)	#H	HD (Inch)	Wt. (Lbs.)
2	6 1/2	1	5	8	3/4	7
2 1/2	7 1/2	1	5 7/8	8	7/8	9
3	8 1/4	1	6 5/8	8	7/8	11
3 1/2	9	1 1/8	7 1/4	8	7/8	15
4	10	1 1/8	7 7/8	8	7/8	19
5	11	1 1/4	9 1/4	8	7/8	24
6	12 1/2	1 1/2	10 5/8	12	7/8	34
8	15	1 1/2	13	12	1	49
10	17 1/2	1 3/4	15 1/4	16	1 1/8	66
12	20 1/2	2	17 3/4	16	1 1/4	102
14	23	2	20 1/4	20	1 1/4	132
16	25 1/2	2 1/4	22 1/2	20	1 3/8	175
18	28	2 1/2	24 3/4	24	1 3/8	226
20	30 1/2	2 1/2	27	24	1 3/8	265
22	33	2 3/4	29 1/4	24	1 5/8	326
24	36	2 3/4	32	24	1 5/8	394



Notes: Plate flanges are designed for use with sheet gasket.
Flange gasket seating surface is a smooth mill finish.
May be used against raised face or flat face mating flanges.
Not recommended for use with spiral wound gaskets.

A36 material not recommended for use above 700°F or below 20°F.
Not recommended for applications where ASME B31.3 or Section VIII Pressure Vessel Code requirements apply.

Consult factory for drilling above 24" NPS.

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. Sleeves 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 in. 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 whole restraining the full pressure loading and dynamic forces generated by the anchor failure.

Weld Ends - The ends of a bellows 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.

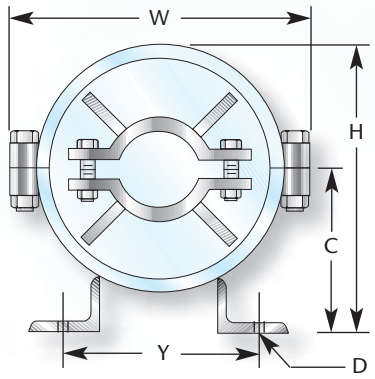
Van Stoned Ends - In this type of construction, the flanges are slipped over the ends of the bellows and the bellows material is flared out or "Van Stoned" over the faces of the flanges. The bellows material prevents contact between the flanges and the medium flowing through the pipe. During installation, 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 F.	Carbon Steel Carbon-Moly Low-Chrome	Austenitic Stainless Steels	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	-.--

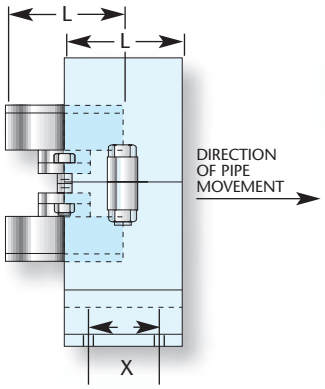
PIPE ALIGNMENT GUIDES

Proper pipe guiding is vital for safe operation of all piping systems and is especially important for systems with expansion joints. Senior Flexonics Pathway improved, easy to install alignment guides are your ideal answer. These guides permit free axial movement of the pipe while restricting lateral, angular, or buckling movements. U-bolts, hangers, and rollers only support the piping. Senior Flexonics Pathway alignment guides protect.



NOTE: BODY SIZE 14" & ABOVE SUPPLIED WITH 4 BOLTS.

For proper spacing of guides on piping systems with expansion joints and compensators, see pages 6 and 33. Proper support of the piping system's weight usually requires additional pipe supports.



