KURBO

Metal Expansion Joint and Flexible Metal Hose

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INTRODUCTION TO KURBO

Reborn Company of Kurbo

In 1996, Kurbo Company Limited was established to design, manufacture and supply rubber expansion joints for a broad range of Industries and now it has been known as leading manufacturer in Korea and Asia. Substantial exports have been delivered to over 20 countries. Since 2010, not a few our customers who have purchased our rubber expansion joints for over 10 years and have been very familiar with our service, quality and reliability have asked us to supply metal expansion joints and fabric expansion joints as well, in which we are encouraged to start manufacturing metal and fabric expansion joints and keep sailing around the world.

Kurbo's skilled welder using modern TIG welding for bellows and weld end atttachment

Manufacturing Capability

Now we design and manufacture a full range of expansion joints, including single and double unrestrained joints, tied single and double expansion joints, tied universal expansion joints, hinged expansion joints, gimbal expansion joints, pressure balanced expansion joints, externally pressurized expansion joints, heat exchanger expansion joints and rectangular type expansion joints.

All these assemblies are available with flanged ends, weld ends, internal liners and covers. We have automatic longitudinal welder to weld the pipe/tube and also have hydraulic and mechanical roll forming machines to manufacture bellows which is formed from a thin–walled stainless steel tube. With these machines, we manufacture wide variety of expansion joints and their assemblies from DN50 to DN5000.

Mechanical roll forming of bellows

Longitudinal seam welding after rolling tube

Design and Engineering Capability

Our engineers' main activity is to design metal expansion joints that can meet or exceed the specific requirements demanded by piping and ducting industry. We design all expansion joints in compliance with EJMA latest edition. In addition to the EJMA Standard, Kurbo's design also complies with ASME Section VIII, ASME Section IX, ASME B31.1 and ASME B31.3. Kurbo's commitment to develop is reinforced through the use of 3D modeling computer design system technology and finite element analysis, which enables Kurbo to pinpoint potential critical areas and provide timely sound engineered solutions.

Quality Assurance and Testing Capability

With full range of manufacturing, engineering and testing capabilities, Kurbo can provide full quality assurance that its products meet customers' needs. All aspects of manufacture are quality-assured with the plant being accredited to ISO 9001: 2000.

Various types of testing to ensure quality of products in each stage are performed: These testing includes non-destructive test such as dye penetrant, magnetic particle, ultrasonic, radiography and other performance testing of finished products includes hydro testing, vacuum testing, spring rate testing.

Kurbo's bellows design software developed to cater to the design and analysis of the expandable metal bellows

Verifying bellows design through movement/spring rate testing

Kurbo's 600mm diameter single expansion joint being hydrotested before painting and packaging

KURBO BELLOWS TYPE METAL EXPANSION JOINT

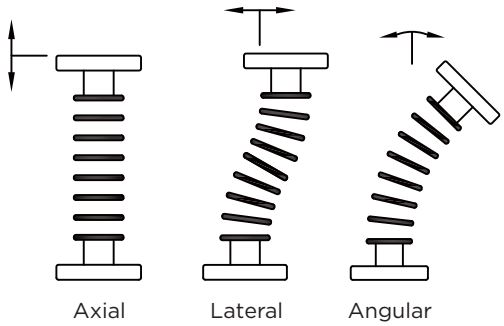
Kurbo metallic expansion joints are device containing one or more bellows. They are installed in pipe work and duct systems to prevent damage caused by thermal growth, vibration, pressure thrust and other mechanical forces. Kurbo metallic expansion joints are available in many different designs, shapes and materials in order to absorb axial, lateral, angular movement and concurrent movements.

Provided that they are corrected chosen and installed in a professional manner,
Kurbo metallic expansion joints are:

- pressure resistant
- vacuum tight
- temperature resistant
- corrosion proof
- maintenance free
- durable and reliable
- economical

Bellows Movements

Axial Movements
The dimensional shortening or lengthening of an expansion joint along its longitudinal axis



Lateral Movement
The relative displacement of the two ends of expansion joint perpendicular to its longitudinal axis.
Referred to as lateral offset, lateral deflection, parallel misalignment, transverse movement.

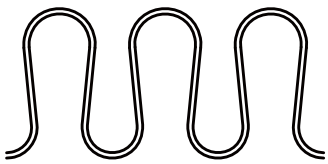
Angular Movement
The displacement of longitudinal axis of expansion joint from its initial straight line position into a circular arc. Referred to as angular rotation, rotational movement

Torsional Movement
The twisting of one end of the expansion joint with respect to the other end about its longitudinal axis.
Kurbo discourages any torsional rotation of metal bellows expansion joints. Torsion destabilizes an expansion joint reducing its ability to contain pressure and absorb movement

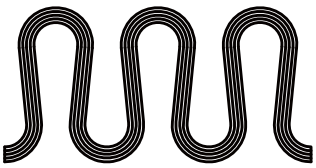
Rated Movement
The maximum amount of movement (axial compression, axial extension, lateral deflection, angular rotation, or any combination thereof) which an expansion joint is capable of absorbing

Bellows Profile

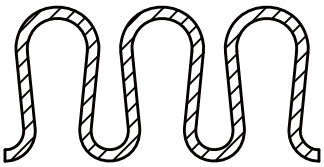
Kurbo manufactures single-wall, multi-wall, heavy-wall metal bellows in many materials and thickness.



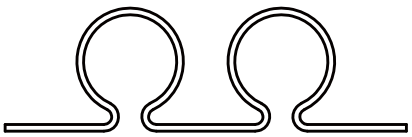
Single-wall bellows



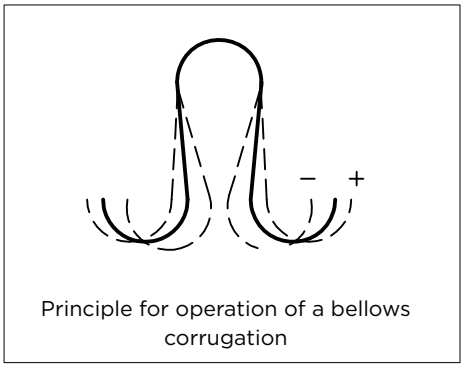
Multi-wall bellows



Heavy-wall bellows



Toroidal Shape



Principle for operation of a bellows corrugation

Materials of Bellows

The basic constituent element of expansion bellows can be specified, taking into consideration the movement, pressure, temperature, service life and corrosion rate required.

Our standard material for the circular expansion bellows is austenitic steel like AISI 304, 316 and 321. In addition, other special Nickel based alloy material, like as Inconel, Incoloy, Monel and Hasteloy can be applied on the service of aggressive fluid.

Basically, austenitic steel is resistant to both high temperature and an aggressive media. It has good mechanical properties as well when it comes to the effect of continuous motion in axial, lateral and angular direction

Bellows Design

The design of bellows is very complex. It involves an evaluation of pressure capability, both internal and external, stress due to deflection, fatigue life, spring forces and instability(squirm). The determination of an acceptable design is further complicated by the numerous variables involved such as diameter, convolution thickness, pitch, height, number of plies of material, method of reinforcement, manufacturing technique, material and heat treatment.

Cycle Life

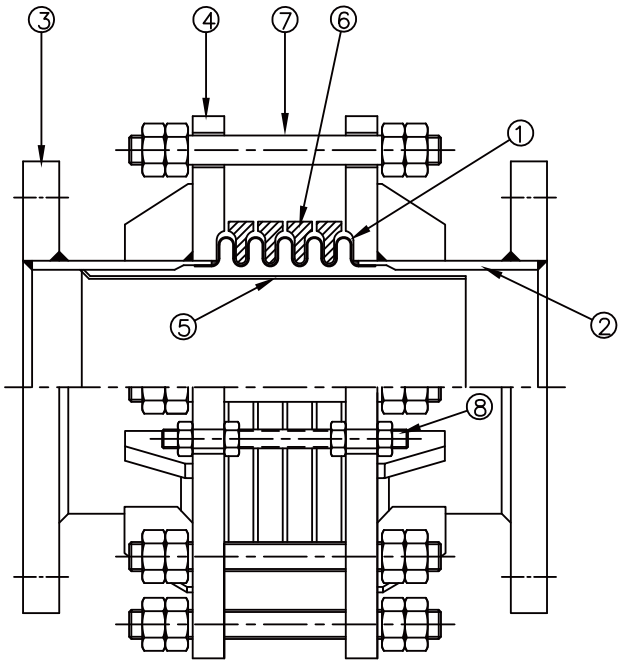
The cycle life of bellows is proportional to the sum of the meridional pressure stress(EJMA stress S4) and total meridional deflection stress(EJMA stress S6). The ability of bellows to carry pressure is limited by the S4. This is an important bending stress that is located in the side wall of the convolution running in the longitudinal direction. When a bellows deflects, the motion is absorbed by deformation of side walls of each convolution. The associated stress caused by this motion is the S6. This stress is the primary bending stress influencing fatigue life.

It is important to specify realistic cycle life as a design consideration when ordering expansion joint. In many cases, design for application involves compromise of normally conflicting requirements: high pressure usually necessitates thick wall bellows, while low forces and high cyclic fatigue life require thin flexible bellows.

