

**ENGINEERED SOLUTIONS FOR
METAL BELLOWS APPLICATIONS**



Facilities

Manufacturing Floor Area	200,000 sq. feet
Total Land Area	31 acres
Bridge Crane Capacity	40 ton
Maximum Hook Height	37 feet
Fork Lift Capacity	30,000 Ibs.
Welding Qualifications – All weld procedures and welders are qualified to ASME Section IX: Sub ARC, ARC, Pulse ARC, TIG, MIG, Core Wire, Resistance, Electroslag, Tube Welding, Track Welding, Large Turn Tables, Rolls, Positioners	

Fabrication

Plate Roll	1 1/2" Thickness
Angle Roll	5" x 5" x 1"
Press Brake	5 ton through 400 ton
Radial Expanders	5 ton through 400 ton
	1/2" through 96" diameter
Plate Shear	.003" through 1"
Flame and Plasma Cutting	4-torch computer controlled water table
Abrasive Blasting	16' x 16' x 24', recirculating system
Painting and finishing equipment	

Bellows Forming

Expanding mandrel forming from 1/2" to 30 foot diameter
 Large bellows of unlimited diameter can be made in sections
 Roll forming to 14-foot diameter
 Hydraulic forming, 1200 ton press for specialized toroidal bellows

Quality Assurance

Senior Flexonics Pathway® Quality Assurance System has been certified to ISO 9001 and is in compliance with ASME Section VII, Division 1, ASME B31.1 and ASME B31.3, AWS B1.1, AISI, ASIC, Stoomwezen and T.U.V.

Section VIII (U Stamp), (R Stamp)
 Section III (N Stamp), (NPT Stamp)
 Xray 300KV – 10 MA and 5 MA Magnetic Particle, Dye Penetrant, Zyglo, Ultrasonic and Eddy Current Testing
 Mass Spectrometer and Halogen Leak Detection
 Positive Material Identification (PMI)
 Hydro Testing
 Cycle Testing
 Spring Rate Testing
 Dead Weight Testing
 Hardness Testing

Test Programs and Design Verification Tests

Ambient Temperature Bellows Fatigue Testing
 Elevated Temperature Bellows Fatigue Testing
 Seismic Analysis of Fabricated Components
 Vibration Analysis of Fabricated Components
 Shock Loading Performance Testing
 Bellows Spring Rate Testing
 Expansion Joint Deflection Testing
 Bellows Torsion Testing
 Burst Testing

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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.

—INTRODUCTION—

Senior Flexonics Pathway is pleased to present this catalog of metal expansion joints from 2" pipe size (50mm ND) to 144" diameter (3.6M ND). The units presented are standard products and range from the simplest single bellows expansion joints with weld ends to the more complicated universals, hinged and gimbal expansion joints. If your system requirements can not be satisfied by the expansion joints provided in this catalog, Senior Flexonics Pathway will design a custom product to suit your needs.

This catalog contains excellent technical references to help you understand how expansion joints work, how to apply them, and how to select the expansion joint best suited for your application. You will find spring rate references and other performance criteria that are essential for modeling expansion joints in pipe stress programs. All performance information is provided in English and metric units. The back of the catalog contains useful engineering tables.

—EMERGENCY SERVICE 24/7—

Emergency service 24 hours/day, 7 days/week:

For over 25 years Senior Flexonics Pathway's reputation has been built on our ability to exceed client expectation on "Emergency requirements". 48 hour shipment on catalog parts is a promise we've made and keep. Our best performance is same day shipment.

Emergencies happen. When they do, we are ready to respond to your needs. Senior Flexonics Pathway's culture is molded around our ability to deliver expedited shipments. Manufacturing redundancies, 24 hour staffing and a client response team of customer service, engineering and production personnel on-call 24 hours a day 365 days a year will continue to be a Senior Flexonics Pathway exclusive.

Call our 24-hour hotline anytime @ 830 660 0337



— [THE SENIOR FLEXONICS PATHWAY ADVANTAGE] —

We have been innovating solutions since October 27, 1902. Globally, there are more than 1000 Senior Flexonics Pathway personnel devoted to the design, manufacture and service of metal bellows expansion joints and devices. Senior Flexonics Pathway is the largest metal expansion joint manufacturing company in the world and the only expansion joint company with a global presence.

The Senior Flexonics Pathway ADVANTAGE is our EXPERIENCE, our PEOPLE, and our manufacturing and research FACILITIES strategically located around the world. Expansion joints are made from 1/4 inch (6.4 mm) to 45 feet (13.7 meters) in diameter; in shapes that include round, oval and rectangular; for temperatures to 2000°F (1093°C); and pressures to 4000 PSI (276 Bar). The Senior Flexonics Pathway ADVANTAGE provides you with the widest range of sizes and types of engineered expansion joints available in the world today.

Industries that use the Senior Flexonics Pathway Advantage include:

- Petrochemicals and Refining
- Cogeneration
- Cryogenics
- LNG
- District Heating, Cooling, Steam Distribution
- Fossil Fuel Power Generation
- Heating, Ventilating and Air Conditioning (HVAC)
- Hot Metal Processing
- Nuclear Power Generation
- Pulp and Paper
- Shipbuilding and Repair



Other industrial applications such as:

- Engine Manifolds
- Heat Exchangers
- Hot or Cold Piping



—[ENGINEERING]—

Our engineers use the latest computer aided design tools to provide fast proposal turn around and the most efficient use of space and materials. Pipe Stress analysis and math modeling of expansion joint systems is performed using Caesar II and other Finite Element Analysis (FEA) based programs. FEA is used extensively for design of highly loaded components and for design of high temperature hardware, a special area of competence for Senior Flexonics Pathway.

Senior Flexonics Pathway is a charter member of the Expansion Joint Manufacturers Association (EJMA). Every expansion joint produced by Senior Flexonics Pathway is designed and manufactured in strict accordance with EJMA standards.

Detailed calculations to validate design in accordance with latest edition of the EJMA standards are available to every Senior Flexonics Pathway customer. Customers should require full compliance with the EJMA Standards and calculations to prove compliance, regardless of the expansion joint manufacturer.



—[QUALITY ASSURANCE]—

We maintain quality assurance programs in accordance with the standards and requirements of:

- ASME Section III (Nuclear N Stamp, NPT Stamp)
- ASME Section VIII (U Stamp, R Stamp)
- MIL-I-45208A



—[RESEARCH AND DEVELOPMENT]—

We maintain the only fully equipped laboratory of its kind in the expansion joint industry. It is dedicated to bellows materials research and analysis. In addition, we have the largest and most comprehensive testing facility available. We routinely perform vibration testing, cyclic fatigue testing, seismic shake analysis and cryogenic and elevated temperature testing.

A substantial portion of each annual budget is devoted to research into new and improved methods of bellows forming, verification of bellows properties, validating calculations and development of new EJMA equations. New bellows materials and pressure thrust restraint structures are also evaluated. As a result, Senior Flexonics Pathway is the leading innovator in expansion joint design.



—[MANUFACTURING]—

Senior Flexonics Pathway is the only major metal expansion joint manufacturer that regularly uses all recognized bellows forming technologies, including, hydroforming, expanding mandrel or punch forming, roll forming and elastomer forming.

We use the *optimum forming method* to make the *best expansion joint bellows* for the application.



—[HOW A BELLOWS WORKS]—

A bellows is a flexible seal. The convoluted portion of an expansion joint is designed to flex when thermal movements occur in the piping system. The number of convolutions depends upon the amount of movement the bellows must accommodate or the force that must be used to accomplish this deflection.

The convoluted element must be strong enough circumferentially to withstand the internal pressure of the system, yet responsive enough to flex. The longitudinal load (pressure thrust) must then be absorbed by some other type of device. These devices include pipe anchors, tie rods, hinges, or gimbals structures. Pressure thrust can be calculated by multiplying the effective area shown in the catalog by the working pressure.

Pressure Thrust

For the purpose of understanding pressure thrust, a single bellows designed for pure axial motion can be modeled as hydraulic cylinder with a spring inside.

Force on equipment or adjacent piping anchors “F” = (the effective area of the bellows) x (the working pressure) + (the spring rate of the bellows) x (the stroke of the bellows).

The spring represents the axial spring rate of the bellows. The hydraulic piston represents the effect of the pressure thrust which the expansion joint can exert on the piping anchors or

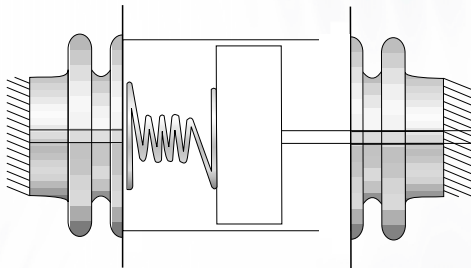


Figure 1. Working pressure acting on the effective area of the bellows.

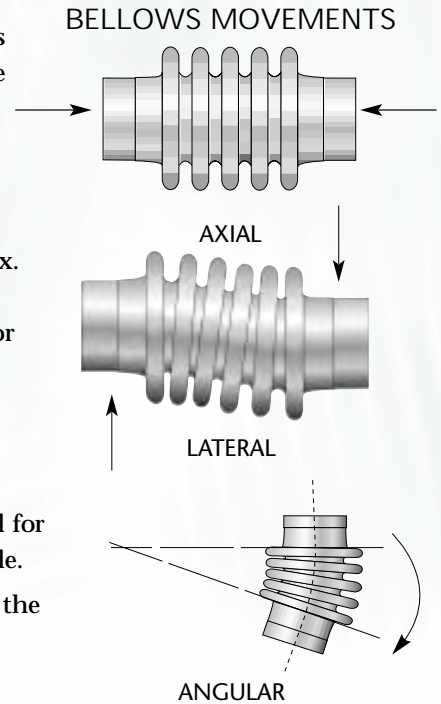
The pressure thrust force is typically much higher than the spring force.

Expansion joints designed for lateral offset or angular motion are more complicated to model accurately. However, the effect of pressure thrust is the same.

The pages following the “HOW A BELLOWS WORKS” section describe expansion joints which can be applied to eliminate the effect of pressure thrust on rotating equipment or other stress sensitive devices.

Pressure Stresses

The ability of a bellows to carry pressure is limited by hoop stress or S_2 as defined in the standards of the Expansion Joint Manufacturers Association (EJMA). This is a stress that runs circumferentially around the bellows due to the pressure difference between the inside and the outside of the bellows.



pressure thrust restraints (hinges, gimbals, tie rods) which may be part of the expansion joint assembly. The area of the hydraulic cylinder would be the effective area of the bellows. For a 20”, 150 psig catalog standard expansion joint with 20 convolutions, the spring force for 1” of axial stroke would be (the axial motion) x (the spring rate of the bellows) or 1 in. x 1521lbs./in. = 1521 pounds.

The pressure thrust force would equal (the working pressure) x (the bellows effective area) or (150 lbs./in.²) x (359 in.²) = 53,850 pounds.

Hoop stress is what holds a bellows together like the hoops on a barrel. This stress must be held to a code stress level. The customer should specify the code to be used.

The bellows's ability to carry pressure is also limited by bulge stress or EJMA stress S4. This is a stress that runs longitudinal to the bellows centerline. More specifically, it is located in the bellows sidewall and it is a measure of the tendency of the convolutions to become less U-shaped and more spherical.

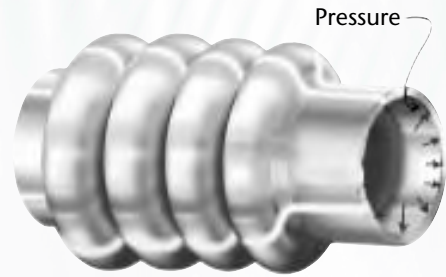


Figure 2. Hoop stress or S2 runs in the circumferential direction.

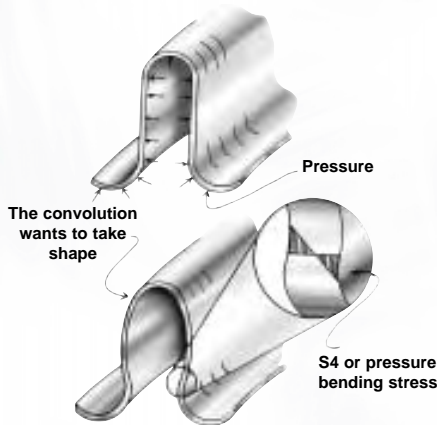


Figure 3.

For bellows that are not annealed after forming, S4 is allowed by EJMA to exceed the initial yield strength of the bellows material by a large margin because it is cold worked. If a bellows is annealed after forming, S4 must be severely limited because the bellows sidewall material is no longer cold worked.

Accommodating a requirement for annealing will often result in the addition of reinforcing rings or a much heavier bellows material and more convolutions. Our standard policy is to provide bellows in the as-formed condition to take advantage of the added performance that is imparted to the bellows through cold work. Senior Flexonics Pathway will accommodate annealing requirements on request.

Squirm

A bellows that is pressurized internally is similar in many ways to a column loaded in compression. At some loading, a long column will buckle. Similarly, an internally pressurized expansion joint will eventually buckle or squirm at some internal pressure loading. It is the responsibility of the expansion joint manufacturer to design the bellows to avoid squirm during operating conditions or pressure testing.

Squirm can lead to catastrophic failure of a bellows. Our design equations treat squirm conservatively. A hydrostatic test of the completed expansion joint verifies stability. If hydrostatic testing is desired, it should be specified at the time of order placement.

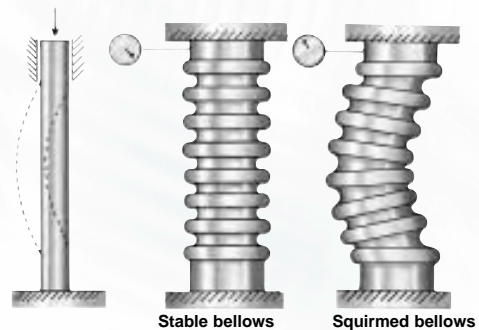


Figure 4. Bellows squirm is similar to column buckling.

Cycle Life

When a bellows deflects, the motion is absorbed by bending of the sidewalls of each convolution. The associated stress caused by this motion is the deflection stress or EJMA stress S6. This stress runs longitudinal to the bellows centerline. The maximum value of S6 is located in the sidewall of each convolution near the crest or root.

HOW A BELLOW WORKS (CONTINUED)

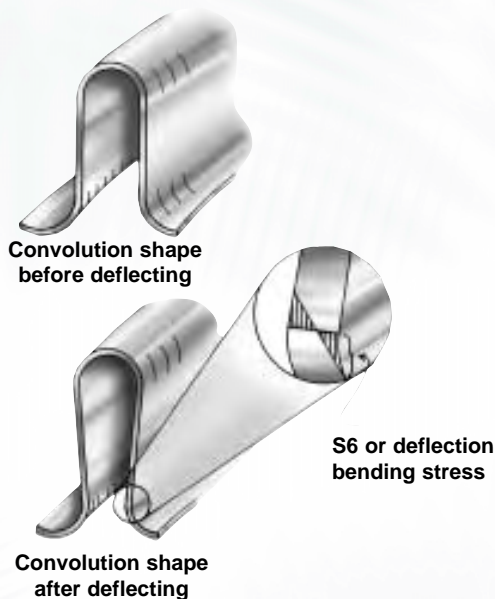


Figure 5. When the bellows compresses, the side walls bend to shorten the bellows.

Expansion joints are designed to operate with a value for S_6 that far exceeds the yield strength of the bellows material. This means that most expansion joints will take a permanent set at the rated axial, angular or lateral motion. Expansion joint bellows are rarely designed to operate in the elastic stress range. Therefore the bellows will eventually fatigue after a finite number of movement cycles. It is important to specify a realistic cycle life as a design consideration when ordering an expansion joint. An overly conservative cycle life requirement can result in a bellows design that is so long and soft that it is subject to squirm failure.

Multiple Ply Construction

The necessary amount of metal to contain pressure can be achieved with a single ply of bellows material or multiple plies of material of reduced thickness. A bellows of multiple ply construction often has a lower spring rate than a single ply bellows for the same service. Thin material experiences less strain than a thick material for the same deflection. That means a multiple ply bellows may be shorter and it may have a higher cycle life than a single ply bellows for the same application.

DESIGN VARIABLES AS THEY EFFECT BELLOWS DYNAMICS

VARIATION	Hoop Stress S_2	Bulge Stress S_4	Deflection Stress S_6	Squirm Pressure	External Buckling Pressure	Cycle Life	Rated Axial	Rated Lateral	Rated Angular	Axial Spring Rate	Lateral Spring Rate	Angular Spring Rate	Pressure thrust
Thicker Material	-(1)	-(2)	+(1)	+(3)	+	-	-	-	-	+(3)	+(3)	+(3)	S
Thinner Material	+(1)	+(2)	-(1)	-(3)	-	+	+	+	+	-(3)	-(3)	-(3)	S
Higher Convolute	-(1)	+(2)	-(2)	-(3)	+	+	+	+	+	-(3)	-(3)	-(3)	+
Lower Convolute	+(1)	-(2)	+(2)	+(3)	-	-	-	-	-	+(3)	+(3)	+(3)	-
Smaller Pitch	-	+	-	-	+	+	+	+	+	-	-	-	S
Larger Pitch	+	-	+	+	-	-	-	-	-	+	+	+	S
More Plies	-	-	S	+	+	S	S	S	S	+	+	+	S
Fewer Plies	+	+	S	-	-	S	S	S	S	-	-	-	S
Larger Diameter	+(1)	S	S	+	-	S	S	-	-	+	+	+	+
Smaller Diameter	-(1)	S	S	-	+	S	S	+	+	-	-	-	-
More Convolutions	S	S	-	-	S	+	+	+	+	-	-	-	S
Fewer Convolutions	S	S	+	+	S	-	-	-	-	+	+	+	S

LEGEND: + INCREASE; - DECREASE; S SAME

(#) INDICATES HOW STEEPLY THE VARIATION AFFECTS THE DESIGN VARIABLE, I.E., (1) MEANS THE CHANGE IS LINEAR; (2) MEANS THE DESIGN VARIABLE CHANGES BY THE SQUARE OF THE VARIABLE; (3) MEANS THE DESIGN VARIABLE CHANGES BY THE CUBE OF THE VARIABLE.

HOW TO INTERPRET A SENIOR FLEXONICS PATHWAY BELLOWS DESIGN ANALYSIS SM

All custom bellows designs should be documented to prove that the critical stress values are within the limits of the selected design code. Documentation should prove that the design is safe and mechanically stable, and that the cycle life is in accordance with the specification requirements. The Senior Flexionics Pathway bellows design analysis shows all the critical information in a summary format. The following explanation is offered to help customers interpret the information that is shown on the Pathway bellows design analysis so the information is more meaningful.

SENIOR FLEXONICS INC. PATHWAY DIV. REF: 100000 ITEM: 1 CUSTOMER REF: EJ 5 DATE: 1/20/00 13:44 AUTHOR: Robert Broyles		SENIOR FLEXONICS INC. PATHWAY DIVISION SHEET 1 OF 1 REVISION: 1/3/00 APPROVED BY: <i>R. Broyles</i>							
DESIGN IS COMPLIANT WITH ASME B31.3 STRESS ALLOWABLES WITH CYCLE LIFE IN ACCORDANCE WITH THE STANDARDS OF THE EXPANSION JOINT MANUFACTURER'S ASSOCIATION, INC. 7TH. EDITION.									
SINGLE BELLOWS DESIGN ANALYSIS									
DESIGN PRESSURE DESIGN TEMPERATURE BELLOWS MATERIAL ALLOWABLE STRESS ELASTIC MODULUS WELD JOINT EFFICIENCY	150 PSIG 800 DEG. F. A240-T316 (S31600) 15,900 PSI 24,100,000 PSI 1.00								
DESIGN MOVEMENT CONDITIONS									
CONDITION	CYCLES	AXIAL 1	AXIAL 2	LAT 1	LAT 2	ANG 1	ANG 2	S5	S6
A	2000	1.000	0.000	0.500	0.000	0.00	0.00	2835	218299
INSIDE DIAMETER	24.000 INCHES								
OUTSIDE DIAMETER	26.750 INCHES								
NUMBER OF CONVOLUTIONS	18 CONVOLUTIONS								
MATERIAL THICKNESS	0.060 INCHES								
NUMBER OF PLYS	1 PLYS								
FREE LENGTH OVER CONVOLUTIONS	15.750 INCHES								
INSTALLED LENGTH OVER CONVOLUTIONS	15.750 INCHES								
S1 (TANGENT CIRC. MEMBRANE STRESS DUE TO PRESSURE)	10,443 PSI								
S2 (CIRC. MEMBRANE STRESS DUE TO PRESSURE)	9,119 PSI								
S2' (RING CIRC. MEMBRANE STRESS DUE TO PRESSURE)	NA								
S2" (FASTENER CIRC. MEMBRANE STRESS DUE TO PRESSURE)	NA								
S3 (MERIDIONAL MEMBRANE STRESS DUE TO PRESSURE)	1,690 PSI								
S4 (MERIDIONAL BENDING STRESS DUE TO PRESSURE)	29,087 PSI								
S5 (MERIDIONAL MEMBRANE STRESS DUE TO DEFLECTION)	SEE TABLE ABOVE								
S6 (MERIDIONAL BENDING STRESS DUE TO DEFLECTION)	SEE TABLE ABOVE								
ST (STRESS RANGE FOR PRIMARY DESIGN CONDITION)	242,678 PSI								
DESIGN CYCLE LIFE FOR PRIMARY DESIGN CONDITIONS	2,000 CYCLES								
RATED CYCLE LIFE FOR PRIMARY DESIGN CONDITION	2,393 CYCLES								
MAXIMUM DESIGN PRESSURE BASED ON STABILITY	213 PSI								
AXIAL SPRING RATE	2,039 LB/IN								
LATERAL SPRING RATE	7,940 LB/IN								
ANGULAR SPRING RATE	2,865 IN-LB/DEG								
TORSIONAL SPRING RATE	1.848E+06 IN-LB/DEG								
BELLOWS EFFECTIVE AREA	505.7 SQ. INCHES								

This is the actual temperature used for the bellows design. For certain applications such as refractory lined expansion joints, the bellows is often designed for a lower temperature than the media.

This is the allowable primary stress for the bellows material at the design temperature.

This is the modulus of elasticity of the bellows material at the design temperature. The room temperature modulus of elasticity is used to calculate the deflection stresses (S5 & S6).

The longitudinal weld joint efficiency varies based on the method of inspection and the specified code.

The design movements create the deflection stresses that determine cycle life. One complete cycle is based upon moving the bellows from the installed position to the maximum specified movement and then back to the installed position.

Material thickness is stated as the standard sheet gauge thickness.

Hoop Stress (S2) is a critical membrane stress that runs in the circumferential direction. The S2 value must be lower than the allowable stress for the bellows material multiplied by the bellows longitudinal weld joint efficiency.

Pressure Bending (S4) is a critical bending stress that is located in the sidewall of the convolution running in the longitudinal direction. It is the stress that makes a "U" shaped convolution balloon out into an omega shape. The value of S3 + S4 must be limited to 1.5 times the allowable stress for bellows in the asformed condition.

Deflection Bending (S6) is the primary bending stress influencing fatigue life. This stress runs in the longitudinal direction and is most severe near the convolution crest or root. Since bellows operate in the plastic range, the value of S6 is generally well above the allowable code stress value. It is a theoretical calculation based on elastic theory, and the value is used to calculate cycle life.

This is the specified cycle life value. If ASME B31.3 or ASME Sect. VIII are specified, this value should realistically represent the actual number of cycles the bellows will experience in service. This is typically in the hundreds of cycles, not thousands.

The bellows effective area is the area of the bellows that creates pressure thrust when acted upon by the operating pressure. The system anchors and/or the hardware on the expansion joint must be designed to withstand pressure thrust at the operating and test conditions.

Torsional spring rate is offered for those pipe stress analysts who are inputting bellows characteristics into a pipe stress program. Bellows are not generally designed for torsional movements. But, the torsional stiffness value can affect the output of a pipe stress analysis that includes an expansion joint.

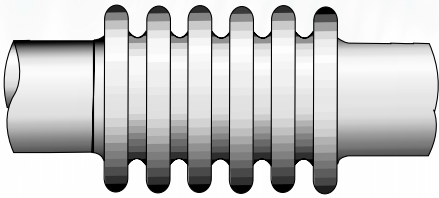
The proposed design has this calculated cycle life at the specified conditions.

There are two types of squirm or instability that can occur for internally pressurized bellows. One is called column squirm (similar to buckling of a column) and the other is called in-plane squirm (localized plastic deformation). Senior Flexionics Pathway calculates the maximum stability pressure based on the lower of the two values. The design stability pressure is the predicted squirm pressure divided by a safety factor of 2.25.

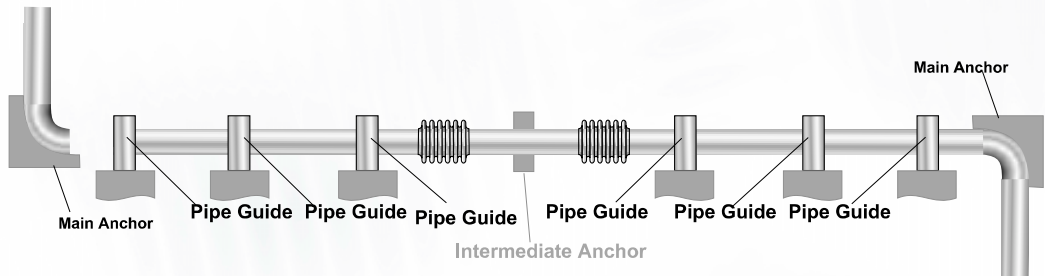
The Senior Flexionics Pathway spring rate calculations are based on the initial elastic spring rate criteria from EJMA.

—[APPLICATIONS]—

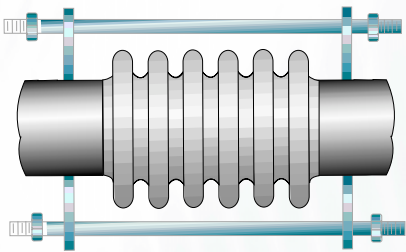
Single Expansion Joints AS have one bellows. **Axial compression** and **extension, lateral** and **angular** movement can be accommodated. These expansion joints do not restrain the internal pressure thrust. The piping designer must provide the system with separate anchoring and guiding to resist the pressure thrust. Where small thermal movements are involved and proper anchoring and guiding is feasible, a single expansion joint is the most economical installation.



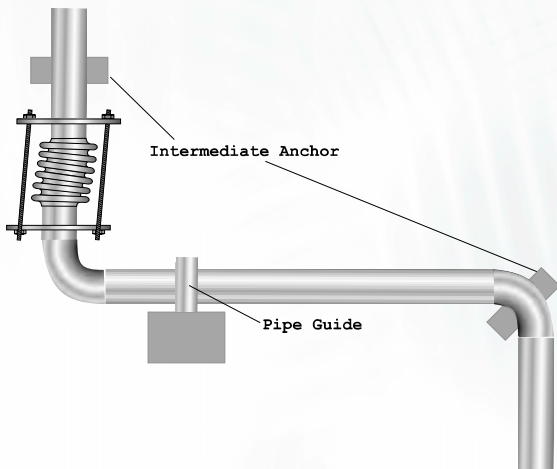
SINGLE UNRESTRAINED AS



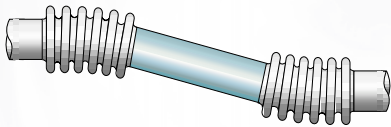
Tied Single AT Expansion Joints also have one bellows, except the overall length is restrained by tie rods designed to contain pressure thrust. A tied single is usually designed for lateral offset so that the tie rods can remain fully engaged and loaded with the pressure thrust force. A two tie rod design can accept **angular** deflection in a single plane.



TIED SINGLE AT



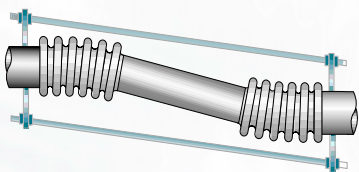
Universal AU Expansion Joints consist of two bellows separated by a pipe spool. This configuration accommodates **large lateral** movements, in addition to **axial compression** and **extension** and **angular** deflection. These expansion joints have no restraints to resist pressure thrust and like the singles, the piping designer must provide separate anchoring to handle pressure thrust.



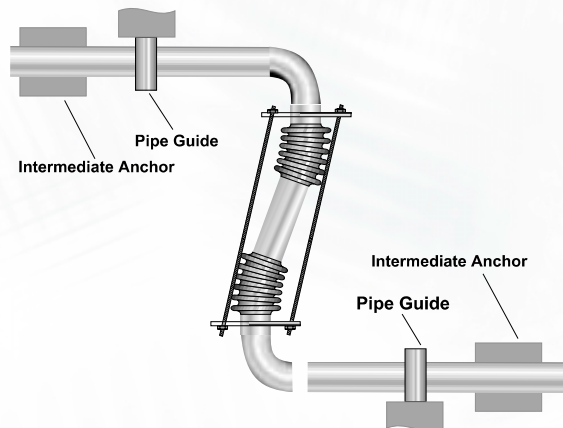
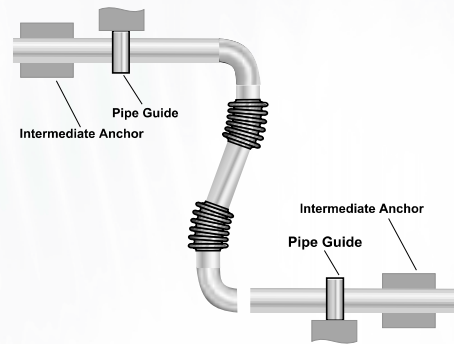
UNIVERSAL AU

Universal Tied, AUT Expansion Joints contain two bellows separated by a pipe spool and tie rods designed to contain the pressure thrust force. These expansion joints are generally designed to accommodate lateral movement only. A universal expansion joint can be designed to have a very low lateral spring force to minimize forces on adjacent equipment. A two tie rod design can also accept **angular** deflection in a single plane.

The tie rods are usually at or near ambient temperatures and, therefore, do not expand and contract as a function of the temperature of the media within the pipe. As a result, the thermal expansion of the length of pipe between the tie rod end plates is forced into the bellows as an axial movement. The bellows design must accommodate this axial thermal expansion as well as the specified lateral movement.

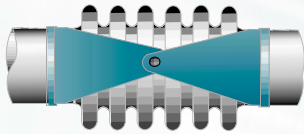


UNIVERSAL TIED AUT



Sometimes a universal expansion joint has a very heavy center spool that can exert excessive weight on the bellows elements. To protect the bellows elements from excessive lateral loads, a support system such as a slotted hinge can be installed across the individual bellows elements to support the dead weight of the center spool.

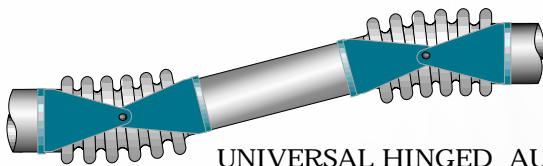
APPLICATIONS (CONTINUED)



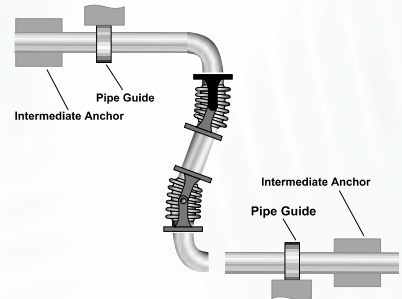
HINGED AH

Hinged Expansion Joints AH have a single bellows with overall length restrained by hinge hardware designed to accommodate pressure thrust. A hinged expansion joint allows **angular** movement **in a single plane**.

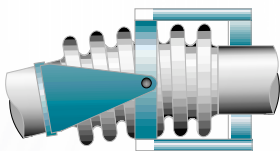
Universal Hinged AUH Expansion Joints have two bellows separated by a pipe spool with overall length restrained by hinge hardware designed to contain pressure thrust. A hinged universal expansion joint accepts **large lateral** movements in a single plane with very low spring forces.



UNIVERSAL HINGED AUH



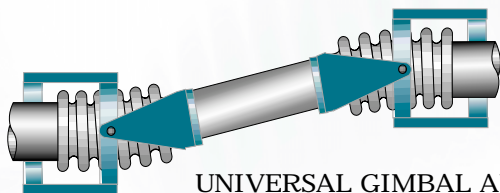
A three-hinge system can accommodate very large movements with very low reaction loads on the adjacent equipment. This is a very attractive application for large diameter hot piping systems if the movements are in the same plane.



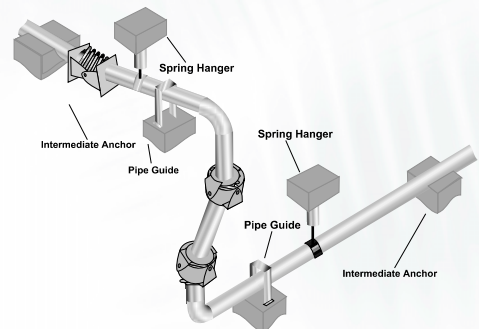
GIMBAL AG

Gimbal AG Expansion Joints have a single bellows and gimbal hardware designed to resist pressure thrust. The gimbal expansion joint hardware operates like the universal joint on a drive shaft to accommodate **angular** movements **in any plane**.

Universal Gimbale AUG Expansion Joints are similar to the hinged universals except that the two expansion joints are gimbal type. The advantage of this arrangement is the ability of the expansion joint to accept **large lateral movements and independent angular movements in any plane**.



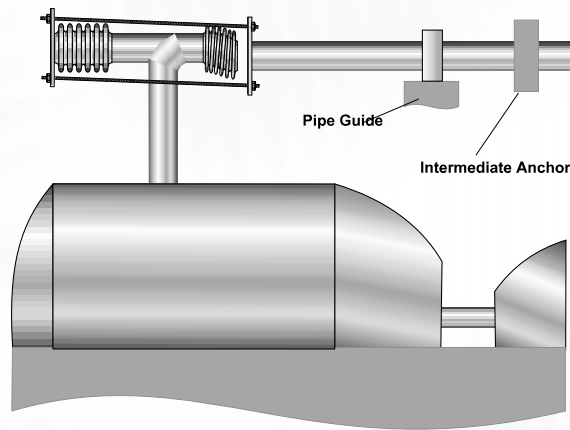
UNIVERSAL GIMBAL AUG



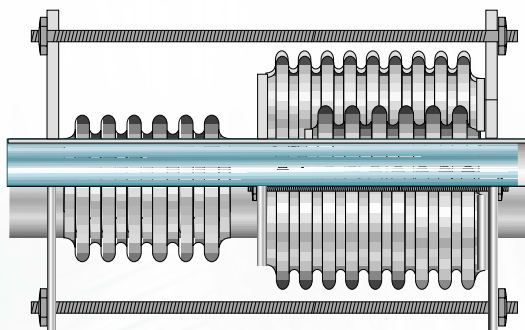
A system consisting of two gimbals and a hinge can accommodate very large movements with very low reaction loads on the adjacent equipment. This is a very attractive application for large diameter hot piping systems even if the movements are complex and not in a single plane.

Pressure Balanced Expansion Joints are devices which produce no pressure thrust forces in the piping system on the main anchors. In addition to eliminating the pressure thrust, the expansion joint can accept axial compression, axial extension, lateral and angular movements. The balancing thrust is created by using a balancing bellows.

Pressure Balanced Elbows are expansion joints which can consist of a single or double bellows in the flow section, and a balancing bellows of equal area on the back side of the elbow. Tie rods attach the outboard end of the balancing bellows to the outboard end of the flow bellows. Under pressure the tie rods are loaded with the pressure thrust force. If the flow bellows compresses in service, the balancing bellows extends the same amount without exposing the adjacent anchors to pressure thrust forces. However, the spring forces associated with bellows movements are imposed on the adjacent equipment. A pressure balanced elbow type expansion joint can accept **axial compression, axial extension, lateral** movements and very limited angular motion.



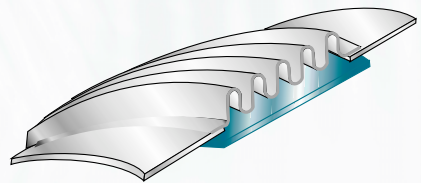
In-Line Pressure Balanced Expansion Joints consist of single or double (universal) bellows to accept the piping induced **axial compression, extension** and **lateral** movements. An oversize bellows with approximately two times the area of the flow bellows is used to create an annular pressure chamber that produces a balancing pressure thrust force. Tie rods are used to link the bellows elements and contain the pressure thrust force. In-Line pressure balanced expansion joints are typically used in straight pipe runs between intermediate anchors (non pressure thrust resistant) or adjacent to rotating equipment that cannot operate with large externally applied loads.



ACCESSORIES

STANDARD LINERS (PART NUMBER L)

Liners can be installed inside the expansion joint to protect the bellows from damage. Liners should be specified by adding the letter L to the part number when the following conditions exist:



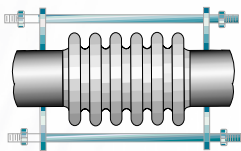
- Smooth flow or low pressure drop is required.
- Velocities which may produce flow induced vibrations described below.
- For air, steam and other gases
 - a) Up to 6" Dia. flow greater than 4 ft/sec per inch of Dia. (Up to 150 mm Dia. flow greater than 0.05 M/sec per mm of Dia.)
 - b) Over 6" Dia. flow greater than 24 ft/sec (over 150-mm Dia. flow greater than 7.5 M/sec)
- For water and other liquids
 - a) Up to 6" Dia. flow greater than 1.67 ft/sec per inch of Dia. (up to 150 mm Dia. flow greater than 0.02 M/sec per mm of Dia.)
 - b) Over 6" Dia. flow greater than 10 ft/sec (over 150 mm Dia. flow greater than 3.0 M/sec)

HEAVY-DUTY LINERS (PART NUMBER HL)

Heavy-duty liners should be used in the following conditions:

- When high velocity, extremely turbulent or damaging two-phase flow exists upstream of the bellows.
- When extremely high temperatures are present, the liners can create an insulating barrier which would permit the bellows to operate at lower temperatures ensuring longer life and resisting oxidation. Steam purging and/or insulation can be added to enhance protection.
- When the media is erosive such as in catalyst carrying services.
- When an expansion joint is located within 10 pipe diameters downstream of an elbow, tee or valve.

When liners are specified, Senior Flexonics Pathway should be provided with the axial, lateral and angular movement expected. This is required so that the diameter of the liner can be properly determined to avoid interference with the downstream pipe or flange.



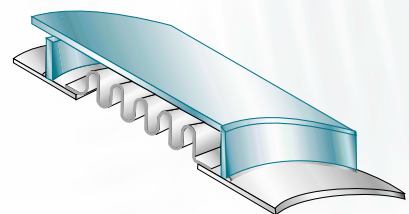
TIE RODS OR LIMIT RODS (PART NUMBER T)

This part number designation adds threaded rods that are designed to contain pressure thrust. The rods will have nuts or stops on the ends of the assembly to limit the overall length. When an expansion joint is designed for pure lateral offset the rods are defined as Tie Rods. If the expansion joint is intended to absorb axial motion as well as lateral offset, the rods will have outboard stops to limit the expansion joint to the installed length plus any specified axial extension. This is defined as a Limit Rod. The designation "T" applies to either purpose. The required movements determine if the rods are Tie Rods or Limit Rods. Limit rods are generally used to limit expansion joint movement in the event of main anchor failure. During normal operation Limit Rods do not contain pressure thrust.

COVERS (PART NUMBER C)

Covers should be specified when:

- Protection from falling objects or protection from traffic is needed.
- Protection of personnel is needed.
- Insulation will be applied over the expansion joint.
- When high flow velocities may exist around the outside of the expansion joint, such as in the exhaust of a steam turbine.

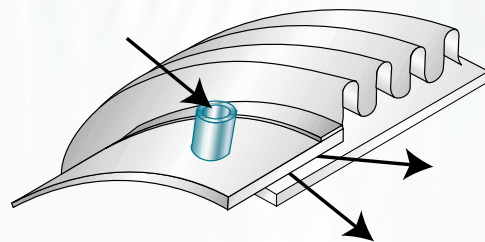


Senior Flexonics Pathway always recommends a cover. The small cost for the cover is insurance against costly downtime due to damage. The standard cover is a removable design.