How to order:
Example P/N

DIA	STYLE
1.5	HPGI

SPECIFICATIONS: SERIES PGT

Nom. Pipe Size in.	Style	General Dimensions-inches							Maximum Insulation Thickness in.	Maximum Allowable Movement in.	Spider Fits Into Stand Wt. Pipe Size	Wt. lb.
		W	H	C	Y	X	D	L				
3/4	HPG	5 7/8	5 3/4	3 1/2	4 1/4	1 3/4	5/8	3	1	3	4	6
1	HPG	5 7/8	5 3/4	3 1/2	4 1/4	1 3/4	5/8	3	1	3	4	6
1 1/4	HPG	5 7/8	5 3/4	3 1/2	4 1/4	1 3/4	5/8	3	1	3	4	6
1 1/2	HPG	7	6 3/4	4	4 1/2	1 3/4	5/8	3	1 1/2	3	5	8
2	HPG	7	6 3/4	4	4 1/2	1 3/4	5/8	3	1	3	5	8
2 1/2	HPG	10 3/8	9 1/2	5 1/4	6 1/4	1 3/4	5/8	3	2 1/2	3	8	13
3	HPG	10 3/8	9 1/2	5 1/4	6 1/4	1 3/4	5/8	3	2	3	8	13
4	HPG	12 1/2	11 5/8	6 1/4	7 1/4	2 3/4	5/8	4	2 1/2	4	10	20
5	HPG	12 1/2	11 5/8	6 1/4	7 1/4	2 3/4	5/8	4	2	4	10	20
6	HPG	14 1/2	13 5/8	7 1/4	8 1/4	2 3/4	5/8	4	2 1/2	4	12	25
8	HPG	17 3/4	17	9	11	4	3/4	6	3	8	16	40
10	HPG	17 3/4	17	9	11	4	3/4	6	2	8	16	40
12	HPG	22 1/8	21 1/8	11 1/8	13 1/2	4	3/4	6	3	8	20	65
14	HPG	24 1/8	23 1/8	12 1/8	14 1/2	6	3/4	8	3 1/2	8	22	95
16	HPG	26 5/8	25	13	15 1/2	6	7/8	8	3 1/2	8	24	115
18	HPG	28 5/8	27 3/4	14 3/4	17 1/2	6	1 1/8	8	3 1/2	8	26	135
20	HPG	32 5/8	31 1/2	16 1/2	19 1/2	6	1 1/8	8	4	8	30	150

NOTE: Additional sizes, insulation thickness, and motion options are available. Please consult factory for pricing and availability.

INTERMEDIATE GUIDE SPACING CHART

FIGURE NO. 1: EXPANSION JOINTS

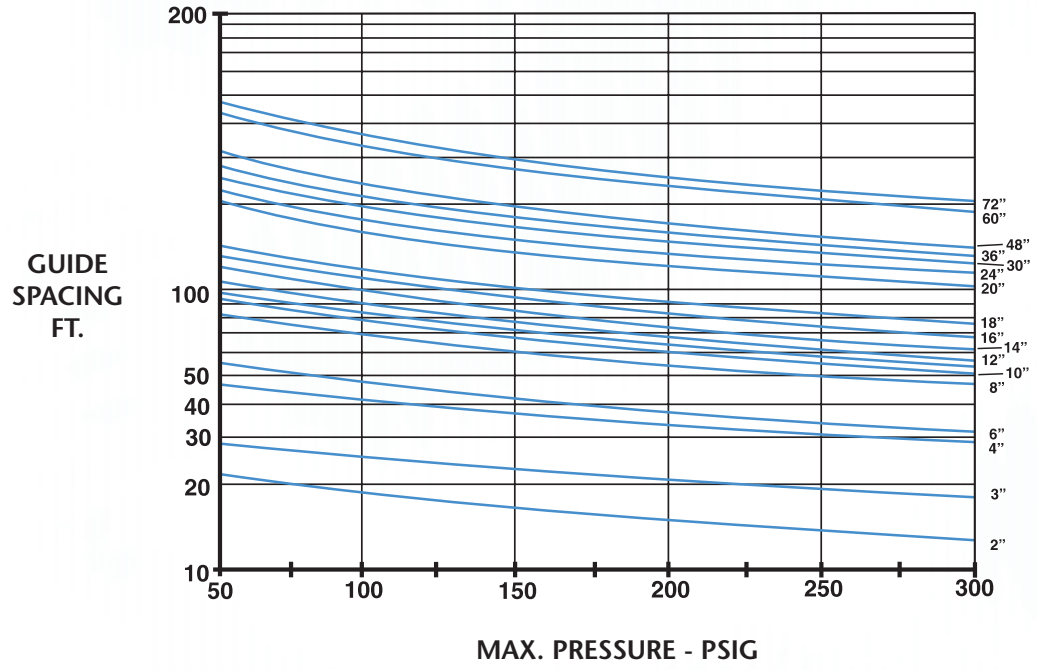


Chart is based upon sch. 40 pipe.