TYPICAL COMPOSITION OF KURBO METAL EXPANSION JOINT

1 Bellows

The flexible element of an expansion joint, consisting of one or more convolutions. This part is the most important one of an expansion joint to absorb axial, lateral and angular movements.
The number of convolutions depends on the amount of movement the bellows must accommodate or the force that must be used to accomplish this deflection. Bellows is formed from a thin-walled stainless steel tube by hydraulic forming or roll forming process. Annealing heat treatment and pickle cleaning are required to remove stress accumulated in bellows during the forming process.
There are two types of bellows: Unreinforced bellows and Reinforced bellows



2 End Pipe

Mostly made of steel pipes. End pipe is used to connect the bellows with a pipe or flanges. It is of the same quality and dimension as those used for piping.

3 Flange

Expansion joint is fitted with cast iron, cast steel, forged steel, plate steel, forged alloy or alloy plate flanges. The choice of flanges is dependent on service conditions. KS and ANSI flanges are standard specifications. Special facings and drilling are available to suit unusual service conditions and applications.

4 Guide Flange

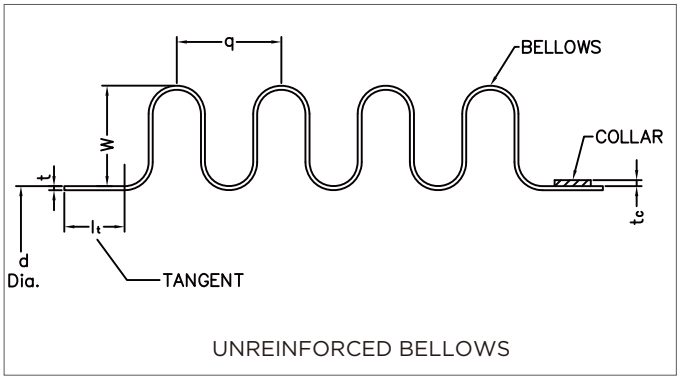
When used with tie rods, it restrain pressure thrust caused by internal pressure in order to prevent damages that may occur in bellows.

5 Internal Sleeve(Liner)

It serves to minimize contact between the inner surface of the bellows of expansion joint and the fluid flowing through it and hold friction losses and provide smooth flow.

6 Reinforcing Ring/Equalizing Ring

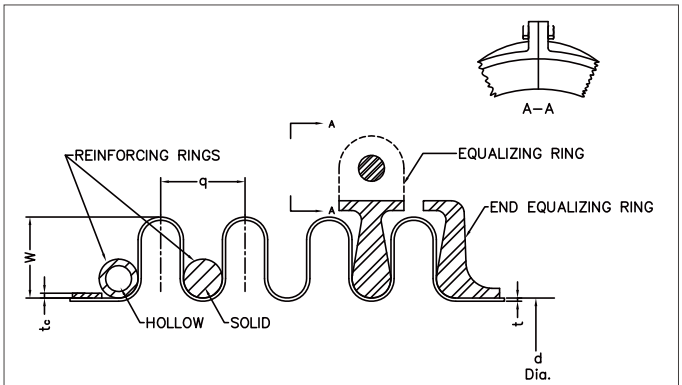
Devices used on expansion joints fitting snugly in the roots of the convolutions. The primary purpose of these devices is to reinforce the bellows against internal pressure. Equalizing rings are made of cast iron, steel, stainless steel or other alloy and are "T" shaped in cross section. Reinforcing rings are fabricated from tubing or solid round bars of carbon steel, stainless steel or other suitable alloys



UNREINFORCED BELLOWS

7 Tie Rod

Devises, usually rods or assemblies made from rod and pipe whose primary function is to react the full pressure thrust at operating and test conditions, and to allow lateral offset. They can also function as limit stops to prevent over travel of the individual bellows elements of a universal expansion joint, and to stabilize the center spool of a universal expansion joint



REINFORCED BELLOWS

8 Set Bolt/Shipping Bar

Shipping bar is installed on an expansion joint to maintain shipping length and give the expansion joint stability during transit and installation. These shipping devices in the form of rod, bar, angle should not be removed until the installation is complete.

ACCESSORIES AND OPTIONS

Internal Sleeves/Liners

Internal sleeve or liner should be specified for all expansion joint in the following cases:

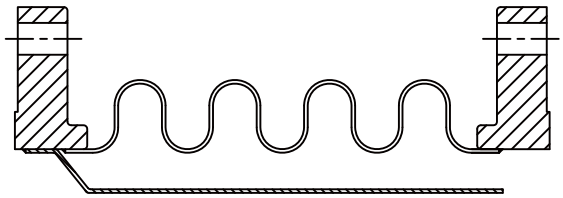
- Where friction losses must be held to a minimum and smooth flow is desired
- Where flow velocities are high and produce resonant vibration. Internal sleeves are recommended when internal flows exceed the following:

Air, steam and other gases

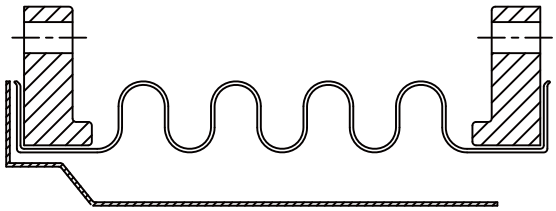
1) Up to 6" diameter – 4 ft/sec. per inch of diameter
2) Over 6" diameter – 25 ft/sec.

Water and other liquids

1) Up to 6" diameter – 1 2/3 ft/sec. per inch of diameter
2) Over 6" diameter – 10 ft/sec.



Typical Flanged Expansion Joint with Liner



Typical Vanstone Expansion Joint with Liner

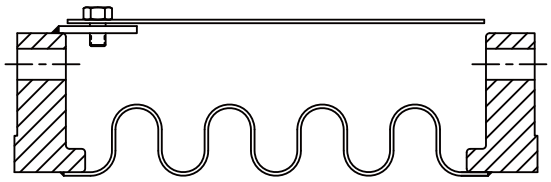
- When turbulent flow is generated upstream of the expansion joint, heavy gauge sleeves are required.
- Where there is a possibility of erosion, such as in lines carrying catalyst or other abrasive media, heavy gauge sleeves should be used.
- Where there is a reverse flow, heavy gauge sleeves should be used.
- When extremely high temperatures are present, internal sleeves produce an air barrier which will decrease the operating temperature of the bellows.
- Internal sleeve should not be used where high viscosity fluids are transmitted due to the packing up of fluid.

Covers/Shrouds

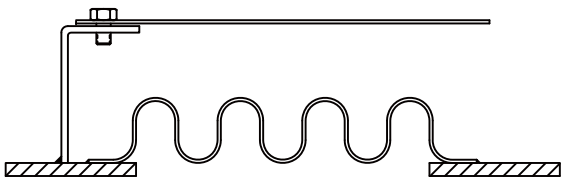
Kurbo's cover or shroud is used to protect the bellows externally from foreign objects or mechanical damage. It should be specified when the following conditions prevail.

- Where there is a possibility of accidental damage to the bellows element during shipment, installation or while in service
- When welding is going to be done in the immediate vicinity of the bellows and there is a possibility of weld splatter or arc strikes hitting the bellows element.
- When the expansion joint is going to be externally insulated.

  Note : one end of the cover must be left free to permit movement of the bellows, and the insulation used should be free from any substance which could prove harmful to the bellows material in the event of leaching.



Typical Flanged Expansion Joint with Cover



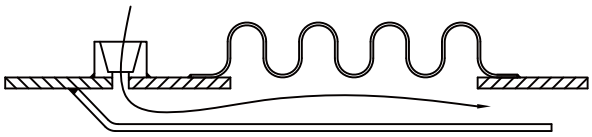
Typical Weld End Expansion Joint with Cover

In the case of Kurbo's externally pressurized expansion joint, the cover is provided as an integral part of the expansion joint and serves as a protection for personnel in the event of a bellows failure.

Purge Connections

Purge connections are used in conjunction with internal sleeves/liners to:

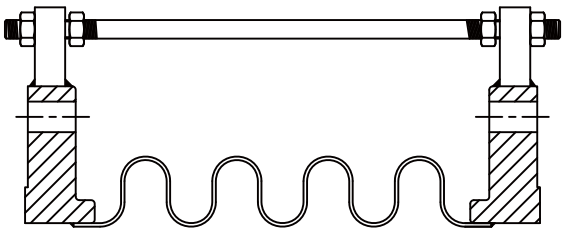
- prevent packing or collection of solids in the area between the liner and the bellows.
- lower skin temperature of the bellows in high temperature applications such as catalytic cracking unit



Air Purge Under Bellows

Tie Rods

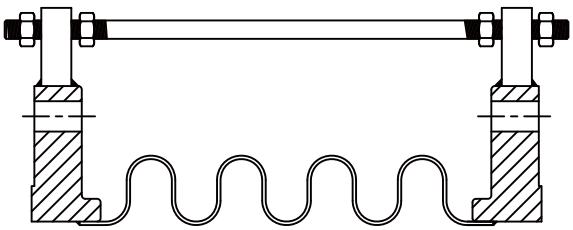
Tie rods are devises, usually rods or assemblies made from rod and pipe whose primary function is to restrain the full bellows pressure thrust during normal operation while permitting lateral offset. Angular rotation can be accommodated only if two tie rods are used and located 90˚ opposed to the direction of rotation



Tie Rod Installed

Limit Rods

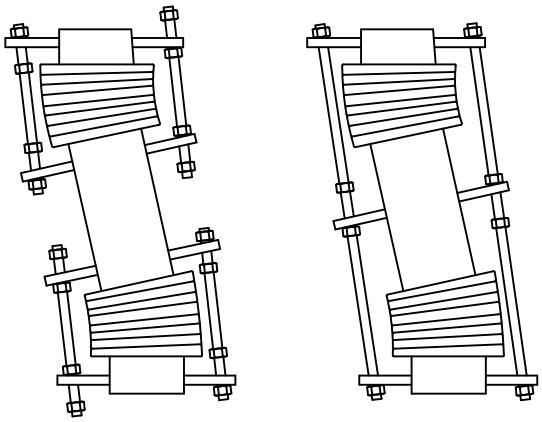
Limit rods are used to restrict the bellows movement range axially, laterally and angularly during normal operation.
In the event of anchor failure, the limit rods function as a tie rods and prevent bellows over-extension and over-compression while restraining full pressure loading and dynamic forces generated by anchor failure. This safety device prevent damage to piping, equipment and personnel.