PURGE CONNECTIONS (PART NUMBER P#)

Purge Connections are installed upstream of the bellows and downstream of the liner attachment to:

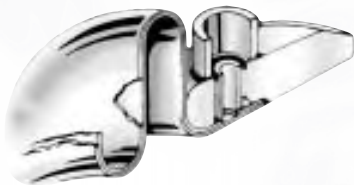
- Prevent packing or caking of media borne solids in the convolutions which would prevent the bellows from freely flexing.
- Introduce a cooling media such as steam between the outside of the liner and the inside of the bellows.



The number of purge connections around the circumference can be specified by adding the number after the letter P in the Accessories portion of the part number, such as **P2** or **P3**, etc.

PLY TESTABLE (PART NUMBER PT)

A ply testable bellows has an extra ply of material that is not required to satisfy basic design conditions. It is a redundant ply that acts as a protective barrier between the media and the essential bellows material. By tapping into the cavity between the redundant ply and the essential bellows material, it is possible to detect a leak that occurs in the redundant ply. If a leak occurs, the essential bellows material is still present to hold pressure with full design compliance.



The ply testable bellows allows for a 100% safety factor on design. This is a requirement for certain hazardous ASME code applications. It is highly recommended for applications in which the cost of replacement or cost of

down time for a leaking bellows would be extreme. It is also recommended for applications in which a leak would be very hazardous to personnel.

RED TOP® LEAK INDICATOR (PART NUMBER RT)

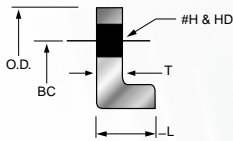
The ply testable connection on the bellows can be fitted with a pressure gage or another type of pressure sensing device. However, bellows are very reliable and pressure gages that never change are not noticed after a while. The Senior Flexonics Pathway patented "Red Top" leak indicator is a device that extends a large red button if a leak is detected. The red button is very noticeable from several meters distance.



STANDARD FLANGE DATA

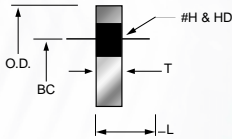
This abbreviated flange data summary is to aid system designers in selecting the optimum pipe and duct flanges. The working pressure at temperature ratings were obtained from applicable flange specifications. Where elevated temperature data was not available, the rated working pressure at ambient was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

SLIP ON FLANGES	NOMINAL I.D.	WORKING PRESSURE RATING (PSIG) AT TEMPERATURE (DEG. F)							
		(20) TO 100	200	300	400	500	600	700	800
CLASS 125 L.W. FORGED STEEL MAT'L. A-105	6" TO 12"	175	152	134	116	98	80	62	46
AWWA 125 L.W. C207-54T CLASS D MAT'L. A-105	14" TO 96"	150	131	115	99	83	67	51	38
CLASS 150 FORGED STEEL ANSI B16.5 MAT'L. A-105	1" TO 24"	285	260	230	200	170	140	110	80
CLASS 125 FORGED STEEL C207-54T CLASS E MAT'L. A-105	26" TO 96"	275	240	210	180	150	130	110	80
CLASS 300 FORGED STEEL ANSI B16.5 MAT'L. A-105	1" TO 24"	740	675	655	635	600	550	535	410
CLASS 400 FORGED STEEL ANSI B16.5 MAT'L. A-105	1" TO 24"	990	900	875	845	800	730	710	550



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

Size Inch	Class 125 L.W								Class 150 B16.5								Class 300 B16.5								Size Inch	
	OD	T	L	BC	#H	HD	WT Lbs.	OD	T	L	BC	#H	HD	WT Lbs.	OD	T	L	BC	#H	HD	WT Lbs.					
1 1/2								5	1 1/16	7/8	3 7/8	4	5/8	3	6 1/8	1 3/16	1 3/16	4 1/2	4	7/8	6	1 1/2				
2								6	3/4	1	4 3/4	4	3/4	5	6 1/2	7/8	1 5/16	5	8	3/4	7	2				
2 1/2								7	7/8	1 1/8	5 1/2	4	3/4	7	7 1/2	1	1 1/2	5 7/8	8	7/8	10	2 1/2				
3								7 1/2	1 5/16	1 3/16	6	4	3/4	8	8 1/4	1 1/8	1 11/16	6 5/8	8	7/8	13	3				
3 1/2								8 1/2	1 5/16	1 1/4	7	8	3/4	11	9	1 3/16	1 3/4	7 1/4	8	7/8	17	3 1/2				
4								9	1 5/16	1 5/16	7 1/2	8	3/4	13	10	1 1/4	1 7/8	7 7/8	8	7/8	22	4				
5								10	1 5/16	1 7/16	8 1/2	8	7/8	15	11	1 3/8	2	9 1/4	8	7/8	28	5				
6	11	9/16	1 1/4	9 1/2	8	7/8	13	11	1	1 9/16	9 1/2	8	7/8	19	12 1/2	1 7/16	2 1/16	10 5/8	12	7/8	39	6				
8	13 1/2	9/16	1 1/4	11 3/4	8	7/8	18	13 1/2	1 1/8	1 3/4	11 3/4	8	7/8	30	15	1 5/8	2 7/16	13	12	1	58	8				
10	16	1 1/16	1 1/4	14 1/4	12	1	26	16	1 3/16	1 15/16	14 1/4	12	1	43	17 1/2	1 7/8	2 5/8	15 1/4	16	1 1/8	81	10				
12	19	1 1/16	1 1/4	17	12	1	42	19	1 1/4	2 3/16	17	12	1	64	20 1/2	2	2 7/8	17 3/4	16	1 1/4	115	12				
14	21	3/4	1 1/4	18 3/4	12	1 1/8	44	21	1 3/8	2 1/4	18 3/4	12	1 1/8	90	23	2 1/8	3	20 1/4	20	1 1/4	165	14				
16	23 1/2	3/4	1 1/4	21 1/4	16	1 1/8	58	23 1/2	1 7/16	2 1/2	21 1/4	16	1 1/8	98	25 1/2	2 1/4	3 1/4	22 1/2	20	1 3/8	190	16				
18	25	3/4	1 1/4	22 3/4	16	1 1/4	59	25	1 9/16	2 11/16	22 3/4	16	1 1/4	130	28	2 3/8	3 1/2	24 3/4	24	1 3/8	250	18				
20	27 1/2	3/4	1 1/4	25	20	1 1/4	69	27 1/2	1 11/16	2 7/8	25	20	1 1/4	165	30 1/2	2 1/2	3 3/4	27	24	1 3/8	315	20				
22	29 1/2	1	1 3/4	27 1/4	20	1 3/8	76	29 1/2	1 13/16	3 1/8	27 1/4	20	1 3/8	185	33	2 5/8	4	29 1/4	24	1 5/8	370	22				
24	32	1	1 3/4	29 1/2	20	1 3/8	115	32	1 7/8	3 1/4	29 1/2	20	1 3/8	220	36	2 3/4	4 3/16	32	24	1 5/8	475	24				
26	34 1/4	1	1 3/4	31 3/4	24	1 3/8	125	Class 125																		26
28	36 1/2	1	1 3/4	34	28	1 3/8	140	36 1/2	2 1/16	3 7/16	34	28	1 3/8	270									28			
30	38 3/4	1	1 3/4	36	28	1 3/8	150	38 3/4	2 1/8	3 1/2	36	28	1 3/8	305									30			
32	41 3/4	1 1/8	1 3/4	38 1/2	28	1 5/8	205																32			
34	43 3/4	1 1/8	1 3/4	40 1/2	32	1 5/8	215																34			
36	46	1 1/8	1 3/4	42 3/4	32	1 5/8	235	46	2 3/8	3 3/4	42 3/4	32	1 5/8	450									36			
38	48 3/4	1 1/8	1 3/4	45 1/4	32	1 5/8	250																38			
40	50 3/4	1 1/8	1 3/4	47 1/4	36	1 5/8	280																40			
42	53	1 1/4	1 3/4	49 1/2	36	1 5/8	330	53	2 5/8	4	49 1/2	36	1 5/8	650									42			
48	59 1/2	1 3/8	2 1/2	56	44	1 5/8	425	59 1/2	2 3/4	4 1/8	56	44	1 5/8	800									48			
54	66 1/4	1 3/8	2 1/2	62 3/4	44	1 7/8	500	66 1/4	3	4 3/8	62 3/4	44	1 7/8	1025									54			
60	73	1 1/2	2 3/4	69 1/4	52	1 7/8	640	73	3 1/8	4 1/2	69 1/4	52	1 7/8	1250									60			
66	80	1 1/2	2 3/4	76	52	1 7/8	750	80	3 3/8	4 7/8	76	52	1 7/8	1775									66			
72	86 1/2	1 1/2	2 3/4	82 1/2	60	1 7/8	850	86 1/2	3 1/2	5	82 1/2	60	1 7/8	1925									72			
84	99 3/4	1 3/4	3	95 1/2	64	2 1/8	1000	99 3/4	3 7/8	5 3/8	95 1/2	64	2 1/8	2600									84			
96	113 1/4	2	3 1/4	108 1/2	68	2 3/8	1650	113 1/4	4 1/4	5 3/4	108 1/2	68	2 3/8	3275									96			



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

To select the overall length of an assembly that uses plate flanges, use the FF (Flange by Flange) overall length from the data pages and adjust the overall catalog overall length by the amount shown in the column labeled FF OAL adjust.

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

Notes:

Plate flanges are designed for use with sheet gasket.

Flange gasket seating surface is a smooth mill finish.

Not recommended for use with spiral wound gaskets.

A36 material not recommended for use above 700°F. or below 20°F.

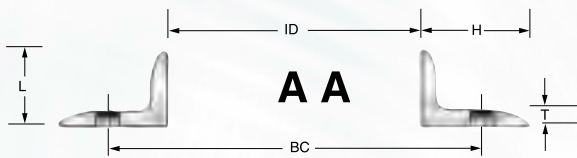
Not suggested for applications where ASME B31.3 or Section VIII Pressure Vessel Code requirements apply

Standard Catalog Flanges: 50 psig design/Class 125 L.W., 150 psig design/Class 150, 300 psig design/Class 300

* Length difference includes space required to avoid interference with bellows and flange nuts.

ANGLE 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 + 2*L.

Nominal Diameter (Inch)	Actual ID (Inch)	Angle Thickness "T" (Inch)	"H"	"L"	Approx. Weight (Lbs.)	Bolt Holes		
						Bolt Circle (Inch)	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
50	50 1/4	1/4	3	3	54	53 1/2	11/16	48
52	52 1/4	1/4	3	3	57	55 1/2	11/16	48
54	54 1/4	1/4	3	3	59.7	57 1/2	11/16	52
60	60 1/4	1/4	3	3	68.2	63 1/2	11/16	56
66	66 1/4	1/4	3	3	76.7	69 1/2	11/16	60
72	72 5/16	3/8	3	3	119.3	75 1/2	11/16	68
84	84 5/16	3/8	3	3	141.9	87 1/2	13/16	76
96	96 5/16	3/8	3	3	164.5	99 1/2	13/16	88
108	108 3/8	3/8	3	3	187.3	111 1/2	13/16	100
120	120 3/8	3/8	3	3	209.9	123 1/2	13/16	108
132	132 3/8	3/8	3	3	232.5	135 1/2	13/16	120
144	144 3/8	3/8	3	3	255.1	147 1/2	13/16	132

PART NUMBER EXAMPLE	Nominal Diameter	Style	Ends	Pressure	Number of Convolutions	Accessories	Bellows Material
English	66	HS	(A = angle flange)	5	10	(L = Liner, C = Cover)	304L

MATERIALS – COMMON METALLURGICAL PROBLEMS

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

Standard Material Specifications For Bellows Shown In This Catalog

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

BELLOWS MATERIAL DATA

Senior Flexonics Pathway engineers can form bellows from most ductile materials that can be welded by the automatic TIG butt welding process that results in a homogenous ductile weld structure.

Companies specifying and purchasing bellows must give careful consideration to the selection of bellows material. When in doubt, consult with basic supplier mill Metallurgist. Senior Flexonics does not take responsibility for alloy selection.

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

**ASME “SA” or “SB” materials are inventoried and are available upon request*

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

HOW TO SPECIFY A

SPECIAL NOTE

If a non-standard flange rating is required or a non-standard weld end thickness is required or if the fittings are non-standard materials, those preferences must be stated along with the part number.

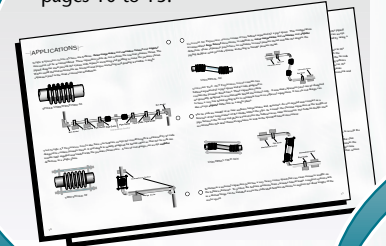
STEP 1

Expansion joints are specified with part numbers starting with the nominal pipe size. If the part is metric, the pipe size should have an "M" suffix so that all units are understood to be Metric (millimeters and Kg/Cm²). Go the data page that shows the size required. (pages 22-53)

STEP 2

Identify the style (AS for Single Unrestrained, AH for Hinged, AG for Gimbal, AT for Tied) using the illustrations at the top of each data page. (pages 22-53)

See applications descriptions on pages 10 to 13.



STEP 5 EXAMPLE

A 12" - 150 PSIG expansion joint is required to accept 1" of axial compression and .5" of lateral offset. The 12 convolution 150 PSIG catalog part has an allowable lateral offset of .51". The example would use up .5/.51 or 98% of the available catalog lateral movement, leaving almost nothing for the required axial movement. The 16 convolution 150 PSIG catalog part lists 2.71" of available axial compression and .91" of available lateral offset. The example expansion joint would use up 1/2.71 or 36% of the catalog axial movement + .5/.91 or 55% of the catalog lateral movement or 36% + 55% = 91% of the total available catalog movement. The 16-convolution profile works. Therefore, the number 16 goes in the part number.

	Nominal Pipe Size	Style	End Fittings
English	12	AS	WW
Metric	200 m	AS	WW

STEP 5

Select the number of convolutions based on movement capability and/or spring rate. This is a simple iterative process. Utilizing the movement data for the size and pressure class required, compare the movements required with the movements available for a given convolution count. An acceptable design satisfies the following equation.

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

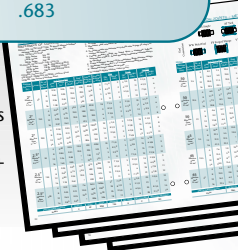
MODIFY CYCLE LIFE

The catalog movements are based on a cycle life of 2000 using the Expansion Joint Manufacturer Association's calculation method. If a higher cycle life is required, the available catalog movements should be reduced by the following amount before the above calculation is performed.

Desired Cycle Life	2000	3000	5000	7000	10000
Catalog Movement Reduction Factor	1	.905	.801	.741	.683

MODIFY CYCLE LIFE EXAMPLE

20 convolutions would be required if the required cycle life were 5000. The catalog movements for a 12" - 150 PSIG expansion joint with 20 convolutions are 3.39" available axial compression, 1.42" available lateral offset. The calculation for 5000 cycles using the above example would be: $1 / (.801 * 3.39) + .5 / (.801 * 1.42) = .37 + .44 = .81$ or 81% of the available movement. Twenty convolutions works for a required cycle life of 5000. (see pages 22-53)



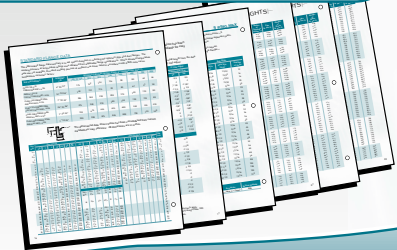
MODIFY SPRING RATE

If spring rate is the limiting design factor, select the convolution count that results in a total force that is less than the required amount for lateral and axial movements. Keep in mind that pressure thrust must be added to the axial spring force for a single expansion joint that has axial compression even if limit rods are specified. To calculate the pressure thrust force, multiply the area of the bellows times the operating pressure. The affective area for any design is located under the pressure class on each page of design data. For the above example assuming 16 convolutions, the pressure thrust is $150 * 153 = 22,950$ pounds. The axial spring force is $1 * 1861 = 1861$ pounds. The lateral offset force is $.5 * 2766 = 1383$ pounds. (see pages 22-53)

SINGLE EXPANSION JOINT

STEP 3 Choose the type of each end fitting required (W for weld end, F for forge flange, P for plate flange, A for angle flange, V for van stone flange) using the illustrations at the top of each odd numbered data pages 22-53. Review the bill of material information at the top of each even numbered pages 22-53 to understand the standard flange rating, weld end thickness, and materials of construction that will be applied.

See pages 16, 17 and 18 for references on pressure ratings and dimensions for various flanges. See pages 87 through 89 for available pipe schedules.



STEP 4 Choose the working pressure required. If the required pressure is between one of the listed values, use the higher of the two values listed in the catalog. If the required pressure is above the highest value listed, indicate the required pressure in the part number and the factory will custom design an expansion joint for the application.

Pressure Rating	Number of Convolutions	Optional Hardware	Alternate Bellows Material
150	20	L, C	304L
10.5	20	L, C	304L

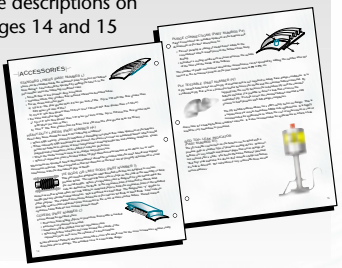
STEP 8 The basic part number is now complete. For a Single untied 12" – 150 psig weld end expansion joint with T321 bellows and a liner and cover designed for 5000 cycles at 1" axial compression and .5" lateral offset the basic part number reads:

12 – AS – WW – 150 – 20 – L,C – 304L

1" axial .5" lateral 0° angular

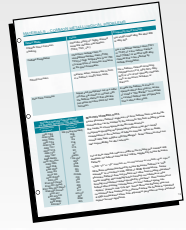
STEP 6 Select the letter code for accessories and options (L for Liner, HL for heavy liner, P# for Purges, C for Cover, PT for ply testable, RT for Red Top leak detector). Separate multiple options with commas to avoid confusion.

See descriptions on pages 14 and 15



STEP 7 Select the bellows material. If no entry is made, the bellows material is ASTM A240 T304 stainless steel.

See page 19 if an alternate bellows material is preferred. Select one of the materials and insert the material code into the part number.



SUMMARY
It is necessary to have the required movement information included in the description so that liner, cover, and limit rods can be designed with proper clearances.

SINGLE EXPANSION JOINTS - METAL

2" AND 2.5" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

50 lb. Series: Sch. 40

150 lb. Series: Sch. 40

300 lb. Series: Sch. 40

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
2" Effective Area 5.7 in. ²	50	4	0.32	0.05	10.0	598	4148	9	7 1/4	2	3 1/4	10	5 1/4	6
		8	0.64	0.20	10.0	299	518	5	8 1/2	2	4 1/2	11	6 1/2	6
		12	0.96	0.45	10.0	199	154	3	9 3/4	2	5 3/4	11	7 3/4	7
		16	1.28	0.79	*	150	65	2	11	2	7	12	9	7
2" Effective Area 5.7 in. ²	150	4	0.23	0.04	10.0	1168	8101	18	7 1/4	2	3 1/4	10	5 1/4	6
		8	0.47	0.15	10.0	584	1013	9	8 1/2	2	4 1/2	11	6 1/2	6
		12	0.70	0.33	10.0	389	300	6	9 3/4	2	5 3/4	12	7 3/4	7
		16	0.97	0.61	*	413	175	6	11	2	7	14	9	8
2" Effective Area 5.7 in. ²	300	4	0.18	0.03	7.7	2019	13999	32	7 1/4	2	3 7/8	14	5 1/2	8
		8	0.36	0.11	10.0	1009	1750	16	8 1/2	2	5 1/8	15	6 3/4	8
		12	0.54	0.25	10.0	673	518	11	9 3/4	2	6 3/8	16	8	9
		16	0.72	0.45	*	806	341	12	11	3	7 5/8	19	9 1/4	11
2.5" Effective Area 8.3 in. ²	50	4	0.42	0.05	10.0	419	4252	10	7 1/4	3	3 1/2	14	5 3/8	9
		8	0.84	0.21	10.0	210	531	5	8 1/2	3	4 3/4	15	6 5/8	9
		12	1.26	0.48	*	140	157	3	9 3/4	3	6	15	7 7/8	9
		16	1.63	0.83	*	210	133	5	11	4	7 1/4	19	9 1/8	12
2.5" Effective Area 8.3 in. ²	150	4	0.30	0.04	10.0	819	8304	19	7 1/4	3	3 1/2	14	5 3/8	9
		8	0.60	0.15	10.0	409	1038	9	8 1/2	3	4 3/4	15	6 5/8	9
		12	0.89	0.34	10.0	546	615	13	9 3/4	4	6	18	7 7/8	11
		16	1.18	0.61	*	409	259	9	11	4	7 1/4	21	9 1/8	12
2.5" Effective Area 8.2 in. ²	300	4	0.21	0.03	7.6	1612	16186	37	7 1/4	3	4 1/4	20	5 3/4	12
		8	0.43	0.11	10.0	806	2023	18	8 1/2	3	5 1/2	21	7	12
		12	0.63	0.25	10.0	1074	1199	25	9 3/4	4	6 3/4	24	8 1/4	14
		16	0.85	0.44	*	806	506	18	11	4	8	28	9 1/2	16

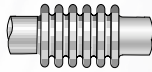
PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	2	AT	WW	150	8	C	321

SINGLE EXPANSION JOINTS - METAL

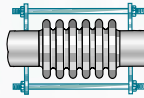
50MM AND 65MM SIZE

Style

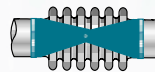
AS Single



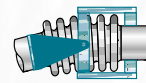
AT Tied



AH Hinged

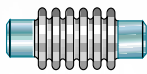


AG Gimbal

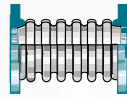


End Connection

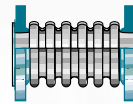
WW Weld End



FF Forged Flange



VV Vanstone End



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
50 Effective Area 37 cm ²	3.5	4	8.1	1.3	10.0	11	74	0.11	184	1	83	5	133	3
		8	16.2	5.0	10.0	5	9	0.05	216	1	114	5	165	3
		12	24.4	11.3	10.0	4	3	0.04	248	1	146	5	197	3
		16	32.5	20.1	*	3	1	0.03	279	1	178	6	229	3
50 Effective Area 37 cm ²	10.5	4	6.0	0.9	10.0	21	145	0.21	184	1	83	5	133	3
		8	11.9	3.7	10.0	10	18	0.11	216	1	114	5	165	3
		12	17.9	8.3	10.0	7	5	0.07	248	1	146	5	197	3
		16	24.8	15.5	*	7	3	0.07	279	1	178	6	229	4
50 Effective Area 37 cm ²	21	4	4.6	0.7	7.7	36	250	0.37	184	1	98	6	140	4
		8	9.2	2.9	10.0	18	31	0.18	216	1	130	7	171	4
		12	13.8	6.4	10.0	12	9	0.12	248	1	162	7	203	4
		16	18.2	11.4	*	14	6	0.14	279	1	194	9	235	5
65 Effective Area 54 cm ²	3.5	4	10.6	1.4	10.0	7	76	0.11	184	1	89	6	137	4
		8	21.3	5.5	10.0	4	9	0.06	216	1	121	7	168	4
		12	31.9	12.3	*	2	3	0.04	248	1	152	7	200	4
		16	41.3	21.2	*	4	2	0.06	279	2	184	9	232	5
65 Effective Area 54 cm ²	10.5	4	7.6	1.0	10.0	15	148	0.22	184	1	89	6	137	4
		8	15.3	3.9	10.0	7	19	0.11	216	1	121	7	168	4
		12	22.5	8.7	10.0	10	11	0.14	248	2	152	8	200	5
		16	30.0	15.4	*	7	5	0.11	279	2	184	9	232	6
65 Effective Area 53 cm ²	21	4	5.4	0.7	7.6	29	289	0.42	184	1	108	9	146	5
		8	10.9	2.8	10.0	14	36	0.21	216	1	140	10	178	5
		12	16.1	6.2	10.0	19	21	0.28	248	2	171	11	210	6
		16	21.5	11.1	*	14	9	0.21	279	2	203	13	241	7

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	50m	AT	WW	10.5	8	C	321

SINGLE EXPANSION JOINTS - METAL

3" AND 3.5" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

- 50 lb. Series: Sch. 40
- 150 lb. Series: Sch. 40
- 300 lb. Series: Sch. 40

FLANGES: ASTM A105/A36/A516-70

- 50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
- 150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
- 300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

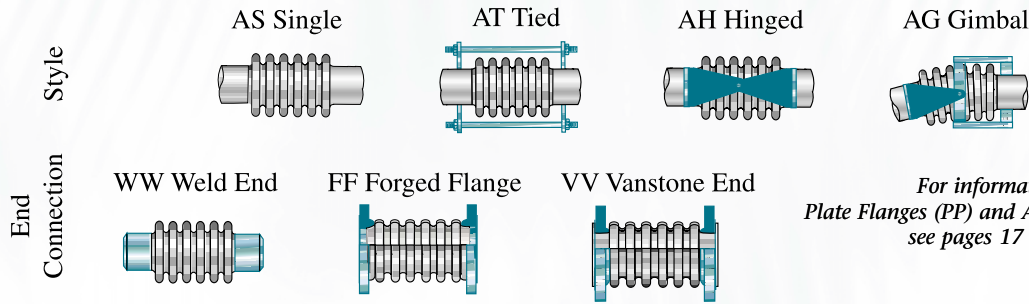
* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
3" Effective Area 12.4 in. ²	50	4	0.46	0.07	10.0	881	6794	30	7 3/4	4	5 7/8	16	6 3/4	10
		8	0.92	0.27	10.0	440	849	15	9 1/2	4	7 5/8	17	8 1/2	11
		12	1.38	0.61	10.0	294	252	10	11 1/4	5	9 3/8	19	10 1/4	12
		16	1.85	1.09	*	220	106	8	13	5	11 1/8	21	12	13
		20	2.40	1.78	*	252	76	9	14 3/4	6	12 7/8	29	13 3/4	17
3" Effective Area 12.4 in. ²	150	4	0.24	0.04	6.9	4077	31455	140	7 3/4	4	5 7/8	17	6 3/4	10
		8	0.48	0.14	10.0	2039	3932	70	9 1/2	5	7 5/8	18	8 1/2	11
		12	0.72	0.32	10.0	1359	1165	47	11 1/4	5	9 3/8	21	10 1/4	13
		16	0.96	0.56	10.0	1019	491	35	13	6	11 1/8	24	12	15
		20	1.20	0.88	*	815	252	28	14 3/4	6	12 7/8	29	13 3/4	18
3" Effective Area 12.2 in. ²	300	4	0.21	0.03	6.0	5035	38232	170	7 3/4	4	5 1/8	27	6 3/8	15
		8	0.41	0.12	10.0	2517	4779	85	9 1/2	5	6 7/8	28	8 1/8	16
		12	0.62	0.28	10.0	1678	1416	57	11 1/4	5	8 5/8	31	9 7/8	18
		16	0.83	0.49	10.0	1259	597	43	13	6	10 3/8	34	11 5/8	20
		20	1.11	0.83	*	1293	387	43	14 3/4	7	12 1/8	45	13 3/8	26
3.5" Effective Area 15.9 in. ²	50	4	0.50	0.06	10.0	833	8258	37	7 3/4	4	4 1/4	22	6	13
		8	1.00	0.26	10.0	416	1032	18	9 1/2	4	6	23	7 3/4	14
		12	1.50	0.58	*	278	306	12	11 1/4	5	7 3/4	25	9 1/2	15
		16	2.00	1.04	*	208	129	9	13	5	9 1/2	27	11 1/4	16
		20	2.69	1.76	*	235	92	10	14 3/4	6	11 1/4	35	13	21
3.5" Effective Area 15.9 in. ²	150	4	0.26	0.03	6.7	3855	38232	170	7 3/4	4	4 1/4	23	6	13
		8	0.53	0.14	10.0	1927	4779	85	9 1/2	5	6	24	7 3/4	15
		12	0.79	0.31	10.0	1285	1416	57	11 1/4	5	7 3/4	27	9 1/2	16
		16	1.06	0.55	*	964	597	43	13	6	9 1/2	31	11 1/4	18
		20	1.32	0.86	*	771	306	34	14 3/4	7	11 1/4	36	13	21
3.5" Effective Area 15.9 in. ²	300	4	0.26	0.03	6.6	2967	28613	127	7 3/4	4	5 1/4	34	6 1/2	19
		8	0.51	0.14	10.0	1483	3577	64	9 1/2	5	7	36	8 1/4	20
		12	0.77	0.30	10.0	989	1060	42	11 1/4	5	8 3/4	38	10	21
		16	0.96	0.50	10.0	1927	1195	85	13	8	10 1/2	52	11 3/4	30
		20	1.19	0.77	*	1542	612	68	14 3/4	9	12 1/4	62	13 1/2	36

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	3	AT	PP	50	8	C	304L

SINGLE EXPANSION JOINTS - METAL

80MM AND 90MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
80 Effective Area 80 cm ²	3.5	4	11.7	1.7	10.0	16	121	0.35	197	2	149	7	171	5
		8	23.4	6.9	10.0	8	15	0.17	241	2	194	8	216	5
		12	35.2	15.5	10.0	5	4	0.12	286	2	238	9	260	5
		16	46.9	27.6	*	4	2	0.09	330	2	283	10	305	6
		20	60.9	45.1	*	4	1	0.10	375	3	327	13	349	8
80 Effective Area 80 cm ²	10.5	4	6.1	0.9	6.9	73	562	1.61	197	2	149	7	171	5
		8	12.2	3.6	10.0	36	70	0.81	241	2	194	8	216	5
		12	18.3	8.1	10.0	24	21	0.54	286	2	238	9	260	6
		16	24.4	14.3	10.0	18	9	0.40	330	3	283	11	305	7
		20	30.5	22.4	*	15	4	0.32	375	3	327	13	349	8
80 Effective Area 79 cm ²	21	4	5.2	0.8	6.0	90	683	1.96	197	2	130	12	162	7
		8	10.5	3.1	10.0	45	85	0.98	241	2	175	13	206	7
		12	15.7	7.0	10.0	30	25	0.65	286	2	219	14	251	8
		16	21.0	12.4	10.0	22	11	0.49	330	3	264	15	295	9
		20	28.2	21.1	*	23	7	0.50	375	3	308	20	340	12
90 Effective Area 103 cm ²	3.5	4	12.7	1.6	10.0	15	148	0.42	197	2	108	10	152	6
		8	25.4	6.6	10.0	7	18	0.21	241	2	152	11	197	6
		12	38.1	14.8	*	5	5	0.14	286	2	197	11	241	7
		16	50.8	26.3	*	4	2	0.11	330	2	241	12	286	7
		20	68.3	44.6	*	4	2	0.12	375	3	286	16	330	9
90 Effective Area 103 cm ²	10.5	4	6.7	0.9	6.7	69	683	1.96	197	2	108	10	152	6
		8	13.4	3.5	10.0	34	85	0.98	241	2	152	11	197	7
		12	20.1	7.8	10.0	23	25	0.65	286	2	197	12	241	7
		16	26.8	13.9	*	17	11	0.49	330	3	241	14	286	8
		20	33.5	21.7	*	14	5	0.39	375	3	286	16	330	10
90 Effective Area 103 cm ²	21	4	6.5	0.9	6.6	53	511	1.47	197	2	133	16	165	9
		8	13.1	3.4	10.0	26	64	0.73	241	2	178	16	210	9
		12	19.6	7.7	10.0	18	19	0.49	286	2	222	17	254	10
		16	24.3	12.6	10.0	34	21	0.98	330	4	267	24	298	14
		20	30.4	19.7	*	28	11	0.78	375	4	311	28	343	16

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	80m	AT	PP	3.5	8	C	304L

SINGLE EXPANSION JOINTS - METAL

4" AND 4.5" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

50 lb. Series: Sch. 40
 150 lb. Series: Sch. 40
 300 lb. Series: Sch. 40

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
 150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
 300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

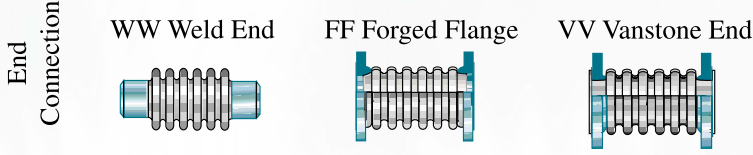
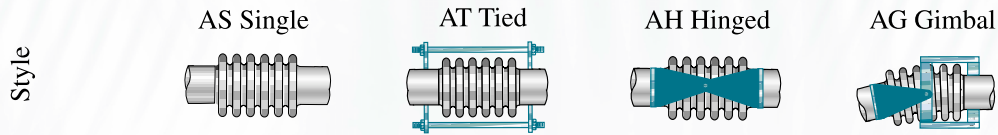
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
4" Effective Area 19.1 in. ²	50	4	0.39	0.05	9.0	1416	16905	75	7 3/4	6	4 3/8	26	6	16
		8	0.78	0.18	10.0	708	2113	38	9 1/2	6	6 1/8	27	7 3/4	17
		12	1.17	0.41	10.0	472	626	25	11 1/4	6	7 7/8	29	9 1/2	18
		16	1.55	0.73	*	354	264	19	13	7	9 5/8	31	11 1/4	19
		20	1.94	1.15	*	283	135	15	14 3/4	7	11 3/8	34	13	20
4" Effective Area 20.1 in. ²	150	4	0.32	0.04	7.2	3046	38232	170	7 3/4	6	4 3/8	27	6	16
		8	0.64	0.15	10.0	1523	4779	85	9 1/2	7	6 1/8	28	7 3/4	18
		12	0.96	0.33	10.0	1015	1416	57	11 1/4	7	7 7/8	32	9 1/2	19
		16	1.28	0.59	*	761	597	43	13	8	9 5/8	36	11 1/4	22
		20	1.75	1.02	*	743	368	41	14 3/4	11	11 3/8	49	13	30
4" Effective Area 20.1 in. ²	300	4	0.25	0.03	5.7	5263	66065	294	7 3/4	6	5 1/2	45	6 5/8	25
		8	0.50	0.12	10.0	2631	8258	147	9 1/2	7	7 1/4	47	8 3/8	27
		12	0.76	0.26	10.0	1754	2447	98	11 1/4	8	9	51	10 1/8	29
		16	1.01	0.47	10.0	1316	1032	74	13	9	10 3/4	56	11 7/8	32
		20	1.32	0.76	*	1451	719	80	14 3/4	12	12 1/2	73	13 5/8	43
5" Effective Area 30.4 in. ²	50	4	0.54	0.05	10.0	1218	23065	103	7 3/4	8	6 3/8	31	7	19
		8	1.08	0.20	10.0	609	2883	51	9 1/2	9	8 1/8	32	8 3/4	21
		12	1.62	0.46	10.0	406	854	34	11 1/4	10	9 7/8	35	10 1/2	22
		16	2.17	0.81	*	304	360	26	13	10	11 5/8	39	12 1/4	25
		20	2.71	1.27	*	244	185	21	14 3/4	11	13 3/8	44	14	28
5" Effective Area 29.5 in. ²	150	4	0.31	0.03	5.9	3805	69923	311	7 3/4	8	6 3/8	31	7	19
		8	0.63	0.12	10.0	1903	8740	156	9 1/2	9	8 1/8	32	8 3/4	21
		12	0.94	0.27	10.0	1268	2590	104	11 1/4	10	9 7/8	36	10 1/2	23
		16	1.25	0.48	10.0	951	1093	78	13	11	11 5/8	40	12 1/4	25
		20	1.57	0.75	*	761	559	62	14 3/4	12	13 3/8	45	14	28
5" Effective Area 29.2 in. ²	300	4	0.27	0.03	5.1	4529	82368	367	7 3/4	8	5 3/4	57	6 3/4	32
		8	0.54	0.10	10.0	2264	10296	183	9 1/2	9	7 1/2	58	8 1/2	34
		12	0.81	0.23	10.0	1510	3051	122	11 1/4	10	9 1/4	61	10 1/4	36
		16	1.08	0.42	10.0	1696	1889	135	13	12	11	70	12	41
		20	1.35	0.65	10.0	1357	967	108	14 3/4	13	12 3/4	77	13 3/4	45

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	5	AH	WW	300	16	L, C	321

SINGLE EXPANSION JOINTS - METAL 100MM AND 125MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
100 Effective Area 124 cm ²	3.5	4	9.9	1.2	9.0	25	302	0.87	197	3	111	12	152	7
		8	19.7	4.7	10.0	13	38	0.43	241	3	156	12	197	8
		12	29.6	10.5	10.0	8	11	0.29	286	3	200	13	241	8
		16	39.5	18.6	*	6	5	0.22	330	3	244	14	286	9
		20	49.3	29.1	*	5	2	0.17	375	3	289	15	330	9
100 Effective Area 130 cm ²	10.5	4	8.1	0.9	7.2	54	683	1.96	197	3	111	12	152	7
		8	16.2	3.7	10.0	27	85	0.98	241	3	156	13	197	8
		12	24.3	8.4	10.0	18	25	0.65	286	3	200	14	241	9
		16	32.4	14.9	*	14	11	0.49	330	4	244	16	286	10
		20	44.5	25.8	*	13	7	0.47	375	5	289	22	330	14
100 Effective Area 130 cm ²	21	4	6.4	0.7	5.7	94	1180	3.39	197	3	140	20	168	12
		8	12.8	3.0	10.0	47	148	1.70	241	3	184	21	213	12
		12	19.2	6.6	10.0	31	44	1.13	286	4	229	23	257	13
		16	25.6	11.8	10.0	24	18	0.85	330	4	273	25	302	15
		20	33.4	19.4	*	26	13	0.92	375	5	318	33	346	19
125 Effective Area 196 cm ²	3.5	4	13.7	1.3	10.0	22	412	1.18	197	4	162	14	178	9
		8	27.5	5.2	10.0	11	52	0.59	241	4	206	15	222	9
		12	41.2	11.6	10.0	7	15	0.39	286	4	251	16	267	10
		16	55.0	20.6	*	5	6	0.30	330	5	295	18	311	11
		20	68.7	32.2	*	4	3	0.24	375	5	340	20	356	13
125 Effective Area 190 cm ²	10.5	4	8.0	0.8	5.9	68	1249	3.59	197	4	162	14	178	9
		8	15.9	3.0	10.0	34	156	1.79	241	4	206	15	222	9
		12	23.9	6.8	10.0	23	46	1.20	286	4	251	16	267	10
		16	31.8	12.1	10.0	17	20	0.90	330	5	295	18	311	11
		20	39.8	19.0	*	14	10	0.72	375	5	340	21	356	13
125 Effective Area 188 cm ²	21	4	6.9	0.7	5.1	81	1471	4.23	197	4	146	26	171	15
		8	13.8	2.6	10.0	40	184	2.11	241	4	191	26	216	15
		12	20.6	5.9	10.0	27	54	1.41	286	4	235	28	260	16
		16	27.4	10.6	10.0	30	34	1.55	330	5	279	32	305	18
		20	34.2	16.5	10.0	24	17	1.24	375	6	324	35	349	20

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	125m	AH	WW	21	16	L, C	321

SINGLE EXPANSION JOINTS - METAL

6" AND 8" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

50 lb. Series: Sch. 40
 150 lb. Series: Sch. 40
 300 lb. Series: Sch. 40

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
 150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
 300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