FIGURE NO. 2: MODEL H COMPENSATORS

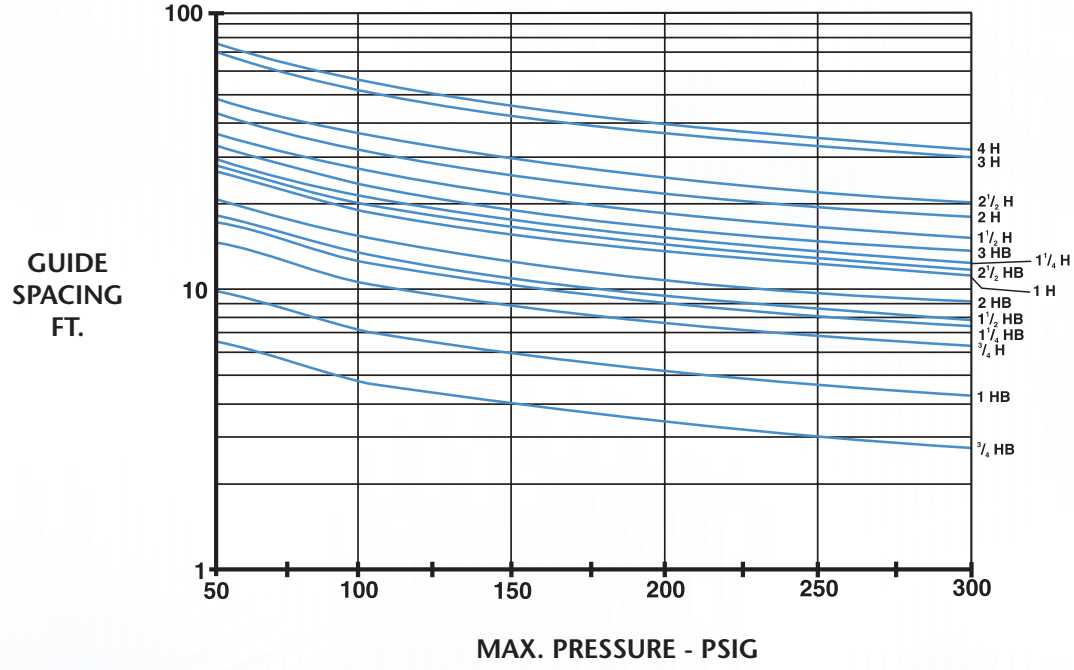


Chart is based upon sch. 40 pipe and type K copper tubing.

SENIOR FLEXONICS PATHWAY INSTALLATION INSTRUCTIONS

Senior Flexonics Pathway 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 an expansion joint is required to absorb thermal and/or mechanical movements, the bellows must be constructed of a relatively thin gauge material. This requires special installation precautions. Failure to comply with the following instructions could lead to premature failure and void the warranty.

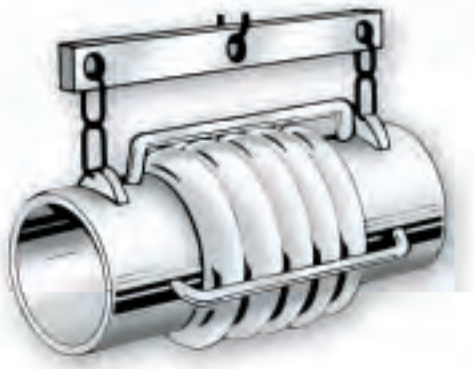
The following steps should be taken prior to installation of the expansion joint:

1. The location into which the expansion joint will be installed should be examined to verify that the opening does not exceed the installation tolerances designated by the designer and/or purchaser. Do not use the expansion joint to make up for excessive piping misalignment. Doing so may severely reduce the service life of the bellows. If the opening exceeds the tolerance, notify the factory at once.
2. At all times, protect the bellows element itself from damage, such as dents, or scratches due to falling tools, sharp objects, weld splatter, arc strikes, etc.
3. 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. NEVER USE A CHAIN OR ANY OTHER HANDLING DEVICES DIRECTLY ON THE BELLOWS ELEMENT OR BELLOWS COVER. For expansion joins not provided with lifting lugs (i.e., less than 500 lbs.), the best lifting method should be evaluated at the time of installation.
4. The shipping bars are installed on an expansion joint to maintain shipping length and to give the expansion joint stability during transit and installation. DO NOT REMOVE THE SHIPPING BAR 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. Check inside expansion joint for dessicant bags or any other material.