Limit Rod Installed

Control Rods

Control rods are used to distribute the movement between bellows of a universal expansion joint.
These rods are not designed to restrain bellows pressure thrust



Control Rod Installed

TYPICAL APPLICATION OF EXPANSION JOINTS IN PIPING SYSTEM

In selecting proper Kurbo metal expansion joint to satisfy system requirements, it is essential that all the operating parameters be fully considered. The following section is presented as a guide for the piping system designer in evaluating the most significant operating requirements and how to apply them in selecting Kurbo metallic expansion joints.

Single expansion joint with flanged end

Axial Movement Application

Figure A through D represents good practice in the use of metallic expansion joint to absorb axial pipeline expansion. Note the relative positions of expansion joints, anchors and guides to achieve proper control of operating conditions.

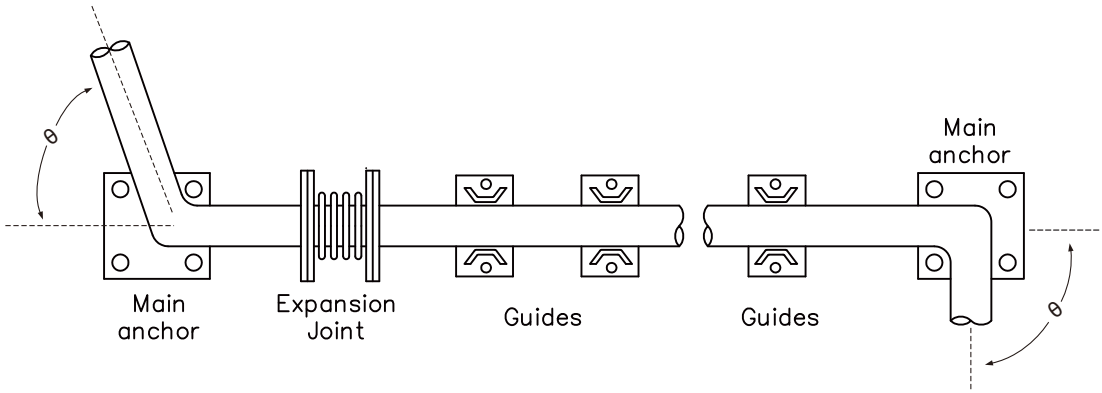


Figure A : Single Expansion Joint Application between Main Anchors

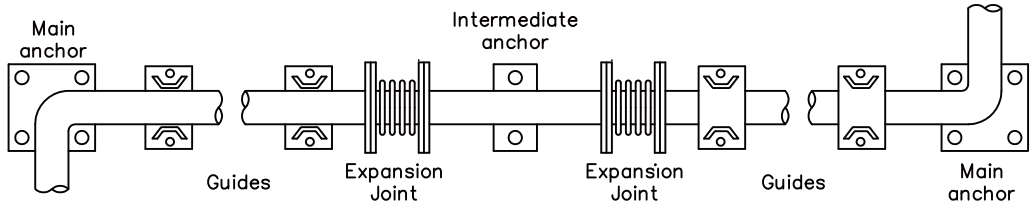


Figure B : Double Expansion Joint Application between Intermediate anchor

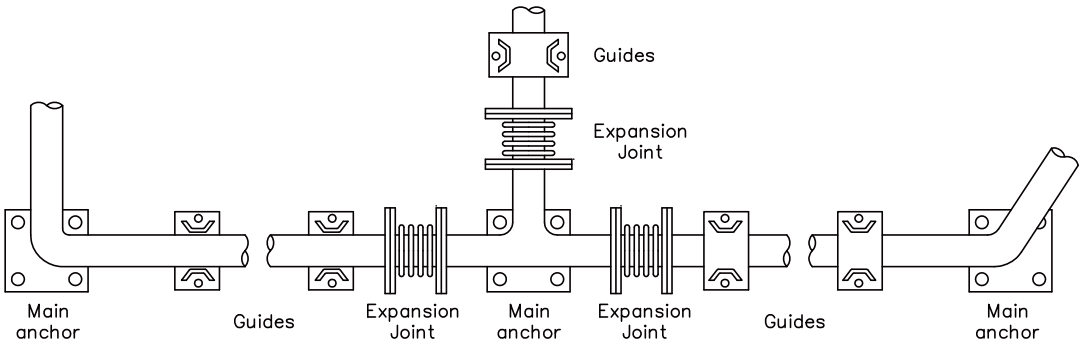


Figure C : Axial Expansion Joint Application in a Pipeline with a Branch Connection

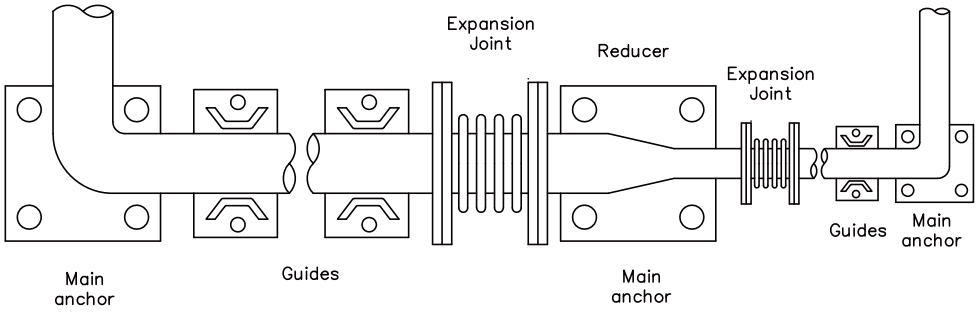


Figure D : Axial Expansion Joint Application in a Pipeline Containing a Reducer

Lateral Deflection Application

Figure E shows typical arrangement in which the expansion joint is installed in the short piping leg and the principal expansion is absorbed as lateral deflection. The longer piping leg is free of compressive pressure loading and requires only an intermediate anchor and directional guiding

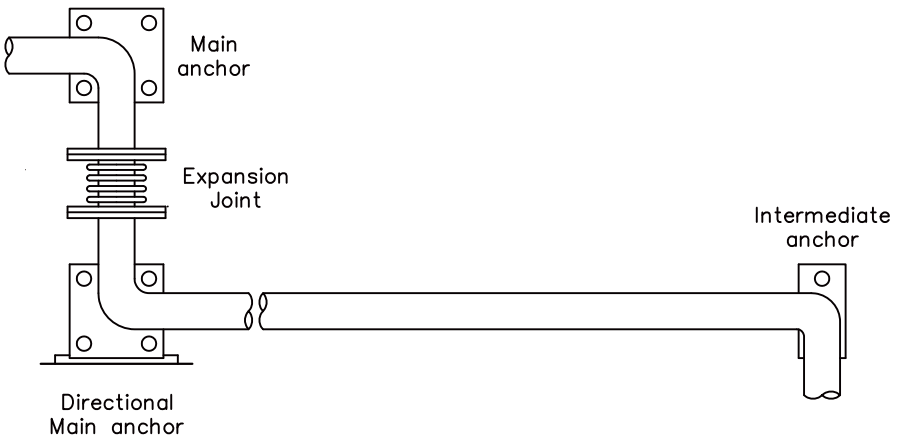


Figure E

Figure F shows a tied universal expansion joint to absorb lateral deflection in a single plane “Z” bend. The tie rods absorbing pressure thrust allow the use of intermediate anchors. Where dimensionally feasible, the expansion joint should be designed to fill the entire offset leg so that its expansion is absorbed within the tie rods as axial movement. Any thermal expansion of the offset leg external to the tie rods must be absorbed by bending of the horizontal pipe legs

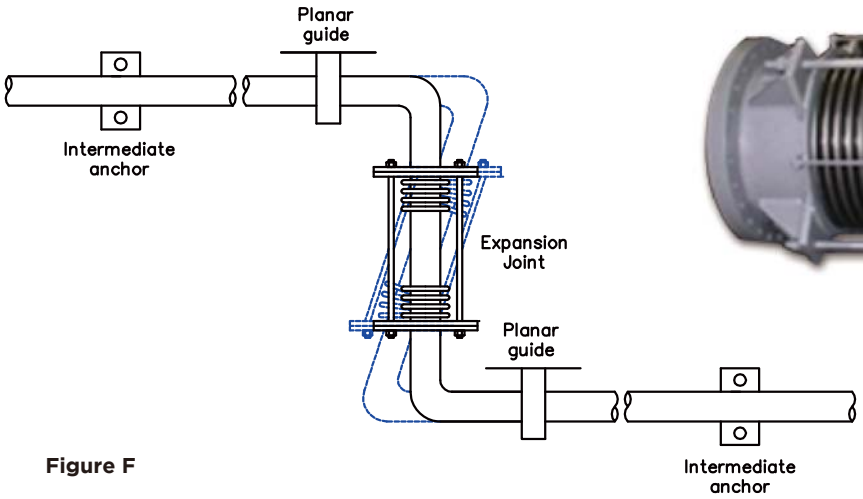


Figure F

Angular Deflection Application

Figure G shows a typical arrangement in which Kurbo’s three hinged expansion joints are installed in a single plane “Z” bend. The thermal expansion of offset piping section is absorbed by the action of expansion joints “2” and “3”. Note that thrust absorbing Hinges eliminate the need for main anchors and that Kurbo’s expansion joint “2” must be capable of absorbing the total of the rotation of expansion joints “1” and “3”. Usually center expansion joint contains a greater number of convolutions than those at either end.