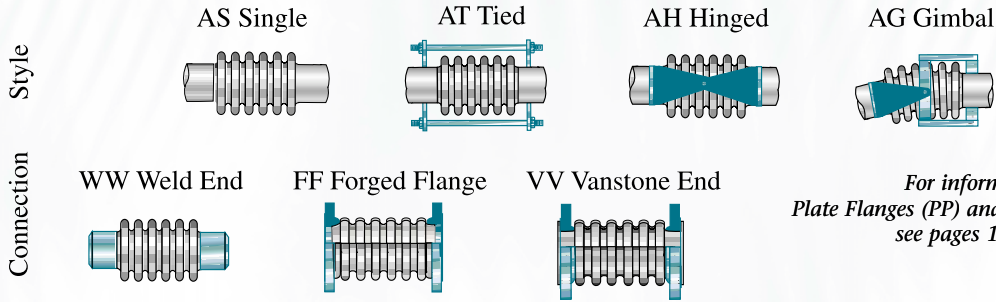
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
6" Effective Area 43 in. ²	50	4	0.62	0.07	9.7	1902	24823	226	8 1/2	11	6 7/8	39	7 5/8	25
		8	1.25	0.28	10.0	951	3103	113	11	12	9 3/8	41	10 1/8	27
		12	1.87	0.63	10.0	634	919	75	13 1/2	14	11 7/8	45	12 5/8	30
		16	2.50	1.13	*	475	388	56	16	15	14 3/8	51	15 1/8	33
		20	3.12	1.76	*	380	199	45	18 1/2	16	16 7/8	59	17 5/8	38
6" Effective Area 43 in. ²	150	4	0.48	0.05	7.5	3286	42895	390	8 1/2	11	6 7/8	39	7 5/8	25
		8	0.97	0.22	10.0	1643	5362	195	11	13	9 3/8	42	10 1/8	27
		12	1.45	0.49	10.0	1095	1589	130	13 1/2	14	11 7/8	47	12 5/8	31
		16	1.98	0.90	*	1240	994	145	16	20	14 3/8	63	15 1/8	41
		20	2.47	1.41	*	992	509	116	18 1/2	22	16 7/8	77	17 5/8	49
6" Effective Area 42 in. ²	300	4	0.32	0.04	5.0	6694	83720	761	8 1/2	11	6 5/8	79	7 1/2	45
		8	0.64	0.15	10.0	3347	10465	381	11	12	9 1/8	81	10	47
		12	0.95	0.33	10.0	2231	3101	254	13 1/2	14	11 5/8	85	12 1/2	50
		16	1.20	0.55	10.0	2539	2036	296	16	18	14 1/8	98	15	58
		20	1.50	0.85	10.0	2031	1043	237	18 1/2	20	16 5/8	109	17 1/2	64
8" Effective Area 70 in. ²	50	4	0.69	0.06	8.4	1964	41983	382	8 1/2	16	7 1/4	61	7 7/8	39
		8	1.38	0.24	10.0	982	5248	191	11	18	9 3/4	64	10 3/8	41
		12	2.07	0.55	10.0	655	1555	127	13 1/2	20	12 1/4	68	12 7/8	44
		16	2.77	0.98	*	491	656	95	16	22	14 3/4	74	15 3/8	48
		20	3.46	1.53	*	393	336	76	18 1/2	24	17 1/4	82	17 7/8	53
8" Effective Area 69 in. ²	150	4	0.47	0.04	5.8	4329	91322	830	8 1/2	16	7 1/4	61	7 7/8	39
		8	0.95	0.17	10.0	2165	11415	415	11	19	9 3/4	64	10 3/8	41
		12	1.42	0.38	10.0	1443	3382	277	13 1/2	21	12 1/4	69	12 7/8	45
		16	1.90	0.67	10.0	1082	1427	208	16	23	14 3/4	76	15 3/8	49
		20	2.39	1.07	*	1305	1087	247	18 1/2	31	17 1/4	99	17 7/8	65
8" Effective Area 69 in. ²	300	4	0.34	0.03	4.1	10262	216468	1968	8 1/2	17	7 3/8	117	7 7/8	67
		8	0.68	0.12	8.3	5131	27058	984	11	20	9 7/8	121	10 3/8	71
		12	1.01	0.27	10.0	3421	8017	656	13 1/2	23	12 3/8	128	12 7/8	75
		16	1.35	0.48	10.0	2566	3382	492	16	26	14 7/8	137	15 3/8	81
		20	1.69	0.75	10.0	2052	1732	394	18 1/2	29	17 3/8	149	17 7/8	89

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	8	AG	WW	50	20	L, C	304

SINGLE EXPANSION JOINTS - METAL 150MM AND 200MM SIZE



METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
150 Effective Area 276 cm ²	3.5	4	15.9	1.8	9.7	34	443	2.60	216	5	175	18	194	11
		8	31.7	7.2	10.0	17	55	1.30	279	6	238	19	257	12
		12	47.6	16.1	10.0	11	16	0.87	343	6	302	21	321	13
		16	63.4	28.7	*	8	7	0.65	406	7	365	23	384	15
		20	79.3	44.8	*	7	4	0.52	470	7	429	27	448	17
150 Effective Area 276 cm ²	10.5	4	12.3	1.4	7.5	59	766	4.49	216	5	175	18	194	11
		8	24.6	5.6	10.0	29	96	2.25	279	6	238	19	257	12
		12	36.9	12.5	10.0	20	28	1.50	343	7	302	21	321	14
		16	50.2	22.9	*	22	18	1.67	406	9	365	28	384	19
		20	62.8	35.8	*	18	9	1.33	470	10	429	35	448	22
150 Effective Area 271 cm ²	21	4	8.1	0.9	5.0	120	1496	8.77	216	5	168	36	191	20
		8	16.2	3.7	10.0	60	187	4.38	279	6	232	37	254	21
		12	24.2	8.4	10.0	40	55	2.92	343	6	295	39	318	22
		16	30.4	13.9	10.0	45	36	3.41	406	8	359	44	381	26
		20	38.0	21.6	10.0	36	19	2.73	470	9	422	49	445	29
200 Effective Area 451 cm ²	3.5	4	17.6	1.6	8.4	35	750	4.40	216	7	184	28	200	17
		8	35.1	6.2	10.0	18	94	2.20	279	8	248	29	264	19
		12	52.7	14.0	10.0	12	28	1.47	343	9	311	31	327	20
		16	70.3	24.8	*	9	12	1.10	406	10	375	34	391	22
		20	87.8	38.8	*	7	6	0.88	470	11	438	37	454	24
200 Effective Area 445 cm ²	10.5	4	12.0	1.1	5.8	77	1631	9.56	216	7	184	28	200	18
		8	24.1	4.3	10.0	39	204	4.78	279	8	248	29	264	19
		12	36.1	9.6	10.0	26	60	3.19	343	9	311	31	327	20
		16	48.2	17.1	10.0	19	25	2.39	406	10	375	34	391	22
		20	60.8	27.2	*	23	19	2.85	470	14	438	45	454	29
200 Effective Area 445 cm ²	21	4	8.6	0.8	4.1	183	3867	22.67	216	8	187	53	200	30
		8	17.2	3.1	8.3	92	483	11.34	279	9	251	55	264	32
		12	25.8	6.9	10.0	61	143	7.56	343	10	314	58	327	34
		16	34.4	12.2	10.0	46	60	5.67	406	12	378	62	391	37
		20	43.0	19.1	10.0	37	31	4.53	470	13	441	68	454	40

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	200m	AG	WW	3.5	20	L, C	304

SINGLE EXPANSION JOINTS - METAL

10" AND 12" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

50 lb. Series: STD. WALL

150 lb. Series: STD. WALL

300 lb. Series: STD. WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

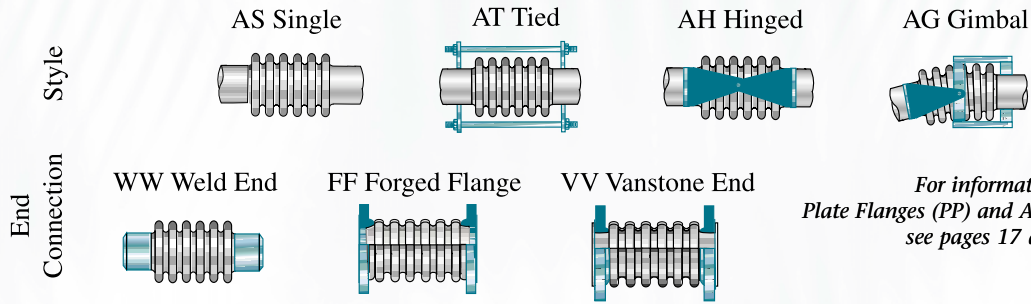
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
10" Effective Area 109 in. ²	50	4	0.98	0.10	9.6	2067	35133	626	9 1/2	24	9 1/8	87	9 1/4	56
		8	1.97	0.39	10.0	1034	4392	313	13	28	12 5/8	91	12 3/4	60
		12	2.95	0.88	10.0	689	1301	209	16 1/2	31	16 1/8	98	16 1/4	65
		16	3.94	1.56	*	517	549	156	20	35	19 5/8	108	19 3/4	71
		20	5.04	2.51	10.0	639	428	191	23 1/2	49	23 1/8	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 1/8	88	9 1/4	56
		8	1.24	0.25	10.0	2963	12458	888	13	30	12 5/8	93	12 3/4	61
		12	1.86	0.55	10.0	1976	3691	592	16 1/2	34	16 1/8	102	16 1/4	68
		16	2.48	0.99	10.0	1482	1557	444	20	39	19 5/8	114	19 3/4	76
		20	3.00	1.48	*	1600	1099	490	23 1/2	52	23 1/8	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	8 3/4	164	9 1/8	95
		8	0.99	0.20	9.6	5255	22209	1583	13	32	12 1/4	171	12 5/8	102
		12	1.48	0.44	10.0	3503	6581	1055	16 1/2	38	15 3/4	182	16 1/8	110
		16	1.97	0.78	10.0	2627	2776	791	20	44	19 1/4	198	19 5/8	121
		20	2.70	1.35	10.0	2619	1752	781	23 1/2	66	22 3/4	247	23 1/8	156
12" Effective Area 154 in. ²	50	4	0.98	0.08	8.0	3260	78244	1394	9 1/2	33	9 5/8	130	9 1/2	81
		8	1.97	0.33	10.0	1630	9781	697	13	40	13 1/8	137	13	88
		12	2.95	0.74	10.0	1087	2898	465	16 1/2	46	16 5/8	147	16 1/2	97
		16	3.93	1.31	*	815	1223	349	20	53	20 1/8	162	20	108
		20	4.91	2.05	*	652	626	279	23 1/2	60	23 5/8	182	23 1/2	121
12" Effective Area 153 in. ²	150	4	0.68	0.06	5.6	7443	177051	3154	9 1/2	34	9 5/8	131	9 1/2	82
		8	1.36	0.23	10.0	3722	22131	1577	13	42	13 1/8	138	13	90
		12	2.03	0.51	10.0	2481	6557	1051	16 1/2	50	16 5/8	151	16 1/2	101
		16	2.71	0.91	10.0	1861	2766	789	20	59	20 1/8	169	20	114
		20	3.39	1.42	*	1489	1416	631	23 1/2	67	23 5/8	192	23 1/2	129
12" Effective Area 151 in. ²	300	4	0.56	0.05	4.6	9558	224309	3996	9 1/2	34	9 1/4	232	9 3/8	133
		8	1.12	0.19	9.3	4779	28039	1998	13	41	12 3/4	240	12 7/8	140
		12	1.68	0.43	10.0	3186	8308	1332	16 1/2	49	16 1/4	252	16 3/8	150
		16	2.38	0.81	10.0	3213	4648	1325	20	71	19 3/4	287	19 7/8	179
		20	2.98	1.26	10.0	2570	2380	1060	23 1/2	83	23 1/4	319	23 3/8	201

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	10	AT	PW	150	12	HL	316

SINGLE EXPANSION JOINTS - METAL 250MM AND 300MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
250 Effective Area 703 cm ²	3.5	4	25.0	2.5	9.6	37	628	7.2	241	11	232	40	235	25
		8	50.0	9.9	10.0	18	78	3.6	330	13	321	41	324	27
		12	75.0	22.3	10.0	12	23	2.4	419	14	410	45	413	29
		16	100.0	39.6	*	9	10	1.8	508	16	498	49	502	32
		20	127.9	63.8	10.0	11	8	2.2	597	22	587	63	591	43
250 Effective Area 710 cm ²	10.5	4	15.7	1.6	6.1	106	1780	20.5	241	11	232	40	235	26
		8	31.5	6.3	10.0	53	223	10.2	330	13	321	42	324	28
		12	47.2	14.1	10.0	35	66	6.8	419	16	410	46	413	31
		16	62.9	25.1	10.0	26	28	5.1	508	18	498	52	502	35
		20	76.2	37.5	*	29	20	5.6	597	24	587	66	591	45
250 Effective Area 700 cm ²	21	4	12.5	1.2	4.8	188	3174	36.5	241	12	222	74	232	43
		8	25.1	5.0	9.6	94	397	18.2	330	15	311	78	321	46
		12	37.6	11.2	10.0	63	118	12.2	419	17	400	83	410	50
		16	50.1	19.9	10.0	47	50	9.1	508	20	489	90	498	55
		20	68.5	34.2	10.0	47	31	9.0	597	30	578	112	587	71
300 Effective Area 993 cm ²	3.5	4	25.0	2.1	8.0	58	1398	16.1	241	15	244	59	241	37
		8	49.9	8.3	10.0	29	175	8.0	330	18	333	62	330	40
		12	74.9	18.7	10.0	19	52	5.4	419	21	422	67	419	44
		16	99.8	33.3	*	15	22	4.0	508	24	511	74	508	49
		20	124.8	52.0	*	12	11	3.2	597	27	600	82	597	55
300 Effective Area 984 cm ²	10.5	4	17.2	1.4	5.6	133	3163	36.3	241	15	244	59	241	37
		8	34.4	5.8	10.0	66	395	18.2	330	19	333	63	330	41
		12	51.6	13.0	10.0	44	117	12.1	419	23	422	69	419	46
		16	68.8	23.1	10.0	33	49	9.1	508	27	511	77	508	52
		20	86.1	36.0	*	27	25	7.3	597	30	600	87	597	59
300 Effective Area 971 cm ²	21	4	14.2	1.2	4.6	171	4007	46.0	241	15	235	105	238	60
		8	28.5	4.8	9.3	85	501	23.0	330	19	324	109	327	64
		12	42.7	10.8	10.0	57	148	15.3	419	22	413	114	416	68
		16	60.5	20.5	10.0	57	83	15.3	508	32	502	130	505	81
		20	75.6	32.1	10.0	46	43	12.2	597	38	591	145	594	91

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	250m	AT	PW	10.5	12	HL, C	316

SINGLE EXPANSION JOINTS - METAL

14" AND 16" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

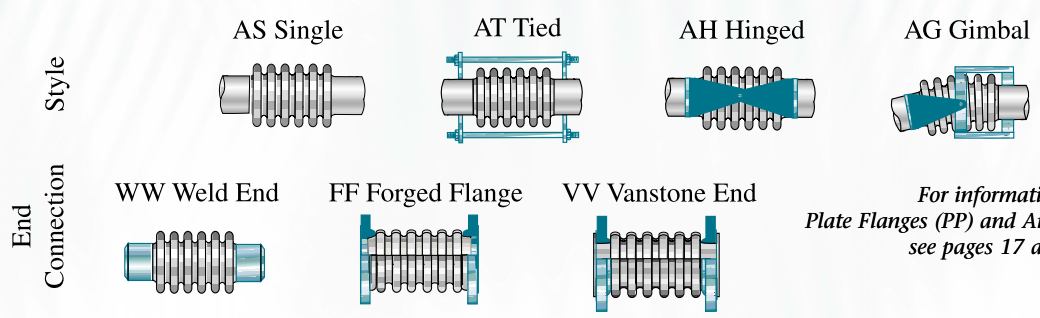
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
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
		8	1.91	0.30	10.0	1360	9406	670	13	41	9 1/2	93	11 1/4	67
		12	2.86	0.67	10.0	907	2787	447	16 1/2	46	13	100	14 3/4	73
		16	3.81	1.18	*	680	1176	335	20	51	16 1/2	110	18 1/4	80
		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	8	183	8 3/4	112
		8	1.41	0.22	10.0	3791	26877	1915	13	50	11 1/2	190	12 1/4	120
		12	2.11	0.49	10.0	2527	7964	1277	16 1/2	60	15	204	15 3/4	132
		16	2.81	0.86	10.0	1895	3360	958	20	69	18 1/2	222	19 1/4	145
		20	3.52	1.35	*	1516	1720	766	23 1/2	78	22	246	22 3/4	162
14" Effective Area 180 in. ²	300	4	0.58	0.04	4.4	9669	270853	4826	9 1/2	40	9 1/2	332	9 1/2	186
		8	1.16	0.18	8.8	4835	33857	2413	13	49	13	340	13	194
		12	1.74	0.40	10.0	3223	10032	1609	16 1/2	58	16 1/2	352	16 1/2	205
		16	2.49	0.77	10.0	3224	5574	1589	20	83	20	389	20	236
		20	3.11	1.21	10.0	2579	2854	1271	23 1/2	95	23 1/2	421	23 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
		8	2.08	0.28	10.0	1306	11682	833	13	47	9 1/2	122	11 1/4	84
		12	3.12	0.64	10.0	871	3461	555	16 1/2	53	13	129	14 3/4	91
		16	4.16	1.13	*	653	1460	416	20	59	16 1/2	139	18 1/4	99
		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	8 1/2	199	9	123
		8	1.45	0.20	9.6	4032	36728	2618	13	58	12	207	12 1/2	132
		12	2.18	0.44	10.0	2688	10882	1745	16 1/2	68	15 1/2	220	16	144
		16	2.90	0.79	10.0	2016	4591	1309	20	79	19	239	19 1/2	159
		20	3.63	1.23	10.0	1613	2351	1047	23 1/2	90	22 1/2	263	23	176
16" Effective Area 231 in. ²	300	4	0.60	0.04	4.0	10217	368226	6561	9 1/2	46	10	383	9 3/4	214
		8	1.20	0.16	8.0	5108	46028	3280	13	56	13 1/2	390	13 1/4	223
		12	1.80	0.37	10.0	3406	13638	2187	16 1/2	66	17	403	16 3/4	234
		16	2.59	0.71	10.0	3380	7531	2147	20	95	20 1/2	440	20 1/4	268
		20	3.24	1.11	10.0	2704	3856	1717	23 1/2	110	24	474	23 3/4	292

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	16	AS	FW	150	8	L, C	316L

SINGLE EXPANSION JOINTS - METAL 350MM AND 400MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
350 Effective Area 1145 cm ²	3.5	4	24.2	1.9	7.3	49	1344	15.4	241	16	152	41	197	28
		8	48.4	7.5	10.0	24	168	7.7	330	19	241	42	286	30
		12	72.7	16.9	10.0	16	50	5.1	419	21	330	46	375	33
		16	96.9	30.1	*	12	21	3.9	508	23	419	50	464	36
		20	121.1	47.0	*	10	11	3.1	597	25	508	55	552	40
350 Effective Area 1174 cm ²	10.5	4	17.9	1.4	5.3	135	3841	44.1	241	19	203	83	222	51
		8	35.7	5.5	10.0	68	480	22.1	330	23	292	86	311	55
		12	53.6	12.3	10.0	45	142	14.7	419	27	381	92	400	60
		16	71.4	21.9	10.0	34	60	11.0	508	31	470	101	489	66
		20	89.3	34.2	*	27	31	8.8	597	35	559	111	578	73
350 Effective Area 1159 cm ²	21	4	14.8	1.1	4.4	173	4838	55.6	241	18	241	151	241	85
		8	29.5	4.6	8.8	86	605	27.8	330	22	330	154	330	88
		12	44.3	10.2	10.0	58	179	18.5	419	26	419	160	419	93
		16	63.1	19.6	10.0	58	100	18.3	508	37	508	176	508	107
		20	78.9	30.6	10.0	46	51	14.6	597	43	597	191	597	117
400 Effective Area 1481 cm ²	3.5	4	26.4	1.8	7.0	47	1669	19.2	241	19	152	53	197	36
		8	52.8	7.2	10.0	23	209	9.6	330	21	241	55	286	38
		12	79.2	16.2	10.0	16	62	6.4	419	24	330	58	375	41
		16	105.6	28.8	*	12	26	4.8	508	27	419	63	464	45
		20	132.0	45.0	*	9	13	3.8	597	29	508	69	552	49
400 Effective Area 1508 cm ²	10.5	4	18.4	1.2	4.8	144	5249	60.3	241	21	216	90	229	56
		8	36.9	5.0	9.6	72	656	30.2	330	26	305	94	318	60
		12	55.3	11.2	10.0	48	194	20.1	419	31	394	100	406	65
		16	73.8	20.0	10.0	36	82	15.1	508	36	483	108	495	72
		20	92.2	31.2	10.0	29	42	12.1	597	41	572	119	584	80
400 Effective Area 1491 cm ²	21	4	15.2	1.0	4.0	183	6578	75.6	241	21	254	173	248	97
		8	30.5	4.1	8.0	91	822	37.8	330	25	343	177	337	101
		12	45.7	9.3	10.0	61	244	25.2	419	30	432	183	425	106
		16	65.9	18.0	10.0	60	135	24.7	508	43	521	200	514	121
		20	82.3	28.1	10.0	48	69	19.8	597	50	610	215	603	132

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	400m	AS	FW	10.5	8	L, C	316L

SINGLE EXPANSION JOINTS - METAL

18" AND 20" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

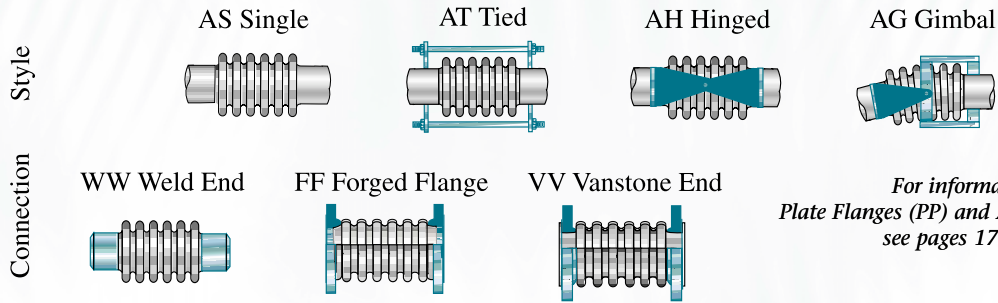
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
18" Effective Area 287 in. ²	50	4	1.08	0.07	6.5	2708	121273	2161	9 1/2	46	6	119	7 3/4	83
		8	2.16	0.26	10.0	1354	15159	1080	13	53	9 1/2	124	11 1/4	88
		12	3.24	0.59	10.0	903	4492	720	16 1/2	60	13	131	14 3/4	95
		16	4.32	1.05	10.0	677	1895	540	20	66	16 1/2	142	18 1/4	104
		20	5.40	1.65	*	542	970	432	23 1/2	73	20	155	21 3/4	114
18" Effective Area 294 in. ²	150	4	0.81	0.05	4.8	7314	335135	5971	9 1/2	53	10 5/8	263	10	158
		8	1.63	0.20	9.6	3657	41892	2986	13	66	14 1/8	273	13 1/2	170
		12	2.44	0.44	10.0	2438	12412	1990	16 1/2	79	17 5/8	290	17	184
		16	3.25	0.78	10.0	1829	5236	1493	20	92	21 1/8	312	20 1/2	202
		20	4.07	1.23	10.0	1463	2681	1194	23 1/2	105	24 5/8	339	24	222
18" Effective Area 295 in. ²	300	4	0.79	0.05	4.6	13643	627118	11173	9 1/2	67	10 1/2	506	10	286
		8	1.57	0.19	9.3	6822	78390	5587	13	93	14	523	13 1/2	308
		12	2.36	0.43	10.0	4548	23227	3724	16 1/2	119	17 1/2	552	17	336
		16	3.14	0.76	10.0	3411	9799	2793	20	145	21	593	20 1/2	369
		20	3.93	1.18	10.0	2729	5017	2235	23 1/2	171	24 1/2	645	24	408
20" Effective Area 352 in. ²	50	4	1.12	0.06	6.1	2777	152215	2712	9 1/2	51	6	140	7 3/4	95
		8	2.24	0.25	10.0	1389	19027	1356	13	59	9 1/2	144	11 1/4	101
		12	3.36	0.56	10.0	926	5638	904	16 1/2	66	13	152	14 3/4	109
		16	4.49	0.99	10.0	694	2378	678	20	74	16 1/2	162	18 1/4	118
		20	5.61	1.55	*	555	1218	542	23 1/2	82	20	176	21 3/4	129
20" Effective Area 359 in. ²	150	4	0.84	0.05	4.5	7606	425551	7582	9 1/2	59	11	333	10 1/4	196
		8	1.68	0.18	9.0	3803	53194	3791	13	74	14 1/2	342	13 3/4	208
		12	2.52	0.41	10.0	2535	15761	2527	16 1/2	88	18	356	17 1/4	222
		16	3.36	0.73	10.0	1902	6649	1896	20	103	21 1/2	376	20 3/4	240
		20	4.20	1.15	10.0	1521	3404	1516	23 1/2	117	25	403	24 1/4	260
20" Effective Area 361 in. ²	300	4	0.84	0.05	4.5	13294	748115	13329	9 1/2	90	11	636	10 1/4	363
		8	1.69	0.18	9.0	6647	93514	6665	13	120	14 1/2	654	13 3/4	387
		12	2.53	0.41	10.0	4431	27708	4443	16 1/2	150	18	684	17 1/4	417
		16	3.38	0.73	10.0	3324	11689	3332	20	180	21 1/2	726	20 3/4	453
		20	4.22	1.15	10.0	2659	5985	2666	23 1/2	210	25	781	24 1/4	495

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	18	AT	WW	300	16	PT, C	600

SINGLE EXPANSION JOINTS - METAL 450MM AND 500MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
450 Effective Area 1853 cm ²	3.5	4	27.4	1.7	6.5	48	2166	24.9	241	21	152	54	197	38
		8	54.8	6.7	10.0	24	271	12.4	330	24	241	56	286	40
		12	82.3	15.1	10.0	16	80	8.3	419	27	330	60	375	43
		16	109.7	26.8	10.0	12	34	6.2	508	30	419	64	464	47
		20	137.1	41.8	*	10	17	5.0	597	33	508	70	552	52
450 Effective Area 1896 cm ²	10.5	4	20.7	1.2	4.8	131	5987	68.8	241	24	270	119	254	72
		8	41.3	5.0	9.6	65	748	34.4	330	30	359	124	343	77
		12	62.0	11.2	10.0	44	222	22.9	419	36	448	131	432	84
		16	82.6	19.9	10.0	33	94	17.2	508	42	537	141	521	91
		20	103.3	31.2	10.0	26	48	13.8	597	47	625	154	610	101
450 Effective Area 1902 cm ²	21	4	19.9	1.2	4.6	244	11203	128.7	241	30	267	229	254	130
		8	39.9	4.8	9.3	122	1400	64.4	330	42	356	237	343	140
		12	59.8	10.8	10.0	81	415	42.9	419	54	445	250	432	152
		16	79.8	19.2	10.0	61	175	32.2	508	66	533	269	521	167
		20	99.7	30.0	10.0	49	90	25.7	597	78	622	293	610	185
500 Effective Area 2268 cm ²	3.5	4	28.5	1.6	6.1	50	2719	31.2	241	23	152	63	197	43
		8	57.0	6.3	10.0	25	340	15.6	330	27	241	65	286	46
		12	85.5	14.1	10.0	17	101	10.4	419	30	330	69	375	49
		16	113.9	25.1	10.0	12	42	7.8	508	34	419	74	464	54
		20	142.4	39.3	*	10	22	6.2	597	37	508	80	552	58
500 Effective Area 2315 cm ²	10.5	4	21.4	1.2	4.5	136	7602	87.4	241	27	279	151	260	89
		8	42.7	4.7	9.0	68	950	43.7	330	33	368	155	349	94
		12	64.1	10.5	10.0	45	282	29.1	419	40	457	162	438	101
		16	85.4	18.6	10.0	34	119	21.8	508	47	546	171	527	109
		20	106.8	29.1	10.0	27	61	17.5	597	53	635	183	616	118
500 Effective Area 2329 cm ²	21	4	21.4	1.2	4.5	237	13364	153.6	241	41	279	288	260	165
		8	42.9	4.7	9.0	119	1671	76.8	330	54	368	297	349	176
		12	64.3	10.5	10.0	79	495	51.2	419	68	457	310	438	189
		16	85.7	18.7	10.0	59	209	38.4	508	82	546	329	527	206
		20	107.2	29.2	10.0	47	107	30.7	597	95	635	354	616	225

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	450m	AT	WW	21	16	PT, C	600

SINGLE EXPANSION JOINTS - METAL

22" AND 24" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

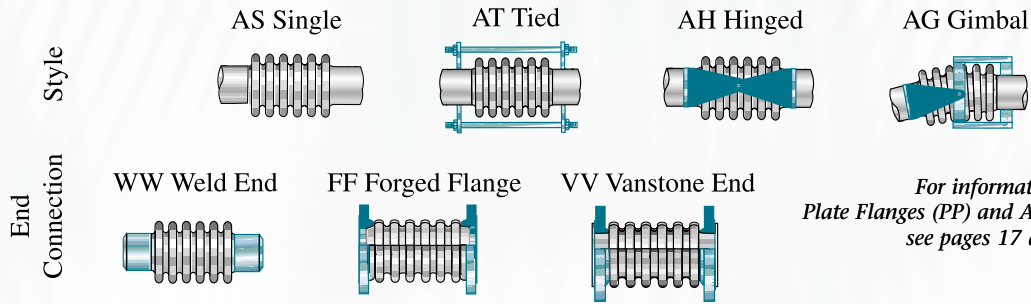
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
22" Effective Area 422 in. ²	50	4	1.16	0.06	5.7	2825	186005	3314	9 1/2	56	7	154	8 1/4	105
		8	2.32	0.23	10.0	1413	23251	1657	13	65	10 1/2	158	11 3/4	112
		12	3.48	0.53	10.0	942	6889	1105	16 1/2	73	14	166	15 1/4	120
		16	4.64	0.93	10.0	706	2906	829	20	82	17 1/2	177	18 3/4	129
		20	5.80	1.46	*	565	1488	663	23 1/2	90	21	190	22 1/4	140
22" Effective Area 429 in. ²	150	4	0.84	0.04	4.1	8392	561448	10003	9 1/2	65	11 1/2	373	10 1/2	219
		8	1.67	0.17	8.2	4196	70181	5002	13	81	15	382	14	231
		12	2.51	0.38	10.0	2797	20794	3334	16 1/2	97	18 1/2	396	17 1/2	246
		16	3.34	0.67	10.0	2098	8773	2501	20	113	22	416	21	264
		20	4.18	1.04	10.0	1678	4492	2001	23 1/2	129	25 1/2	443	24 1/2	286
22" Effective Area 431 in. ²	300	4	0.84	0.04	4.1	14668	986650	17579	9 1/2	98	11 1/2	746	10 1/2	422
		8	1.68	0.17	8.2	7334	123331	8790	13	131	15	764	14	448
		12	2.52	0.38	10.0	4889	36543	5860	16 1/2	164	18 1/2	794	17 1/2	479
		16	3.36	0.67	10.0	3667	15416	4395	20	198	22	836	21	517
		20	4.20	1.04	10.0	2934	7893	3516	23 1/2	231	25 1/2	891	24 1/2	561
24" Effective Area 501 in. ²	50	4	1.26	0.06	5.7	2645	206485	3679	9 1/2	62	7	232	8 1/4	147
		8	2.51	0.23	10.0	1322	25811	1839	13	72	10 1/2	236	11 3/4	154
		12	3.77	0.52	10.0	882	7648	1226	16 1/2	81	14	244	15 1/4	163
		16	5.02	0.93	10.0	661	3226	920	20	91	17 1/2	256	18 3/4	173
		20	6.28	1.45	*	529	1652	736	23 1/2	100	21	270	22 1/4	185
24" Effective Area 506 in. ²	150	4	0.83	0.04	3.8	9177	723559	12892	9 1/2	70	10	443	9 3/4	257
		8	1.66	0.15	7.5	4589	90445	6446	13	88	13 1/2	452	13 1/4	270
		12	2.50	0.34	10.0	3059	26798	4297	16 1/2	105	17	466	16 3/4	286
		16	3.33	0.61	10.0	2294	11306	3223	20	122	20 1/2	486	20 1/4	304
		20	4.16	0.96	10.0	1835	5788	2578	23 1/2	140	24	513	23 3/4	326
24" Effective Area 508 in. ²	300	4	0.84	0.04	3.8	16043	1271132	22648	9 1/2	106	11 7/8	956	10 5/8	531
		8	1.67	0.15	7.5	8022	158892	11324	13	143	15 3/8	974	14 1/8	558
		12	2.51	0.34	10.0	5348	47079	7549	16 1/2	179	18 7/8	1004	17 5/8	592
		16	3.34	0.61	10.0	4011	19861	5662	20	215	22 3/8	1046	21 1/8	631
		20	4.18	0.96	10.0	3209	10169	4530	23 1/2	251	25 7/8	1101	24 5/8	676

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	24	AS	AA	5	8	C	625LCF

SINGLE EXPANSION JOINTS - METAL 550MM AND 600MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VW	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
550 Effective Area 2724 cm ²	3.5	4	29.5	1.5	5.7	50	3323	38.2	241	26	178	70	210	48
		8	58.9	5.9	10.0	25	415	19.1	330	29	267	72	298	51
		12	88.4	13.3	10.0	17	123	12.7	419	33	356	75	387	54
		16	117.9	23.7	10.0	13	52	9.5	508	37	445	80	476	59
		20	147.3	37.1	*	10	27	7.6	597	41	533	86	565	64
550 Effective Area 2769 cm ²	10.5	4	21.2	1.1	4.1	150	10030	115.3	241	29	292	169	267	99
		8	42.5	4.2	8.2	75	1254	57.6	330	37	381	173	356	105
		12	63.7	9.5	10.0	50	371	38.4	419	44	470	180	445	112
		16	84.9	16.9	10.0	37	157	28.8	508	51	559	189	533	120
		20	106.1	26.5	10.0	30	80	23.1	597	58	648	201	622	129
550 Effective Area 2783 cm ²	21	4	21.3	1.1	4.1	262	17625	202.5	241	45	292	338	267	191
		8	42.6	4.2	8.2	131	2203	101.3	330	60	381	347	356	203
		12	63.9	9.5	10.0	87	653	67.5	419	75	470	360	445	217
		16	85.2	17.0	10.0	66	275	50.6	508	90	559	379	533	234
		20	106.6	26.5	10.0	52	141	40.5	597	105	648	404	622	254
600 Effective Area 3231 cm ²	3.5	4	31.9	1.5	5.7	47	3689	42.4	241	28	178	105	210	67
		8	63.8	5.9	10.0	24	461	21.2	330	32	267	107	298	70
		12	95.7	13.3	10.0	16	137	14.1	419	37	356	111	387	74
		16	127.6	23.6	10.0	12	58	10.6	508	41	445	116	476	79
		20	159.4	36.8	*	9	30	8.5	597	46	533	123	565	84
600 Effective Area 3263 cm ²	10.5	4	21.1	1.0	3.8	164	12925	148.5	241	32	254	201	248	116
		8	42.3	3.9	7.5	82	1616	74.3	330	40	343	205	337	122
		12	63.4	8.7	10.0	55	479	49.5	419	48	432	211	425	129
		16	84.6	15.6	10.0	41	202	37.1	508	56	521	221	514	138
		20	105.7	24.3	10.0	33	103	29.7	597	63	610	232	603	148
600 Effective Area 3279 cm ²	21	4	21.2	1.0	3.8	287	22707	260.9	241	48	302	434	270	241
		8	42.5	3.9	7.5	143	2838	130.5	330	65	391	442	359	253
		12	63.7	8.8	10.0	96	841	87.0	419	81	479	455	448	268
		16	84.9	15.6	10.0	72	355	65.2	508	97	568	475	537	286
		20	106.1	24.3	10.0	57	182	52.2	597	114	657	499	625	307

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	600m	AS	AA	.35	8	C	625LCF

SINGLE EXPANSION JOINTS - METAL

26" AND 28" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .5" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify

300 lb. Series: Customer to specify

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

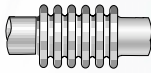
Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
26" Effective Area 585 in. ²	50	4	1.30	0.06	5.5	2664	242809	4326	9 1/2	67	7	252	8 1/4	159
		8	2.60	0.22	10.0	1332	30351	2163	13	78	10 1/2	257	11 3/4	167
		12	3.90	0.50	10.0	888	8993	1442	16 1/2	88	14	265	15 1/4	177
		16	5.20	0.89	10.0	666	3794	1082	20	99	17 1/2	276	18 3/4	188
		20	6.50	1.39	*	533	1942	865	23 1/2	110	21	291	22 1/4	200
26" Effective Area 589 in. ²	150	4	0.83	0.04	3.5	9963	914195	16288	9 1/2	76				
		8	1.66	0.14	7.0	4981	114274	8144	13	94				
		12	2.49	0.32	10.0	3321	33859	5429	16 1/2	113				
		16	3.32	0.57	10.0	2491	14284	4072	20	132				
		20	4.15	0.88	10.0	1993	7314	3258	23 1/2	151				
26" Effective Area 591 in. ²	300	4	0.83	0.04	3.5	17418	1605607	28607	9 1/2	115				
		8	1.67	0.14	7.0	8709	200701	14303	13	154				
		12	2.50	0.32	10.0	5806	59467	9536	16 1/2	193				
		16	3.33	0.57	10.0	4354	25088	7152	20	232				
		20	4.17	0.89	10.0	3484	12845	5721	23 1/2	271				
28" Effective Area 675 in. ²	50	4	1.35	0.05	5.3	2672	281143	5009	9 1/2	72	7	282	8 1/4	177
		8	2.70	0.21	10.0	1336	35143	2505	13	84	10 1/2	287	11 3/4	185
		12	4.04	0.48	10.0	891	10413	1670	16 1/2	96	14	295	15 1/4	195
		16	5.39	0.86	10.0	668	4393	1252	20	107	17 1/2	307	18 3/4	207
		20	6.74	1.34	*	534	2249	1002	23 1/2	119	21	322	22 1/4	220
28" Effective Area 678 in. ²	150	4	0.83	0.03	3.2	10748	1135669	20234	9 1/2	81				
		8	1.66	0.13	6.5	5374	141959	10117	13	101				
		12	2.49	0.30	9.7	3583	42062	6745	16 1/2	122				
		16	3.32	0.53	10.0	2687	17745	5059	20	142				
		20	4.14	0.82	10.0	2150	9085	4047	23 1/2	162				
28" Effective Area 681 in. ²	300	4	0.83	0.03	3.2	18793	1994117	35529	9 1/2	123				
		8	1.66	0.13	6.5	9396	249265	17764	13	165				
		12	2.50	0.30	9.7	6264	73856	11843	16 1/2	208				
		16	3.33	0.53	10.0	4698	31158	8882	20	250				
		20	4.16	0.82	10.0	3759	15953	7106	23 1/2	292				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	28	AG	WW	50	16	L, C, P4	304L

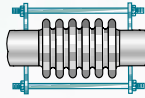
SINGLE EXPANSION JOINTS - METAL 650MM AND 700MM SIZE

Style

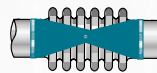
AS Single



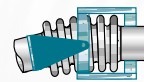
AT Tied



AH Hinged

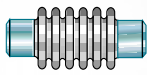


AG Gimbal

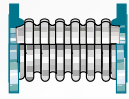


End Connection

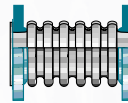
WW Weld End



FF Forged Flange



VV Vanstone End



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
650 Effective Area 3771 cm ²	3.5	4	33.0	1.4	5.5	48	4337	49.8	241	30	178	114	210	72
		8	66.1	5.7	10.0	24	542	24.9	330	35	267	116	298	76
		12	99.1	12.7	10.0	16	161	16.6	419	40	356	120	387	80
		16	132.2	22.6	10.0	12	68	12.5	508	45	445	125	476	85
		20	165.2	35.3	0 (.1) *	10	35	10.0	597	50	533	132	565	91
650 Effective Area 3797 cm ²	10.5	4	21.1	0.9	3.5	178	16331	187.7	241	34				
		8	42.2	3.6	7.0	89	2041	93.8	330	43				
		12	63.3	8.1	10.0	59	605	62.6	419	51				
		16	84.3	14.4	10.0	44	255	46.9	508	60				
		20	105.4	22.5	10.0	36	131	37.5	597	69				
650 Effective Area 3815 cm ²	21	4	21.2	0.9	3.5	311	28682	329.6	241	52				
		8	42.3	3.6	7.0	156	3585	164.8	330	70				
		12	63.5	8.1	10.0	104	1062	109.9	419	88				
		16	84.7	14.4	10.0	78	448	82.4	508	105				
		20	105.8	22.5	10.0	62	229	65.9	597	123				
700 Effective Area 4354 cm ²	3.5	4	34.2	1.4	5.3	48	5022	57.7	241	33	178	128	210	80
		8	68.5	5.4	10.0	24	628	28.9	330	38	267	130	298	84
		12	102.7	12.3	10.0	16	186	19.2	419	43	356	134	387	89
		16	136.9	21.8	10.0	12	78	14.4	508	49	445	139	476	94
		20	171.2	34.1	0 (.1) *	10	40	11.5	597	54	533	146	565	100
700 Effective Area 4372 cm ²	10.5	4	21.1	0.8	3.2	192	20287	233.1	241	37				
		8	42.1	3.3	6.5	96	2536	116.6	330	46				
		12	63.2	7.5	9.7	64	751	77.7	419	55				
		16	84.2	13.4	10.0	48	317	58.3	508	64				
		20	105.3	20.9	10.0	38	162	46.6	597	74				
700 Effective Area 4391 cm ²	21	4	21.1	0.8	3.2	336	35622	409.3	241	56				
		8	42.3	3.3	6.5	168	4453	204.7	330	75				
		12	63.4	7.5	9.7	112	1319	136.4	419	94				
		16	84.5	13.4	10.0	84	557	102.3	508	113				
		20	105.6	20.9	10.0	67	285	81.9	597	132				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	700m	AG	WW	3.5	16	L, C, P4	304L