2. When a flow liner is installed in the expansion joint, orient expansion joint with FLOW ARROW POINTING IN THE DIRECTION OF FLOW.
3. Using lifting lugs, lift joint to desired location and position into piping or duct.
4. Weld-end expansion joints:
   (a) The attachment edges of the pipe should be smooth, clean and parallel to each other.
   (b) PRIOR TO WELDING, COVER THE BELLOWS ELEMENT WITH A CHLORIDE FREE FIRE RETARDANT BLANKET. This is to prevent arc strikes, weld splatter, etc., from damaging the bellows element.
   (c) Using the proper electrode, weld the expansion joint to adjacent piping. DO NOT UTILIZE BELLOWS TO CORRECT FOR MISALIGNMENT BEYOND THE SPECIFIED INSTALLATION TOLERANCES.
5. Flanged-end expansion joints:
   (a) Orient expansion joint 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 lead to 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 vanstone or lap joint flange that will rotate.
   (b) Vanstone type flanges may be secured to the bellows with shipping straps. Remove these straps prior to installation.
   (c) Install gaskets and bolt to the required torque recommended by the flange manufacturer.

SPECIAL INSTRUCTIONS FOR CONTROLLED-FLEXING EXPANSION JOINTS (FIGS. 1 & 2)

Senior Flexonics Pathway Controlled-Flexing expansion joints have built-in guide rods or shipping rods over the bellows that maintain a fixed OAL during shipment and installation. DO NOT REMOVE THESE DEVICES UNTIL AFTER INSTALLATION IS COMPLETE.

CAUTION - On flanged Control-Flexing expansion joints do not stretch the joint as you tighten the bolts. This may cause excessive tension in the shipping rods that can lead to breakage of the control ring casting. After installation, remove the shipping restraints as follows:

3", 4" and 5" NPS expansion joints: Loosen, BUT DO NOT REMOVE, the grip nuts on both ends of the guide rods. Back the nuts off to within one turn of the end of the rods or the gap shown on the drawing. Then, remove all spacer clips from between the control rings, and remove any other shipping restraints (painted yellow). DO NOT RETIGHTEN THE NUTS. Note - The guide rods on these sizes help maintain stability under pressure and must remain in place at all times.

6" NPS and larger expansion joints: Loosen and remove the shipping rods, nuts and all spacer clips from between the control rings. When required, remove any other shipping restraints (painted yellow).

AFTER INSTALLATION BUT PRIOR TO HYDRO TEST

1. Inspect entire system to insure that anchors, guides and pipe supports are installed in strict accordance with piping system drawings. A pipe guide spacing and formula chart is provided on pages 6 and 33 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 BARS (PAINTED YELLOW) PRIOR 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 attack 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 wood and other abrasives should not be used on the bellows element.
3. Hydrostatic test pressure should not exceed 1 1/2 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 insulation materials should be used for insulating an expansion joint.

WARRANTY IS VOID UNLESS THE ABOVE INSTRUCTIONS ARE FOLLOWED

Warranty

Senior Flexonics Pathway warrants that products furnished will, at the time of delivery, be free from defects in material and workmanship. Senior Flexonics Pathway will repair or replace any defects which occur within one year from the date of installation or eighteen months from the date of shipment, whichever occurs first.

Repair or replacement of the product will be, at Senior Flexonics Pathway's option. Products to be examined, and replaced or repaired at Senior Flexonics Pathway's facilities must be returned to Senior Flexonics Pathway by Purchaser within the warranty period with transportation charges prepaid. If the examined equipment is found not to be defective or is not for some other reason within the warranty coverage, Senior Flexonics Pathway service time and other cost incurred on and off location will be charged to Purchaser.

Purchaser shall be responsible for proper installation of the units and operating within the design limits of each unit. Warranty shall not apply if the products are used for any purpose or under any condition beyond those specified including without limitation; (1) abuse or misuse, or (2) modification by others, or (3) uses subject to product abnormal conditions exceeding design limitations.

Correction of defects by repair or replacement shall constitute Senior Flexonics Pathway's sole and exclusive responsibility to Purchaser under this Warranty. Senior Flexonics Pathway shall in no event be liable for injuries to persons or property or direct, incidental, liquidated or consequential damages caused by use of the product.

EXPANSION JOINT SPECIFICATION SHEET

Company:	Date:
	Sheet of
Project:	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 (deg.)			
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 (lbs./in./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			