Just as Kurbo’s hinged expansion joints may offer advantages in single plane applications. Kurbo’s gimble expansion joints are designed to offer similar advantages in multi plane systems. The advantages of using Kurbo gimble expansion joint systems are similar to those mentioned for systems containing hinged expansion joints. Great flexibility of usage is possible since gimble expansion joints are not restricted to single plane systems.

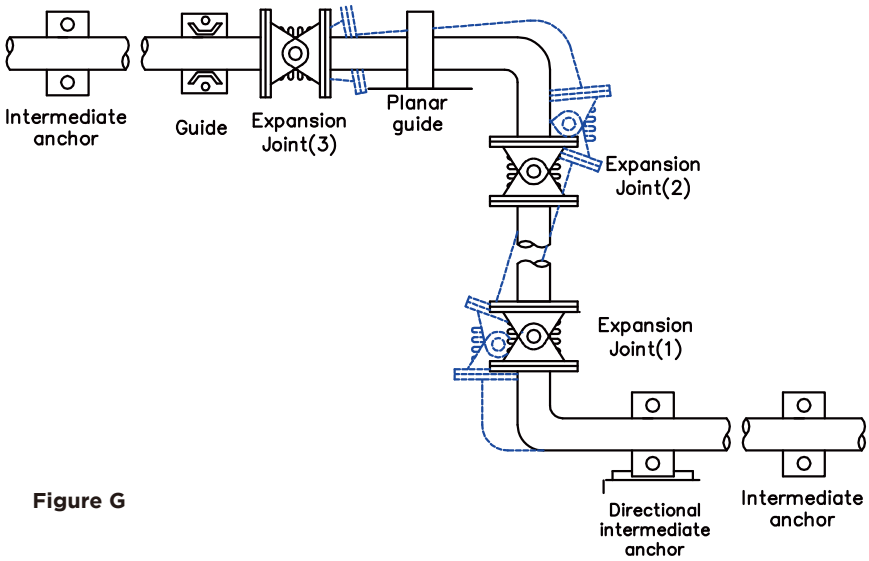


Figure G

Typical Forces/Loads in Piping Systems

The following formulas are presented so that the load imposed on specific anchor can be calculated.

- **Main anchor loads at straight pipe sections** (see Fig. C)

$F_{MA} = F_S + F_M + F_G$

- **Main anchor loads at pipe section with reducer** (see Fig. D)

$F_{MA} = (F_{SX} - F_{SY}) + (F_{MX} - F_{MY}) + (F_{GX} - F_{GY})$

- **Main anchor loads at pipe bends and elbows** (see Fig. A)

$$F_{MA(FLOW)} = \frac{2Apv^2}{g} \sin\frac{\theta}{2}$$

- **Intermediate anchor loads acting on IA** (see Fig. B)

$F_{IA} = F_M + F_G$

An intermediate anchor is designed to absorb forces due to expansion joint deflection and friction only. It is generally considered as good practice to design the intermediate anchor to resist the forces exerted by large pipe section

Notation

F_{MA} = Force acting on main anchor (kg)
F_{IA} = Force acting on intermediate anchor (kg)
F_S = Static thrust due to internal pressure (kg)
F_M = Force due to expansion joint deflection (kg)
F_G = Force due to friction in pipe support and guide (kg)
A = Expansion joint effective area (cm^2)
ρ = Density of fluid (kg/cm^3)
v = Velocity of fluid (cm/sec)
g = Acceleration due to gravity (980 cm/sec^2)
θ = Angle of pipe bend (degree)
MA = Main Anchor
IA = Intermediate Anchor

For lateral and rotational deflection requirements, it is necessary to consider lateral force and bending moments imposed on connection pipe and or equipment (See Figure E, F and G)

ANCHOR, GUIDE AND SUPPORT

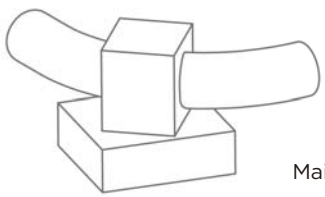
Anchors

Pipe anchor divides a pipe line into individual expanding sections that can be considered more easily. The force generated by expansion joint must be absorbed by anchors adequate to take the anticipated loads. The various types of anchor are as follows:

Main Anchors

Main anchors are designed to absorb the full range of loadings and to prevent movement of the pipeline in any direction. Main anchors must be installed at any of the following locations:

- at a change in direction of flow
- between two expansion joints of different sizes installed in the same straight run
- at a entrance of side branch containing unrestrained expansion joint into the main line
- where shut-off valve or pressure relief valve is installed in a pipe run between two expansion joints
- at a blind end of a pipe



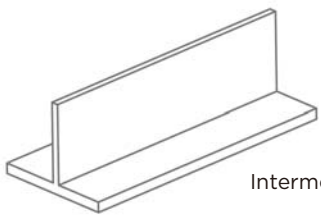
Main Anchor

Intermediate Anchors

Intermediate anchors must be designed to withstand forces and moments imposed upon them which include:

- the force to deflect expansion joint the full rated movements
- the frictional forces due to pipe guides, directional anchors and supports

Although intermediate anchors are not intended to absorb pressure thrust, they must absorb all other forces generated in the system. This force is absorbed by other anchors or by other devices such as tie rods, hinge, gimbal etc. The intermediate anchor is normally an anchor between a double expansion joint where the pressure thrust forces are balanced.



Intermediate Anchor

Pipe Guides

Correct alignment of the adjoining pipe is of vital importance in the proper functioning of Kurbo's expansion joint system. Although Kurbo expansion joints are designed and built for long and satisfactory life, maximum service will be obtained only when the pipeline has the recommended number of guides and is anchored and supported in accordance with good engineering practice.

Pipe guides are necessary to insure proper application of movement to Kurbo's expansion joint and to prevent buckling of the line. Buckling may be caused by a combination of two things:

a) flexibility of Kurbo's expansion joint

b) internal pressure loading on the pipe

Pipe Guide

Pipe alignment guides are primarily designed for applications involving only axial extension and compression and have a sleeve or other framework rigidly mounted to positively restrict pipeline movement to compression and extension only.

Planar Guide

Planar guides are used to restrict movement in one plane and permit movement in another plane. Such restraint is a criterion for stability of most single and universal tied joints when subject to internal pressure.

Guide Designs

Proper design of both pipe alignment guides and planar pipe guides should allow sufficient clearance between the fixed and moving parts of the alignment guide to insure proper guiding without introducing excessive frictional forces.

The first two alignment guides immediately adjacent to each side of Kurbo's expansion joint should be circumferential to the pipe. Planar pipe guides must be designed with additional clearance in one direction to permit the intended lateral deflection and/or bending of the pipe to take place.

As in the case of pipe anchors, alignment guides can be subjected to lateral forces as high as 15% of the total axial force, and the system designer must assure himself that the guide, guide attachment and the structure to which it is attached are all designed to conservative stress levels. The design of the total guiding system must assure that no relative shifting of alignment guides and Kurbo expansion joint will occur from ground settlement or other environmental conditions.

Kurbo expansion joints that do not include internal guides require an alignment guide to be located 4 pipe diameters from the face of the expansion joint, and second guide 14 diameters from the first guide. A typical application for pipe guiding is shown in Figure H on the next page. The remaining guides should be positioned according to pressure and pipe diameter as shown in the Kurbo Guide Spacing Graph on page 15.

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

$$L = 0.131\sqrt{\frac{EI}{PA \pm F \cdot ex}}$$

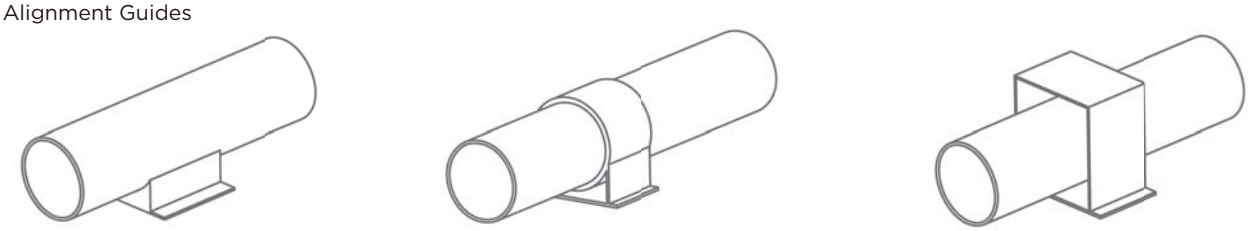
Where

L= maximum intermediate guide spacing (mm)
E = modulus of elasticity of pipe material (kg/mm^2)
I = moment of inertia of pipe (mm^4)
P = design pressure (kg/mm^2)
A = bellows effective area (mm^2)
F = bellows spring rate per convolution (kg/mm/conv.)
ex = axial stroke of bellows per convolution (mm/conv.)