SINGLE EXPANSION JOINTS - METAL

30" AND 32" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .5" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify

300 lb. Series: Customer to specify

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

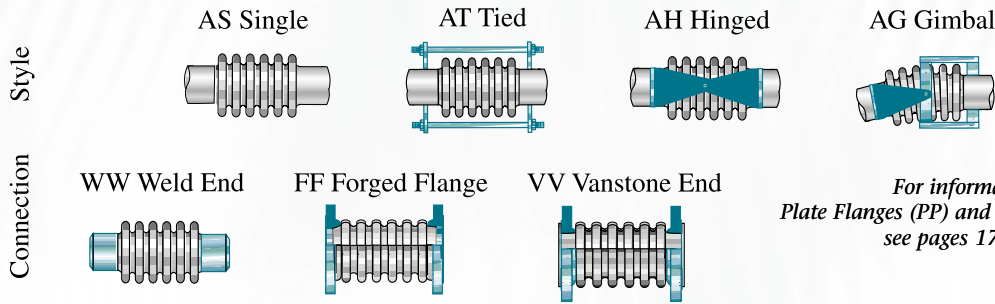
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
30" Effective Area 770 in. ²	50	4	1.57	0.06	5.8	1659	199217	3549	9 1/2	75	7	301	8 1/4	188
		8	3.15	0.23	10.0	830	24902	1775	13	85	10 1/2	306	11 3/4	196
		12	4.72	0.53	10.0	553	7378	1183	16 1/2	96	14	313	15 1/4	204
		16	6.30	0.94	10.0	415	3113	887	20	106	17 1/2	322	18 3/4	214
30" Effective Area 782 in. ²	150	4	1.01	0.04	3.7	7837	955949	17032	9 1/2	90				
		8	2.02	0.15	7.3	3918	119494	8516	13	114				
		12	3.03	0.34	10.0	2612	35406	5677	16 1/2	138				
		16	4.03	0.60	10.0	1959	14937	4258	20	163				
30" Effective Area 782 in. ²	300	4	0.95	0.04	3.4	15674	1911898	34064	9 1/2	136				
		8	1.90	0.14	6.9	7837	238987	17032	13	184				
		12	2.85	0.32	10.0	5225	70811	11355	16 1/2	233				
		16	3.79	0.56	10.0	3918	29873	8516	20	281				
32" Effective Area 872 in. ²	50	4	1.57	0.06	5.4	1772	240826	4291	9 1/2	80	7	411	8 1/4	246
		8	3.15	0.22	10.0	886	30103	2145	13	91	10 1/2	416	11 3/4	253
		12	4.72	0.50	10.0	591	8919	1430	16 1/2	102	14	423	15 1/4	262
		16	6.29	0.88	10.0	443	3763	1073	20	113	17 1/2	432	18 3/4	273
32" Effective Area 886 in. ²	150	4	1.04	0.04	3.5	7886	1089703	19415	9 1/2	96				
		8	2.08	0.14	7.1	3943	136213	9708	13	122				
		12	3.12	0.33	10.0	2629	40359	6472	16 1/2	149				
		16	4.16	0.58	10.0	1971	17027	4854	20	175				
32" Effective Area 886 in. ²	300	4	0.98	0.03	3.3	15771	2179405	38830	9 1/2	145				
		8	1.96	0.14	6.7	7886	272426	19415	13	198				
		12	2.94	0.31	10.0	5257	80719	12943	16 1/2	251				
		16	3.91	0.54	10.0	3943	34053	9708	20	303				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	30	AS	FW	50	8	HL, C	304

SINGLE EXPANSION JOINTS - METAL 750MM AND 800MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
750 Effective Area 4968 cm ²	3.5	4	40.0	1.5	5.8	30	3559	40.9	241	34	178	137	210	85
		8	80.0	6.0	10.0	15	445	20.4	330	39	267	139	298	89
		12	120.0	13.4	10.0	10	132	13.6	419	43	356	142	387	93
		16	160.0	23.8	10.0	7	56	10.2	508	48	445	146	476	97
750 Effective Area 5048 cm ²	10.5	4	25.6	0.9	3.7	140	17077	196.2	241	41				
		8	51.2	3.8	7.3	70	2135	98.1	330	52				
		12	76.9	8.5	10.0	47	632	65.4	419	63				
		16	102.5	15.2	10.0	35	267	49.1	508	74				
750 Effective Area 5048 cm ²	21	4	24.1	0.9	3.4	280	34153	392.5	241	61				
		8	48.2	3.6	6.9	140	4269	196.2	330	83				
		12	72.3	8.0	10.0	93	1265	130.8	419	105				
		16	96.4	14.2	10.0	70	534	98.1	508	128				
800 Effective Area 5623 cm ²	3.5	4	40.0	1.4	5.4	32	4302	49.4	241	36	178	187	210	111
		8	79.9	5.6	10.0	16	538	24.7	330	41	267	188	298	115
		12	119.9	12.6	10.0	11	159	16.5	419	46	356	192	387	119
		16	159.8	22.4	10.0	8	67	12.4	508	51	445	196	476	124
800 Effective Area 5718 cm ²	10.5	4	26.4	0.9	3.5	141	19466	223.7	241	44				
		8	52.8	3.7	7.1	70	2433	111.8	330	55				
		12	79.2	8.3	10.0	47	721	74.6	419	67				
		16	105.7	14.7	10.0	35	304	55.9	508	79				
800 Effective Area 5718 cm ²	21	4	24.9	0.9	3.3	282	38932	447.4	241	66				
		8	49.7	3.5	6.7	141	4867	223.7	330	90				
		12	74.6	7.8	10.0	94	1442	149.1	419	114				
		16	99.4	13.8	10.0	70	608	111.8	508	137				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	750m	AS	FW	3.5	8	HL, C	304

SINGLE EXPANSION JOINTS - METAL

34" AND 36" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .75" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify

300 lb. Series: Customer to specify

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

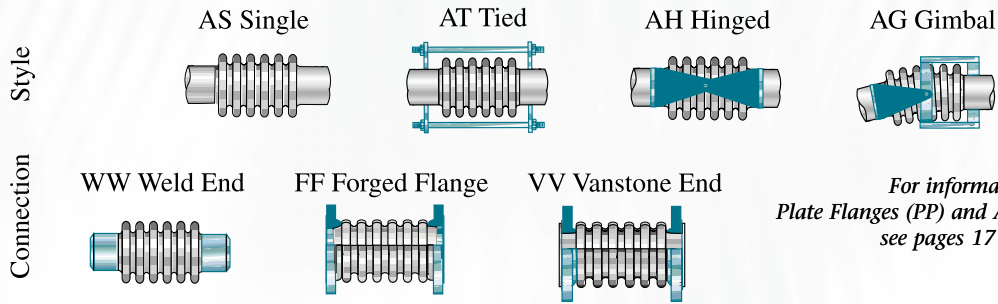
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
34" Effective Area 981 in. ²	50	4	1.63	0.05	5.3	1756	268595	4786	9 1/2	85	7	431	8 1/4	258
		8	3.25	0.21	10.0	878	33574	2393	13	97	10 1/2	436	11 3/4	266
		12	4.88	0.48	10.0	585	9948	1595	16 1/2	109	14	443	15 1/4	276
		16	6.50	0.86	10.0	439	4197	1196	20	121	17 1/2	453	18 3/4	287
34" Effective Area 995 in. ²	150	4	1.04	0.03	3.3	8390	1301590	23190	9 1/2	102				
		8	2.08	0.14	6.7	4195	162699	11595	13	130				
		12	3.11	0.31	10.0	2797	48207	7730	16 1/2	158				
		16	4.15	0.54	10.0	2098	20337	5798	20	186				
34" Effective Area 997 in. ²	300	4	1.01	0.03	3.2	15824	2459101	43814	9 1/2	203				
		8	2.02	0.13	6.5	7912	307388	21907	13	260				
		12	3.03	0.30	9.7	5275	91078	14605	16 1/2	317				
		16	4.04	0.53	10.0	3956	38423	10953	20	374				
36" Effective Area 1095 in. ²	50	4	1.62	0.05	5.0	1861	317827	5663	9 1/2	89	7	471	8 1/4	280
		8	3.25	0.20	10.0	931	39728	2831	13	102	10 1/2	476	11 3/4	289
		12	4.87	0.46	10.0	620	11771	1888	16 1/2	115	14	483	15 1/4	299
		16	6.50	0.81	10.0	465	4966	1416	20	128	17 1/2	493	18 3/4	310
36" Effective Area 1110 in. ²	150	4	1.03	0.03	3.2	8895	1539297	27425	9 1/2	107				
		8	2.07	0.13	6.3	4447	192412	13713	13	137				
		12	3.10	0.29	9.5	2965	57011	9142	16 1/2	167				
		16	4.14	0.51	10.0	2224	24052	6856	20	196				
36" Effective Area 1112 in. ²	300	4	1.01	0.03	3.1	16776	2907999	51811	9 1/2	214				
		8	2.01	0.12	6.1	8388	363500	25906	13	275				
		12	3.02	0.28	9.2	5592	107704	17270	16 1/2	335				
		16	4.03	0.50	10.0	4194	45437	12953	20	395				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	36	AT	WW	50	8	PT, RT	800

SINGLE EXPANSION JOINTS - METAL 850MM AND 900MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VW	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
850 Effective Area 6330 cm ²	3.5	4	41.3	1.4	5.3	31	4798	55.1	241	38	178	196	210	117
		8	82.6	5.5	10.0	16	600	27.6	330	44	267	198	298	121
		12	123.9	12.3	10.0	10	178	18.4	419	49	356	201	387	125
		16	165.2	21.8	10.0	8	75	13.8	508	55	445	205	476	130
850 Effective Area 6420 cm ²	10.5	4	26.4	0.9	3.3	150	23251	267.2	241	46				
		8	52.7	3.5	6.7	75	2906	133.6	330	59				
		12	79.1	7.8	10.0	50	861	89.1	419	71				
		16	105.4	13.8	10.0	37	363	66.8	508	84				
850 Effective Area 6413 cm ²	21	4	25.6	0.8	3.2	283	43929	504.8	241	92				
		8	51.2	3.4	6.5	141	5491	252.4	330	118				
		12	76.9	7.6	9.7	94	1627	168.3	419	144				
		16	102.5	13.4	10.0	71	686	126.2	508	169				
900 Effective Area 7066 cm ²	3.5	4	41.3	1.3	5.0	33	5678	65.2	241	41	178	214	210	127
		8	82.5	5.2	10.0	17	710	32.6	330	46	267	216	298	131
		12	123.8	11.6	10.0	11	210	21.7	419	52	356	219	387	136
		16	165.1	20.6	10.0	8	89	16.3	508	58	445	223	476	141
900 Effective Area 7161 cm ²	10.5	4	26.3	0.8	3.2	159	27497	316.0	241	49				
		8	52.6	3.3	6.3	79	3437	158.0	330	62				
		12	78.8	7.3	9.5	53	1018	105.3	419	76				
		16	105.1	13.0	10.0	40	430	79.0	508	89				
900 Effective Area 7173 cm ²	21	4	25.6	0.8	3.1	300	51947	596.9	241	97				
		8	51.1	3.2	6.1	150	6493	298.5	330	125				
		12	76.7	7.1	9.2	100	1924	199.0	419	152				
		16	102.3	12.7	10.0	75	812	149.2	508	179				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	900m	AT	WW	3.5	8	PT, RT	800

SINGLE EXPANSION JOINTS - METAL

38" AND 40" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .75" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify

300 lb. Series: Customer to specify

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

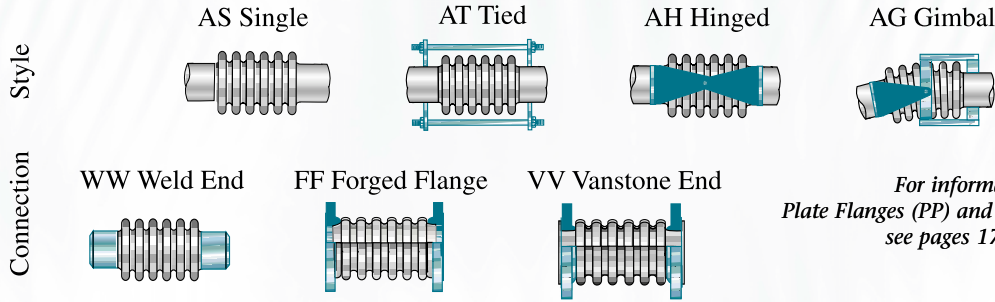
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
38" Effective Area 1216 in. ²	50	4	1.62	0.05	4.7	1966	372734	6641	9 1/2	94	7	501	8 1/4	298
		8	3.25	0.19	9.5	983	46592	3320	13	108	10 1/2	506	11 3/4	307
		12	4.87	0.43	10.0	655	13805	2214	16 1/2	121	14	513	15 1/4	317
		16	6.49	0.77	10.0	492	5824	1660	20	135	17 1/2	523	18 3/4	329
38" Effective Area 1231 in. ²	150	4	1.03	0.03	3.0	9399	1804308	32147	9 1/2	113				
		8	2.06	0.12	6.0	4700	225538	16074	13	144				
		12	3.10	0.27	9.0	3133	66826	10716	16 1/2	175				
		16	4.13	0.49	10.0	2350	28192	8037	20	207				
38" Effective Area 1233 in. ²	300	4	1.00	0.03	2.9	17728	3408435	60728	9 1/2	226				
		8	2.01	0.12	5.8	8864	426054	30364	13	289				
		12	3.01	0.27	8.7	5909	126238	20243	16 1/2	353				
		16	4.02	0.47	10.0	4432	53257	15182	20	416				
40" Effective Area 1342 in. ²	50	4	1.62	0.05	4.5	2072	433626	7726	9 1/2	99	7	561	8 1/4	330
		8	3.25	0.18	9.0	1036	54203	3863	13	113	10 1/2	566	11 3/4	339
		12	4.87	0.41	10.0	691	16060	2575	16 1/2	127	14	573	15 1/4	350
		16	6.49	0.73	10.0	518	6775	1931	20	142	17 1/2	583	18 3/4	362
40" Effective Area 1359 in. ²	150	4	1.03	0.03	2.8	9904	2098106	37382	9 1/2	119				
		8	2.06	0.12	5.7	4952	262263	18691	13	151				
		12	3.09	0.26	8.5	3301	77708	12461	16 1/2	184				
		16	4.12	0.46	10.0	2476	32783	9345	20	217				
40" Effective Area 1361 in. ²	300	4	1.00	0.03	2.8	18680	3963210	70612	9 1/2	237				
		8	2.01	0.11	5.5	9340	495401	35306	13	304				
		12	3.01	0.25	8.3	6227	146786	23537	16 1/2	371				
		16	4.01	0.45	10.0	4670	61925	17653	20	438				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	38	AS	WW	150	16	L, C	825

SINGLE EXPANSION JOINTS - METAL 950MM AND 1000MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
950 Effective Area 7843 cm ²	3.5	4	41.2	1.2	4.7	35	6658	76.5	241	43	178	227	210	135
		8	82.5	4.9	9.5	18	832	38.3	330	49	267	229	298	139
		12	123.7	11.0	10.0	12	247	25.5	419	55	356	233	387	144
		16	165.0	19.6	10.0	9	104	19.1	508	61	445	237	476	149
950 Effective Area 7943 cm ²	10.5	4	26.2	0.8	3.0	168	32232	370.4	241	51				
		8	52.4	3.1	6.0	84	4029	185.2	330	65				
		12	78.6	6.9	9.0	56	1194	123.5	419	80				
		16	104.8	12.4	10.0	42	504	92.6	508	94				
950 Effective Area 7956 cm ²	21	4	25.5	0.8	2.9	317	60887	699.7	241	102				
		8	51.0	3.0	5.8	158	7611	349.8	330	131				
		12	76.6	6.8	8.7	106	2255	233.2	419	160				
		16	102.1	12.0	10.0	79	951	174.9	508	189				
1000 Effective Area 8681 cm ²	3.5	4	41.2	1.2	4.5	37	7746	89.0	241	45	178	255	210	150
		8	82.4	4.7	9.0	19	968	44.5	330	51	267	257	298	154
		12	123.6	10.5	10.0	12	287	29.7	419	58	356	260	387	159
		16	164.9	18.6	10.0	9	121	22.3	508	64	445	264	476	164
1000 Effective Area 8766 cm ²	10.5	4	26.2	0.7	2.8	177	37480	430.7	241	54				
		8	52.4	2.9	5.7	88	4685	215.3	330	69				
		12	78.5	6.6	8.5	59	1388	143.6	419	84				
		16	104.7	11.8	10.0	44	586	107.7	508	99				
1000 Effective Area 8779 cm ²	21	4	25.5	0.7	2.8	334	70797	813.5	241	107				
		8	51.0	2.9	5.5	167	8850	406.8	330	138				
		12	76.5	6.4	8.3	111	2622	271.2	419	168				
		16	102.0	11.4	10.0	83	1106	203.4	508	199				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	950m	AS	WW	10.5	16	L, C	825

SINGLE EXPANSION JOINTS - METAL

42" TO 48" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API-5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .75" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify

300 lb. Series: Customer to specify

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

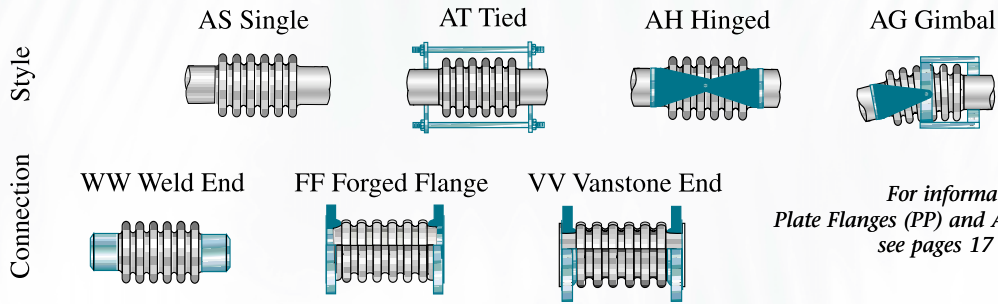
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
42" Effective Area 1476 in. ²	50	4	1.62	0.04	4.3	2177	500811	8923	9 1/2	104	7	661	8 1/4	383
		8	3.24	0.17	8.6	1089	62601	4461	13	119	10 1/2	666	11 3/4	392
		12	4.86	0.39	10.0	726	18549	2974	16 1/2	133	14	673	15 1/4	403
		16	6.47	0.70	10.0	544	7825	2231	20	148	17 1/2	683	18 3/4	416
42" Effective Area 1493 in. ²	150	4	1.03	0.03	2.7	10409	2422175	43156	9 1/2	124				
		8	2.06	0.11	5.4	5204	302772	21578	13	159				
		12	3.09	0.25	8.1	3470	89710	14385	16 1/2	193				
		16	4.12	0.44	10.0	2602	37846	10789	20	228				
42" Effective Area 1495 in. ²	300	4	1.00	0.03	2.6	19633	4575124	81514	9 1/2	248				
		8	2.01	0.11	5.3	9816	571890	40757	13	319				
		12	3.01	0.24	7.9	6544	169449	27171	16 1/2	389				
		16	4.01	0.43	10.0	4908	71486	20379	20	459				
44" Effective Area 1615 in. ²	50	4	1.61	0.04	4.1	2282	574600	10238	9 1/2	108	8	701	8 3/4	405
		8	3.23	0.17	8.2	1141	71825	5119	13	124	11 1/2	706	12 1/4	415
		12	4.84	0.37	10.0	761	21281	3413	16 1/2	140	15	713	15 3/4	426
		16	6.46	0.66	10.0	571	8978	2559	20	155	18 1/2	723	19 1/4	439
46" Effective Area 1760 in. ²	50	4	1.61	0.04	3.9	2388	655302	11675	9 1/2	113	8	731	8 3/4	422
		8	3.22	0.16	7.8	1194	81913	5838	13	129	11 1/2	736	12 1/4	433
		12	4.84	0.36	10.0	796	24270	3892	16 1/2	146	15	743	15 3/4	444
		16	6.45	0.64	10.0	597	10239	2919	20	162	18 1/2	753	19 1/4	457
48" Effective Area 1912 in. ²	50	4	1.61	0.04	3.7	2493	743225	13242	9 1/2	118	8 1/2	851	9	485
		8	3.22	0.15	7.5	1246	92903	6621	13	135	12	856	12 1/2	495
		12	4.83	0.34	10.0	831	27527	4414	16 1/2	152	15 1/2	863	16	507
		16	6.44	0.61	10.0	623	11613	3310	20	169	19	873	19 1/2	521

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
English	48	AT	WW	50	8	L, C	316

SINGLE EXPANSION JOINTS - METAL 1050MM TO 1200MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
1050 Effective Area 9519 cm ²	3.5	4	41.1	1.1	4.3	39	8946	102.8	241	47	178	300	210	173
		8	82.2	4.4	8.6	19	1118	51.4	330	54	267	302	298	178
		12	123.3	10.0	10.0	13	331	34.3	419	61	356	305	387	183
		16	164.5	17.7	10.0	10	140	25.7	508	67	445	310	476	188
1050 Effective Area 9630 cm ²	10.5	4	26.2	0.7	2.7	186	43269	497.2	241	56				
		8	52.3	2.8	5.4	93	5409	248.6	330	72				
		12	78.5	6.3	8.1	62	1603	165.7	419	88				
		16	104.7	11.2	10.0	46	676	124.3	508	103				
1050 Effective Area 9643 cm ²	21	4	25.5	0.7	2.6	351	81728	939.2	241	113				
		8	51.0	2.7	5.3	175	10216	469.6	330	145				
		12	76.4	6.1	7.9	117	3027	313.1	419	176				
		16	101.9	10.9	10.0	88	1277	234.8	508	208				
1100 Effective Area 10418 cm ²	3.5	4	41.0	1.1	4.1	41	10264	117.9	241	49	203	318	222	184
		8	82.0	4.2	8.2	20	1283	59.0	330	56	292	320	311	188
		12	123.1	9.5	10.0	14	380	39.3	419	63	381	323	400	193
		16	164.1	16.9	10.0	10	160	29.5	508	70	470	328	489	199
1150 Effective Area 11357 cm ²	3.5	4	40.9	1.0	3.9	43	11706	134.5	241	51	203	332	222	191
		8	81.9	4.0	7.8	21	1463	67.3	330	59	292	334	311	196
		12	122.8	9.1	10.0	14	434	44.8	419	66	381	337	400	201
		16	163.8	16.1	10.0	11	183	33.6	508	74	470	341	489	207
1200 Effective Area 12337 cm ²	3.5	4	40.9	1.0	3.7	45	13277	152.6	241	53	216	386	229	220
		8	81.8	3.9	7.5	22	1660	76.3	330	61	305	388	318	225
		12	122.7	8.7	10.0	15	492	50.9	419	69	394	391	406	230
		16	163.6	15.5	10.0	11	207	38.1	508	77	483	396	495	236

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	1200m	AT	WW	3.5	8	L, C	316

SINGLE EXPANSION JOINTS - METAL

50" TO 60" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A516-70

25 lb. Series: .375" WALL

50 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

25 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

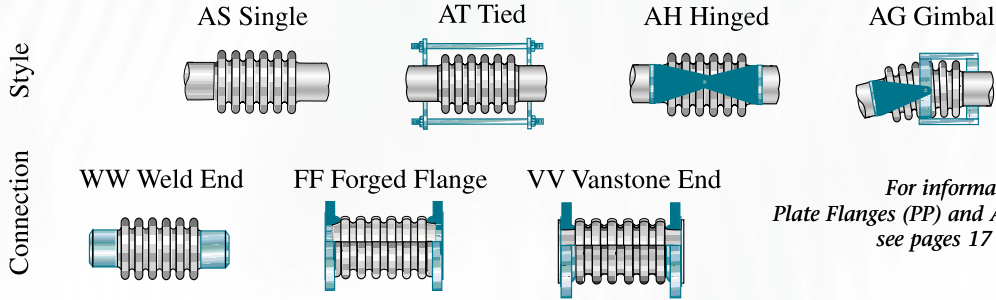
LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
50" Effective Area 2134 in. ²	50	2	1.47	0.04	3.2	5341	1548020	31662	9 3/4	132	8 3/4	901	9 1/4	516
		4	2.93	0.14	6.4	2671	193503	15831	13 1/2	155	12 1/2	904	13	530
		6	4.40	0.32	9.7	1780	57334	10554	17 1/4	179	16 1/4	909	16 3/4	544
		8	5.86	0.56	10.0	1335	24188	7915	21	203	20	915	20 1/2	559
		10	7.33	0.88	10.0	1068	12384	6332	24 3/4	227	23 3/4	924	24 1/4	575
		12	8.79	1.26	10.0	890	7167	5277	28 1/2	250	27 1/2	934	28	592
52" Effective Area 2301 in. ²	50	2	1.46	0.03	3.1	5559	1737218	35531	9 3/4	136	8 3/4	951	9 1/4	544
		4	2.92	0.14	6.2	2780	217152	17766	13 1/2	161	12 1/2	954	13	557
		6	4.39	0.30	9.3	1853	64341	11844	17 1/4	186	16 1/4	959	16 3/4	572
		8	5.85	0.54	10.0	1390	27144	8883	21	211	20	965	20 1/2	588
		10	7.31	0.84	10.0	1112	13898	7106	24 3/4	235	23 3/4	974	24 1/4	605
		12	8.77	1.22	10.0	927	8043	5922	28 1/2	260	27 1/2	984	28	622
54" Effective Area 2474 in. ²	50	2	1.46	0.03	3.0	5777	1941233	39704	9 3/4	141	8 3/4	1001	9 1/4	571
		4	2.92	0.13	6.0	2889	242654	19852	13 1/2	167	12 1/2	1004	13	585
		6	4.38	0.29	8.9	1926	71898	13235	17 1/4	193	16 1/4	1009	16 3/4	601
		8	5.83	0.52	10.0	1444	30332	9926	21	218	20	1015	20 1/2	617
		10	7.29	0.81	10.0	1155	15530	7941	24 3/4	244	23 3/4	1024	24 1/4	634
		12	8.75	1.17	10.0	963	8987	6617	28 1/2	270	27 1/2	1034	28	652
60" Effective Area 3031 in. ²	25	2	1.53	0.03	2.8	6432	2647763	54155	9 3/4	156	9 1/4	1281	9 1/2	719
		4	3.05	0.12	5.6	3216	330970	27077	13 1/2	185	13	1284	13 1/4	734
		6	4.58	0.28	8.5	2144	98065	18052	17 1/4	213	16 3/4	1289	17	751
		8	6.11	0.49	10.0	1608	41371	13539	21	242	20 1/2	1295	20 3/4	768
		10	7.64	0.77	10.0	1286	21182	10831	24 3/4	270	24 1/4	1304	24 1/2	787
		12	9.16	1.11	10.0	1072	12258	9026	28 1/2	299	28	1314	28 1/4	806
PART NUMBER EXAMPLE			NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL					
English			60	AS	WW	25	10	L, C, PT	321					

SINGLE EXPANSION JOINTS - METAL 1250MM TO 1500MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
1250 Effective Area 13767 cm ²	3.5	2	37.2	0.9	3.2	95	27653	364.8	248	60	222	409	235	234
		4	74.4	3.6	6.4	48	3457	182.4	343	70	318	410	330	240
		6	111.6	8.0	9.7	32	1024	121.6	438	81	413	412	425	247
		8	148.9	14.3	10.0	24	432	91.2	533	92	508	415	521	254
		10	186.1	22.3	10.0	19	221	221	629	103	603	419	616	261
		12	223.3	32.1	10.0	16	128	60.8	724	113	699	424	711	269
1300 Effective Area 14844 cm ²	3.5	2	37.1	0.9	3.1	99	31033	409.4	248	62	222	431	235	247
		4	74.3	3.4	6.2	50	3879	204.7	343	73	318	433	330	253
		6	111.4	7.7	9.3	33	1149	136.5	438	84	413	435	425	260
		8	148.5	13.7	10.0	25	485	102.3	533	95	508	438	521	267
		10	185.7	21.4	10.0	20	248	81.9	629	107	603	442	616	274
		12	222.8	30.9	10.0	17	144	68.2	724	118	699	446	711	282
1350 Effective Area 15961 cm ²	3.5	2	37.1	0.8	3.0	103	34678	457.4	248	64	222	454	235	259
		4	74.1	3.3	6.0	52	4335	228.7	343	76	318	455	330	266
		6	111.2	7.4	8.9	34	1284	152.5	438	87	413	457	425	272
		8	148.2	13.2	10.0	26	542	114.4	533	99	508	460	521	280
		10	185.3	20.6	10.0	21	277	91.5	629	111	603	464	616	287
		12	222.3	29.7	10.0	17	161	76.2	724	122	699	469	711	296
1500 Effective Area 19556 cm ²	1.8	2	38.8	0.8	2.8	115	47299	623.9	248	71	235	581	241	326
		4	77.6	3.1	5.6	57	5912	312.0	343	84	330	582	337	333
		6	116.4	7.0	8.5	38	1752	208.0	438	97	425	584	432	341
		8	155.2	12.5	10.0	29	739	156.0	533	110	521	587	527	349
		10	193.9	19.5	10.0	23	378	124.8	629	123	616	591	622	357
		12	232.7	28.1	10.0	19	219	104.0	724	135	711	596	718	366
PART NUMBER EXAMPLE			NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL					
Metric			1500m	AS	WW	1.8	10	L, C, PT	321					

SINGLE EXPANSION JOINTS - METAL

66" TO 96" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A516-70

25 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

25 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

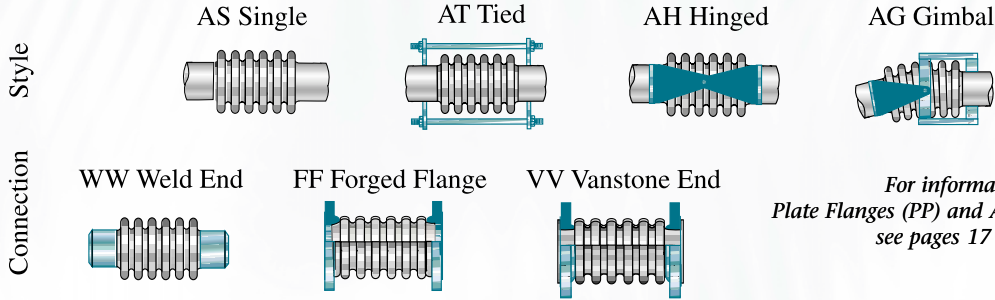
LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
66" Effective Area 3645 in. ²	25	2	1.52	0.03	2.6	7086	3507747	71744	9 3/4	171	9 1/4	1481	9 1/2	826
		4	3.04	0.11	5.1	3543	438468	35872	13 1/2	202	13	1484	13 1/4	843
		6	4.56	0.25	7.7	2362	129917	23915	17 1/4	234	16 3/4	1489	17	861
		8	6.07	0.45	10.0	1771	54809	17936	21	265	20 1/2	1495	20 3/4	880
		10	7.59	0.70	10.0	1417	28062	14349	24 3/4	297	24 1/4	1504	24 1/2	900
		12	9.11	1.00	10.0	1181	16240	11957	28 1/2	328	28	1514	28 1/4	921
72" Effective Area 4315 in. ²	25	2	1.51	0.03	2.3	7740	4536264	92780	9 3/4	186	9 1/4	1701	9 1/2	943
		4	3.02	0.10	4.7	3870	567033	46390	13 1/2	220	13	1704	13 1/4	962
		6	4.54	0.23	7.0	2580	168010	30927	17 1/4	254	16 3/4	1709	17	981
		8	6.05	0.41	9.4	1935	70879	23195	21	289	20 1/2	1715	20 3/4	1002
		10	7.56	0.64	10.0	1548	36290	18556	24 3/4	323	24 1/4	1724	24 1/2	1023
		12	9.07	0.92	10.0	1290	21001	15463	28 1/2	357	28	1734	28 1/4	1046
84" Effective Area 5826 in. ²	25	2	1.50	0.02	2.0	9049	7159214	146428	9 3/4	216	9 3/4	2001	9 3/4	1108
		4	3.00	0.09	4.0	4524	894902	73214	13 1/2	256	13 1/2	2004	13 1/2	1130
		6	4.51	0.20	6.0	3016	265156	48809	17 1/4	295	17 1/4	2009	17 1/4	1152
		8	6.01	0.35	8.0	2262	111863	36607	21	335	21	2015	21	1175
		10	7.51	0.55	10.0	1810	57274	29286	24 3/4	375	24 3/4	2024	24 3/4	1200
		12	9.01	0.78	10.0	1508	33145	24405	28 1/2	415	28 1/2	2034	28 1/2	1225
96" Effective Area 7562 in. ²	25	2	1.49	0.02	1.7	10357	10637239	217564	9 3/4	245	10 1/4	3301	10	1773
		4	2.98	0.08	3.5	5179	1329655	108782	13 1/2	291	14	3304	13 3/4	1797
		6	4.47	0.17	5.2	3452	393972	72521	17 1/4	337	17 3/4	3309	17 1/2	1823
		8	5.96	0.30	7.0	2589	166207	54391	21	382	21 1/2	3315	21 1/4	1849
		10	7.45	0.47	8.7	2071	85098	43513	24 3/4	428	25 1/4	3324	25	1876
		12	8.94	0.68	10.0	1726	49246	36261	28 1/2	473	29	3334	28 3/4	1904
PART NUMBER EXAMPLE			NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL					
English			96	AS	AA	5	4	HL, C	304					

SINGLE EXPANSION JOINTS - METAL 1650MM TO 2400MM SIZE



METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VV	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
1650 Effective Area 23516 cm ²	1.8	2	38.6	0.7	2.6	127	62661	826.6	248	78	235	672	241	375
		4	77.1	2.8	5.1	63	7833	413.3	343	92	330	673	337	382
		6	115.7	6.4	7.7	42	2321	275.5	438	106	425	675	432	391
		8	154.3	11.3	10.0	32	979	206.6	533	120	521	678	527	399
		10	192.8	17.7	10.0	25	501	165.3	629	134	616	682	622	408
		12	231.4	25.5	10.0	21	290	137.8	724	149	711	687	718	418
1800 Effective Area 27841 cm ²	1.8	2	38.4	0.6	2.3	138	81034	1068.9	248	84	235	771	241	428
		4	76.8	2.6	4.7	69	10129	534.5	343	100	330	773	337	436
		6	115.2	5.8	7.0	46	3001	356.3	438	115	425	775	432	445
		8	153.7	10.4	9.4	35	1266	267.2	533	131	521	778	527	454
		10	192.1	16.2	10.0	28	648	213.8	629	146	616	782	622	464
		12	230.5	23.3	10.0	23	375	178.2	724	162	711	786	718	474
2100 Effective Area 37585 cm ²	1.8	2	38.2	0.6	2.0	162	127890	1687.0	248	98	248	907	248	503
		4	76.3	2.2	4.0	81	15986	843.5	343	116	343	909	343	512
		6	114.5	5.0	6.0	54	4737	562.3	438	134	438	911	438	522
		8	152.6	8.9	8.0	40	1998	421.8	533	152	533	914	533	533
		10	190.8	13.8	10.0	32	1023	337.4	629	170	629	918	629	544
		12	228.9	19.9	10.0	27	592	281.2	724	188	724	923	724	555
2400 Effective Area 48788 cm ²	1.8	2	37.9	0.5	1.7	185	190020	2506.6	248	111	260	1497	254	804
		4	75.7	1.9	3.5	93	23752	1253.3	343	132	356	1498	349	815
		6	113.6	4.3	5.2	62	7038	835.5	438	153	451	1500	445	827
		8	151.4	7.7	7.0	46	2969	626.7	533	173	546	1503	540	838
		10	189.3	12.1	8.7	37	1520	501.3	629	194	641	1507	635	851
		12	227.2	17.4	10.0	31	880	417.8	724	215	737	1512	730	863

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	2400m	AS	AA	.35	4	HL, C	304

SINGLE EXPANSION JOINTS - METAL

108" TO 144" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A516-70

25 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

25 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

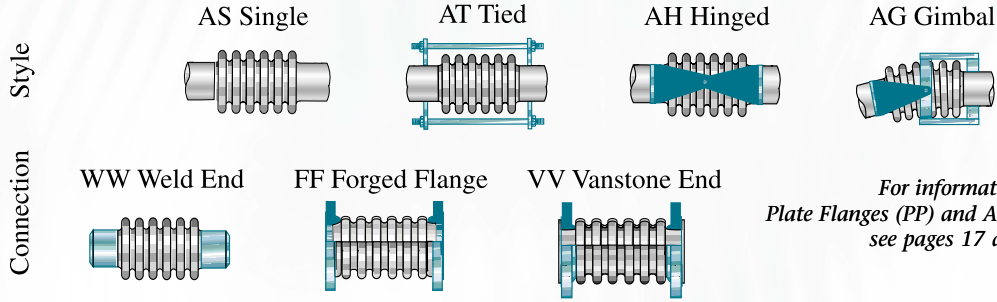
LINERS: 300 Series Stainless Steel

1. Rated cycle life is 2000 cycles per EJMA 7th edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movements, refer to page 20, step 5.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life refer to page 20, step 5 or 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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

* For available angular rotation, contact factory.

Nominal Diameter (In.)	Pressure (psig)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Lbs./In.)	Lateral Spring Rate (Lbs./In.)	Angular Spring Rate (In.-Lb./Deg)	WW		FF/VV		FW/VW	
			Axial (In.)	Lateral (In.)	Angular (Deg.)				OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)	OAL (In.)	Weight (Lbs.)
108" Effective Area 9525 in. ²	25	2	1.49	0.02	1.5	11666	15090967	308656	9 3/4	275				
		4	2.98	0.07	3.1	5833	1886371	154328	13 1/2	326				
		6	4.47	0.15	4.6	3889	558925	102885	17 1/4	378				
		8	5.95	0.27	6.2	2916	235796	77164	21	429				
		10	7.44	0.42	7.7	2333	120728	61731	24 3/4	480				
		12	8.93	0.61	9.3	1944	69866	51443	28 1/2	532				
120" Effective Area 11714 in. ²	25	2	1.49	0.02	1.4	12975	20641027	422172	9 3/4	305				
		4	2.97	0.06	2.8	6487	2580128	211086	13 1/2	362				
		6	4.46	0.14	4.2	4325	764482	140724	17 1/4	419				
		8	5.95	0.24	5.6	3244	322516	105543	21	476				
		10	7.43	0.38	7.0	2595	165128	84434	24 3/4	533				
		12	8.92	0.55	8.4	2162	95560	70362	28 1/2	590				
132" Effective Area 14129 in. ²	25	2	1.48	0.01	1.3	14283	27408045	560578	9 3/4	335				
		4	2.97	0.06	2.5	7142	3426006	280289	13 1/2	397				
		6	4.45	0.12	3.8	4761	1015113	186859	17 1/4	460				
		8	5.94	0.22	5.1	3571	428251	140145	21	523				
		10	7.42	0.35	6.3	2857	219264	112116	24 3/4	585				
		12	8.91	0.50	7.6	2381	126889	93430	28 1/2	648				
144" Effective Area 16770 in. ²	25	2	1.48	0.01	1.2	15592	35512650	726342	9 3/4	364				
		4	2.96	0.05	2.3	7796	4439081	363171	13 1/2	433				
		6	4.44	0.11	3.5	5197	1315283	242114	17 1/4	501				
		8	5.92	0.20	4.6	3898	554885	181586	21	569				
		10	7.40	0.32	5.8	3118	284101	145268	24 3/4	638				
		12	8.88	0.46	7.0	2599	164410	121057	28 1/2	706				
PART NUMBER EXAMPLE			NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL					
English			144	AT	WW	25	8	L, C	600					

SINGLE EXPANSION JOINTS - METAL 2700MM TO 3600MM SIZE



For information on Plate Flanges (PP) and Angle Flanges (AA), see pages 17 and 18.

METRIC

Nominal Diameter (mm)	Pressure (Kg/Cm ²)	No. of Convolutions	Non-Concurrent			Axial Spring Rate (Kg/mm)	Lateral Spring Rate (Kg/mm)	Angular Spring Rate (Kg-M/Deg)	WW		FF/VV		FW/VW	
			Axial (mm)	Lateral (mm)	Angular (Deg.)				OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)	OAL (mm)	Weight (Kg)
2700 Effective Area 61451 cm ²	1.8	2	37.8	0.4	1.5	208	269580	3556.1	248	125				
		4	75.6	1.7	3.1	104	33697	1778.1	343	148				
		6	113.4	3.9	4.6	69	9984	1185.4	438	171				
		8	151.2	6.9	6.2	52	4212	889.0	533	195				
		10	189.1	10.7	7.7	42	2157	711.2	629	218				
		12	226.9	15.5	9.3	35	1248	592.7	724	241				
3000 Effective Area 75573 cm ²	1.8	2	37.8	0.4	1.4	232	368724	4864.0	248	138				
		4	75.5	1.5	2.8	116	46091	2432.0	343	164				
		6	113.3	3.5	4.2	77	13656	1621.3	438	190				
		8	151.0	6.2	5.6	58	5761	1216.0	533	216				
		10	188.8	9.7	7.0	46	2950	972.8	629	242				
		12	226.6	13.9	8.4	39	1707	810.7	724	267				
3300 Effective Area 91154 cm ²	1.8	2	37.7	0.4	1.3	255	489608	6458.6	248	152				
		4	75.4	1.4	2.5	128	61201	3229.3	343	180				
		6	113.2	3.2	3.8	85	18134	2152.9	438	209				
		8	150.9	5.6	5.1	64	7650	1614.6	533	237				
		10	188.6	8.8	6.3	51	3917	1291.7	629	265				
		12	226.3	12.7	7.6	43	2267	1076.4	724	294				
3600 Effective Area 108195 cm ²	1.8	2	37.6	0.3	1.2	279	634385	8368.4	248	165				
		4	75.2	1.3	2.3	139	79298	4184.2	343	196				
		6	112.8	2.9	3.5	93	23496	2789.5	438	227				
		8	150.4	5.1	4.6	70	9912	2092.1	533	258				
		10	188.0	8.0	5.8	56	5075	1673.7	629	289				
		12	225.6	11.6	7.0	46	2937	1394.7	724	320				

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	NO. CONS	ACCESSORIES	BELLOWS MATERIAL
Metric	3600m	AT	WW	1.8	8	L, C	600

HOW TO SPECIFY A

SPECIAL NOTE

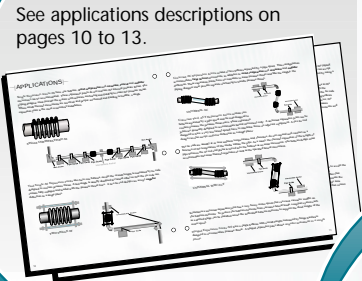
If a non-standard rating is required or a non-standard weld end thickness is required or if the fittings are non-standard materials, those preferences must be stated along with the part number.



Universal expansion joints are specified with a part number that starting with the nominal pipe size. If the part is metric, the pipe size should have an "M" suffix so that all units are in metric (millimeters and bar). Go the data page that shows the size required for a universal expansion joint.



Identify the style (AU for Dual unrestrained, AUT for Dual Tied, AUH for Dual Hinged, and AUG for Dual Gimbal) using the illustrations at the top of each data page.



See applications descriptions on pages 10 to 13.

STEP 5 EXAMPLE

A 12" - 150 PSIG expansion joint is required to accept 1" of axial compression and 2.5" of lateral offset. The 150 PSIG catalog part with 36" of live length has a catalog rated lateral offset of 3.87" and catalog rated axial movement of 2.03". The example would use up 2.5/3.87 or 65% of the available catalog lateral movement and 1/2.03 or 49% of the available catalog axial movement or 65% + 49% = 114% of the rated movement. That is unacceptable. Going to a 48" live length the calculation becomes 2.5/5.58 or 45% of the catalog lateral movement and 1/2.03 or 49% of the available catalog axial movement or 45% + 49% = 94% of the rated movement. That works because the total is less than 100%. Therefore, the number 48 goes in the part number.

	Nominal Pipe Size	Style	End Fittings
English	24	AUT	FF
Metric	600 m	AUT	FF



Select the Live Length based on movement capability and/or spring rate. The live length is the distance from the outboard end of one bellows element to the outboard end of the second bellows element. The length of end fittings are added to this dimension to determine the assembly overall length. Selection of live length is an iterative process. Working with the movement data for the size and pressure class required, compare the movements required with the movements available for a given live length. An acceptable design satisfies the following equation.

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

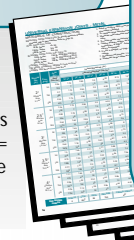
MODIFY CYCLE LIFE

The catalog movements are based on a cycle life of 2000 using the Expansion Joint Manufacturer Association's calculation method. If a higher cycle life is required, the available catalog movements should be reduced by the following amount before the above calculation is performed.

Desired Cycle Life	2000	3000	5000	7000	10000
Catalog Movement Reduction Factor	1	.905	.801	.741	.683

MODIFY CYCLE LIFE EXAMPLE

A 84" live length would be required if the required cycle life were 5000. The catalog movements for a 12" - 150 PSIG universal expansion joint with 84" live length are 2.03" available axial compression, 10.78" available lateral offset. The calculation for 5000 cycles using the above example would look like: $1/(\.801 \cdot 2.03) + 2.5/(\.801 \cdot 10.78) = .61 + .29 = .90$ or 90% of the available movement. The 84" live length works for a required cycle life of 5000. The OAL is $84" + (2 \cdot 3 \frac{3}{4}" \text{ end connectors}) = 90.5"$ (see pages 56-57).



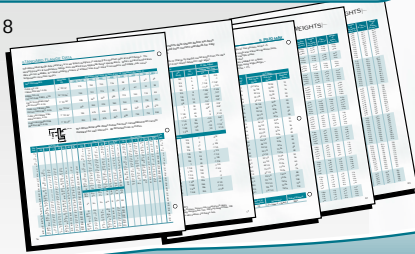
MODIFY SPRING RATE

If spring rate is the limiting design factor, select the live length that results in a total force that is less than the required amount for lateral and axial movements. Keep in mind that pressure thrust must be added to the axial spring force for a universal expansion joint that has axial compression even if limit rods are specified. To calculate the pressure thrust force, multiply the area of the bellows times the operating pressure. The effective area for any design is located under the pressure class on each page of design data. For the above example assuming 48" live length, the pressure thrust is $150 \cdot 154 = 23100$ pounds. The axial spring force is $1 \cdot 2481 = 2481$ pounds. The lateral offset force is $2.5 \cdot 131 = 328$ pounds. It is acceptable to interpolate the movements and the spring rates to obtain a live length that falls between the catalog values. It is not necessary to specify the number of convolutions because all catalog universal expansion joints are based on the use of 6 convolutions in each bellows element.

UNIVERSAL EXPANSION JOINT

STEP 3 Choose the type of each end fittings required (W for weld end, F for flange, A for angle flange, V for van stoned flange, E for Elbow) using the illustrations at the top of each odd number data pages 56-67. Review the bill of material information at the top of each even number pages 56-57 to understand the standard flange rating, weld end thickness, and materials of construction that will be applied.

See pages 16, 17 and 18 for references on pressure ratings and dimensions for various flanges. See pages 87 through 89 for available pipe schedules.



STEP 4 Choose the working pressure required. If the required pressure is between one of the listed values, use the higher of the two values listed in the catalog. If the required pressure is above the highest value listed, indicate the required pressure in the part number and the factory will custom design an expansion joint for the application.

Pressure Rating	Overall Length	Optional Hardware	Alternate Bellows Material
150	90.5"	L, C	321
10.5	2299	L, C	321

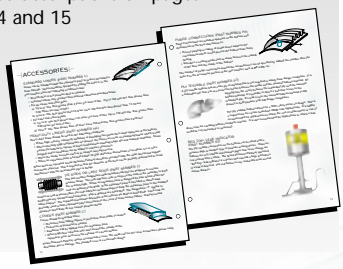
STEP 8 The basic part number is now complete. For a Universal untied 24" – 150 psig weld end expansion joint with T321 bellows and a liner and cover designed for 5000 cycles at 1" axial compression and 2.5" lateral offset the basic part number reads:

24 - AUT - FF - 150 - 90.5 - L,C - 321

1" axial 2.5" lateral 0° angular

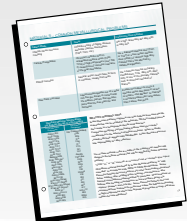
STEP 6 Select the letter code for accessories and options (L for Liner, HL for heavy liner, P# for Purges, C for Cover, PT for ply testable, RT for Red Top leak detector). Separate multiple options with commas to avoid confusion.

See descriptions on pages 14 and 15



STEP 7 Select the bellows material. If no entry is made, the bellows material is ASTM A240 T304 stainless steel.

See page 19 if an alternate bellows material is preferred. Select one of the materials and insert the material code into the part number.



SUMMARY

It is necessary to have the required movement information included in the description so that liner, cover, and limit rods can be designed with proper clearances.

UNIVERSAL EXPANSION JOINTS - METAL

2" TO 4" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

- 50 lb. Series: ch. 40
- 150 lb. Series: Sch. 40
- 300 lb. Series: Sch. 40

FLANGES: ASTM A105/A36/A516-70

- 50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
- 150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.
- 300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

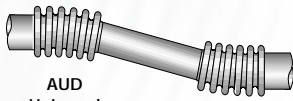
LINERS: 300 Series Stainless Steel

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 54.
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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

Nominal Size (In.)	Press. (psig)	Axial (In.) Axial (Lbs./In.)	Lateral Movement (In.)						Length of end Fitting (In.) Add to "LL" to obtain assembly OAL		
			Lateral Spring Rate (Lbs./In.)						F	W	E
			12" LL	18" LL	24" LL	36" LL	48" LL	84" LL			
2" Effective Area 5.7 in. ²	50	0.96	1.79	2.84	3.9	6.02	8.13	14.48	1	4	3
		199	7	3	1.5	0.6	0.3	0.1			
	150	0.7	1.79	2.84	3.9	6.02	8.13	14.48	1	4	3
		389	14	5	2.9	1.2	0.7	0.2			
	300	0.54	1.75	2.84	3.9	6.02	8.13	14.48	1 5/16	4	3
		673	23	9	5	2.1	1.1	0.4			
2.5" Effective Area 8.3 in. ²	50	1.26	1.79	2.84	3.9	6.02	8.13	14.48	1 1/8	4	3 3/4
		140	7	3	1.5	0.6	0.3	0.1			
	150	0.89	1.79	2.84	3.9	6.02	8.13	14.48	1 1/8	4	3 3/4
		546	28	11	5.9	2.5	1.4	0.4			
	300	0.63	1.69	2.84	3.9	6.02	8.13	14.48	1 1/2	4	3 3/4
		1074	54	22	11	4.8	2.6	0.8			
3" Effective Area 12.4 in. ²	50	1.38	1.65	2.71	3.77	5.88	8	14.35	1 3/16	4	4 1/2
		294	26	10	5	2.1	1.1	0.3			
	150	0.72	1.36	2.41	3.47	5.62	7.79	14.31	1 3/16	4	4 1/2
		1359	119	45	23	9.6	5.2	1.6			
	300	0.62	1.18	2.08	3.01	4.87	6.75	12.4	1 11/16	4	4 1/2
		1678	144	55	28	11.7	6.3	2			
3.5" Effective Area 15.9 in. ²	50	1.5	1.65	2.71	3.77	5.88	8	14.35	1 1/4	4	5 1/4
		278	31	12	6.1	2.5	1.4	0.4			
	150	0.79	1.32	2.33	3.37	5.46	7.56	13.88	1 1/4	4	5 1/4
		1285	144	55	28	11.7	6.3	2			
	300	0.77	1.31	2.3	3.33	5.39	7.46	13.71	1 3/4	4	5 1/4
		989	108	41	21	8.7	4.7	1.5			
4" Effective Area 20.1 in. ²	50	1.17	1.65	2.71	3.77	5.88	8	14.35	1 5/16	4	6
		472	64	24	13	5.2	2.8	0.9			
	150	0.96	1.42	2.51	3.62	5.86	8	14.35	1 5/16	4	6
		1015	144	55	28	12	6.3	2			
	300	0.76	1.12	1.98	2.86	4.64	6.42	11.8	1 7/8	4	6
		1754	249	94	49	20	11	3.4			

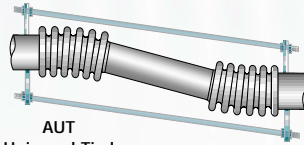
PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
	4	AUT	EE	150	60"	C	321

UNIVERSAL EXPANSION JOINTS - METAL 50MM TO 100MM SIZE



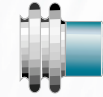
AUD
Universal
(Unrestrained)

Style



AUT
Universal Tied

End Connection



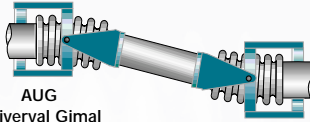
W Weld End



F Forged Flange



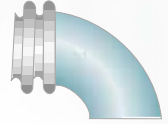
AUH
Universal Hinged



AUG
Universal Gimal



V Vanstone End



E Elbow

METRIC

Nominal Size (mm)	Press. (Kg/Cm ²)	Axial (mm)	Lateral Movement (mm)						Length of end Fitting (mm) Add to "LL" to obtain assembly OAL			
			Axial (Kg/mm)	Lateral Spring Rate (Kg/mm)						F	W	E
				305 mm LL	457 mm LL	610 mm LL	914 mm LL	1219 mm LL	2133 mm LL			
50 Effective Area 37 cm ²	3.5	24	45	72	99	153	207	368	25	102	76	
		3.6	0.124	0.049	0.026	0.011	0.006	0.002				
	10.5	18	45	72	99	153	207	368	25	102	76	
		7	0.242	0.096	0.051	0.022	0.012	0.004				
	21	14	44	72	99	153	207	368	33	102	76	
		12	0.419	0.166	0.088	0.037	0.02	0.006				
65 Effective Area 54 cm ²	3.5	32	45	72	99	153	207	368	29	102	95	
		2.5	0.127	0.05	0.027	0.011	0.006	0.002				
	10.5	23	45	72	99	153	207	368	29	102	95	
		9.8	0.497	0.197	0.105	0.044	0.024	0.008				
	21.1	16	43	72	99	153	207	368	38	102	95	
		19.2	0.968	0.384	0.205	0.086	0.047	0.015				
80 Effective Area 80 cm ²	3.5	35	42	69	96	149	203	364	30	102	114	
		5.2	0.458	0.173	0.09	0.037	0.02	0.006				
	10.5	18	35	61	88	143	198	363	30	102	114	
		24.3	2.12	0.801	0.416	0.171	0.093	0.029				
	21	16	30	53	76	124	171	315	43	102	114	
		30	2.577	0.974	0.506	0.208	0.113	0.035				
90 Effective Area 103 cm ²	3.5	38	42	69	96	149	203	364	32	102	133	
		5	0.557	0.21	0.109	0.045	0.024	0.008				
	10.5	20	34	59	86	139	192	353	32	102	133	
		23	2.577	0.974	0.506	0.208	0.113	0.035				
	21	20	33	59	84	137	190	348	44	102	133	
		17.7	1.928	0.729	0.379	0.156	0.084	0.026				
100 Effective Area 130 cm ²	3.5	30	42	69	96	149	203	364	33	102	152	
		8.4	1.14	0.43	0.22	0.09	0.05	0.02				
	10.5	24	36	64	92	149	203	364	33	102	152	
		18.1	2.58	0.97	0.51	0.21	0.11	0.04				
	21	19	29	50	73	118	163	300	48	102	152	
		31.3	4.45	1.68	0.87	0.36	0.19	0.06				



PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES.	ALT. BELLOWS MAT.
	100m	AUT	EE	10.5	1523	C	321

UNIVERSAL EXPANSION JOINTS - METAL

5" TO 12" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106

50 lb. Series: STD. WALL

150 lb. Series: STD. WALL

300 lb. Series: STD. WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

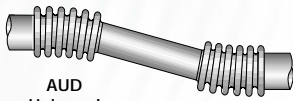
LINERS: 300 Series Stainless Steel

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 54.
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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

Nominal Size (In.)	Press. (psig)	Axial (In.)	Lateral Movement (In.)						Length of end Fitting (In.) Add to "LL" to obtain assembly OAL		
		Axial (Lbs./In.)	Lateral Spring Rate (Lbs./In.)						F	W	E
			12" LL	18" LL	24" LL	36" LL	48" LL	84" LL			
5" Effective Area 30.4 in. ²	50	1.62	1.65	2.71	3.77	5.88	8	14.35	1 7/16	4	7 1/2
		406	87	33	17	7	3.8	1.2			
	150	0.94	1.15	2.04	2.94	4.76	6.59	12.1	1 7/16	4	7 1/2
		1268	264	100	52	21	12	3.6			
	300	0.81	1	1.77	2.55	4.13	5.73	10.51	2	4	7 1/2
		1510	311	117	61	25	14	4.2			
6" Effective Area 42.7 in. ²	50	1.87	1.45	2.51	3.57	5.69	7.8	14.15	1 9/16	6	9
		634	237	83	42	17	8.8	2.7			
	150	1.45	1.2	2.28	3.41	5.69	7.8	14.15	1 9/16	6	9
		1095	409	143	72	29	15	5			
	300	0.95	0.8	1.53	2.28	3.84	5.4	10.14	2 1/16	6	9
		2231	799	280	140	56	30	9			
8" Effective Area 70 in. ²	50	2.07	1.33	2.51	3.57	5.69	7.8	14.15	1 3/4	6	12
		655	401	140	70	28	15	5			
	150	1.42	0.92	1.75	2.62	4.4	6.2	11.64	1 3/4	6	12
		1443	872	305	153	61	32	10			
	300	1.01	0.66	1.25	1.87	3.14	4.43	8.3	2 7/16	6	12
		3421	2066	724	362	144	77	23			
10" Effective Area 109 in. ²	50	2.95	1.14	2.25	3.31	5.42	7.54	13.89	1 15/16	6	15
		689	873	278	133	50	26	8			
	150	1.86	0.72	1.51	2.38	4.2	6.07	11.72	1 15/16	6	15
		1976	2478	790	376	142	74	22			
	300	1.48	0.57	1.2	1.89	3.34	4.82	9.31	2 5/8	6	15
		3503	4417	1408	670	253	132	39			
12" Effective Area 154 in. ²	50	2.95	0.96	2.01	3.17	5.42	7.54	13.89	2 3/16	8	18
		1087	1945	620	295	112	58	17			
	150	2.03	0.67	1.39	2.19	3.87	5.58	10.78	2 3/16	8	18
		2481	4402	1403	668	252	131	39			
	300	1.68	0.55	1.16	1.83	3.22	4.65	8.98	2 7/8	8	18
		3186	5576	1778	846	320	166	49			

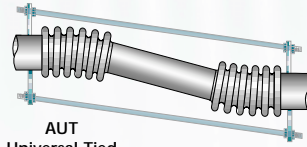
PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
	12	AU	WW	50	52	L, C	600

UNIVERSAL EXPANSION JOINTS - METAL 125MM TO 300MM SIZE



AUD
Universal
(Unrestrained)

Style



AUT
Universal Tied

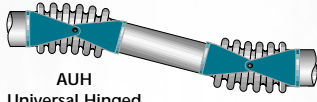
End Connection



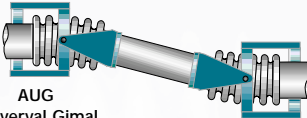
W Weld End



F Forged Flange



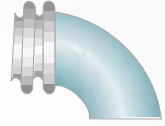
AUH
Universal Hinged



AUG
Universal Gimal



V Vanstone End



E Elbow

METRIC

Nominal Size (mm)	Press. (Kg/Cm ²)	Axial (mm)	Lateral Movement (mm)						Length of end Fitting (mm) Add to "LL" to obtain assembly OAL			
			Axial (Kg/mm)	Lateral Spring Rate (Kg/mm)						F	W	E
				305 mm LL	457 mm LL	610 mm LL	914 mm LL	1219 mm LL	2133 mm LL			
125 Effective Area 196 cm ²	3.5	41	42	69	96	149	203	364	37	102	191	
		7.3	1.55	0.59	0.31	0.13	0.07	0.02				
	10.5	24	29	52	75	121	167	307	37	102	191	
		22.7	4.71	1.78	0.93	0.38	0.21	0.06				
	21	21	25	45	65	105	145	267	51	102	191	
		27	5.55	2.1	1.09	0.45	0.24	0.08				
150 Effective Area 276 cm ²	3.5	48	37	64	91	144	198	359	40	152	229	
		11.3	4.23	1.48	0.74	0.29	0.16	0.05				
	10.5	37	30	58	87	144	198	359	40	152	229	
		19.6	7.31	2.56	1.28	0.51	0.27	0.08				
	21	24	20	39	58	97	137	258	52	152	229	
		39.9	14.28	5	2.5	0.99	0.53	0.16				
200 Effective Area 451 cm ²	3.5	53	34	64	91	144	198	359	44	152	305	
		11.7	7.16	2.51	1.26	0.5	0.27	0.08				
	10.5	36	23	44	67	112	158	296	44	152	305	
		25.8	15.57	5.45	2.73	1.08	0.58	0.18				
	21	26	17	32	48	80	112	211	62	152	305	
		61.1	36.91	12.93	6.47	2.57	1.37	0.42				
250 Effective Area 703 cm ²	3.5	75	29	57	84	138	191	353	49	152	381	
		12.3	15.6	5	2.4	0.9	0.5	0.1				
	10.5	47	18	38	61	107	154	298	49	152	381	
		35.3	44.3	14.1	6.7	2.5	1.3	0.4				
	21	38	15	31	48	85	122	237	67	152	381	
		62.6	78.9	25.2	12	4.5	2.4	0.7				
300 Effective Area 993 cm ²	3.5	75	24	51	80	138	191	353	56	203	457	
		19.4	34.7	11.1	5.3	2	1	0.3				
	10.5	52	17	35	56	98	142	274	56	203	457	
		44.3	78.6	25.1	11.9	4.5	2.3	0.7				
	21	43	14	29	46	82	118	228	73	203	457	
		56.9	99.6	31.8	15.1	5.7	3	0.9				



PART NUMBER	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
EXAMPLE	300m	AU	WW	3.5	1320	L, C	600

UNIVERSAL EXPANSION JOINTS - METAL

14" TO 22" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70 API 56

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .375" WALL 14"-20"/.5" WALL 22"

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. Series: 300 lb. ANSI B16.5 R.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

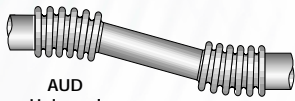
LINERS: 300 Series Stainless Steel

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 54.
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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

Nominal Size (In.)	Press. (psig)	Axial (In.)	Lateral Movement (In.)						Length of end Fitting (In.) Add to "LL" to obtain assembly OAL		
		Axial (Lbs./In.)	Lateral Spring Rate (Lbs./In.)						F	W	E
			18" LL	24" LL	30" LL	36" LL	48" LL	84" LL			
14" Effective Area 182 in. ²	50	2.86	1.82	2.86	3.94	5.05	7.28	13.89	1 1/4	8	21
		907	596	284	165	107	56	16			
	150	2.11	1.32	2.08	2.87	3.68	5.3	10.25	2 1/4	8	21
		2527	1704	811	471	307	159	47			
	300	1.74	1.1	1.73	2.39	3.06	4.41	8.52	3	8	21
		3223	2146	1022	593	386	201	59			
16" Effective Area 234 in. ²	50	3.12	1.74	2.74	3.78	4.84	6.98	13.48	1 1/4	8	24
		871	741	353	205	133	69	20			
	150	2.18	1.21	1.9	2.62	3.35	4.83	9.34	2 1/2	8	24
		2688	2329	1109	643	419	218	64			
	300	1.8	1	1.58	2.17	2.78	4.02	7.76	3 1/4	8	24
		3406	2918	1389	806	525	273	81			
18" Effective Area 295 in. ²	50	3.24	1.62	2.55	3.51	4.49	6.48	12.52	1 1/4	8	27
		903	961	458	265	173	90	27			
	150	2.44	1.2	1.9	2.61	3.35	4.83	9.33	2 11/16	8	27
		2438	2656	1264	734	478	248	73			
	300	2.36	1.16	1.83	2.52	3.22	4.65	8.99	3 1/2	8	27
		4548	4970	2366	1373	894	465	137			
20" Effective Area 361 in. ²	50	3.36	1.52	2.39	3.3	4.22	6.09	11.76	1 1/4	9	30
		926	1206	574	333	217	113	33			
	150	2.52	1.13	1.77	2.45	3.13	4.51	8.72	2 7/8	9	30
		2535	3372	1606	932	607	315	93			
	300	2.53	1.13	1.78	2.45	3.13	4.52	8.73	3 3/4	9	30
		4431	5929	2823	1638	1067	554	164			
22" Effective Area 431 in. ²	50	3.48	1.43	2.26	3.11	3.98	5.74	11.1	1 3/4	9	33
		942	1474	702	407	265	138	41			
	150	2.51	1.02	1.61	2.22	2.84	4.1	7.93	3 1/8	9	33
		2797	4449	2118	1229	800	416	123			
	300	2.52	1.02	1.61	2.23	2.85	4.11	7.94	4	9	33
		4889	7819	3723	2160	1407	731	216			

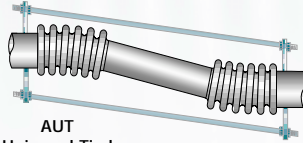
PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
	20	AUG	EE	150	108	L, C	825

UNIVERSAL EXPANSION JOINTS - METAL 350MM TO 550MM SIZE



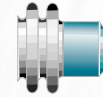
AUD
Universal
(Unrestrained)

Style

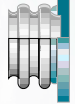


AUT
Universal Tied

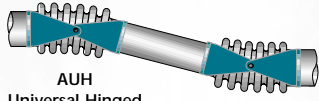
End Connection



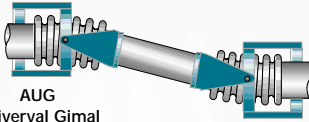
W Weld End



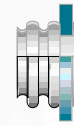
F Forged Flange



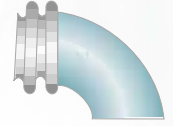
AUH
Universal Hinged



AUG
Universal Gimal



V Vanstone End



E Elbow

METRIC

Nominal Size (mm)	Press. (Kg/Cm ²)	Axial (mm)	Lateral Movement (mm)						Length of end Fitting (mm) Add to "LL" to obtain assembly OAL			
			Axial (Kg/mm)	Lateral Spring Rate (Kg/mm)						F	W	E
				305 mm LL	457 mm LL	610 mm LL	914 mm LL	1219 mm LL	2133 mm LL			
350 Effective Area 1174 cm ²	3.5	73	46	73	100	128	185	353	32	203	533	
		16.2	10.7	5.1	2.9	1.9	1	0.3				
	10.5	54	34	53	73	93	135	260	57	203	533	
		45.1	30.4	14.5	8.4	5.5	2.8	0.8				
	21	44	28	44	61	78	112	216	76	203	533	
		57.6	38.3	18.3	10.6	6.9	3.6	1.1				
400 Effective Area 1508 cm ²	3.5	79	44	70	96	123	177	342	32	203	610	
		15.6	13.2	6.3	3.7	2.4	1.2	0.4				
	10.5	55	31	48	66	85	123	237	64	203	610	
		48	41.6	19.8	11.5	7.5	3.9	1.2				
	21	46	25	40	55	71	102	197	83	203	610	
		60.8	52.1	24.8	14.4	9.4	4.9	1.4				
450 Effective Area 1902 cm ²	3.5	82	41	65	89	114	165	318	32	203	686	
		16.1	17.2	8.2	4.7	3.1	1.6	0.5				
	10.5	62	31	48	66	85	123	237	68	203	686	
		43.6	47.4	22.6	13.1	8.5	4.4	1.3				
	21	60	29	46	64	82	118	228	89	203	686	
		81.2	88.8	42.3	24.5	16	8.3	2.5				
500 Effective Area 2329 cm ²	3.5	85	39	61	84	107	155	299	32	229	762	
		16.5	21.5	10.3	6	3.9	2	0.6				
	10.5	64	29	45	62	79	115	222	73	229	762	
		45.3	60.2	28.7	16.6	10.8	5.6	1.7				
	21	64	29	45	62	80	115	222	95	229	762	
		79.2	105.9	50.4	29.3	19.1	9.9	2.9				
550 Effective Area 2783 cm ²	3.5	88	36	57	79	101	146	282	44	229	838	
		16.8	26.3	12.5	7.3	4.7	2.5	0.7				
	10.5	64	26	41	56	72	104	201	79	229	838	
		50	79.5	37.8	22	14.3	7.4	2.2				
	21	64	26	41	57	72	104	202	102	229	838	
		87.3	139.7	66.5	38.6	25.1	13.1	3.9				



PART NUMBER	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT
EXAMPLE	500m	AUG	EE	10.5	2743	L, C	825

UNIVERSAL EXPANSION JOINTS - METAL

24" TO 32" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70/API 5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .5" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify 8F > 24"

300 lb. Series: Customer to specify 8F > 24"

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

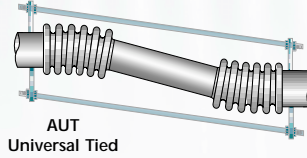
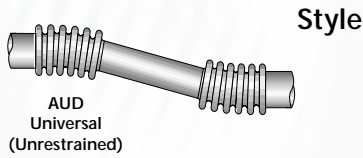
LINERS: 300 Series Stainless Steel

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 54.
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. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

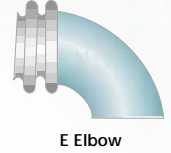
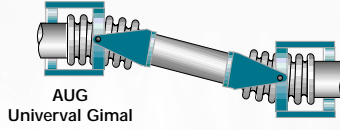
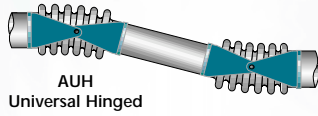
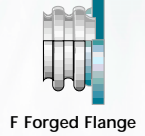
Nominal Size (In.)	Press. (psig)	Axial (In.)	Lateral Movement (In.)						Length of end Fitting (In.) Add to "LL" to obtain assembly OAL		
		Axial (Lbs./In.)	Lateral Spring Rate (Lbs./In.)						F	W	E
			18" LL	24" LL	30" LL	36" LL	48" LL	84" LL			
24" Effective Area 508 in. ²	50	3.77	1.42	2.24	3.09	3.96	5.71	11.03	1 3/4	9	36
		882	1636	779	452	294	153	45			
	150	2.5	0.94	1.48	2.04	2.61	3.77	7.28	3 1/4	9	36
		3059	5734	2730	1584	1032	536	159			
	300	2.51	0.94	1.48	2.04	2.61	3.77	7.29	4 3/16	9	36
		5348	10074	4796	2783	1812	942	279			
26" Effective Area 591 in. ²	50	3.9	1.36	2.15	2.96	3.79	5.47	10.58	1 3/4	10	39
		888	1924	916	532	346	180	53			
	150	2.49	0.87	1.37	1.89	2.41	3.48	6.73	*	10	39
		3321	7245	3449	2001	1303	677	200			
	300	2.5	0.87	1.37	1.89	2.42	3.49	6.74	*	10	39
		5806	12724	6058	3515	2289	1190	352			
28" Effective Area 681 in. ²	50	4.04	1.32	2.07	2.86	3.66	5.28	10.2	1 3/4	10	42
		891	2228	1061	615	401	208	62			
	150	2.49	0.81	1.27	1.75	2.24	3.24	6.26	*	10	42
		3583	9000	4285	2486	1619	842	249			
	300	2.5	0.81	1.27	1.76	2.25	3.24	6.27	*	10	42
		6264	15803	7524	4365	2843	1478	437			
30" Effective Area 782 in. ²	50	4.72	1.44	2.27	3.13	4	5.77	11.15	1 3/4	10	45
		553	1579	752	436	284	148	44			
	150	3.03	0.91	1.44	1.99	2.54	3.67	7.09	*	10	45
		2612	7576	3607	2093	1363	708	210			
	300	2.85	0.86	1.36	1.87	2.39	3.45	6.67	*	10	45
		5225	15152	7214	4185	2726	1417	419			
32" Effective Area 886 in. ²	50	4.72	1.35	2.13	2.94	3.76	5.42	10.47	1 3/4	11	48
		591	1909	909	527	343	178	53			
	150	3.12	0.89	1.4	1.92	2.46	3.55	6.87	*	11	48
		2629	8636	4111	2386	1554	808	239			
	300	2.94	0.83	1.31	1.81	2.32	3.34	6.46	*	11	48
		5257	17272	8223	4771	3107	1615	478			

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
	32	AUT	FF	50	39.5	L, C	316

UNIVERSAL EXPANSION JOINTS - METAL 600MM TO 800MM SIZE



End Connection



METRIC

Nominal Size (mm)	Press. (Kg/Cm ²)	Axial (mm)	Lateral Movement (mm)						Length of end Fitting (mm) Add to "LL" to obtain assembly OAL			
			Axial (Kg/mm)	Lateral Spring Rate (Kg/mm)						F	W	E
				305 mm LL	457 mm LL	610 mm LL	914 mm LL	1219 mm LL	2133 mm LL			
600 Effective Area 3279 cm ²	3.5	96	36	57	79	100	145	280	44	229	914	
		16	29	14	8	5	3	1				
	10.5	63	24	38	52	66	96	185	83	229	914	
		55	102	49	28	18	10	3				
21	64	24	38	52	66	96	185	106	229	914		
	96	180	86	50	32	17	5					
650 Effective Area 3815 cm ²	3.5	99	35	55	75	96	139	269	44	254	991	
		16	34	16	9	6	3	1				
	10.5	63	22	35	48	61	88	171	*	254	991	
		59	129	62	36	23	12	4				
21	63	22	35	48	61	89	171	*	254	991		
	104	227	108	63	41	21	6					
700 Effective Area 4391 cm ²	3.5	103	33	53	73	93	134	259	44	254	1067	
		16	40	19	11	7	4	1				
	10.5	63	21	32	45	57	82	159	*	254	1067	
		64	161	77	44	29	15	4				
21	63	21	32	45	57	82	159	*	254	1067		
	112	282	134	78	51	26	8					
750 Effective Area 5048 cm ²	3.5	120	37	58	79	102	147	283	44	254	1143	
		10	28	13	8	5	3	1				
	10.5	77	23	37	50	65	93	180	*	254	1143	
		47	135	64	37	24	13	4				
21	72	22	34	47	61	88	169	*	254	1143		
	93	271	129	75	49	25	7					
800 Effective Area 5718 cm ²	3.5	120	34	54	75	95	138	266	44	279	1219	
		11	34	16	9	6	3	1				
	10.5	79	23	35	49	63	90	174	*	279	1219	
		47	154	73	43	28	14	4				
21	75	21	33	46	59	85	164	*	279	1219		
	94	309	147	85	56	29	9					

PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLAWS MAT.
	800m	AUT	FF	3.5	1002	L, C	316

UNIVERSAL EXPANSION JOINTS - METAL

34" TO 42" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A516-70/API 5L

50 lb. Series: .375" WALL

150 lb. Series: .375" WALL

300 lb. Series: .75" WALL

FLANGES: ASTM A105/A36/A516-70

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

150 lb. Series: Customer to specify

300 lb. Series: Customer to specify

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

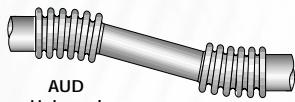
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any one movement tabulated.
2. To combine axial, lateral movements, refer to page 54.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalog pressure ratings are based upon a maximum bellows temperature of 800°F. Actual operating temperature should always be specified.
6. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

Nominal Size (In.)	Press. (psig)	Axial (In.) Axial (Lbs./In.)	Lateral Movement (In.)						Length of end Fitting (In.) Add to "LL" to obtain assembly OAL		
			Lateral Spring Rate (Lbs./In.)						F	W	E
			18" LL	24" LL	30" LL	36" LL	48" LL	84" LL			
34" Effective Area 997 in. ²	50	4.88	1.32	2.07	2.86	3.66	5.28	10.21	1 3/4	11	51
		585	2129	1013	588	383	199	59			
	150	3.11	0.83	1.31	1.81	2.32	3.35	6.47	*	11	51
		2797	10315	4911	2849	1856	965	285			
	300	3.03	0.81	1.28	1.76	2.25	3.25	6.28	*	11	51
		5275	19488	9278	5383	3506	1822	539			
36" Effective Area 1112 in. ²	50	4.87	1.25	1.96	2.71	3.46	5	9.65	1 3/4	11	54
		620	2519	1199	696	453	236	70			
	150	3.1	0.79	1.24	1.71	2.19	3.16	6.1	*	11	54
		2965	12199	5808	3370	2194	1141	337			
	300	3.02	0.77	1.21	1.66	2.13	3.07	5.93	*	11	54
		5592	23046	10972	6366	4146	2155	637			
38" Effective Area 1233 in. ²	50	4.87	1.18	1.86	2.57	3.28	4.74	9.15	1 3/4	12	57
		655	2954	1406	816	531	276	82			
	150	3.1	0.75	1.18	1.62	2.07	2.99	5.78	*	12	57
		3133	14299	6808	3950	2572	1337	395			
	300	3.01	0.73	1.14	1.58	2.02	2.91	5.62	*	12	57
		5909	27012	12860	7462	4859	2526	747			
49" Effective Area 1361 in. ²	50	4.87	1.12	1.77	2.44	3.12	4.51	8.71	1 3/4	12	60
		691	3436	1636	949	618	321	95			
	150	3.09	0.71	1.12	1.54	1.97	2.84	5.5	*	12	60
		3301	16627	7916	4593	2991	1555	460			
	300	3.01	0.69	1.09	1.5	1.92	2.77	5.35	*	12	60
		6227	31408	14953	8676	5650	2937	869			
42" Effective Area 1495 in. ²	50	4.86	1.07	1.68	2.32	2.97	4.29	8.28	1 3/4	12	63
		726	3969	1890	1096	714	371	110			
	150	3.09	0.68	1.07	1.47	1.88	2.71	5.24	*	12	63
		3470	19196	9139	5303	3453	1795	531			
	300	3.01	0.66	1.04	1.43	1.83	2.64	5.1	*	12	63
		6544	36258	17262	10016	6522	3390	1003			

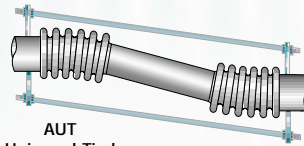
PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
	42	AUH	WW	150	60	C	800

UNIVERSAL EXPANSION JOINTS – METAL 850MM TO 1050MM SIZE

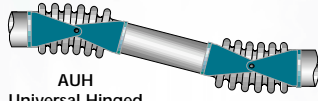
Style



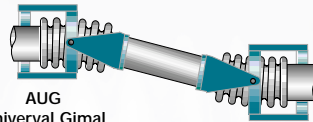
AUD
Universal
(Unrestrained)



AUT
Universal Tied



AUH
Universal Hinged

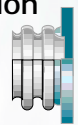


AUG
Universal Gimal

End Connection



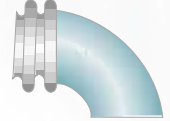
W Weld End



F Forged Flange



V Vanstone End



E Elbow

METRIC

Nominal Size (mm)	Press. (Kg/Cm ²)	Axial (mm)	Lateral Movement (mm)						Length of end Fitting (mm) Add to "LL" to obtain assembly OAL			
			Axial (Kg/mm)	Lateral Spring Rate (Kg/mm)						F	W	E
				305 mm LL	457 mm LL	610 mm LL	914 mm LL	1219 mm LL	2133 mm LL			
850 Effective Area 6431 cm ²	3.5	124	33	53	73	93	134	259	44	279	1295	
		10	38	18	11	7	4	1				
	10.5	79	21	33	46	59	85	164	*	279	1295	
		50	184	88	51	33	17	5				
21	77	21	32	45	57	83	160	*	279	1295		
	94	348	166	96	63	33	10					
900 Effective Area 7173 cm ²	3.5	124	32	50	69	88	127	245	44	279	1372	
		11	45	21	12	8	4	1				
	10.5	79	20	32	43	56	80	155	*	279	1372	
		53	218	104	60	39	20	6				
21	77	19	31	42	54	78	151	*	279	1372		
	100	412	196	114	74	38	11					
950 Effective Area 7956 cm ²	3.5	124	30	47	65	83	120	233	44	305	1448	
		12	53	25	15	9	5	1				
	10.5	79	19	30	41	53	76	147	*	305	1448	
		56	255	122	71	46	24	7				
21	77	18	29	40	51	74	143	*	305	1448		
	106	483	230	133	87	45	13					
1000 Effective Area 8779 cm ²	3.5	124	29	45	62	79	114	221	44	305	1524	
		12	61	29	17	11	6	2				
	10.5	79	18	28	39	50	72	140	*	305	1524	
		59	297	141	82	53	28	8				
21	76	18	28	38	49	70	136	*	305	1524		
	111	561	267	155	101	52	16					
1050 Effective Area 9643 cm ²	3.5	123	27	43	59	75	109	210	44	305	1600	
		13	71	34	20	13	7	2				
	10.5	78	17	27	37	48	69	133	*	305	1600	
		62	343	163	95	62	32	9				
21	76	17	26	36	46	67	130	*	305	1600		
	117	648	308	179	117	61	18					

PART NUMBER	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLAWS MAT.
EXAMPLE	1050m	AUH	WW	10.5	1524	C	800

UNIVERSAL EXPANSION JOINTS - METAL

44" TO 144" SIZE

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM A240 T304. To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A516-70/API-5L

25 lb. Series: .375" WALL

50 lb. Series: .375" WALL

FLANGES: ASTM A105/A36/A516-70

25 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

50 lb. Series: 125 lb. Lt. Wt. F.F.S.O.