Notes:

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

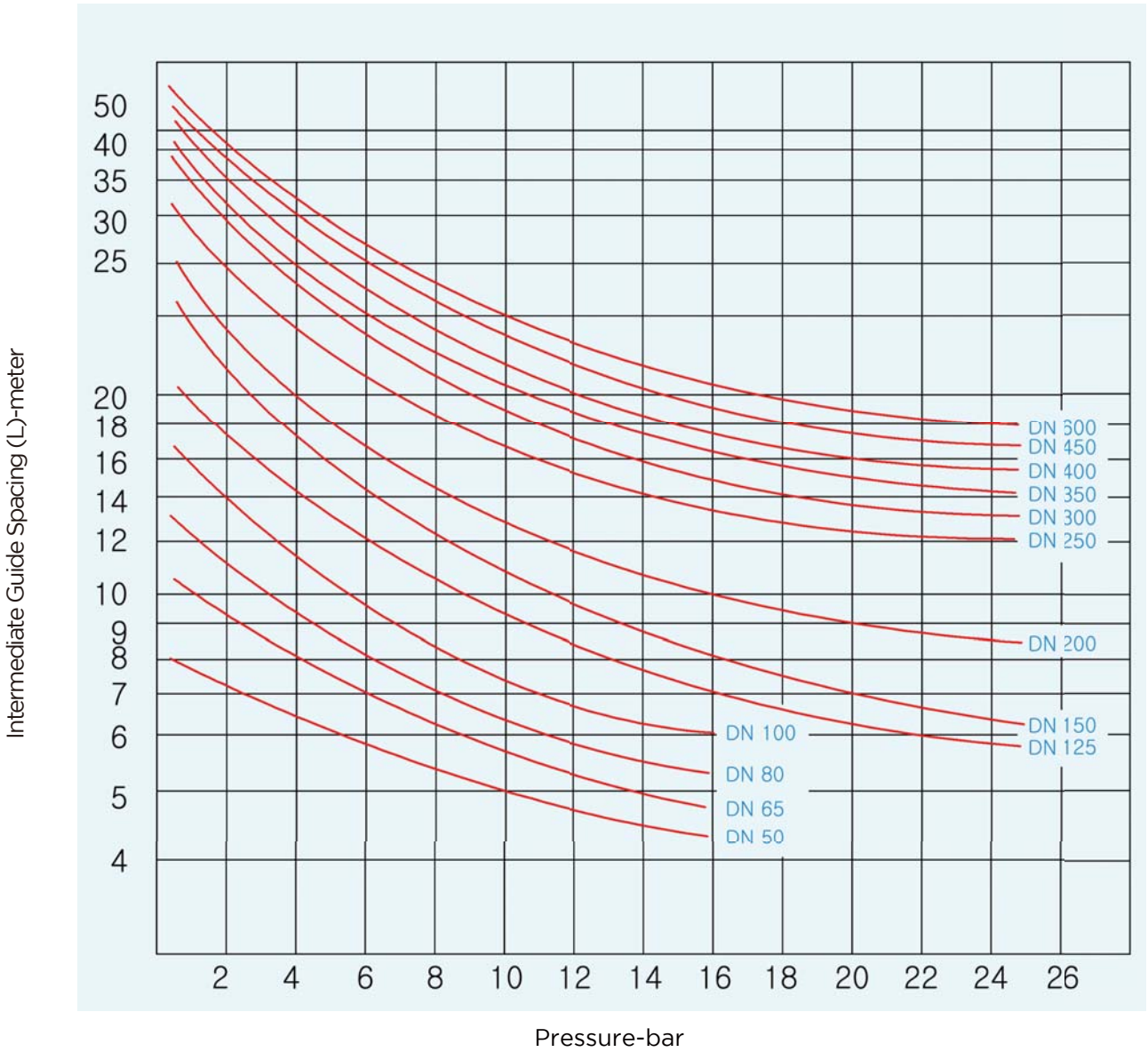
Pipe Alignment Guides



Pipe Support

A pipe support permits free movement of the piping and supports only the weight of pipe and fluid. Pipe rings, U-bolts, spring hangers and rollers are examples of pipe supports. However these devices cannot control direction of pipeline movement as does a pipe alignment guide or a planar guide.

Recommended Maximum Intermediate Guide Spacing



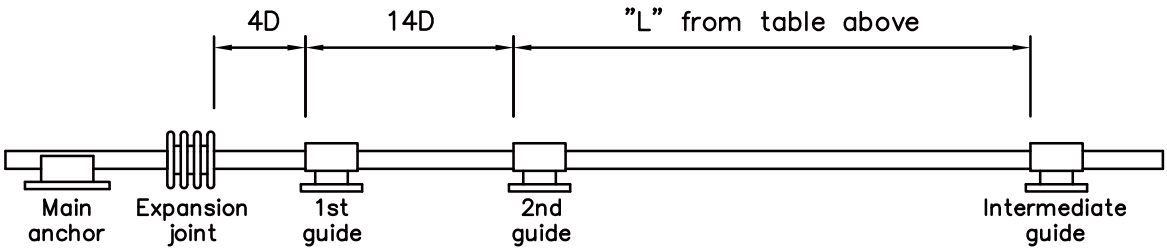


Figure H : Typical Application of pipe Guiding

PIPE THERMAL EXPANSION TABLE

Temperature		Thermal expansion from 21 C to the noted temperature (mm / meter)					
˚C	˚F	Carbon Steel Carbon-Moly 3Cr-Mo	Alloy Steel 5 Cr-Mo to 9 Cr-Mo	Austenitic Stainless Steel 18 Cr-8 Ni	Ferritic Stainless Steel 12 to 27 Cr	Monel 400	Copper
−129	−200	−1.42	−1.34	−2.26	−1.22	−1.69	−2.29
−115	−175	−1.31	−1.24	−2.07	−1.12	−1.59	−2.10
−101	−150	−1.20	−1.14	−1.89	−1.03	−1.49	−1.92
−87	−125	−1.08	−1.02	−1.67	−0.93	−1.32	−1.72
−73	−100	−0.95	−0.90	−1.45	−0.82	−1.15	−1.52
−59	−75	−0.83	−0.78	−1.25	−0.71	−0.98	−1.31
−46	−50	−0.70	−0.65	−1.03	−0.60	−0.81	−1.10
−32	−25	−0.55	−0.52	−0.81	−0.48	−0.64	−0.89
−18	0	−0.41	−0.39	−0.60	−0.35	−0.47	−0.65
−4	25	−0.26	−0.25	−0.38	−0.22	−0.33	−0.41
10	50	−0.11	−0.11	−0.17	−0.10	−0.13	−0.18
21	70	0.00	0.00	0.00	0.00	0.00	0.00
38	100	0.18	0.17	0.27	0.15	0.22	0.28
52	125	0.34	0.32	0.50	0.29	0.41	0.52
66	150	0.50	0.47	0.74	0.43	0.61	0.75
79	175	0.66	0.62	0.97	0.57	0.81	1.00
93	200	0.83	0.78	1.21	0.71	1.01	1.25
107	225	1.00	0.94	1.45	0.85	1.22	1.50
121	250	1.16	1.10	1.69	1.00	1.42	1.73
135	275	1.34	1.25	1.93	1.15	1.66	1.98
149	300	1.51	1.42	2.17	1.30	1.84	2.22
163	325	1.70	1.59	2.42	1.45	2.05	2.44
177	350	1.87	1.75	2.66	1.60	2.26	2.72
191	375	2.06	1.92	2.91	1.75	2.45	2.97
204	400	2.25	2.08	3.16	1.91	2.70	3.23
218	425	2.44	2.26	3.41	2.07	2.92	3.48
232	450	2.63	2.44	3.66	2.23	3.15	3.74
236	475	2.82	2.61	3.91	2.40	3.38	
260	500	3.01	2.79	4.17	2.56	3.60	
274	525	3.21	2.97	4.42	2.73	3.84	
288	550	3.41	3.15	4.68	2.90	4.07	
302	575	3.62	3.34	4.94	3.07	4.30	
316	600	3.83	3.53	5.20	3.25	4.55	
329	625	4.04	3.71	5.46	3.41	4.79	
343	650	4.25	3.90	5.72	3.59	5.03	
357	675	4.46	4.09	5.98	3.76	5.28	
371	700	4.68	4.28	6.25	3.94	5.53	
385	725	4.90	4.48	6.51	4.12	5.78	
399	750	5.13	4.68	6.79	4.30	6.03	
413	775	5.35	4.88	7.05	4.48	6.28	
427	800	5.58	5.08	7.33	4.66	6.54	
441	825	5.80	5.28	7.60	4.85	6.80	
454	850	6.04	5.48	7.88	5.03	7.04	
468	875	6.27	5.68	8.15	5.22	7.33	
482	900	6.50	5.89	8.43	5.40	7.60	
496	925	6.73	6.10	8.71	5.60	7.86	
510	950	6.95	6.30	9.00	5.78	8.14	
524	975	7.18	6.50	9.28	5.97	8.40	
538	1000	7.40	6.71	9.56	6.16	8.68	
551	1025	7.65	6.91	9.85	6.35		
566	1050	7.88	7.12	10.13	6.54		
580	1075	8.12	7.33	10.41	6.73		
593	1100	8.36	7.54	10.70	6.92		
607	1125	8.58	7.74	10.98	7.10		
621	1150	8.80	7.93	11.26	7.29		
635	1175	9.03	8.13	11.55	7.47		
649	1200	9.25	8.33	11.83	7.65		
663	1225	9.48	8.55	12.12	7.85		
677	1250	9.71	8.77	12.40	8.04		
691	1275	9.95	9.00	12.68	8.23		
704	1300	10.18	9.21	12.96	8.42		
718	1325	10.41	9.41	13.25	8.60		
732	1350	10.65	9.62	13.53	8.80		
746	1375	10.88	9.83	13.81	8.99		
760	1400	11.11	10.04	14.10	9.17		

INSTALLATION AND HANDLING GUIDE

General

Proper storage, handling and installation in approved manner are very critical factors so that Kurbo expansion joints can fulfill their function perfectly. Maximum service life can only be obtained by paying attention during handling, storage and installation. If properly installed, expansion joints will need almost no maintenance. Proper installation of your expansion joints is key to increasing the service life and maintaining reliability.