COVERS: Carbon Steel

TIE RODS, GIMBALS, HINGES: Carbon Steel

LINERS: 300 Series Stainless Steel

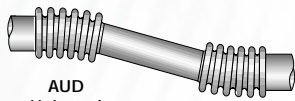
1. Rated cycle life is 2000 cycles per EJMA 7th edition for any one movement tabulated.
2. To combine axial, lateral movements, refer to page 54.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements or cycle life, contact the factory.
5. Catalog pressure ratings are based upon a maximum bellows temperature of 800°F. Actual operating temperature should always be specified.
6. If unit is flanged, see page 16 for maximum flange pressure ratings.
7. Maximum test pressure: 1 1/2 x maximum working pressure.
8. Maximum torque values are on page 68.

Nominal Size (In.)	Press. (psig)	Axial (In.) Axial (Lbs./In.)	Lateral Movement (In.)						Length of end Fitting (In.) Add to "LL" to obtain assembly OAL		
			Lateral Spring Rate (Lbs./In.)						F	W	E
			30" LL	36" LL	48" LL	60" LL	84" LL	120" LL			
44" Effective Area 1615 in. ²	50	4.84	2.21	2.83	4.09	5.35	7.9	11.73	2 1/4	8	66
		761	1258	819	426	260	126	59			
46" Effective Area 1760 in. ²	50	4.84	2.12	2.71	3.91	5.12	7.55	11.22	2 1/4	8	69
		796	1435	934	486	297	144	68			
48" Effective Area 1912 in. ²	50	4.83	2.03	2.6	3.75	4.91	7.24	10.75	2 1/2	8	72
		831	1627	1060	551	336	163	77			
50" Effective Area 2134 in. ²	50	8.79	2.21	3.07	4.89	6.8	10.71	16.68	2 1/2	8 1/2	75
		890	3071	1847	868	500	227	102			
52" Effective Area 2301 in. ²	50	8.77	2.13	2.95	4.7	6.53	10.29	16.03	2 1/2	8 1/2	78
		927	3447	2073	974	561	254	114			
54" Effective Area 2474 in. ²	50	8.75	2.05	2.84	4.52	6.29	9.9	15.42	2 1/2	8 1/2	81
		963	3852	2316	1089	627	284	128			
60" Effective Area 3031 in. ²	25	9.16	1.94	2.68	4.28	5.95	9.37	14.59	2 3/4	10	90
		1072	5253	3159	1485	855	388	174			
66" Effective Area 3645 in. ²	25	9.11	1.76	2.43	3.88	5.39	8.49	13.23	2 3/4	10	99
		1181	6960	4185	1968	1133	514	231			
72" Effective Area 4315 in. ²	25	9.07	1.61	2.23	3.55	4.94	7.77	12.11	2 3/4	10	108
		1290	9001	5413	2545	1465	664	299			
84" Effective Area 5826 in. ²	25	9.01	1.37	1.9	3.04	4.22	6.65	10.35	3	12	126
		1508	14205	8542	4016	2312	1048	471			
96" Effective Area 7562 in. ²	25	8.94	1.2	1.66	2.64	3.67	5.79	9.01	3 1/4	12	144
		1726	21106	12692	5967	3436	1558	700			
108" Effective Area 9525 in. ²	25	8.93	1.06	1.48	2.35	3.27	5.15	8.02	*	12	162
		1944	29942	18007	8465	4874	2210	993			
120" Effective Area 11714 in. ²	25	8.92	0.96	1.33	2.12	2.94	4.64	7.22	*	13 1/2	180
		2162	40954	24629	11578	6667	3023	1359			
132" Effective Area 14129 in. ²	25	8.91	0.87	1.21	1.93	2.68	4.22	6.57	*	13 1/2	198
		2381	54381	32703	15374	8853	4014	1804			
144" Effective Area 16770 in. ²	25	8.88	0.8	1.11	1.76	2.45	3.86	6.01	*	13 1/2	216
		2599	70462	42374	19920	11470	5201	2338			

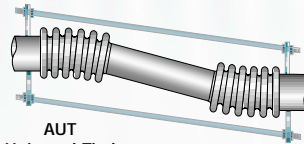
PART NUMBER EXAMPLE	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
	96	AU	FF	25	42.5	L, C	304L

UNIVERSAL EXPANSION JOINTS-METAL 1100MM TO 3600MM SIZE

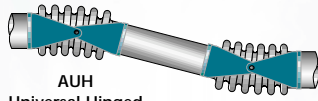
Style



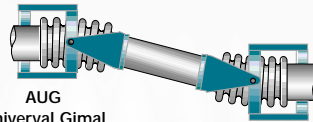
AUD
Universal
(Unrestrained)



AUT
Universal Tied



AUH
Universal Hinged

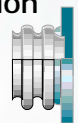


AUG
Universal Gimal

End Connection



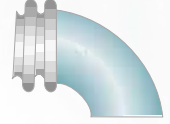
W Weld End



F Forged Flange



V Vanstone End



E Elbow

METRIC

Nominal Size (mm)	Press. (Kg/Cm ²)	Axial (mm)	Lateral Movement (mm)						Length of end Fitting (mm) Add to "LL" to obtain assembly OAL		
			Lateral Spring Rate (Kg/mm)						F	W	E
			Axial (Kg/mm)	305 mm LL	457 mm LL	610 mm LL	914 mm LL	1219 mm LL			
1100 Effective Area 10418 cm ²	3.5	123	56	72	104	136	201	298	57	203	1676
		14	22	15	8	5	2	1			
1150 Effective Area 11357 cm ²	3.5	123	54	69	99	130	192	285	57	203	1753
		14	26	17	9	5	3	1			
1200 Effective Area 12337 cm ²	3.5	123	52	66	95	125	184	273	64	203	1829
		15	29	19	10	6	3	1			
1250 Effective Area 13767 cm ²	3.5	223	56	78	124	173	272	424	64	216	1905
		16	55	33	16	9	4	2			
1300 Effective Area 14844 cm ²	3.5	223	54	75	119	166	261	407	64	216	1981
		17	62	37	17	10	5	2			
1350 Effective Area 15961 cm ²	3.5	222	52	72	115	160	252	392	64	216	2057
		17	69	41	19	11	5	2			
1500 Effective Area 19556 cm ²	1.8	233	49	68	109	151	238	371	70	254	2286
		19	94	56	27	15	7	3			
1650 Effective Area 23516 cm ²	1.8	231	45	62	99	137	216	336	70	254	2515
		21	124	75	35	20	9	4			
1800 Effective Area 27841 cm ²	1.8	230	41	57	90	125	197	308	70	254	2743
		23	161	97	45	26	12	5			
2100 Effective Area 37585 cm ²	1.8	229	35	48	77	107	169	263	76	305	3200
		27	254	153	72	41	19	8			
2400 Effective Area 48788 cm ²	1.8	227	30	42	67	93	147	229	83	305	3658
		31	377	227	107	61	28	13			
2700 Effective Area 61451 cm ²	1.8	227	27	37	60	83	131	204	*	305	4115
		35	535	322	151	87	39	18			
3000 Effective Area 75573 cm ²	1.8	227	24	34	54	75	118	183	*	343	4572
		39	732	440	207	119	54	24			
3300 Effective Area 91154 cm ²	1.8	226	22	31	49	68	107	167	*	343	5029
		43	971	584	275	158	72	32			
3600 Effective Area 108195 cm ²	1.8	226	20	28	45	62	98	153	*	343	5486
		46	1259	757	356	205	93	42			

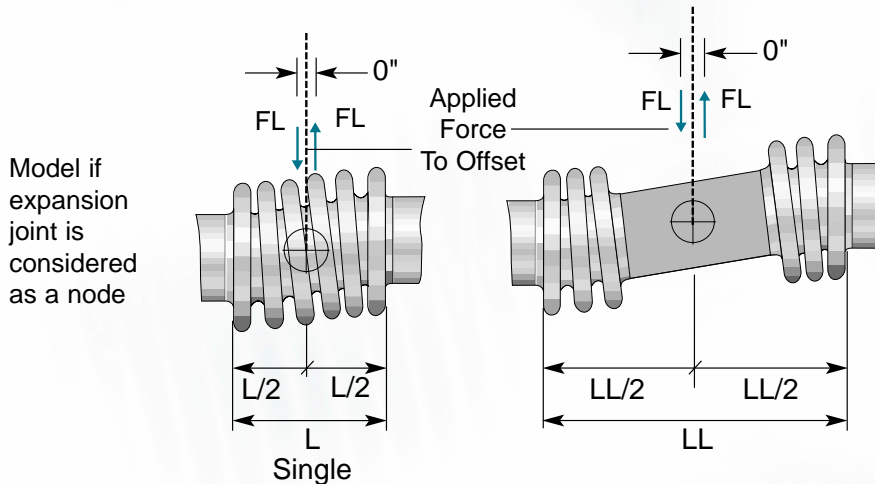
PART NUMBER	NOM I.D.	STYLE	ENDS	PRESSURE	OVERALL LENGTH	ACCESSORIES	ALT. BELLOWS MAT.
EXAMPLE	2400m	AU	FF	1.8	1080	L, C	304L

[MOMENT AND TORSION DATA]

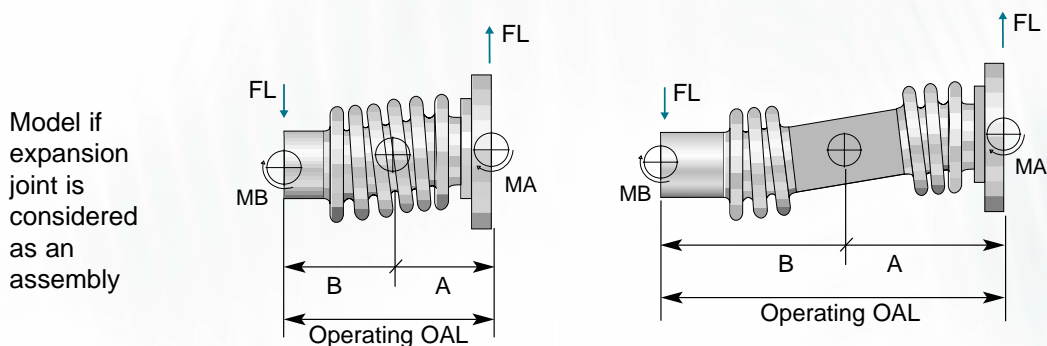
The information on the following pages is offered for the benefit of those specifiers who are modeling expansion joints in computer stress programs.

Forces and Moments

When an expansion joint is offset laterally, the offset force can be assumed to act at a node at the center of the bellows element if the expansion joint is a single bellows type. If the expansion joint is a universal type, the offset force can be assumed to act at a node at the center of the spool that separates the two bellows elements. The expansion joint can be considered as a node with stiffness values acting at the node point.



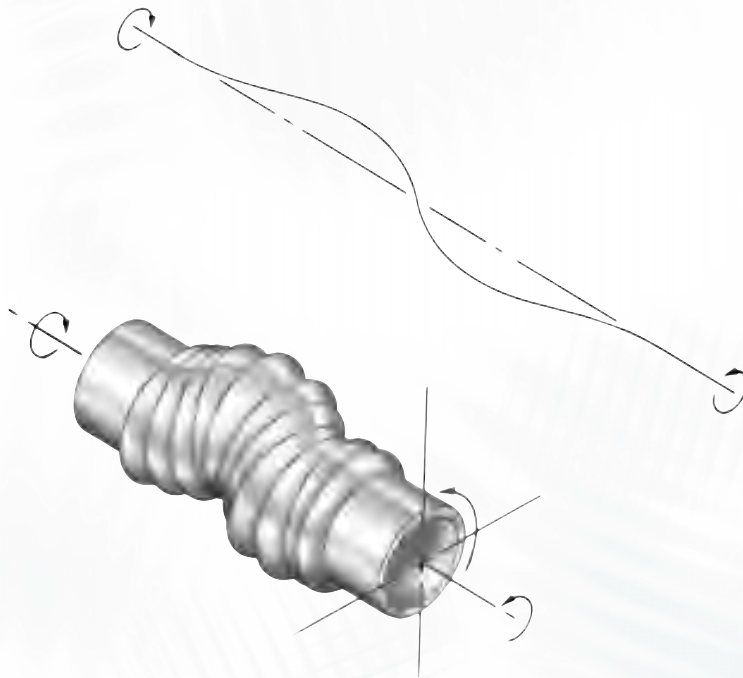
If the expansion joint is being evaluated as an component with offset loads acting at the ends of the assembly, there is a moment that must be considered to properly evaluate the effect of the expansion joint on the adjacent piping. The moment is equal to (the offset force) X (the distance from the end of the assembly to the center of the bellows element) if the expansion joint is a single bellows type. If the expansion joint is a universal, the moment is equal to (the offset force) X (the distance from the center of the center spool to the end of the assembly).



Torsion

Pipe stress programs require that expansion joints be modeled with 6 degrees of stiffness. One of these values is torsional stiffness. The Caesar II pipe stress program by COADE contains a data base that includes all the spring rate values for Senior Flexonics Pathway standard bellows elements from this catalog, including torsion spring rate values. When other software programs are used, the torsional spring rates and torsional limits in the following tables will be helpful.

Torsion can be very damaging to an expansion joint. Torque causes a bellows to want to take a cork screw shape, significantly reducing its pressure carrying capacity. **If torsion is present in any amount, it is very important to specify the torsion loading in the inquiry so that the effects of torsion can be taken into account in the product design.** If a significant amount of torsion is present, it may be necessary to add hardware to the expansion joint to isolate the bellows element from excessive torque. Expansion joint design engineers assume there is no torsion load on an expansion joint unless a torsion value is specified. Contact the factory for further information about torsion loading.

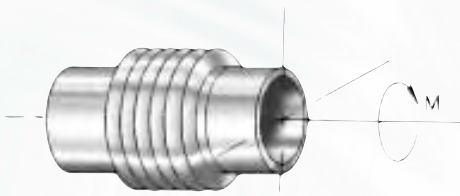


The torsion spring rates are based on torsional stiffness for single bellows elements with no lateral offset. Testing indicates that lateral offset drastically reduces torsional stiffness and the pressure carrying capacity of the bellows.

The torsion data following is applicable to single bellows elements without hinge or gimbal hardware. A universal expansion joint without hardware to resist torque is made up of two single bellows elements. The universal expansion joints specified in this catalog use two 6 convolution bellows elements. Therefore, the torsion criteria for a standard universal expansion joints should be based on a 12-convolution single bellows element if the assembly is being evaluated in total. If each bellows of the universal is being evaluated, use the criteria for a 6 convolution bellows.

TORSIONAL STIFFNESS VALUES

2" TO 28" SIZE



SPRING RATES BELOW RESIST BELLOWS
MOVEMENT FOR TORSIONALLY APPLIED
MOMENT M

VALUES ARE BASED ON:

1. Standard Convolution Height and Pitch
2. T-304 S/S Bellows Material
3. 800°F Maximum Operating Condition
4. Data is Based Upon Single Bellows With Stated Convolution Counts Only

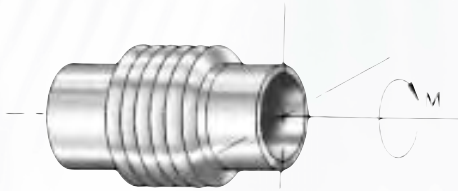
** Torsional Spring Rate (Kg - M) X 10³ for catalog parts

† Maximum Allowable Torsion Angle in Degrees

Nom. Dia. (In.)	# of Coils	50 PSIG		150 PSIG		300 PSIG		Nom. Dia. (In.)	# of Coils	50 PSIG		150 PSIG		300 PSIG		Nom. Dia. (In.)	# of Coils	50 PSIG		150 PSIG		300 PSIG			
		**	†	**	†	**	†			**	†	**	†	**	†			**	†	**	†	**	†	**	†
2	4	.006	.062	.008	.062	.010	.061	6	4	.152	.052	.184	.051	.223	.042	18	4	2.46	.028	3.58	.032	7.30	.032		
	8	.003	.125	.004	.124	.005	.123		8	.076	.103	.092	.102	.112	.085		8	1.23	.057	1.79	.065	3.65	.064		
	12	.002	.187	.003	.186	.003	.184		12	.051	.155	.061	.154	.074	.127		12	.820	.085	1.19	.097	2.43	.095		
	16	.002	.250	.004	.222	.005	.218		16	.038	.206	.085	.185	.067	.188		16	.615	.113	.895	.130	1.82	.127		
	20								20	.030	.258	.068	.231	.054	.235		20	.492	.141	.716	.162	1.46	.159		
2 1/2	4	.010	.060	.012	.059	.016	.057	8	4	.314	.042	.406	.039	.549	.039	20	4	3.30	.026	4.81	.030	9.61	.030		
	8	.005	.120	.006	.119	.008	.114		8	.157	.085	.203	.079	.274	.078		8	1.65	.052	2.41	.060	4.81	.060		
	12	.003	.179	.009	.172	.011	.164		12	.105	.127	.135	.118	.183	.116		12	1.10	.078	1.60	.089	3.20	.089		
	16	.005	.233	.006	.230	.008	.218		16	.079	.170	.102	.157	.137	.155		16	.825	.104	1.20	.119	2.40	.119		
	20								20	.063	.212	.150	.178	.110	.194		20	.660	.130	.963	.149	1.92	.149		
3	4	.021	.063	.036	.061	.038	.058	10	4	.564	.044	.799	.041	.983	.042	22	4	4.29	.024	6.41	.027	12.8	.027		
	8	.011	.125	.018	.123	.019	.116		8	.282	.088	.400	.083	.492	.084		8	2.15	.048	3.20	.054	6.40	.054		
	12	.007	.188	.012	.184	.013	.174		12	.188	.132	.266	.124	.328	.126		12	1.43	.073	2.14	.081	4.26	.081		
	16	.005	.250	.009	.245	.009	.231		16	.141	.176	.200	.166	.246	.168		16	1.07	.097	1.60	.108	3.20	.108		
	20	.008	.289	.007	.306	.013	.263		20	.208	.199	.182	.227	.343	.193		20	.859	.121	1.28	.135	2.56	.135		
3 1/2	4	.030	.058	.051	.057	.045	.051	12	4	1.08	.043	1.42	.041	1.52	.038	24	4	5.33	.023	8.32	.025	16.6	.025		
	8	.015	.115	.025	.113	.022	.102		8	.538	.087	.708	.082	.760	.077		8	2.67	.046	4.16	.050	8.30	.050		
	12	.010	.173	.017	.170	.015	.154		12	.358	.130	.472	.123	.507	.115		12	1.78	.070	2.77	.074	5.54	.075		
	16	.007	.231	.013	.226	.027	.215		16	.269	.173	.354	.164	.677	.138		16	1.33	.093	2.08	.099	4.15	.099		
	20	.011	.268	.010	.283	.021	.269		20	.215	.217	.283	.205	.541	.172		20	1.07	.116	1.66	.124	3.32	.124		
4	4	.047	.046	.065	.056	.079	.055	14	4	1.25	.034	1.83	.038	1.96	.036	26	4	6.64	.022	10.6	.023	21.1	.023		
	8	.024	.092	.033	.111	.040	.110		8	.623	.068	.917	.077	.982	.071		8	3.32	.044	5.29	.046	10.6	.046		
	12	.016	.138	.022	.167	.026	.165		12	.415	.101	.611	.115	.655	.107		12	2.21	.066	3.53	.069	7.04	.069		
	16	.012	.184	.016	.222	.020	.220		16	.311	.135	.459	.153	.872	.129		16	1.66	.087	2.64	.092	5.28	.092		
	20	.009	.230	.023	.257	.029	.252		20	.249	.169	.367	.191	.698	.161		20	1.33	.109	2.12	.114	4.22	.115		
5	4	.086	.052	.123	.045	.129	.043	16	4	1.77	.031	2.68	.034	2.86	.032	28	4	8.12	.021	13.2	.021	26.4	.021		
	8	.043	.104	.062	.090	.065	.086		8	.885	.062	1.34	.068	1.43	.064		8	4.06	.041	6.60	.043	13.2	.043		
	12	.029	.155	.041	.135	.043	.128		12	.590	.093	.893	.103	.955	.096		12	2.71	.062	4.40	.064	8.79	.064		
	16	.021	.207	.031	.180	.059	.149		16	.442	.124	.670	.137	1.27	.116		16	2.03	.083	3.30	.085	6.59	.085		
	20	.017	.259	.025	.225	.048	.187		20	.354	.155	.536	.171	1.015	.145		20	1.62	.104	2.64	.106	5.27	.106		

TORSIONAL STIFFNESS VALUES

50MM TO 700MM SIZE



VALUES ARE BASED ON:

1. Standard Convolution Height and Pitch
2. T-304 S/S Bellows Material
3. 800°F Maximum Operating Condition
4. Data is Based Upon Single Bellows With Stated Convolution Counts Only

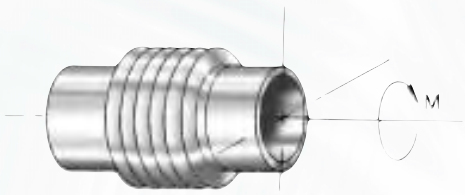
SPRING RATES BELOW RESIST BELLOWS
MOVEMENT FOR TORSIONALLY APPLIED
MOMENT M

METRIC

** Torsional Spring Rate (Kg - M) X 10 ³ for catalog parts																							
† Maximum Allowable Torsion Angle in Degrees																							
Nom. Dia. (mm)	# of Cons	3.5 Kg/Cm ²		10.5 Kg/Cm ²		21. Kg/Cm ²		Nom. Dia. (mm)	# of Cons	3.5 Kg/Cm ²		10.5 Kg/Cm ²		21. Kg/Cm ²		Nom. Dia. (mm)	# of Cons	3.5 Kg/Cm ²		10.5 Kg/Cm ²		21. Kg/Cm ²	
		**	†	**	†	**	†			**	†	**	†	**	†			**	†	**	†	**	†
50	4	0.075	0.062	0.094	0.062	0.114	0.061	150	4	1.76	0.052	2.12	0.051	2.57	0.042	450	4	28.4	0.028	41.3	0.032	84.1	0.032
	8	0.037	0.125	0.047	0.124	0.057	0.123		8	0.878	0.103	1.06	0.102	1.29	0.085		8	14.2	0.057	20.6	0.065	42	0.064
	12	0.025	0.187	0.031	0.186	0.038	0.184		12	0.585	0.155	0.707	0.154	0.857	0.127		12	9.45	0.085	13.8	0.097	28	0.095
	16	0.019	0.25	0.042	0.222	0.053	0.218		16	0.439	0.206	0.978	0.185	0.771	0.188		16	7.09	0.113	10.3	0.13	21	0.127
	20								20	0.351	0.258	0.783	0.231	0.617	0.235		20	5.67	0.141	8.25	0.162	16.8	0.159
65	4	0.114	0.06	0.143	0.059	0.18	0.057	200	4	3.62	0.042	4.68	0.039	6.32	0.039	500	4	38	0.026	55.5	0.03	111	0.03
	8	0.057	0.12	0.072	0.119	0.09	0.114		8	1.811	0.085	2.34	0.079	3.16	0.078		8	19	0.052	27.7	0.06	55.4	0.06
	12	0.038	0.179	0.099	0.172	0.125	0.164		12	1.21	0.127	1.56	0.118	2.11	0.116		12	12.7	0.078	18.5	0.089	36.9	0.089
	16	0.059	0.233	0.074	0.23	0.094	0.218		16	0.905	0.17	1.17	0.157	1.58	0.155		16	9.5	0.104	13.9	0.119	27.7	0.119
	20								20	0.724	0.212	1.73	0.178	1.26	0.194		20	7.6	0.13	11.1	0.149	22.1	0.149
80	4	0.242	0.063	0.413	0.061	0.437	0.058	250	4	6.49	0.044	9.21	0.041	11.3	0.042	550	4	49.5	0.024	73.8	0.027	147	0.027
	8	0.121	0.125	0.206	0.123	0.218	0.116		8	3.25	0.088	4.6	0.083	5.66	0.084		8	24.7	0.048	36.9	0.054	73.7	0.054
	12	0.081	0.188	0.138	0.184	0.146	0.174		12	2.16	0.132	3.07	0.124	3.78	0.126		12	16.5	0.073	24.6	0.081	49.1	0.081
	16	0.061	0.25	0.103	0.245	0.109	0.231		16	1.62	0.176	2.3	0.166	2.83	0.168		16	12.4	0.097	18.5	0.108	36.8	0.108
	20	0.087	0.289	0.083	0.306	0.154	0.263		20	2.39	0.199	2.1	0.227	3.95	0.193		20	9.89	0.121	14.8	0.135	29.5	0.135
90	4	0.343	0.058	0.583	0.057	0.516	0.051	300	4	12.4	0.043	16.3	0.041	17.5	0.038	600	4	61.5	0.023	95.8	0.025	191	0.025
	8	0.172	0.115	0.292	0.113	0.258	0.102		8	6.19	0.087	8.16	0.082	8.76	0.077		8	30.7	0.046	47.9	0.05	95.7	0.05
	12	0.114	0.173	0.194	0.17	0.172	0.154		12	4.13	0.13	5.44	0.123	5.84	0.115		12	20.5	0.07	31.9	0.074	63.8	0.075
	16	0.086	0.231	0.146	0.226	0.307	0.215		16	3.1	0.173	4.08	0.164	7.79	0.138		16	15.4	0.093	24	0.099	47.8	0.099
	20	0.123	0.268	0.117	0.283	0.246	0.269		20	2.48	0.217	3.26	0.205	6.24	0.172		20	12.3	0.116	19.2	0.124	38.3	0.124
100	4	0.545	0.046	0.752	0.056	0.91	0.055	350	4	14.3	0.034	21.1	0.038	22.6	0.036	650	4	76.5	0.022	121.8	0.023	243	0.023
	8	0.272	0.092	0.376	0.111	0.455	0.11		8	7.17	0.068	10.6	0.077	11.3	0.071		8	38.3	0.044	60.9	0.046	121.6	0.046
	12	0.182	0.138	0.251	0.167	0.303	0.165		12	4.78	0.101	7.04	0.115	7.55	0.107		12	25.5	0.066	40.6	0.069	81.1	0.069
	16	0.136	0.184	0.188	0.222	0.228	0.22		16	3.59	0.135	5.28	0.153	10	0.129		16	19.1	0.087	30.5	0.092	60.8	0.092
	20	0.109	0.23	0.26	0.257	0.332	0.252		20	2.87	0.169	4.23	0.191	8.04	0.161		20	15.3	0.109	24.4	0.114	48.7	0.115
125	4	0.986	0.052	1.42	0.045	1.49	0.043	400	4	20.4	0.031	30.9	0.034	33	0.032	700	4	93.6	0.021	152.2	0.021	304	0.021
	8	0.493	0.104	0.71	0.09	0.745	0.086		8	10.2	0.062	15.4	0.068	16.5	0.064		8	46.8	0.041	76.1	0.043	152	0.043
	12	0.329	0.155	0.473	0.135	0.497	0.128		12	6.8	0.093	10.3	0.103	11	0.096		12	31.2	0.062	50.7	0.064	101	0.064
	16	0.247	0.207	0.355	0.18	0.684	0.149		16	5.1	0.124	7.71	0.137	14.6	0.116		16	23.4	0.083	38	0.085	76	0.085
	20	0.197	0.259	0.284	0.225	0.547	0.187		20	4.08	0.155	6.17	0.171	11.7	0.145		20	18.7	0.104	30.4	0.106	60.8	0.106

TORSIONAL STIFFNESS VALUES

30" TO 144" SIZE



SPRING RATES BELOW RESIST BELLOWS
MOVEMENT FOR TORSIONALLY APPLIED
MOMENT M

VALUES ARE BASED ON:

1. Standard Convolution Height and Pitch
2. T-304 S/S Bellows Material
3. 800°F Maximum Operating Condition
4. Data is Based Upon Single Bellows With Stated Convolution Counts Only

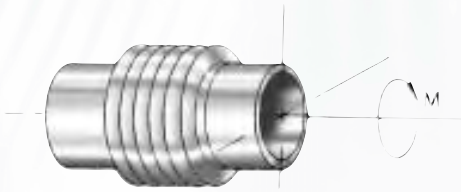
** Torsional Spring Rate (In. - Lb/Deg) X 10⁶ for catalog parts

† Maximum Allowable Torsion Angle in Degrees

Nom. Dia. (In.)	# of Cons	50 PSIG		150 PSIG		300 PSIG		Nom. Dia. (In.)	# of Cons	50 PSIG		Nom. Dia. (In.)	# of Cons	25 PSIG		Nom. Dia. (In.)	# of Cons	25 PSIG		
		**	†	**	†	**	†			**	†			**	†			**	†	
30	4	8.29	.019	14.5	.022	30.0	.021	44	4	25.6	.014	60	2	125	.008	108	2	726	.005	
	8	4.15	.039	7.25	.044	15.0	.043		8	12.8	.027		4	62.3	.017		4	363	.009	
	12	2.76	.058	4.84	.067	10.0	.064		12	8.55	.041		6	41.5	.025		6	242	.014	
	16	2.07	.078	3.63	.089	7.51	.086		16	6.41	.054		8	31.1	.033		8	182	.018	
32	4	10.1	.018	17.3	.021	35.8	.020	46	4	29.3	.013	66	10	24.9	.041	120	10	145	.023	
	8	5.03	.036	8.65	.042	17.9	.041		8	14.7	.026		12	20.8	.050		12	121	.028	
	12	3.36	.055	5.77	.064	11.9	.061		12	9.77	.039		2	166	.008		2	996	.004	
	16	2.52	.073	4.32	.085	8.95	.082		16	7.33	.052		4	82.9	.015		4	498	.008	
34	4	11.8	.017	20.7	.020	42.2	.020	48	4	33.3	.012	72	6	55.3	.023	132	6	332	.012	
	8	5.92	.035	10.4	.040	21.1	.039		8	16.6	.025		8	41.4	.030		8	249	.017	
	12	3.94	.052	6.92	.060	14.1	.059		12	11.1	.037		10	33.2	.038		10	199	.021	
	16	2.96	.070	5.19	.080	10.5	.079		16	8.32	.050		12	27.6	.045		12	166	.025	
36	4	14.0	.017	24.6	.019	50.1	.019	50	2	72.1	.010	84	2	215	.007	144	2	1326	.004	
	8	7.02	.033	12.31	.038	25.0	.037		4	36.0	.020		4	108	.014		4	663	.008	
	12	4.68	.050	8.21	.057	16.7	.056		6	24.0	.030		6	71.7	.021		6	442	.011	
	16	3.51	.066	6.16	.075	12.5	.074		8	18.0	.040		8	53.8	.028		8	332	.015	
38	4	16.5	.016	29.0	.018	58.9	.018	52	10	14.4	.050	96	10	43.0	.035	180	10	265	.019	
	8	8.26	.031	14.5	.036	29.4	.035		12	12.0	.060		12	35.9	.041		12	221	.023	
	12	5.51	.047	9.66	.054	19.6	.053		2	81.1	.010		2	342	.006		2	1722	.003	
	16	4.13	.063	7.24	.071	14.7	.070		4	40.5	.019		4	171	.012		4	861	.007	
40	4	19.3	.015	33.8	.017	68.7	.017	54	6	27.0	.029	108	6	114	.018	216	6	574	.010	
	8	9.63	.030	16.9	.034	34.3	.033		8	20.3	.038		8	85.4	.024		8	430	.014	
	12	6.42	.045	11.3	.051	22.9	.050		10	16.2	.048		10	68.4	.030		10	344	.017	
	16	4.82	.059	8.45	.068	17.2	.067		12	13.5	.057		12	57.0	.035		12	287	.021	
42	4	22.3	.014	39.1	.016	79.5	.016	54	2	90.8	.009	108	2	510	.005	216	2	3162	.002	
	8	11.15	.028	19.6	.032	39.8	.032		4	45.4	.018		4	255	.010		4	1581	.003	
	12	7.44	.042	13.0	.048	26.5	.048		6	30.3	.028		6	170	.016		6	1050	.005	
	16	8	5.58	.057	9.78	.065	19.9		.064	8	22.7		.037	8	128		.021	8	675	.007
		10								10	18.2		.046	10	102		.026	10	450	.010
		12								12	15.1		.055	12	85.0		.031	12	315	.013
16																				

TORSIONAL STIFFNESS VALUES

750MM TO 3600MM SIZE



VALUES ARE BASED ON:

1. Standard Convolution Height and Pitch
2. T-304 S/S Bellows Material
3. 800°F Maximum Operating Condition
4. Data is Based Upon Single Bellows With Stated Convolution Counts Only

SPRING RATES BELOW RESIST BELLOWS
MOVEMENT FOR TORSIONALLY APPLIED
MOMENT M

METRIC

** Torsional Spring Rate (Kg - M) X 10³ for catalog parts

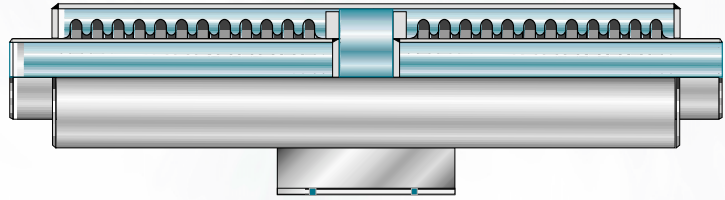
† Maximum Allowable Torsion Angle in Degrees

Nom. Dia. (In.)	# of Cons	3.5 Kg/Cm ²				10.5 Kg/Cm ²				21. Kg/Cm ²				Nom. Dia. (In.)	# of Cons	3.5 Kg/Cm ²				Nom. Dia. (In.)	# of Cons	1.8 Kg/Cm ²				Nom. Dia. (In.)	# of Cons	1.8 Kg/Cm ²			
		**		†		**		†		**		†				**		†				**		†				**		†	
		**	†	**	†	**	†	**	†	**	†	**	†			**	†	**	†			**	†	**	†			**	†	**	†
750	4	95.6	0.019	167	0.022	346	0.021	1100	4	295	0.014	1500	2	1435	0.008	2700	2	8369	0.005												
	8	47.8	0.039	83.6	0.044	173	0.043		8	148	0.027		4	718	0.017		4	4185	0.009												
	12	31.9	0.058	55.7	0.067	115	0.064		12	98.5	0.041		6	478	0.025		6	2790	0.014												
	16	23.9	0.078	41.8	0.089	87	0.086		16	73.9	0.054		8	359	0.033		8	2092	0.018												
800	4	116	0.018	199	0.021	412	0.02	1150	4	338	0.013	1650	10	287	0.041	3000	10	1674	0.023												
	8	58	0.036	99.6	0.042	206	0.041		8	169	0.026		12	239	0.05		12	1395	0.028												
	12	38.7	0.055	66.4	0.064	137	0.061		12	113	0.039		2	1910	0.008		2	11480	0.004												
	16	29	0.073	49.8	0.085	103	0.082		16	84.4	0.052		4	955	0.015		4	5740	0.008												
850	4	136	0.017	239	0.02	486	0.02	1200	4	384	0.012	1800	6	637	0.023	3300	6	3827	0.012												
	8	68.2	0.035	120	0.04	243	0.039		8	192	0.025		8	478	0.03		8	2870	0.017												
	12	45.4	0.052	79.7	0.06	162	0.059		12	128	0.037		10	382	0.038		10	2296	0.021												
	16	34.1	0.07	59.8	0.08	121	0.079		16	95.9	0.05		12	318	0.045		12	1913	0.025												
900	4	162	0.017	284	0.019	577	0.019	1250	2	830	0.01	2100	2	2480	0.007	3600	2	15280	0.004												
	8	80.9	0.033	142	0.038	288	0.037		4	415	0.02		4	1240	0.014		4	7640	0.008												
	12	53.9	0.05	94.6	0.057	192	0.056		6	277	0.03		6	827	0.021		6	5093	0.011												
	16	40.5	0.066	70.9	0.075	144	0.074		8	208	0.04		8	620	0.028		8	3820	0.015												
950	4	190	0.016	334	0.018	678	0.018	1300	10	166	0.05	2400	10	496	0.035	3600	10	3056	0.019												
	8	95.2	0.031	167	0.036	339	0.035		12	138	0.06		12	413	0.041		12	2547	0.023												
	12	63.4	0.047	111	0.054	226	0.053		2	934	0.01		2	3938	0.006		2	19838	0.003												
	16	47.6	0.063	83.4	0.071	170	0.07		4	467	0.019		4	1969	0.012		4	9919	0.007												
1000	4	222	0.015	389	0.017	791	0.017	1350	6	311	0.029	2400	6	1313	0.018	3600	6	6613	0.01												
	8	111	0.03	195	0.034	396	0.033		8	234	0.038		8	984	0.024		8	4960	0.014												
	12	74	0.045	130	0.051	264	0.05		10	187	0.048		10	788	0.03		10	3968	0.017												
	16	55.5	0.059	97.3	0.068	198	0.067		12	156	0.057		12	656	0.035		12	3306	0.021												
1050	4	257	0.014	451	0.016	916	0.016	1350	2	1046	0.009	2400	2	5878	0.005	3600	2	36710	0.002												
	8	128	0.028	225	0.032	458	0.032		4	523	0.018		4	2939	0.01		4	15060	0.005												
	12	85.7	0.042	150	0.048	305	0.048		6	349	0.028		6	1959	0.016		6	9880	0.009												
	16	8	64.2	0.057	113	0.065	229		0.064	8	262		0.037	8	1469		0.021	8	7440	0.012											
		10	209	0.046	10	1176	0.026		10	1176	0.026		10	1176	0.026		10	1176	0.026	10	1176	0.026									
12	174	0.055	12	980		0.031	12	980	0.031	12	980	0.031	12	980	0.031	12	980	0.031													

[X-PRESS EXPANSION JOINTS]

Features

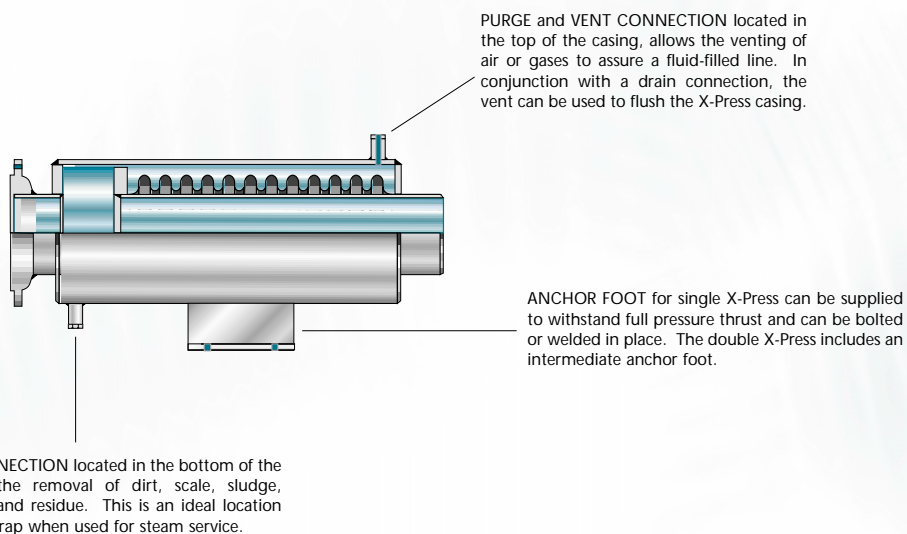
- Long axial movements
- Self draining convolutions
- Integral cover and liner
- Leak proof – packless
- Maintenance free
- Integral guide ring
- 5 Year Warranty with alloy 625 bellows



The X-Press bellows absorbs a very long stroke that minimizes the number of expansion joints required for a typical installation. Inherent in the design are internal guide rings, a full thickness cover, self draining convolutions, and an integral liner that is insensitive to flow direction. The internal guide rings permit the designer to reduce the number of guides compared with a conventional internally pressurized bellows system. The full thickness cover is designed to contain the full pressure of the system. If a bellows leak were to occur, flow is directed along the pipe rather than radially toward personnel. The heavy wall cover is also very easy to insulate due to its nominal pipe size. The self draining convolutions eliminate the possibility of sediment and residue collecting in the convolutions and causing corrosive attack.

The X-Press design is inherently safe. In the event of an anchor failure, the bellows compress and actually increase its strength. The end rings limit the extension of the expansion joint so that an anchor failure is controlled and contained. The X-Press does not require maintenance, therefore, it can be installed in areas where accessibility is limited. Lubrication and repacking are eliminated.

Normally located near an anchor, the single X-Press should be placed with the fixed end adjacent to the anchor. The double X-Press is typically mounted in the middle of a long pipe run to absorb similar movements from either direction. A support foot is included with the double X-Press and acts as an intermediate anchor.

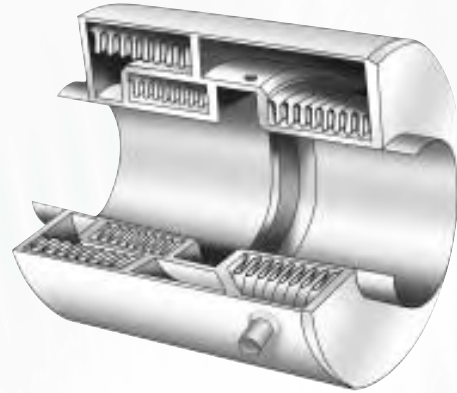


A reprint of the paper "Expansion Joints Vs Loops, an Economic Decision" by Robert K. Broyles, is available without charge on request.

[IN-LINE PRESSURE BALANCED X-PRESS II EXPANSION JOINTS]

Features

- Eliminates main anchors
- Eliminates pressure thrust
- Long axial movement
- Self draining convolutions
- Integral cover and liner
- Leak proof – packless
- Maintenance free
- Integral guide ring
- 5 Year Warranty with alloy 625 bellows



The X-Press II is an inline externally pressurized, pressure balanced expansion joint. The built in pressure compensating bellows eliminates all pressure thrust traditionally created from using unrestrained bellows. The X-Press II is capable of long axial movements while eliminating pressure thrust on the system. Main anchors are no longer required!

The unique design also incorporates internal guide rings to minimize external guiding requirements, a full thickness cover that is easy to insulate, self draining convolutions to minimize corrosion and an integral liner that insensitive to flow direction. The X-Press can be supplied in single or double ended design. Either type can be supplied with a support that acts as an intermediate anchor.

Pipe Guide Spacing

Senior Flexonics Pathway recommends the first guide for an X-Press or X-Press II should be located within 12 pipe diameters of the expansion joint. The remaining guides should be spaced in accordance with the formula below.

$$L = 0.131 * (E_p * I_p / (P * A + SR * AX))^{.5}$$

L = Maximum intermediate guide spacing (Feet)

E_p = pipe modulus of elasticity (lb/In²)

I_p = Pipe moment of inertia (Inches⁴)

P = Design pressure (lb/In²)

A = Bellows effective area (Inches²)

SR = Bellows spring rate

AX = Axial movement

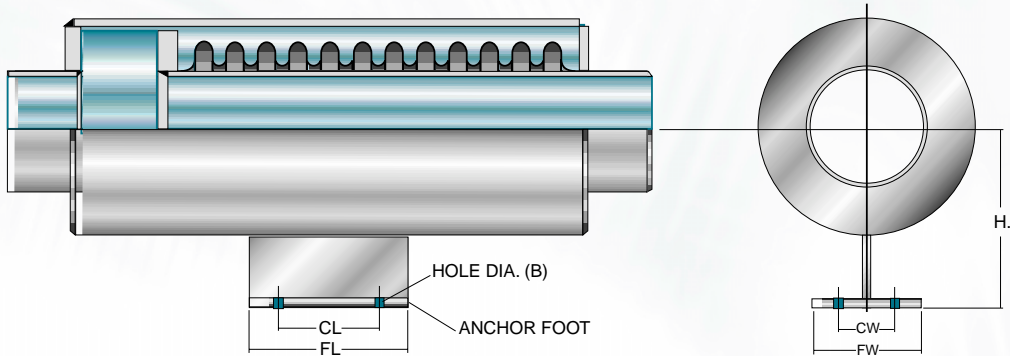
E_p - 27,400,000 lb/In² for carbon steel pipe at 300F.

I_p - See pages 87 through 89 for pipe moments of inertia

A - See pages 78 and 81 for effective areas

SR - See pages 78 and 81 for expansion joint spring rates

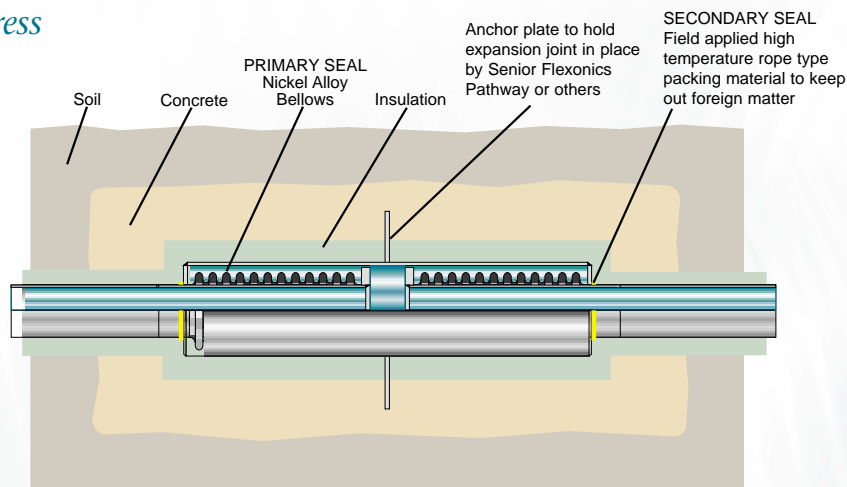
[X-PRESS DIMENSIONAL DATA]



TYPE ANCHOR FOOT	FL	FW	CL	CW	B
A	8"	4"	6 ¹ / ₂ "	3"	5/8"
B	8"	6 ¹ / ₂ "	5 ³ / ₄ "	4"	7/8"
C	10"	8 ¹ / ₈ "	6 ¹ / ₄ "	4 ³ / ₄ "	1 ³ / ₈ "
D	12"	6 ¹ / ₂ "	9 ¹ / ₂ "	4"	7/8"
E	← Custom Design →				

Refer to individual data pages 78-81 for diameter, shell O.D., O.A.L., and "H".

Direct Buried X-Press



Many Senior Flexonics Pathway customers have direct buried X-Press Expansion Joints in steam and condensate service. This eliminates the need for maintenance manways which are inconvenient to locate and expensive to build. Years of dependable maintenance-free buried service have proven that manways are not always required nor are they cost effective. Consider this money-saving approach when comparing the total installed cost of slip joints versus X-Press.

Additional information on direct buried X-Press is available upon request.

HOW TO SPECIFY AN EXTERNALLY PRESSURIZED EXPANSION JOINT

SPECIAL NOTE

If a special flange rating or non-standard wall thickness is required, indicate any special requirements as free text at the end of the part number.



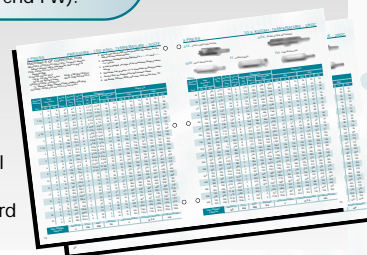
The nominal pipe size is the first item of the part number.

If the metric tables have been used, the letter "M" should follow the nominal pipe size.



Select the type of end fittings (weld ends WW, flanges FF, flange by weld end FW).

Review the bill of material located on even number pages 78 through 81 to obtain the flange ratings and weld wall thickness that is supplied with standard expansion joints.



Select the style required (Single X-Press ASX, Double X-Press ADX)

	Nominal Pipe Size	Style	End Fittings	Pressure Rating	Axial Movement	Optional Hardware	Alternate Bellows Material
English	3 1/2	ASX	WW	50	4	D, P	625
Metric	90 m	ASX	WW	3.5	100	D, P	625



Specify the design pressure. If the required design pressure is less than 150 PSIG, specify 150 PSIG. If the required design pressure is greater than 150 PSIG but less than 300 PSIG, specify 300 PSIG. If the required design pressure is greater than 300 PSIG, indicate the required design pressure in the part number and a custom design will be developed for the application.



Indicate the desired axial movement in increments of 4" through 16" as shown in the product description tables on pages 78 through 81.



Specify any options that are preferred. Options are described above.



Specify an alternate bellows material. The standard bellows material is Alloy 625. If Alloy 625 is acceptable, it is not necessary to specify a material. If an alternate bellows material is preferred, indicate the bellows material from the alloy choices listed on page 19. Keep in mind that the five-year warranty only applies to Alloy 625 because Alloy 625 has superior corrosion properties when compared to other bellows materials in steam and condensate service.

ALLOY 625 WARRANTY

Senior Flexonics Pathway will replace in kind any X-Press style expansion joint made with Alloy 625 bellows that fails due to workmanship or corrosion within 6 years of the date of shipment or 5 years from date of first use. Coverage does not include field removal and replacement costs or charges required for obtaining access to the part. Coverage does not apply to failures caused by over pressurization due to water hammer, excessive test pressure, or process upset conditions. Return of the failed part is required for warranty replacement.

X-PRESS

PRESSURE - 150 PSIG, TEMPERATURE - 500°F

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM B443 (Alloy 625). To specify alternate bellows material, add to part number. Refer to page 19.

PIPE: ASTM A53/A106/A516-70

Standard Wall

FLANGES: ASTM A105

150 lb. (10.5 Kg/Cm²) Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. (21 Kg/Cm²) Series: 300 lb. ANSI B16.5 R.F.S.O.

DRAIN/PURGE: ASTMA105

³/₄" Diameter 3000# Threaded half coupling with plug.

ANCHOR: ASTM A36/A516-70 Carbon Steel

1. Rated cycle life is 1000 cycles per EJMA 7th edition for the full rated movement shown.
2. Maximum installation misalignment is + / - 1/4" axial, + / - 1/16" lateral.
3. If unit is flanged, see page 16 for maximum flange pressure ratings.
4. Maximum test pressure: 1 1/2 x maximum working pressure.
5. Anchor Feet are designed for full pressure thrust.
6. All double X-Press (ADX) will come with anchor foot "D".

Nominal Diameter (In.)	Axial Movement (In.)		Spring Rate (Lb./In.)	Bellows Effective Area (In. ²)	Type of Anchor Foot for ASX	Dimensions				Weight (Lb)					
						Shell OD (In.)	Anchor Height "H" (In.)	Overall Length (In.)		ASX			ADX		
	ASX	ADX						WW	FF	FW	WW	FF	FW		
1	4	8	43	8.4	A	4 1/2	6 1/4	23	37	31	35	33	55	59	57
	8	16	22	8.4	A	4 1/2	6 1/4	36	64	52	56	54	96	100	98
1 1/2	4	8	43	8.4	A	4 1/2	6 1/4	23	37	36	42	39	62	68	65
	8	16	22	8.4	A	4 1/2	6 1/4	36	64	54	60	57	98	104	101
2	4	8	43	8.4	A	4 1/2	6 1/4	23	37	41	51	46	71	81	76
	8	16	22	8.4	A	4 1/2	6 1/4	36	64	63	73	68	116	126	121
2 1/2	4	8	163	11.4	A	5 9/16	6 3/4	27	46	56	70	63	99	113	106
	8	16	82	11.4	A	5 9/16	6 3/4	44	80	91	115	103	167	181	174
3	4	8	195	15.5	A	6 5/8	7 5/16	27	46	62	78	70	107	123	115
	8	16	98	15.5	A	6 5/8	7 5/16	44	80	97	113	105	177	193	185
3 1/2	4	8	216	19.2	A	6 5/8	7 5/16	27	46	75	96	86	131	152	142
	8	16	108	19.2	A	6 5/8	7 5/16	44	80	108	129	119	174	168	183
4	4	8	124	24.9	B	8 5/8	8 5/16	25	41	88	114	101	155	181	168
	8	16	62	24.9	B	8 5/8	8 5/16	39	69	119	145	132	217	143	180
5	4	8	141	35.6	B	8 5/8	8 5/16	25	41	107	139	123	189	221	205
	8	16	70	35.6	B	8 5/8	8 5/16	39	69	140	172	156	253	235	244
6	4	8	168	47.9	B	10 3/4	9 3/8	25	41	126	164	145	222	260	241
	8	16	84	47.9	B	10 3/4	9 3/8	39	69	161	199	180	289	327	308
8	4	8	218	75.6	C	12 3/4	10 3/8	26	42	234	294	264	399	459	429
	8	16	109	75.6	C	12 3/4	10 3/8	40	70	306	366	336	542	602	572
10	4	8	267	112	C	14	11	26	42	291	377	334	414	500	457
	8	16	134	112	C	14	11	40	70	355	441	398	559	645	602
12	4	8	362	152.6	C	16	12	26	41	361	489	425	617	745	681
	8	16	181	152.6	C	16	12	40	69	464	592	528	824	952	888
14	4	8	451	185.7	C	18	13	27	43	388	568	476	665	845	755
	8	16	226	185.7	C	18	13	42	73	509	689	599	907	1087	997
16	4	8	513	235.4	C	20	14	27	43	384	580	482	640	836	738
	8	16	257	235.4	C	20	14	42	73	577	773	675	1027	1223	1125
18	4	8	577	293	C	24	16	28	44	437	697	567	729	989	859
	8	16	289	293	C	24	16	43	74	637	897	767	1127	1387	1257
20	4	8	641	356.8	E	24	E	28	44	487	817	652	812	1142	977
	8	16	321	356.8	E	24	E	43	74	734	1064	899	1306	1636	1471
24	4	8	769	503.2	E	30	E	29	45	624	1064	844	1056	1496	1276
	8	16	385	503.2	E	30	E	44	75	904	1344	1124	1614	2054	1834

PART NUMBER EXAMPLE	DIAMETER	STYLE	ENDS	PRESSURE	AXIAL MOVEMENT	OPTIONAL FEATURES	ALT BELLOWS MAT.
	4	ASX	WW	150	4	D, P, A	625

X-PRESS

10.5 KG/CM², TEMPERATURE - 260C

ASX - SINGLE X-PRESS (WW SHOWN)

ADX - DOUBLE X-PRESS (WW SHOWN)



WW - WELD END/WELD END

FF - FLANGE/FLANGE

FW - FLANGE/WELD END



METRIC

Nominal Diameter (mm)	Axial Movement (mm)		Spring Rate (Kg/mm)	Bellows Effective Area (Cm ²)	Type of Anchor Foot for ADX	Dimensions				Weight (Lb)					
	ASX	ADX				Shell OD (mm)	Anchor Height "H" (mm)	Overall Length (mm)		ASX			ADX		
								ASX	ADX	WW	FF	FW	WW	FF	FW
25	100	200	0.77	54	A	114	159	584	940	14	16	15	25	27	26
	200	400	0.39	54	A	114	159	914	1626	24	25	24	44	45	44
40	100	200	0.77	54	A	114	159	584	940	16	19	18	28	31	29
	200	400	0.39	54	A	114	159	914	1626	24	27	26	44	47	46
50	100	200	0.77	54	A	114	159	584	940	19	23	21	32	37	34
	200	400	0.39	54	A	114	159	914	1626	29	33	31	53	57	55
65	100	200	2.91	74	A	141	171	686	1168	25	32	29	45	51	48
	200	400	1.46	74	A	141	171	1118	2032	41	52	47	76	82	79
80	100	200	3.48	100	A	168	186	686	1168	28	35	32	49	56	52
	200	400	1.75	100	A	168	186	1118	2032	44	51	48	80	88	84
90	100	200	3.86	124	A	168	186	686	1168	34	44	39	59	69	64
	200	400	1.93	124	A	168	186	1118	2032	49	59	54	79	76	83
100	100	200	2.22	161	B	219	211	635	1041	40	52	46	70	82	76
	200	400	1.11	161	B	219	211	991	1753	54	66	60	98	65	82
125	100	200	2.52	230	B	219	211	635	1041	49	63	56	86	100	93
	200	400	1.25	230	B	219	211	991	1753	63	78	71	115	107	111
150	100	200	3	309	B	273	238	635	1041	57	74	66	101	118	109
	200	400	1.5	309	B	273	238	991	1753	73	90	82	131	148	140
200	100	200	3.89	488	C	324	264	660	1067	106	133	120	181	208	195
	200	400	1.95	488	C	324	264	1016	1778	139	166	152	246	273	259
250	100	200	4.77	723	C	356	279	660	1067	132	171	151	188	227	207
	200	400	2.39	723	C	356	279	1016	1778	161	200	180	254	293	273
300	100	200	6.47	985	C	406	305	660	1041	164	222	193	280	338	309
	200	400	3.23	985	C	406	305	1016	1753	210	268	239	374	432	403
350	100	200	8.06	1198	C	457	330	686	1092	176	258	216	302	383	342
	200	400	4.04	1198	C	457	330	1067	1854	231	312	272	411	493	452
400	100	200	9.16	1519	C	508	356	686	1092	174	263	219	290	379	335
	200	400	4.59	1519	C	508	356	1067	1854	262	351	306	466	555	510
450	100	200	10.31	1890	C	610	406	711	1118	198	316	257	331	449	390
	200	400	5.16	1890	C	610	406	1092	1880	289	407	348	511	629	570
500	100	200	11.45	2302	E	610	E	711	1118	221	371	296	368	518	443
	200	400	5.73	2302	E	610	E	1092	1880	333	483	408	592	742	667
600	100	200	13.74	3246	E	762	E	737	1143	283	483	383	479	678	579
	200	400	6.88	3246	E	762	E	1118	1905	410	610	510	732	932	832

PART NUMBER EXAMPLE	DIAMETER	STYLE	ENDS	PRESSURE	AXIAL MOVEMENT	OPTIONAL FEATURES	ALT BELLOWS MAT.
	100	ASX	WW	10.5	4	D, P, A	625

X-PRESS

PRESSURE - 300 PSIG, TEMPERATURE - 500°F

MATERIALS OF CONSTRUCTION

BELLOWS: ASTM B443 (Alloy 625). To specify alternate bellows material, add to part number. Refer to page 20.

PIPE: ASTM A53/A106/A516-70

Standard Wall

FLANGES: ASTM A105

150 lb. (10.5 Kg/Cm²) Series: 150 lb. ANSI B16.5 R.F.S.O.

300 lb. (21 Kg/Cm²) Series: 300 lb. ANSI B16.5 R.F.S.O.

DRAIN/PURGE: ASTMA105

³/₄" Diameter 3000# Threaded half coupling with plug.

ANCHOR: ASTM A36/A516-70 Carbon Steel

1. Rated cycle life is 1000 cycles per EJMA 7th edition for the full rated movement shown.
2. Maximum installation misalignment is + / - 1/4" axial, + / - 1/16" lateral.
3. If unit is flanged, see page 18 for maximum flange pressure ratings.
4. Maximum test pressure: 1 1/2 x maximum working pressure.
5. Anchor Feet are designed for full pressure thrust.
6. All double X-Press (ADX) will come with anchor foot "D".

Nominal Diameter (In.)	Axial Movement (In.)		Spring Rate (Lb./In.)	Bellows Effective Area (In. ²)	Type of Anchor Foot for ASX	Dimensions				Weight (Lb)					
						Shell OD (In.)	Anchor Height "H" (In.)	Overall Length (In.)		ASX			ADX		
	ASX	ADX						WW	FF	FW	WW	FF	FW		
1	4	8	86	8.4	A	4 1/2	6 1/4	23	37	37	43	40	66	72	69
	8	16	43	8.4	A	4 1/2	6 1/4	36	64	61	67	64	115	121	118
1 1/2	4	8	86	8.4	A	4 1/2	6 1/4	23	37	42	54	48	74	86	80
	8	16	43	8.4	A	4 1/2	6 1/4	36	64	67	79	73	125	137	131
2	4	8	86	8.4	A	4 1/2	6 1/4	23	37	49	63	56	87	101	94
	8	16	43	8.4	A	4 1/2	6 1/4	36	64	80	94	87	148	162	155
2 1/2	4	8	163	11.4	A	5 9/16	6 3/4	27	46	57	77	67	102	122	112
	8	16	82	11.4	A	5 9/16	6 3/4	44	80	91	111	101	170	190	180
3	4	8	195	15.5	A	6 5/8	7 5/16	27	46	74	100	87	131	157	144
	8	16	98	15.5	A	6 5/8	7 5/16	44	80	118	144	131	219	145	182
3 1/2	4	8	216	19.2	A	6 5/8	7 5/16	27	46	99	129	114	158	187	172.5
	8	16	108	19.2	A	6 5/8	7 5/16	44	80	156	191	173.5	271	256	263.5
4	4	8	249	24.9	B	8 5/8	8 5/16	25	41	124	158	141	185	229	207
	8	16	125	24.9	B	8 5/8	8 5/16	39	69	194	238	216	322	366	344
5	4	8	282	35.6	B	8 5/8	8 5/16	25	41	131	187	159	214	275	244.5
	8	16	141	35.6	B	8 5/8	8 5/16	39	69	208	269	238.5	365	426	395.5
6	4	8	337	47.9	B	10 3/4	9 3/8	25	41	137	215	176	242	320	281
	8	16	169	47.9	B	10 3/4	9 3/8	39	69	221	299	260	408	486	447
8	4	8	436	75.6	C	12 3/4	10 3/8	26	42	251	367	309	432	548	490
	8	16	218	75.6	C	12 3/4	10 3/8	40	70	398	514	456	726	842	784
10	4	8	535	112	C	14	11	26	42	296	458	377	522	684	603
	8	16	268	112	C	14	11	40	70	455	617	536	714	876	795
12	4	8	731	152.6	C	16	12	26	41	384	614	499	663	893	778
	8	16	366	152.6	C	16	12	40	69	583	815	699	1062	1292	1177
14	4	8	676	185.7	E	18	E	27	43	435	765	600	758	1088	923
	8	16	338	185.7	E	18	E	42	73	623	953	788	1129	1459	1294
16	4	8	769	235.4	E	20	E	27	43	427	807	617	727	1107	917
	8	16	385	235.4	E	20	E	42	73	602	982	792	1077	1457	1267
18	4	8	865	293	E	24	E	28	44	500	1000	750	854	1354	1104
	8	16	433	293	E	24	E	43	74	728	1228	978	1309	1809	1559
20	4	8	961	356.8	E	24	E	28	44	604	1234	919	1043	1673	1358
	8	16	481	356.8	E	24	E	43	74	921	1521	1221	1678	2308	1993
24	4	8	1538	503.2	E	30	E	29	45	698	1648	1173	1200	2150	1675
	8	16	769	503.2	E	30	E	44	75	1009	1959	1484	1822	2772	2297

PART NUMBER EXAMPLE	DIAMETER	STYLE	ENDS	PRESSURE	AXIAL MOVEMENT	OPTIONAL FEATURES	ALT BELLOWS MAT.
	4	ADX	WW	300	4	D, P, A	625

X-PRESS

21 KG/CM², TEMPERATURE - 260C

ASX – SINGLE X-PRESS (WW SHOWN)

ADX – DOUBLE X-PRESS (WW SHOWN)



WW – WELD END/WELD END

FF – FLANGE/FLANGE

FW – FLANGE/WELD END



METRIC

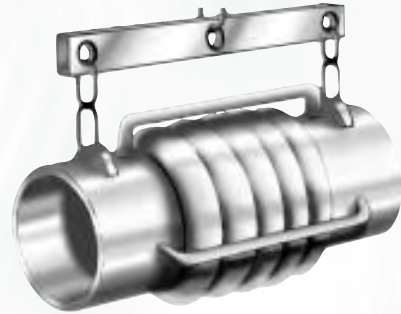
Nominal Diameter (mm)	Axial Movement (mm)		Spring Rate (Kg/mm)	Bellows Effective Area (Cm ²)	Type of Anchor Foot for ADX	Dimensions				Weight (Lb)					
	ASX	ADX				Shell OD (mm)	Anchor Height "H" (mm)	Overall Length (mm)		ASX			ADX		
								ASX	ADX	WW	FF	FW	WW	FF	FW
25	100	200	1.54	54	A	114	159	584	940	17	20	18	30	33	31
	200	400	0.77	54	A	114	159	914	1626	28	30	29	52	55	54
40	100	200	1.54	54	A	114	159	584	940	19	24	22	34	39	36
	200	400	0.77	54	A	114	159	914	1626	30	36	33	57	62	59
50	100	200	1.54	54	A	114	159	584	940	22	29	25	39	46	43
	200	400	0.77	54	A	114	159	914	1626	36	43	39	67	73	70
65	100	200	2.91	74	A	141	171	686	1168	26	35	30	46	55	51
	200	400	1.46	74	A	141	171	1118	2032	41	50	46	77	86	82
80	100	200	3.48	100	A	168	186	686	1168	34	45	39	59	71	65
	200	400	1.75	100	A	168	186	1118	2032	54	65	59	99	66	83
90	100	200	3.86	124	A	168	186	686	1168	45	59	52	72	85	78
	200	400	1.93	124	A	168	186	1118	2032	71	87	79	123	116	120
100	100	200	4.45	161	B	219	211	635	1041	56	72	64	84	104	94
	200	400	2.23	161	B	219	211	991	1753	88	108	98	146	166	156
125	100	200	5.04	230	B	219	211	635	1041	59	85	72	97	125	111
	200	400	2.52	230	B	219	211	991	1753	94	122	108	166	193	179
150	100	200	6.02	309	B	273	238	635	1041	62	98	80	110	145	127
	200	400	3.02	309	B	273	238	991	1753	100	136	118	185	220	203
200	100	200	7.79	488	C	324	264	660	1067	114	166	140	196	249	222
	200	400	3.89	488	C	324	264	1016	1778	180	233	207	329	382	356
250	100	200	9.56	723	C	356	279	660	1067	134	208	171	237	310	273
	200	400	4.79	723	C	356	279	1016	1778	206	280	243	324	397	361
300	100	200	13.06	985	C	406	305	660	1041	174	278	226	301	405	353
	200	400	6.54	985	C	406	305	1016	1753	264	370	317	482	586	534
350	100	200	12.08	1198	C	457	E	686	1092	197	347	272	344	493	419
	200	400	6.04	1198	C	457	E	1067	1854	283	432	357	512	662	587
400	100	200	13.74	1519	C	508	E	686	1092	194	366	280	330	502	416
	200	400	6.88	1519	C	508	E	1067	1854	273	445	359	488	661	575
450	100	200	15.45	1890	C	610	E	711	1118	227	454	340	387	614	501
	200	400	7.73	1890	C	610	E	1092	1880	330	557	444	594	820	707
500	100	200	17.17	2302	E	610	E	711	1118	274	560	417	473	759	616
	200	400	8.59	2302	E	610	E	1092	1880	418	690	554	761	1047	904
600	100	200	27.47	3246	E	762	E	737	1143	317	747	532	544	975	760
	200	400	13.74	3246	E	762	E	1118	1905	458	888	673	826	1257	1042

PART NUMBER EXAMPLE	DIAMETER	STYLE	ENDS	PRESSURE	AXIAL MOVEMENT	OPTIONAL FEATURES	ALT BELLOWS MAT.
	100	ADX	WW	21	4	D, P, A	625

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



1. The opening into which the expansion joint will be installed should be examined to verify that the opening for which the expansion joint was designed does not exceed the installation tolerances designated by the designer and/or purchaser. If the opening exceeds the tolerance, notify Senior flexonics pathway at once for a disposition.
 2. The attachment edges of the pipe or duct should be smooth, clean, and parallel to each other.
 3. The area around the expansion joint should be cleared of any sharp objects or protrusions. If not removable, they should be noted so they can be avoided.
 4. Expansion joints provided with lifting lugs should be lifted only by the designated lifting lugs. SHIPPING BARS (PAINTED YELLOW) ARE NOT DESIGNED TO BE LIFTING DEVICES. NEVER USE A CHAIN OR ANY OTHER HANDLING DEVICES DIRECTLY ON THE BELLOWS ELEMENT OR BELLOWS COVER. For expansion joints not provided with lifting lugs (i.e., less than 500 lbs.), the best lifting method should be evaluated at the time of installation.
 5. The shipping bars are installed on an expansion joint to maintain shipping length and give the expansion joint stability during transit and installation. DO NOT REMOVE THE SHIPPING BARS UNTIL THE INSTALLATION IS COMPLETE.
2. When a flow liner is installed in the expansion joint, orient the expansion joint with FLOW ARROW POINTING IN DIRECTION OF FLOW.
 3. Using lifting lugs, lift joint to desired location and position into pipeline or ducting.
 4. Weld end expansion joints.
 - (a) PRIOR TO WELDING, COVER THE BELLOWS ELEMENT WITH A CHLORIDE FREE FIRE RETARDANT CLOTH. This is to prevent arc strikes, weld splatter, etc. from damaging the bellows element.
 - (b) Using the proper electrode, weld the expansion joint to adjacent piping. DO NOT USE BELLOWS TO CORRECT FOR MISALIGNMENT OF PIPING UNLESS THIS HAS BEEN CONSIDERED IN THE DESIGN OF THE EXPANSION JOINT.
 5. Flanged end expansion joints.
 - (a) Orient expansion 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 cause premature failure of the expansion joint. It is good practice to leave one pipe flange loose until the expansion joint is installed or to purchase an expansion joint with a flange that will rotate.
 - (b) Install gaskets and bolt to the required torque recommended by the flange manufacturer.

Installation:

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

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

INSTALLATION INSTRUCTIONS (CONTINUED)

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 chart is provided below to aid in this check.
2. **ANCHORS MUST BE DESIGNED FOR THE TEST PRESSURE THRUST LOADS.**
Expansion joints exert a force equal to the test pressure times the effective area of the bellows during hydro test. Pressure thrust at design pressure may be found on the individual drawings. Refer to EJMA Safety Recommendations.
3. If the system media is gaseous, check to determine if the piping and/or the expansion joint may require additional temporary supports due to the weight for water during testing.
4. **REMOVE SHIPPING 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 wool 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.

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

Pipe Guide Spacing Table

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

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

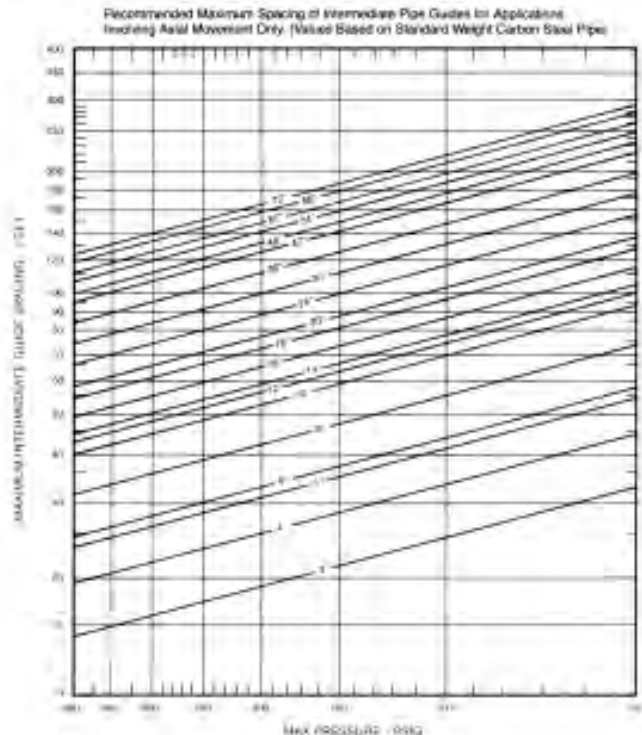
$$L = 0.131 \sqrt{\frac{E1}{PA Ra}}$$

Where L = Maximum intermediate guide spacing (feet)
 E + Modulus of elasticity of pipe material (psi).
 P + Design pressure (psig).
 A + Bellows effective area (in²).
 Δ + Axial stroke of expansion joint (in).
 R_a + Axial spring rate of bellows (lbs/in.).

NOTES:

1. When bellows is compressed in operation use (+) Δ R_a; when extended, use (-) Δ R_a.
2. Dead weight of the pipe should also be considered for guide spacing.

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



[GENERAL CONVERSION FACTORS]

Multiply	By	To Obtain	Multiply	By	To Obtain
Atmospheres	33.9	Feet of water	Inches of water	0.1869	Cms. of mercury
Atmospheres	29.92	Inches of mercury	Inches of water (at 4° C.)	2.54×10^{-3}	Kgs./sq. in.
Atmospheres	103.30	Kilograms/sq. m.	Inches-pounds/deg.	0.66	Kilogram-meters/rad.
Atmospheres	14.7	Pounds/sq. in.	Joules	9.486×10^{-4}	B.T.U.
Atmospheres	760	mm of mercury	Joules	0.7376	Foot-pounds
Bars	9.869×10^{-1}	Atmospheres	Joules	2.390×10^{-4}	Kg.-calories
Bars	1.0×10^6	Dynes/sq. cm.	Kilograms	980665	Dynes
Bars	1.020×10^4	Kgs./sq. meter	Kilograms	1.0×10^3	Grams
Bars	14.5	Pounds/sq. in.	Kilograms	2.205	Pounds
British Thermal Units	777.5	Foot-pounds	Kilogram-calories	3.968	B.T.U.
British Thermal Units	1054.6	Joules	Kilogram-calories	3086	Foot-pounds
British Thermal Units	0.2520	Kg. -calories	Kilogram-calories	4186	Joules
British Thermal Units	2.928×10^{-4}	K.W. -hours	Kilogram-meters	7.233	Foot-pounds
B.T.U./hr.	0.2520	Kg. cal./Hr.	Kilograms/cu. meters	3.613×10^{-5}	Pounds/cu. in.
B.T.U./hr./sq. ft.	2.712	Kg. -cal./hr./sq. m.	Kilograms/sq. cm.	9.80665×10^5	Dynes/sq. cm.
B.T.U./hr./sq. ft./deg F.	4.882	Kg. -cal./hr./sq.m./deg. C.	Kilograms/sq. cm.	14.226	Pounds/sq. in.
B.T.U./sq. ft.	2.712	Kg.cal./sq.m.	Kilograms/sq. meter	9.678×10^{-5}	Atmospheres
B.T.U./sq. ft./in.	6.892	Kg.cal/sq.m./cm.	Kilograms/sq. meters	98.07	Bars
Celsius	$(^{\circ}\text{C} \times 1.8) + 32$	Fahrenheit	Kilometers	1.0×10^5	Centimeters
Centimeters	0.0328	Feet	Kilometers	3281	Feet
Centimeters	0.3937	Inches	Kilometers	3.937×10^4	Inches
Centimeters	0.01	Meters	Kilonewtons/sq. meter	0.145	Pounds/sq. in.
Centimeters	$1. \times 10^4$	Microns	Kilospascals	0.145	Pounds/sq. in.
Centimeters/sec	0.03281	Feet/sec	Liters	10 ³	Cubic centimeters
Centipoises	0.000672	Lbs./ft.-sec.	Liters	0.0351	Cubic feet
Cubic centimeters	3.531×10^{-9}	Cubic feet	Liters	0.2642	Gallons (U.S.)
Cubic centimeters	6.102×10^{-2}	Cubic inches	Mega pascals (mPa)	145	Pounds/sq. in.
Cubic centimeters	1.0×10^{-3}	Liters	Meters	3.281	Feet
Cubic feet	1728	Cubic inches	Meters	39.37	Inches
Cubic feet	0.03704	Cubic yards	Meters	100	Centimeters
Cubic feet	7.481	Gallons	Meters	0.001	Kilometers
Cubic feet	28.32	Liters	Meters	1000	Millimeters
Cubic feet/second	26915	Gallons/hour	Meters/sec.	3.281	Feet/sec.
Cubic inches	1.639×10^{-5}	Cubic meters	Microns	3.94×10^{-5}	Inches
Cubic inches	4.329×10^{-3}	Gallons	Micropecka	1.00	Slug
Cubic meters	1.0×10^6	Cubic cm.	Millimeters	0.1	Centimeters
Cubic meters	35.31	Cubic feet	Millimeters	0.003281	Feet
Cubic meters	1.308	Cubic yards	Millimeters	0.03937	Inches
Degrees (angle)	1.745×10^{-2}	Radians	Millimeters	1.0×10^{-6}	Kilometers
Dynes	1.020×10^{-6}	Kilograms	Millimeters	.001	Meters
Dynes	2.248×10^{-6}	Pounds	Newtons	1.0×10^5	Dynes
Dynes/sq. cm.	9.870×10^{-7}	Atmosphere	Newtons	0.2248	Pounds
Dynes/sq. cm.	1×10^{-6}	Bars	Newtons/mm	5.71	Pounds/inch
Dynes/sq. cm.	0.01020	Kgs./sq. meter	Newton-Meters	8.8504	Inch-pounds
Dynes/sq. cm.	2.089×10^{-3}	Pounds/sq. ft.	Newtons/sq. meter	1	Pascals
Dynes/sq. cm.	1.450×10^{-5}	Pounds/sq. in.	Ounces	28.35	Grams
Fahrenheit	$5/9 (^{\circ}\text{F} - 32)$	Celsius	Ounces (fluid)	0.02957	Liters
Feet	30.48	Centimeters	Pounds	444823	Dynes
Feet	3.048×10^{-4}	Kilometers	Pounds	453.6	Grams
Feet	0.3048	Meters	Pounds	0.4536	Kilograms
Feet	304.8	Millimeters	Pounds of water	0.01602	Cubic feet
Feet/minute	0.01667	Feet/second	Pounds of water	27.68	Cubic inches
Foot-pounds	1.356	Joules	Pounds of water	0.1198	Gallons
Foot-pounds	3.241×10^{-4}	Kg. -calories	Pounds/cu. foot	0.01602	Grams/cu. cm.
Foot-pounds	0.1383	Kg. -meters	Pounds/cubic foot	16.02	Kgs./cu. meter
Gallons (U.S.)	0.1337	Cubic feet	Pounds/cubic foot	5.787×10^4	Pounds/ cu. in.
Gallons (U.S.)	231	Cubic inches	Pounds/cu. in.	2.768×10^4	Kgs./cu. meter
Gallons (U.S.)	3.785×10^{-3}	Cubic meters	Pounds/cu. in.	1.728×10^3	Pounds/cu. ft.
Gallons (U.S.)	3.785	Liters	Pounds/inch	17.86	Kilograms/meter
Gallons of water	8.337	Pounds of water	Pounds/inch	178.6	Grams/cm.
Gallons/hour	3.71×10^{-5}	Cu.ft./sec.	Pounds/square inch	2.036	Inches of mercury
Grams	980.7	Dynes	Pounds/square inch	51.7	Mm of mercury
Grams	2.205×10^{-3}	Pounds	Pounds/square inch	703.1	Kgs./sq. meter
Grams/cubic cm.	0.03613	Lbs./cu. in.	Radians	57.3	Degrees
Grams/sq. cm.	1.422×10^{-2}	Lbs./sq. in.	Slugs	3.217×10^1	Pounds
Inches	2.54	Centimeters	Square centimeters	0.1550	Square inches
Inches	0.0254	Meters	Square feet	929	Square cms.
Inches	25.4	Millimeters	Square feet	0.0929	Square meters
Inches of mercury	0.03342	Atmospheres	Square inches	645.2	Square mms.
Inches of mercury	3.453×10^{-2}	Kgs./sq. cm.	Square inches	6.452	Square cms.
Inches of mercury	0.4912	Lbs./sq. in.	Square meters	1.55×10^3	Square inches
Inches of water	2.458×10^{-3}	Atmospheres	Square millimeters	1.0×10^{-2}	Square cms.
Inches of water	0.07355	Inches of mercury	Square millimeters	1.55×10^{-3}	Square inches
Inches of water	0.03613	Lbs./sq. in.			