This guide is a guideline for general applications. For detailed information, please contact Kurbo directly and inquire about your specific installation

Storage, Transportation and Handling

Expansion joints should be stored in a dry and clean area. Keep them away from moisture, oil, sand and chemicals. As bellows are made of thin wall plate, they are extremely susceptible to damage. Dents, scratches, arc strikes, weld spatter, and other damage can cause the joint to fail.

Our expansion joints are packaged on skids or crated for transportation. The bellows element of the expansion joint is easily damaged and cannot usually be repaired. Do not remove the units from packaging until you are ready to install. Unpack the units carefully. Immediately after unpacking, inspection of the expansion joints has to be done by the customer. Any damage, introduced after this point, will cause the guarantee to void.

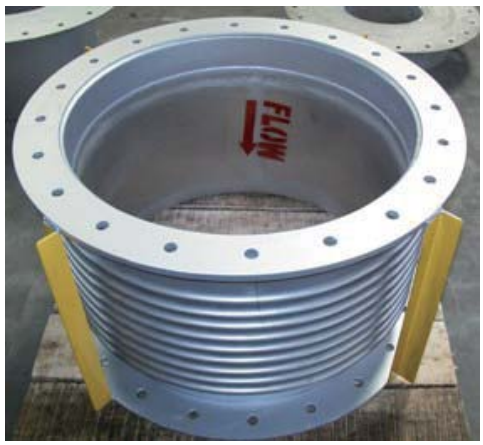
Kurbo expansion joints being packaged for safe shipment

Installation

Expansion joints should be installed in the exact position of the pipeline for which they were designed. If not, the cycle life of the expansion joint will reduce considerably and it could even lead to damage of the installation.

- All anchors, guides, and supports must be installed according to engineering drawings and specifications. The expansion joint will not be subjected to any torsion. The installation gap is in accordance with the design specifications.
- Use only designated lifting lugs. Do not lift the expansion joint by the shipping bars. Lift at the lift points provided. If the lift point clevis pins are not apparent, use correct industry practice to lift and position the joint safely. Please be aware bellows can be damaged easily with chains and improper procedures.
- Make sure that mating flanges are correctly aligned. Do not try to compensate for flange or pipe misalignment by putting any torsional, compressive, extensive, or offset loads on the expansion joint. It is good practice to leave one flange unwelded until the expansion joint has been bolted in position.
- When bolting the joint, care should be taken not to damage the outside diameter of the end convolutions which may be very close to the flange. Tighten the bolts of the flanges in a crosswise sequence
- Movement limiting devices such as tie rods, hinges and gimbal can never be removed

- As the movement of expansion joint with hinges or gimbals under specific design are limited to certain directions, hinge pins should be in a correct plane to ensure that the expansion joint move and function as intended. The orientation of the hinges is of the utmost importance. Install the hinge pins normal to direction of movement.
- When internal liners are used, flow direction should be marked. The open end of liner should be towards the downstream side. Flow arrows are shown on the exterior of the unit. Occasionally, the liner may be marked with the flow direction as shown on the right ..



- Some expansion joints are fitted with permanent covers. If removal of the covers is necessary, they will have to be refitted as quickly as possible.
- Protect the bellows element from weld spatter and arc strikes. Cover the bellows with suitable high temperature cloth or insulation.
- Seal off the open end of liner using duct tape or other suitable material. After welding inside the unit, remove all pieces of weld rod and spatter which could penetrate the bellows during operation
- Remove any foreign materials that may have become lodged between convolutions.
- Remove shipping bars after installation, but prior to system start up/hydro testing. All shipping bars will be marked with yellow paint with removal information on them. Normally removal information indicates “Remove after installation but prior to system start up/hydro testing”
- The expansion joint should not be used for field alignment. Any field alteration to the expansion joint will void the warranty. If an expansion joint has been designed for field alignment it will be stipulated on the drawing.

Periodic Checks

Visually check the movements absorbed by the expansion joint during working conditions.
Check for leaks, mechanical damage, corrosion, unexpected vibrations, etc. Control whether any dirt, debris or particles are accumulating between the convolutions of the expansion joints. This could lead to movement restriction and might decrease the life span of the expansion joint

Note

All installation procedures should conform to EJMA Safety Recommendation in Section B.

TYPES OF KURBO METAL EXPANSION JOINT AND APPLICATION

Single Expansion Joint

Single expansion joint is the simplest form manufactured from single and multi-ply elements. It consists of bellows element with end connections. It is used for axial movement only in pipe configurations. However, it can also absorb small amounts of other two types of basic movements-lateral and angular. This type of expansion joint provides most economical solution in an installation where proper anchoring and guiding is feasible.

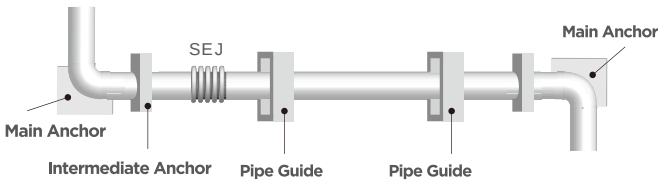
Features

- Absorbs all three types of movement
- Deflects in any direction
- No change in direction of flow
- Minimum installation space and easy to install
- The least expensive type of expansion joint
- Strong anchors require to control pressure thrust

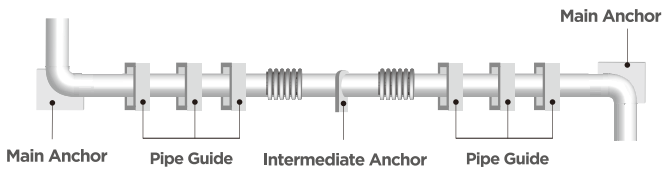
Untied Single Expansion Joint

This type of expansion joint, without any restraints or guides, cannot resist deflections other than those due to spring rate of the bellow elements. The piping should be adequately guided and anchored to avoid unexpected movements and proper functioning of the expansion joint.

Typical application of a single expansion joint is to absorb axial movements of straight pipe between main anchors.

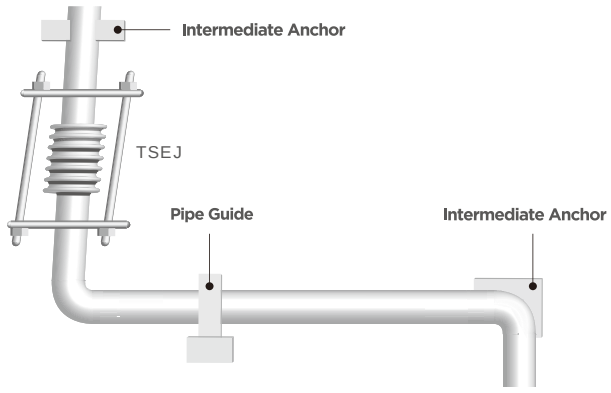


When axial movement of the piping run exceeds the capability of single expansion joint, double expansion joint with intermediate anchor welded to a center spool may be used.



Tied Single Expansion Joint

It has all the characteristics of the untied expansion joint with addition of tie rods to restrain the pressure thrust and to restrict the movement of expansion joint

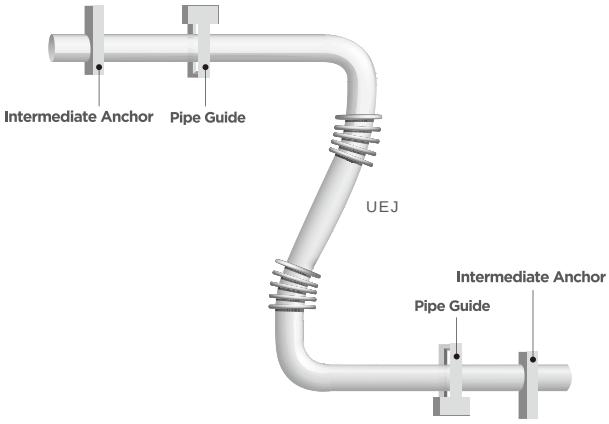


Universal Expansion Joint

Universal expansion joint consists of two bellows elements joined together by a piece of pipe(center spool) and fitted with either pipe ends or flanges. This type of expansion joint is usually furnished with control rods to distribute the movement between two bellows of the expansion joint and stabilize the center spool. When large amount of lateral deflection is required, universal expansion joint is used. For a given bellows element, the amount of lateral deflection capability can be increased or decreased by simply changing the length of the center spool. In addition to this, these assembly can also compensate other two types of movements: axial and angular, but is limited to low pressure applications because of center spool instability. This type of expansion joint also will result in lower forces on the anchors. Only light fixed points are required to absorb lateral movement and friction forces.

Untied Universal Expansion Joint

Untied universal expansion joints can absorb large amount of lateral deflections in addition to axial and angular movements. Usually these type of expansion joints are provided with control rods to distribute the movement equally between the two bellows. Control rods are not designed to withstand pressure thrust.



Kurbo's engineers are checking bellows quality of tied universal expansion joint

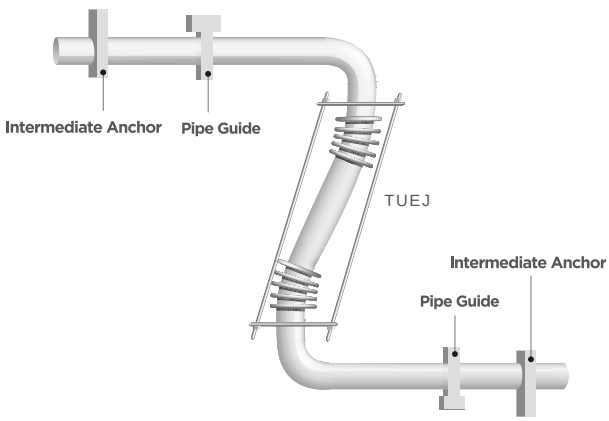
Features

- Absorbs large amounts of lateral deflection
- Simple and robust construction
- Eliminates pressure thrust load
- Low maintenance

Tied Universal Expansion Joint

It is same as untied universal expansion joints, but with addition of tie rods. These tie rods are designed to withstand the pressure thrust and so the external movement of the expansion joint is constrained even if the pressure thrust is increased. Angular movement can be accommodated only if two tie rods are provided 180 degree apart. To restrict this angular movement, four tie rods are provided at interval of 90 degrees, around the circumference of the expansion joint.

Although an axial expansion joint itself is less expensive than a tied universal expansion joint, when the anchoring and guiding costs are taken into consideration, there is no contest. The tied universal expansion joint has a much lower installed cost.



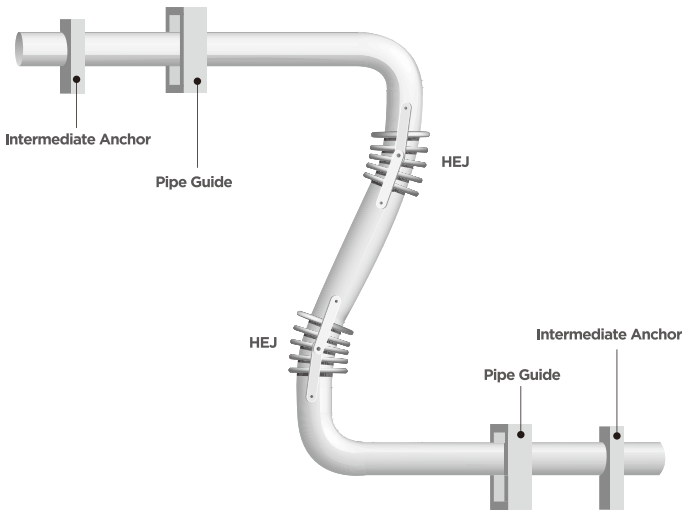
Hinged Expansion Joint

Hinged expansion joint is designed to permit angular rotation in one plane only by the use of a pair of pins through hinge plates attached to the expansion joint ends. The hinge and hinge pin is designed to restrain the pressure thrust loads and other external loads such as dead weight and wind. Slotted hinges assembly can also be provided to allow some amount of axial deflection. These slotted hinge types will not resist pressure thrust forces, and anchoring must be provided. If the full axial restraint of the hinged type is desired, the piping designer should understand that there is no allowance in the expansion joint for any axial travel, including none for any installation misalignment

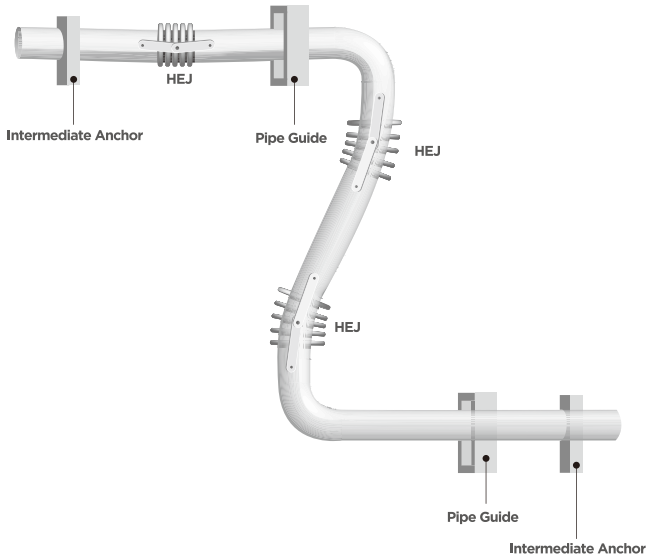
Features

- Permits angular rotation in one plane.
- Eliminates pressure thrust forces
- No main anchors required
- Transmits loads, so low forces on the pipe anchors
- Prevents torsion or twisting of the expansion joint.
- Can also absorb axial deflection, if designed.
- Internal flow liners for eliminating velocity problem
- Anchors only required to absorb spring forces

Hinged expansion joints can be fitted with either pipe ends or flanges and are used in sets of two or three to function properly



Two Hinge System



Three Hinged Expansion Joint

Double Hinged Expansion Joint

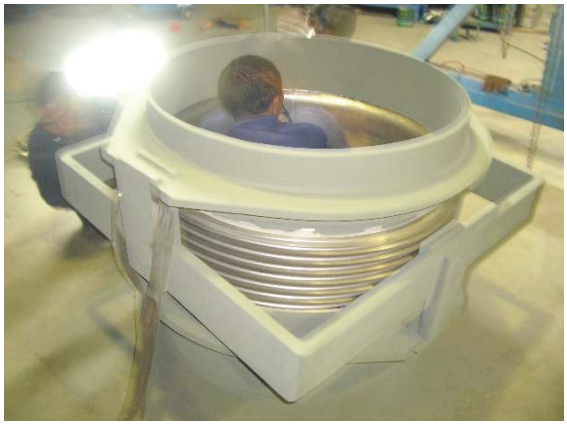
Double hinged expansion joint consist of a two bellows with two pairs of hinges. This type of expansion joint is used to accommodate large amount of lateral deflection in one plane. By providing a special arrangement of hinge box, the universal hinge expansion joint can also accommodate angular movement and lateral deflection in more than one plane.

Gimble Expansion Joint

Gimbal expansion joint is designed to permit angular rotation in any plane by the use of two pairs of hinges affixed to common floating gimbal ring. This expansion joint can consist of a single bellow, where there is no lateral deflection, or two bellows connected by a common connector/pipe spool where it can permit a lateral deflection also. The gimbal ring, hinges and pins must be designed to restrain the pressure thrust loads and other external loads such as dead weight and wind

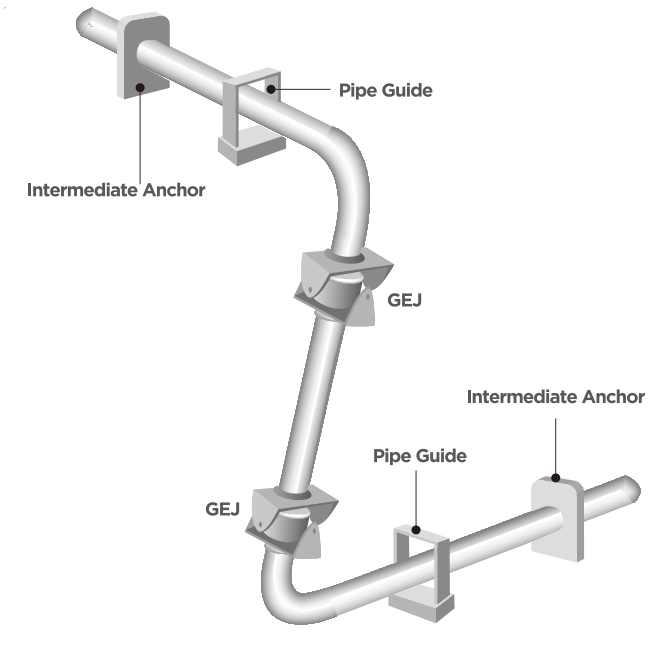
Features

- Permits angular movement in any plane
- Eliminates pressure thrust forces
- No main anchors required
- Transmits loads, so low forces on the pipe anchors
- Prevents torsion or twisting of the expansion joint.
- Internal flow liners for eliminating velocity problem
- Anchors only required to absorb spring forces

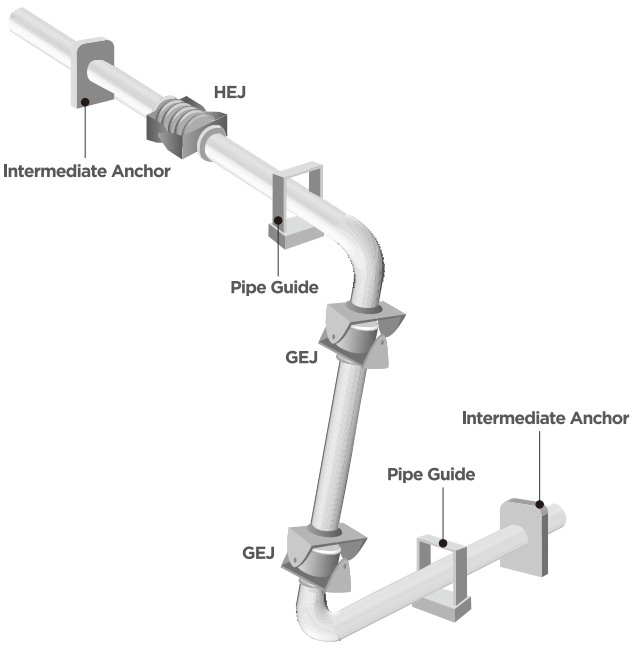


Typical gimbal systems consist of two gimbal expansion joints or two gimbal and one hinged expansion joint

As hinged expansion joints may offer great advantages in one plane applications, gimbal type offer similar advantages in multi-plane systems. The ability of gimbal expansion joint to absorb angular rotation in any plane is most frequently applied by utilizing two such units to absorb lateral deflection. In a two gimbal system, the thermal growth of vertical pipe leg must be absorbed by bending of long horizontal piping and gimbal units absorb the thermal expansion from the two horizontal piping legs. Typical application is shown below.