— [THERMAL EXPANSION DATA] —

Linear Thermal Expansion between 70°F and Indicated Temperature, inches/100 feet

MATERIALS

Saturated Steam (PSIG)	Temp. deg F	Carbon Steel Carbon-Moly Low-Chrome (thru 3 Cr Mo)	Austenitic Stainless Steels Cr 8 Ni	5 Cr Mo thru 9 Cr Mo 18	12 Cr 17 Cr 27 Cr	25 Cr 20 Ni	Monel 67 Ni 30 Cr	3 1/2 Nickel	Bronze	Brass	70 Cu 30 Ni	Aluminum
	-325	-2.37	-3.85	-2.22	-2.04	-3.00	-2.62	-2.22	-3.98	-3.88	-3.15	-4.68
	-300	-2.24	-3.63	-2.10	-1.92	-2.83	-2.50	-2.10	-3.74	-3.64	-2.87	-4.46
	-275	-2.11	-3.41	-1.98	-1.80	-2.66	-2.38	-1.98	-3.50	-3.40	-2.70	-4.21
	-250	-1.98	-3.19	-1.86	-1.68	-2.49	-2.26	-1.86	-3.26	-3.16	-2.53	-3.97
	-225	-1.85	-2.96	-1.74	-1.57	-2.32	-2.14	-1.74	-3.02	-2.93	-2.36	-3.71
	-200	-1.71	-2.73	-1.62	-1.46	-2.15	-2.02	-1.62	-2.78	-2.70	-2.19	-3.44
	-175	-1.58	-2.50	-1.50	-1.35	-1.98	-1.90	-1.50	-2.54	-2.47	-2.12	-3.16
	-150	-1.45	-2.27	-1.37	-1.24	-1.81	-1.79	-1.38	-2.31	-2.24	-1.95	-2.88
	-125	-1.30	-2.01	-1.23	-1.11	-1.60	-1.59	-1.23	-2.06	-2.00	-1.74	-2.57
	-100	-1.15	-1.75	-1.08	-0.98	-1.39	-1.38	-1.08	-1.81	-1.76	-1.53	-2.27
	-75	-1.00	-1.50	-0.94	-0.85	-1.18	-1.18	-0.93	-1.56	-1.52	-1.33	-1.97
	-50	-0.84	-1.24	-0.79	-0.72	-0.98	-0.98	-0.78	-1.32	-1.29	-1.13	-1.67
	-25	-0.68	-0.98	-0.63	-0.57	-0.78	-0.77	-0.62	-1.25	-1.02	-0.89	-1.32
	0	-0.49	-0.72	-0.46	-0.42	-0.58	-0.57	-0.46	-0.77	-0.75	-0.66	-0.97
	25	-0.32	-0.46	-0.30	-0.27	-0.37	-0.37	-0.30	-0.49	-0.48	-0.42	-0.63
	50	-0.14	-0.21	-0.13	-0.12	-0.16	-0.20	-0.14	-0.22	-0.21	-0.19	-0.28
-14.33	70	0	0	0	0	0	0	0	0	0	0	0
-13.75	100	0.23	0.34	0.22	0.20	0.28	0.28	0.22	0.36	0.35	0.31	0.46
-12.75	125	0.42	0.62	0.40	0.36	0.51	0.52	0.40	0.66	0.64	0.56	0.85
-10.97	150	0.61	0.90	0.58	0.53	0.74	0.75	0.58	0.96	0.94	0.82	1.23
-7.98	175	0.80	1.18	0.76	0.69	0.98	0.99	0.76	1.26	1.23	1.07	1.62
-3.16	200	0.99	1.46	0.94	0.86	1.21	1.22	0.94	1.56	1.52	1.33	2.00
4.22	225	1.21	1.75	1.13	1.03	1.45	1.46	1.13	1.86	1.83	1.59	2.41
15.12	250	1.40	2.03	1.33	1.21	1.70	1.71	1.32	2.17	2.14	1.86	2.83
30.71	275	1.61	2.32	1.52	1.38	1.94	1.96	1.51	2.48	2.45	2.13	3.24
52.31	300	1.82	2.61	1.71	1.56	2.18	2.21	1.69	2.79	2.76	2.40	3.67
81.46	325	2.04	2.90	1.90	1.74	2.43	2.44	1.88	3.11	3.08	2.68	4.09
119.9	350	2.26	3.20	2.10	1.93	2.69	2.68	2.08	3.42	3.41	2.96	4.52
169.6	375	2.48	3.50	2.30	2.11	2.94	2.91	2.27	3.74	3.73	3.24	4.95
232.6	400	2.70	3.80	2.50	2.30	3.20	3.25	2.47	4.05	4.05	3.52	5.39
311.3	425	2.93	4.10	2.72	2.50	3.46	3.52	2.69	4.37	4.38		5.83
407.9	450	3.16	4.41	2.93	2.69	3.72	3.79	2.91	4.69	4.72		6.28
525.2	475	3.39	4.71	3.14	2.89	3.98	4.06	3.13	5.01	5.06		6.72
666.2	500	3.62	5.01	3.35	3.08	4.24	4.33	3.34	5.33	5.40		7.17
833.6	525	3.86	5.31	3.58	3.28	4.51	4.61	3.57	5.65	5.75		7.63
1031	550	4.11	5.62	3.80	3.49	4.79	4.90	3.80	5.98	6.10		8.10
1261	575	4.35	5.93	4.02	3.69	5.06	5.18	4.03	6.31	6.45		8.56
1529	600	4.60	6.24	4.24	3.90	5.33	5.46	4.27	6.64	6.80		9.03
	625	4.86	6.55	4.47	4.10	5.60	5.75	4.51	6.96	7.16		
	650	5.11	6.87	4.69	4.31	5.88	6.05	4.75	7.29	7.53		
	675	5.37	7.18	4.92	4.52	6.16	6.34	4.99	7.62	7.89		
	700	5.63	7.50	5.14	4.73	6.44	6.64	5.24	7.95	8.26		
	725	5.90	7.82	5.38	4.94	6.73	6.94	5.50	8.28	8.64		
	750	6.16	8.15	5.62	5.16	7.02	7.25	5.76	8.62	9.02		
	775	6.43	8.47	5.86	5.38	7.31	7.55	6.02	8.96	9.40		
	800	6.70	8.80	6.10	5.60	7.60	7.85	6.27	9.30	9.78		
	825	6.97	9.13	6.34	5.82	7.89	8.16	6.54	9.64	10.17		
	850	7.25	9.46	6.59	6.05	8.19	8.48	6.81	9.99	10.57		
	875	7.53	9.79	6.83	6.27	8.48	8.80	7.08	10.33	10.96		
	900	7.81	10.12	7.07	6.49	8.78	9.12	7.35	10.68	11.35		
	925	8.08	10.46	7.31	6.71	9.07	9.44	7.72	11.02	11.75		
	950	8.35	10.80	7.56	6.94	9.37	9.77	8.09	11.37	12.16		
	975	8.62	11.14	7.81	7.17	9.66	10.09	8.46	11.71	12.57		
	1000	8.89	11.48	8.06	7.40	9.95	10.42	8.83	12.05	12.98		
	1025	9.17	11.82	8.30	7.62	10.24	10.75	8.98	12.40	13.39		
	1050	9.46	12.16	8.55	7.95	10.54	11.09	9.14	12.76	13.81		
	1075	9.75	12.50	8.80	8.18	10.83	11.43	9.29	13.11	14.23		
	1100	10.04	12.84	9.05	8.31	11.12	11.77	9.45	13.47	14.65		
	1125	10.31	13.18	9.28	8.53	11.41	12.11	9.78				
	1150	10.57	13.52	9.52	8.76	11.71	12.47	10.11				
	1175	10.83	13.86	9.76	8.98	12.01	12.81	10.44				
	1200	11.10	14.20	10.00	9.20	12.31	13.15	10.78				
	1225	11.38	14.54	10.26	9.42	12.59	13.50					
	1250	11.66	14.88	10.53	9.65	12.88	13.86					
	1275	11.94	15.22	10.79	9.88	13.17	14.22					
	1300	12.22	15.56	11.06	10.11	13.46	14.58					
	1325	12.50	15.90	11.30	10.33	13.75	14.94					
	1350	12.78	16.24	11.55	10.56	14.05	15.30					
	1375	13.06	16.58	11.80	10.78	14.35	15.66					
	1400	13.34	16.92	12.05	11.01	14.65	16.02					
	1425		17.30									
	1450		17.69									
	1475		18.08									
	1500		18.47									

These data are for information and it is not to be implied that materials are suitable for all the temperatures shown.

- [TEMPERATURE CONVERSIONS] -

Temp. °C. or °F. -459.69 to -19				Temp. °C. or °F. -18 to 53				Temp. °C. or °F. 54 to 350				Temp. °C. or °F. 360 to 1,070				Temp. °C. or °F. 1,080 to 1,790				Temp. °C. or °F. 1,800 to 3,000				
°C.	Temp. °C. or °F.	°F.	°F.	°C.	Temp. °C. or °F.	°F.	°F.	°C.	Temp. °C. or °F.	°F.	°F.	°C.	Temp. °C. or °F.	°F.	°F.	°C.	Temp. °C. or °F.	°F.	°F.	°C.	Temp. °C. or °F.	°F.	°F.	
-273.16	-459.69			-27.78	-18	-0.4		12.2	54	129.2		182.2	360	680.0		582.2	1,080	1,976.0		982.2	1,800	3,272.0		
-267.78	-450			-27.23	-17	1.4		12.8	55	131.0		187.8	370	698.0		587.8	1,090	1,994.0		987.8	1,810	3,290.0		
-262.22	-440			-26.67	-16	3.2		13.3	56	132.8		193.3	380	716.0		593.3	1,100	2,012.0		993.3	1,820	3,308.0		
-256.67	-430			-26.12	-15	5.0		13.9	57	134.6		198.9	390	734.0		598.9	1,110	2,030.0		998.9	1,830	3,326.0		
-251.11	-420			-25.56	-14	6.8		14.4	58	136.4		204.4	400	752.0		604.4	1,120	2,048.0		1,004.4	1,840	3,344.0		
-245.56	-410			-25.00	-13	8.6		15.0	59	138.2		210.0	410	770.0		610.0	1,130	2,066.0		1,010.0	1,850	3,362.0		
-240.00	-400			-24.44	-12	10.4		15.6	60	140.0		215.6	420	788.0		615.6	1,140	2,084.0		1,015.6	1,860	3,380.0		
-234.44	-390			-23.89	-11	12.2		16.1	61	141.8		221.1	430	806.0		621.1	1,150	2,102.0		1,021.1	1,870	3,398.0		
-228.89	-380			-23.33	-10	14.0		16.7	62	143.6		226.7	440	824.6		626.7	1,160	2,120.0		1,026.7	1,880	3,416.0		
-223.33	-370			-22.78	-9	15.8		17.2	63	145.4		232.2	450	842.0		632.2	1,170	2,138.0		1,032.2	1,890	3,434.0		
-217.78	-360			-22.22	-8	17.6		17.8	64	147.2		237.8	460	860.0		637.8	1,180	2,156.0		1,037.8	1,900	3,452.0		
-212.22	-350			-21.67	-7	19.4		18.3	65	149.0		243.3	470	878.0		643.3	1,190	2,174.0		1,043.3	1,910	3,470.0		
-206.67	-340			-21.11	-6	21.2		18.9	66	150.8		248.9	480	896.0		648.9	1,200	2,192.0		1,048.9	1,920	3,488.0		
-201.11	-330			-20.56	-5	23.0		19.4	67	152.6		254.4	490	914.0		654.4	1,210	2,210.0		1,054.4	1,930	3,506.0		
-195.56	-320			-20.00	-4	24.8		20.0	68	154.4		260.0	500	932.0		660.0	1,220	2,228.0		1,060.0	1,940	3,524.0		
-190.00	-310			-19.44	-3	26.6		20.6	69	156.2		265.6	510	950.0		665.6	1,230	2,246.0		1,065.6	1,950	3,542.0		
-184.44	-300			-18.89	-2	28.4		21.1	70	158.0		271.1	520	968.0		671.1	1,240	2,264.0		1,071.1	1,960	3,560.0		
-178.89	-290			-18.33	-1	30.2		21.7	71	159.8		276.7	530	986.0		676.7	1,250	2,282.0		1,076.7	1,970	3,578.0		
-173.33	-280			-17.78	0	32.0		22.2	72	161.6		282.2	540	1004.0		682.2	1,260	2,300.0		1,082.2	1,980	3,596.0		
-167.78	-270			-17.22	1	33.8		22.8	73	163.4		287.8	550	1022.0		687.8	1,270	2,318.0		1,087.8	1,990	3,614.0		
-162.22	-260			-16.67	2	35.6		23.3	74	165.2		293.3	560	1040.0		693.3	1,280	2,336.0		1,093.3	2,000	3,632.0		
-156.67	-250			-16.11	3	37.4		23.9	75	167.0		298.9	570	1058.0		698.9	1,290	2,354.0		1,098.9	2,010	3,650.0		
-151.11	-240			-15.56	4	39.2		24.4	76	168.8		304.4	580	1076.0		704.4	1,300	2,372.0		1,104.4	2,020	3,668.0		
-145.56	-230			-15.00	5	41.0		25.0	77	170.6		310.0	590	1094.0		710.0	1,310	2,390.0		1,110.0	2,030	3,686.0		
-140.00	-220			-14.44	6	42.8		25.6	78	172.4		315.6	600	1112.0		715.6	1,320	2,408.0		1,115.6	2,040	3,704.0		
-134.44	-210			-13.89	7	44.6		26.1	79	174.2		321.1	610	1130.0		721.1	1,330	2,426.0		1,121.1	2,050	3,722.0		
-128.89	-200			-13.33	8	46.4		26.7	80	176.0		326.7	620	1148.0		726.7	1,340	2,444.0		1,126.7	2,060	3,740.0		
-123.33	-190			-12.78	9	48.2		27.2	81	177.8		332.2	630	1166.0		732.2	1,350	2,462.0		1,132.2	2,070	3,758.0		
-117.78	-180			-12.22	10	50.0		27.8	82	179.6		337.8	640	1184.0		737.8	1,360	2,480.0		1,137.8	2,080	3,776.0		
-112.22	-170			-11.67	11	51.8		28.3	83	181.4		343.3	650	1202.0		743.3	1,370	2,498.0		1,143.3	2,090	3,794.0		
-106.67	-160			-11.11	12	53.6		28.9	84	183.2		348.9	660	1220.0		748.9	1,380	2,516.0		1,148.9	2,100	3,812.0		
-101.11	-150			-10.56	13	55.4		29.4	85	185.0		354.4	670	1238.0		754.4	1,390	2,534.0		1,154.4	2,110	3,830.0		
-95.56	-140			-10.00	14	57.2		30.0	86	186.8		360.0	680	1256.0		760.0	1,400	2,552.0		1,160.0	2,120	3,848.0		
-90.00	-130			-9.44	15	59.0		30.6	87	188.6		365.6	690	1274.0		765.6	1,410	2,570.0		1,165.6	2,130	3,866.0		
-84.44	-120			-8.89	16	60.8		31.1	88	190.4		371.1	700	1292.0		771.1	1,420	2,588.0		1,171.1	2,140	3,884.0		
-78.89	-110			-8.33	17	62.6		31.7	89	192.2		376.7	710	1310.0		776.7	1,430	2,606.0		1,176.7	2,150	3,902.0		
-73.33	-100			-7.78	18	64.4		32.2	90	194.0		382.2	720	1328.0		782.2	1,440	2,624.0		1,182.2	2,160	3,920.0		
-67.78	-90			-7.22	19	66.2		32.8	91	195.8		387.8	730	1346.0		787.8	1,450	2,642.0		1,187.8	2,170	3,938.0		
-62.22	-80			-6.67	20	68.0		33.3	92	197.6		393.3	740	1364.0		793.3	1,460	2,660.0		1,193.3	2,180	3,956.0		
-56.67	-70			-6.11	21	69.8		33.9	93	199.4		398.9	750	1382.0		798.9	1,470	2,678.0		1,198.9	2,190	3,974.0		
-51.11	-60			-5.56	22	71.6		34.4	94	201.2		404.4	760	1400.0		804.4	1,480	2,696.0		1,204.4	2,200	3,992.0		
-45.56	-50			-5.00	23	73.4		35.0	95	203.0		410.0	770	1418.0		810.0	1,490	2,714.0		1,210.0	2,210	4,010.0		
-40.00	-40			-4.44	24	75.2		35.6	96	204.8		415.6	780	1436.0		815.6	1,500	2,732.0		1,215.6	2,220	4,028.0		
-34.44	-30			-3.89	25	77.0		36.1	97	206.6		421.1	790	1454.0		821.1	1,510	2,750.0		1,221.1	2,230	4,046.0		
-28.89	-20			-3.33	26	78.8		36.7	98	208.4		426.7	800	1472.0		826.7	1,520	2,768.0		1,226.7	2,240	4,064.0		
-23.33	-10			-2.78	27	80.6		37.2	99	210.2		432.2	810	1490.0		832.2	1,530	2,786.0		1,232.2	2,250	4,082.0		
-17.78	0			-2.22	28	82.4		37.8	100	212.0		437.8	820	1508.0		837.8	1,540	2,804.0		1,237.8	2,260	4,100.0		
-12.22	10			-1.67	29	84.2		43.3	110	230.0		443.3	830	1526.0		843.3	1,550	2,822.0		1,243.3	2,270	4,118.0		
-6.67	20			-1.11	30	86.0		48.9	120	248.0		448.9	840	1544.0		848.9	1,560	2,840.0		1,248.9	2,280	4,136.0		
-1.11	30			-0.56	31	87.8		54.4	130	266.0		454.4	850	1562.0		854.4	1,570	2,858.0		1,254.4	2,290	4,154.0		
4.44	40			0	32	89.6		60.0	140	284.0		460.0	860	1580.0		860.0	1,580	2,876.0		1,260.0	2,300	4,172.0		
10.00	50			0.56	33	91.4		65.6	150	302.0		465.6	870	1598.0		865.6	1,590	2,894.0		1,265.6	2,310	4,190.0		
15.56	60			1.11	34	93.2		71.1	160	320.0		471.1	880	1616.0		871.1	1,600	2,912.0		1,271.1	2,320	4,208.0		
21.11	70			1.67	35	95.0		76.7	170	338.0		476.7	890	1634.0		876.7	1,610	2,930.0		1,276.7	2,330	4,226.0		
26.67	80			2.22	36	96.8		82.2	180	356.0		482.2	900	1652.0		882.2	1,620	2,948.0		1,282.2	2,340	4,244.0		
32.22	90			2.78	37	98.6		87.8	190	374.0		487.8	910	1670.0		887.8	1,630	2,966.0		1,287.8	2,350	4,262.0		
37.78	100			3.33	38	100.4		93.3	200	392.0		493.3	920	1688.0		893.3	1,640	2,984.0		1,293.3	2,360	4,280.0		
43.33	110			3.89	39	102.2		98.9	210	410.0		498.9	930	1706.0		898.9	1,650	3,002.0		1,298.9	2,370	4,298.0		
48.89	120			4.44	40	104.0		104.4	220	428.0		504.4	940	1724.0		904.4	1,660	3,020.0		1,304.4	2,380	4,316.0		

— [PIPE PROPERTIES AND WEIGHTS] —

Nominal Size Outside Diameter inches d	Weight Designation and/or Schedule Number	Average Wall Thickness inches t	Minimum Wall Thickness (=7/8t) inches tm	Inside Diameter inches d	Cross Sectional Metal sq. inches A	Moment of Inertia inches ⁴ I	Section Modulus inches ³ Z	Radius of Gyration inches T _g	Pipe lb. per ft.	Weight of Water lb. per ft.
1/8" 0.405	Std. 10S	0.049	0.043	0.307	0.055	0.0009	0.0043	0.127	0.186	0.032
	40 40S	0.068	0.060	0.269	0.072	0.0011	0.0052	0.122	0.245	0.025
	XS 80 80S	0.095	0.083	0.215	0.002	0.0012	0.0060	0.115	0.315	0.016
1/4" 0.540	Std. 10S	0.065	0.057	0.410	0.097	0.0028	0.0103	0.169	0.330	0.057
	40 40S	0.088	0.077	0.364	0.125	0.0033	0.0123	0.163	0.425	0.045
	XS 80 80S	0.119	0.104	0.302	0.157	0.0038	0.0140	0.155	0.535	0.031
3/8" 0.675	Std. 10S	0.065	0.057	0.545	0.124	0.0059	0.0174	0.217	0.423	0.101
	40 40S	0.091	0.080	0.493	0.167	0.0073	0.0216	0.209	0.568	0.083
	XS 80 80S	0.126	0.110	0.423	0.217	0.0086	0.0255	0.199	0.739	0.061
1/2" 0.840	Std. 10S	0.083	0.073	0.674	0.197	0.0143	0.0341	0.269	0.671	0.154
	40 40S	0.109	0.095	0.622	0.250	0.0171	0.0407	0.261	0.851	0.132
	XS 80 80S	0.147	0.129	0.546	0.320	0.0201	0.0478	0.250	1.09	0.101
	160	0.187	0.164	0.466	0.384	0.0221	0.0527	0.240	1.30	0.074
	XXS	0.294	0.258	0.252	0.504	0.0243	0.0577	0.219	1.72	0.022
3/4" 1.050	Std. 5S	0.065	0.057	0.920	0.201	0.0245	0.0467	0.349	0.684	0.288
	10S	0.083	0.073	0.884	0.252	0.0297	0.0566	0.343	0.857	0.266
	40 40S	0.113	0.099	0.824	0.333	0.0370	0.0706	0.334	1.13	0.231
	XS 80 80S	0.154	0.135	0.742	0.434	0.0448	0.0853	0.321	1.47	0.187
	160	0.218	0.191	0.614	0.570	0.0527	0.100	0.304	1.94	0.128
XXS	0.308	0.270	0.434	0.718	0.0579	0.110	0.284	2.44	0.064	
1" 1.315	Std. 5S	0.065	0.057	1.185	0.255	0.0500	0.076	0.443	0.863	0.478
	10S	0.109	0.095	1.097	0.413	0.0757	0.115	0.428	1.40	0.409
	40 40S	0.133	0.116	1.049	0.494	0.0874	0.133	0.420	1.68	0.374
	XS 80 80S	0.179	0.157	0.957	0.639	0.106	0.161	0.407	2.17	0.311
	160	0.250	0.219	0.815	0.836	0.125	0.190	0.387	2.84	0.226
XXS	0.358	0.313	0.599	1.08	0.141	0.214	0.361	3.66	0.122	
1 1/4" 1.660	Std. 5S	0.065	0.057	1.530	0.33	0.104	0.125	0.56	1.11	0.80
	10S	0.109	0.095	1.442	0.53	0.161	0.193	0.55	1.81	0.71
	40 40S	0.140	0.123	1.380	0.67	0.195	0.235	0.54	2.27	0.65
	XS 80 80S	0.191	0.167	1.278	0.88	0.242	0.291	0.52	3.00	0.56
	160	0.250	0.219	1.160	1.11	0.284	0.342	0.51	3.76	0.46
XXS	0.382	0.334	0.896	1.53	0.341	0.411	0.47	5.22	0.27	
1 1/2" 1.900	Std. 5S	0.065	0.057	1.770	0.38	0.158	0.166	0.65	1.27	1.07
	10S	0.109	0.095	1.682	0.61	0.247	0.260	0.63	2.09	0.96
	40 40S	0.145	0.127	1.610	0.80	0.310	0.326	0.62	2.72	0.88
	XS 80 80S	0.200	0.175	1.500	1.07	0.391	0.412	0.61	3.63	0.77
	160	0.281	0.246	1.338	1.43	0.483	0.508	0.58	4.87	0.61
XXS	0.400	0.350	1.100	1.89	0.568	0.598	0.55	6.41	0.41	
2" 2.375	Std. 5S	0.065	0.057	2.245	0.47	0.315	0.265	0.82	1.60	1.72
	10S	0.109	0.095	2.157	0.78	0.499	0.420	0.80	2.64	1.58
	40 40S	0.154	0.135	2.067	1.07	0.666	0.561	0.79	3.65	1.45
	XS 80 80S	0.218	0.191	1.939	1.48	0.868	0.731	0.77	5.02	1.28
	160	0.343	0.300	1.689	2.19	1.16	0.979	0.73	7.45	0.97
XXS	0.436	0.382	1.503	2.66	1.31	1.10	0.70	9.03	0.77	
2 1/2" 2.875	Std. 5S	0.083	0.073	2.709	0.73	0.710	0.494	0.99	2.48	2.50
	10S	0.120	0.105	2.635	1.04	0.988	0.687	0.98	3.53	2.36
	40 40S	0.203	0.178	2.469	1.70	1.53	1.06	0.95	5.79	2.08
	XS 80 80S	0.276	0.242	2.323	2.25	1.93	1.34	0.92	7.66	1.84
	160	0.375	0.328	2.125	2.95	2.35	1.64	0.89	10.0	1.54
XXS	0.552	0.483	1.771	4.03	2.87	2.00	0.84	13.7	1.07	
3" 3.500	Std. 5S	0.083	0.073	3.334	0.89	1.30	0.744	1.21	3.03	3.78
	10S	0.120	0.105	3.260	1.27	1.82	1.04	1.20	4.33	3.61
	40 40S	0.216	0.189	3.068	2.23	3.02	1.72	1.16	7.58	3.20
	XS 80 80S	0.300	0.263	2.900	3.02	3.90	2.23	1.14	10.3	2.86
	160	0.438	0.382	2.624	4.21	5.04	2.88	1.09	14.3	2.34
XXS	0.600	0.525	2.300	5.47	5.99	3.43	1.05	18.6	1.80	
3 1/2" 4.000	Std. 5S	0.083	0.073	3.834	1.02	1.96	0.980	1.39	3.47	5.00
	10S	0.120	0.105	3.760	1.46	2.76	1.38	1.37	4.97	4.81
	40 40S	0.226	0.198	3.548	2.68	4.79	2.39	1.34	9.11	4.28
	XS 80 80S	0.318	0.278	3.364	3.68	6.28	3.14	1.31	12.5	3.85
	XXS	0.636	0.557	2.728	6.72	9.85	4.93	1.21	22.9	2.53

— [PIPE PROPERTIES AND WEIGHTS] —

Nominal Size Outside Diameter inches d	Weight Designation and/or Schedule Number	Average Wall Thickness inches t	Minimum Wall Thickness (=7/8t) inches tm	Inside Diameter inches d	Cross Sectional Metal sq. inches A	Moment of Inertia inches ⁴ I	Section Modulus inches ³ Z	Radius of Gyration inches T _g	Pipe lb. per ft.	Weight of Water lb. per ft.	
4"	4.500	5S	0.083	0.073	4.334	1.15	2.81	1.25	1.56	3.92	6.40
		10S	0.120	0.105	4.260	1.65	3.96	1.76	1.55	5.61	6.17
		Std. 40	0.237	0.207	4.026	3.17	7.23	3.21	1.51	10.8	5.51
		XS 80	0.337	0.295	3.826	4.41	9.61	4.27	1.48	15.0	4.98
		120	0.438	0.382	3.624	5.59	11.7	5.18	1.45	19.0	4.47
		160	0.531	0.465	3.438	6.62	13.3	5.90	1.42	22.5	4.02
		XX	0.674	0.590	3.152	8.10	15.3	6.79	1.37	27.5	3.38
5"	5.56.3	5S	0.109	0.095	5.345	1.87	6.95	2.50	1.93	6.35	9.73
		10S	0.134	0.117	5.295	2.29	8.43	3.03	1.92	7.77	9.53
		Std. 40	0.258	0.226	5.047	4.30	15.2	5.45	1.88	14.6	8.66
		XS 80	0.375	0.328	4.813	6.11	20.7	7.43	1.84	20.8	7.88
		120	0.500	0.438	4.563	7.95	25.7	9.25	1.80	27.0	7.09
		160	0.625	0.547	4.313	9.70	30.0	10.80	1.76	33.0	6.33
		XXS	0.750	0.655	4.063	11.3	33.6	12.10	1.72	38.6	5.62
6"	6.625	5S	0.109	0.095	6.407	2.23	11.9	3.58	2.30	5.37	14.0
		10S	0.134	0.117	6.357	2.73	14.4	4.35	2.30	9.29	13.7
		Std. 40	0.280	0.245	6.065	5.58	28.1	8.50	2.25	19.0	12.5
		XS 80	0.432	0.378	5.761	8.40	40.5	12.20	2.20	28.6	11.3
		120	0.562	0.492	5.501	10.7	49.6	15.00	2.15	36.4	10.3
		160	0.718	0.628	5.189	13.3	59.0	17.80	2.10	45.3	9.16
		XXS	0.864	0.756	4.897	15.6	66.3	20.00	2.06	53.2	8.14
8"	8.625	5S	0.109	0.095	8.407	2.92	26.5	6.13	3.01	9.91	24.1
		10S	0.148	0.130	8.329	3.94	35.4	8.21	3.00	13.4	23.6
		20	0.250	0.219	8.125	6.58	57.7	13.40	2.96	22.4	22.5
		30	0.277	0.242	8.071	7.26	63.4	14.70	2.95	24.7	22.2
		Std. 40	0.322	0.282	7.984	8.40	72.5	16.80	2.94	28.6	21.7
		60	0.406	0.355	7.813	10.5	88.3	20.60	2.91	35.6	20.8
		XS 80	0.500	0.438	7.625	12.8	106	24.50	2.88	43.4	19.8
		100	0.593	0.519	7.439	15.0	121	28.10	2.85	50.9	18.8
		120	0.718	0.628	7.189	17.8	141	32.60	2.81	60.6	17.6
		140	0.812	0.711	7.001	19.9	154	35.60	2.78	67.8	16.7
		160	0.875	0.766	6.875	21.3	162	37.60	2.76	72.4	16.1
		XXS	0.906	0.793	6.813	22.0	166	38.50	2.75	74.7	15.8
		10"	10.750	5S	0.134	0.117	10.482	4.52	63.7	11.90	3.75
10S	0.165			0.144	10.420	5.49	76.9	14.30	3.74	18.7	36.9
20	0.250			0.219	10.250	8.26	114	21.20	3.71	28.0	35.7
30	0.307			0.269	10.136	10.1	138	25.60	3.69	34.2	34.9
Std. 40	0.365			0.319	10.020	11.9	161	29.90	3.67	40.5	34.1
XS 60	0.500			0.438	9.750	16.1	212	39.40	3.63	54.7	32.3
80	0.593			0.519	9.564	18.9	245	45.50	3.60	64.3	31.1
100	0.625			0.547	9.500	19.9	256	47.60	3.59	67.5	30.70
120	0.718			0.628	9.314	22.6	286	53.20	3.56	76.9	29.5
140	0.750			0.655	9.250	23.6	296	55.10	3.55	80.1	29.1
160	0.843			0.738	9.064	26.2	324	60.30	3.52	89.2	27.9
XXS	0.875			0.766	9.000	27.1	333	62.00	3.51	92.3	27.5
160	1.000			0.875	8.750	30.6	368	68.40	3.47	104	26.0
160	1.125	0.984	8.500	34.0	399	74.30	3.43	116	24.6		
12"	12.750	5S	0.165	0.144	12.420	6.52	129	20.30	4.45	19.6	52.5
		10S	0.180	0.158	12.390	7.11	141	22.00	4.44	24.2	52.2
		20	0.250	0.219	12.250	9.82	192	30.00	4.42	33.4	51.1
		30	0.330	0.289	12.090	12.9	249	29.00	4.39	43.8	49.7
		Std. 40	0.375	0.328	12.000	14.6	279	43.80	4.38	49.6	49.0
		40	0.406	0.355	11.938	15.7	300	47.10	4.37	53.5	48.5
		XS 80	0.500	0.438	11.750	19.2	362	56.70	4.33	65.4	47.0
		60	0.562	0.492	11.626	21.5	401	62.80	4.31	73.2	46.0
		100	0.625	0.547	11.500	32.8	439	68.80	4.29	80.9	45.0
		120	0.687	0.601	11.376	26.0	475	74.50	4.27	88.5	44.0
		140	0.750	0.655	11.250	28.3	511	80.20	4.25	96.2	43.0
		160	0.843	0.738	11.064	31.5	562	88.10	4.22	107	41.6
		160	0.875	0.766	11.000	32.6	579	90.80	4.21	111	41.1
		160	1.000	0.875	10.750	36.9	642	101.00	4.17	125	39.3
		160	1.125	0.983	10.500	41.1	701	110.00	4.13	140	37.5
		160	1.312	1.149	10.126	47.1	781	123.00	4.07	160	34.9

— [PIPE PROPERTIES AND WEIGHTS] —

Nominal Size Outside Diameter inches d	Weight Designation and/or Schedule Number	Average Wall Thickness inches t	Minimum Wall Thickness (-7/8t) inches tm	Inside Diameter inches d	Cross Sectional Metal sq. inches A	Moment of Inertia inches ⁴ I	Section Modulus inches ³ Z	Radius of Gyration inches T _g	Pipe lb. per ft.	Weight of Water lb. per ft.			
14" 14.000	Std.	10	0.250	0.219	13.500	10.8	255	36.50	4.86	36.7	62.0		
		20	0.312	0.273	13.375	13.4	315	45.00	4.84	45.7	60.6		
	XS	30	0.375	0.328	13.250	16.1	373	53.30	4.82	54.6	59.7		
		40	0.438	0.382	13.125	18.7	429	61.40	4.80	63.4	58.6		
	80	40	0.500	0.438	13.000	21.2	484	69.10	4.78	72.1	57.5		
		60	0.593	0.519	12.814	25.0	562	80.30	4.74	84.9	55.9		
	16" 16.000	Std.	60	0.625	0.547	12.750	26.3	589	84.10	4.73	89.3	55.3	
			80	0.750	0.656	12.500	31.2	687	98.20	4.69	106	53.1	
		XS	80	0.875	0.766	12.250	36.1	781	112.00	4.65	123	51.1	
			100	0.937	0.820	12.125	38.4	825	118.00	4.63	131	50.0	
		80	120	1.093	0.956	11.814	44.3	930	133.00	4.58	151	47.5	
			140	1.250	1.094	11.500	50.1	1030	147.00	4.53	170	45.0	
		18" 18.000	Std.	160	1.406	1.230	11.188	55.6	1120	160.00	4.48	189	42.6
				10	0.250	0.219	15.500	12.4	384	48.0	5.57	42.1	81.7
XS	20		0.312	0.273	15.376	15.4	474	59.3	5.55	52.3	80.5		
	30		0.375	0.328	15.250	18.4	562	70.3	5.53	62.6	79.1		
80	40		0.500	0.438	15.000	24.4	732	91.5	5.48	82.8	76.5		
	60		0.625	0.547	14.750	30.2	894	112	5.44	103	74.1		
20" 20.000	Std.		60	0.656	0.574	14.688	31.6	933	117	5.43	108	73.4	
			80	0.750	0.655	14.500	35.9	1050	131	5.40	122	71.5	
	XS	80	0.843	0.738	14.314	40.1	1160	145	5.37	136	69.7		
		100	0.875	0.766	14.250	41.6	1190	149	5.36	141	69.1		
	80	120	1.031	0.902	13.938	48.5	1370	171	5.29	165	66.1		
		140	1.218	1.066	13.564	56.6	1560	195	5.23	192	62.6		
	24" 24.000	Std.	160	1.438	1.258	13.124	65.8	1760	220	5.17	224	58.6	
			10	0.250	0.219	17.500	13.9	549	61.0	6.28	47.4	104	
XS		20	0.312	0.273	17.376	17.3	679	75.5	6.25	59.0	103		
		30	0.375	0.328	17.250	20.8	807	89.6	6.23	70.6	101		
80		40	0.438	0.382	17.124	24.2	932	104	6.21	82.2	99.7		
		60	0.500	0.438	17.000	27.5	1050	117	6.19	93.5	98.9		
30" 30.000		Std.	60	0.562	0.492	16.876	30.8	1170	130	6.17	105	96.9	
			80	0.625	0.547	16.750	34.1	1290	143	6.15	116	95.4	
	XS	80	0.750	0.656	16.500	40.6	1520	168	6.10	138	92.6		
		100	0.875	0.766	16.250	47.1	1730	192	6.06	160	89.9		
	80	120	0.937	0.820	16.126	50.2	1830	204	6.04	171	88.5		
		140	1.156	1.012	15.688	61.2	2180	242	5.97	208	83.7		
	30" 30.000	Std.	160	1.375	1.203	15.250	71.8	2500	278	5.90	244	79.1	
			10	0.250	0.219	19.500	15.5	757	75.7	6.98	52.7	129	
XS		20	0.375	0.328	19.250	23.1	1110	111	6.94	78.6	126		
		30	0.500	0.438	19.000	30.6	1460	146	6.90	104	123		
80		40	0.593	0.519	18.814	36.2	1700	170	6.86	123	120		
		60	0.625	0.547	18.750	38.0	1790	179	6.85	129	120		
30" 30.000		Std.	80	0.750	0.655	18.500	45.4	2100	210	6.81	154	117	
			100	0.812	0.711	18.376	48.9	2260	226	6.79	166	115	
	XS	120	0.875	0.766	18.250	52.6	2410	241	6.77	179	113		
		140	1.031	0.902	17.938	61.4	2770	277	6.72	209	109		
	80	160	1.281	1.121	17.438	75.3	3320	323	6.63	256	103		
		10	0.250	0.219	23.500	18.7	1320	110	8.40	63.4	188		
	24" 24.000	Std.	20	0.375	0.328	23.250	27.8	1940	162	8.35	94.6	184	
			30	0.500	0.438	23.000	36.9	2550	213	8.31	125	180	
XS		40	0.562	0.492	22.875	41.4	2840	237	8.29	141	178		
		60	0.625	0.547	22.750	45.9	3140	261	8.27	156	176		
80		80	0.687	0.601	22.625	50.3	3420	285	8.25	171	174		
		100	0.750	0.656	22.500	54.8	3710	309	8.22	186	172		
30" 30.000		Std.	120	0.968	0.847	22.064	70.0	4650	388	8.15	238	166	
			140	1.218	1.066	21.564	87.2	5670	473	8.07	296	158	
	XS	160	1.531	1.340	20.938	108	6850	571	7.96	367	149		
		10	0.312	0.273	29.376	29.1	3210	214	10.5	98.9	294		
	80	20	0.375	0.328	29.250	34.9	3830	255	10.5	119	291		
		30	0.500	0.438	29.000	46.3	5040	336	10.4	157	286		
	30" 30.000	Std.	40	0.562	0.492	28.875	52.0	5640	376	10.4	177	284	
			60	0.625	0.547	28.750	57.6	6220	415	10.4	196	281	
XS		80	0.750	0.655	28.500	68.9	7380	492	10.3	234	277		

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 all other costs 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.

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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 Reqr.			
18e		Partial Data Reqr.			
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			