Where it is impossible or undesirable for the piping to absorb the growth of the offset leg, a system consisting of two gimbal and one hinged expansion joints are to be used as shown below. The gimbal expansion joints function in unison to absorb the combined movements of the upper and lower legs while the hinged expansion joint and the upper gimbal expansion joint act in combination to absorb deflection of the offset leg. Since the expansion of offset leg takes place in one plane only, the use of simpler hinged expansion joint is justified.



Externally Pressurized Expansion Joint

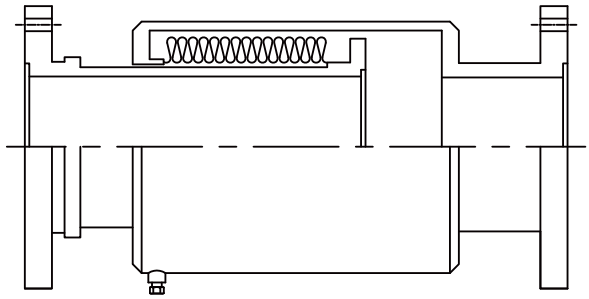
Externally pressurized expansion joints are alternative for standard axial expansion joints. This type of expansion joint is designed so that the pressure is external to the bellows for maximum stability. This unique design makes it possible to allow large amount of axial movements while containing high pressure and high temperature. Kurbo offers 100mm, 150mm and 200mm axial travels with single expansion joint. For larger movement up to 400mm axial travel, dual configuration can be designed. .

Applications

- Replace costly equalizing expansion joint system
- Replace space confining pipe loop
- Replace maintenance required slip joints
- Ideal for long pipe run steam lining that require high pressure/temperature containment with lots of axial movement

Features

- Absorb large amount of axial movements
- Pressure thrust will be transmitted onto the pipeline
- Bellows element is externally pressurized
- Totally enclosed for maximum safety
- Correct anchoring and guiding must be used
- Drains naturally due to gravity
- Available with optional drain port
- Leak-proof and no packing



Pressure is external to bellows for safety

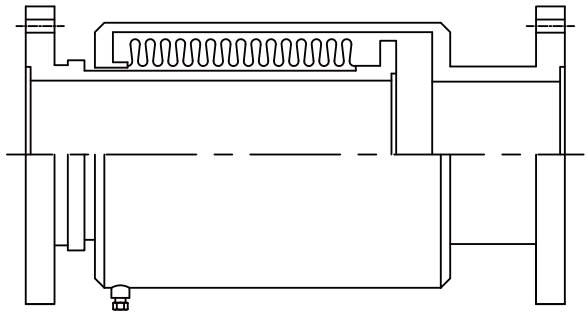
Advantages

- Safety
  The outer cover contains the full line pressure of the system, thus in the event of bellows failure, the media could not escape radially outward and harm personnel in the area.

- No Additional Liner
  Smooth flow eliminates the need for liners

- Self Draining
  Kurbo standard type of externally pressurized expansion joints come with drain port. The sediment or residue collects at the bottom of the casing for easy venting, thus reducing the corrosion problems.

- Maintenance Free/ Improvement over Slip Type
  This type of expansion joint does not require maintenance or need lubrication or repacking, therefore making it ideal in areas where accessibility is limited. This is a distinct improvement over the slip type.



When a pipeline expands, expansion joint compresses, but it stretches the bellows. Bellows remains stable due to external pressure

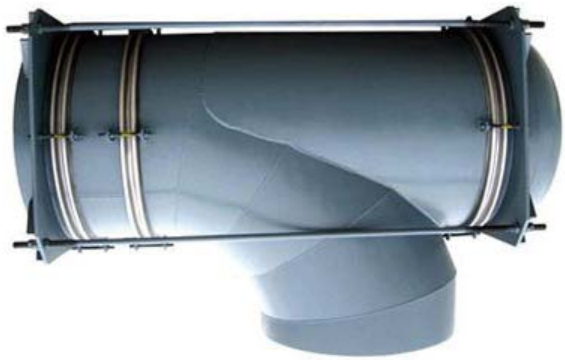
Pressure Balanced Expansion Joint

One of the main problems when installing high pressure bellows particularly with large diameters is that these units must be properly anchored and guided. There are certain installations where this is not practical, nor economical. These types of expansion joints are used in application where main anchoring is not practical and in piping system where pressure loads are critical, and where complex axial and lateral movements are involved with limited space and also seen in piping connecting two load sensitive equipments

Features

- Absorb axial and small amounts of lateral movement
- Eliminate pressure thrust
- Reduce piping costs
- Eliminate main anchors
- No volume change
- Stable at high pressures
- Simple to manufacture

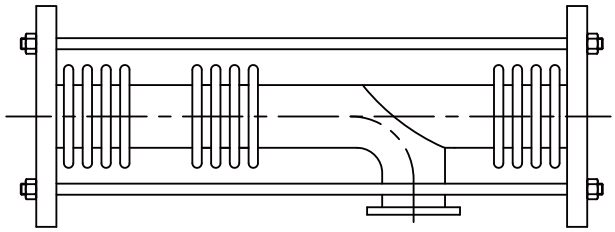
Solution to Many Excessive Loading Problems on Piping and Equipment



Elbow Pressure Balanced Expansion Joint

Elbow pressure balanced expansion joint is designed to restrain and balance the pressure thrust so that main anchor of the pipe or adjacent equipment is not required. This type of expansion joint consists of one or two flow bellows and one balancing bellows. The pressure is balanced by allowing the pressure to pass through a hole in the back of the bend into a sealed bellows having the same effective area.

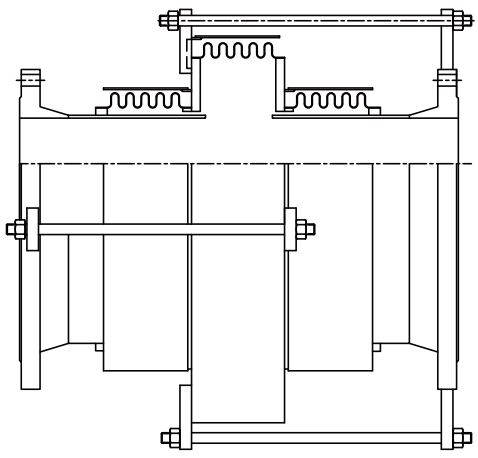
When large amounts of lateral movement are required, we would prefer the use of double pressure balanced joint. In this design two bellows are used in the flow line end of the expansion joint and a single bellows in the balancing end. The balancing bellows is subjected to axial deflection only, while the flow bellows absorbs lateral and/or axial deflections. These bellows can be also used at the bends of the piping or change in direction of piping, where adequate support or main anchors is not possible.



Elbow Pressure Balanced Expansion Joint

In-Line Pressure Balanced Expansion Joint

Inline pressure balanced expansion joint is designed to absorb axial, lateral and angular deflection while restraining the pressure thrust by use of tie rods, without a change of direction in a piping run. This type of expansion joint consists of two flow bellows and one balancing bellow. The effective area of the balancing bellow is twice that of the flow bellow. When flow bellows are compressed by thermal expansion, the balancing bellows extend an equal amount due to tie rod arrangement. As no volume change occurs, the pressure forces remain in balance. So the forces exerted on the pipe anchors or the adjacent equipments is eliminated.



In-Line Pressure Balanced Expansion Joint

Rectangular Expansion Joints

Rectangular type expansion joints are mostly used in low pressure ducting systems including gas turbine exhaust systems, turbine/condenser connections, boiler breaching, flue gas ducts, regenerators, precipitators.

Kurbo also designs and manufactures a wide range of rectangular type metal expansion joints to compensate for axial, lateral and angular movements and any combination of these.

Rectangular and square type expansion joints are designed to suit each customer's individual requirements. Please contact one of our sales engineers for any assistance. These rectangular type joints are available with a large range of options including liners, covers, tie rods, hinges, internal packing, purge and drain points.

Rectangular double expansion joint with round corners

Design Standard

Bellows Type	Max. Working Pressure (bar)	No. of Convolution	Axial Movement (mm)	Overall Length(mm)				Spring Rate (kg/mm)
				L50	L65	L75	L100	
Miter & Round Corner	0.5	1	±20	200	230	250	300	0.032
		2	±40	320	350	370	420	0.016
		3	±60	440	470	490	540	0.011
Camera Corner	0.5	2	±20	200	230	250	300	0.011
		3	±30	250	280	300	350	0.008
		4	±40	400	430	450	500	0.006

Rectangular joint with single miter "V" profile

Kurbo's inspector performing hydrostatic test

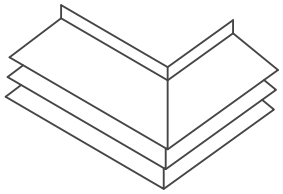
Corner Configuration and Convolution Profile

Rectangular type expansion joints are available in four different corner configurations and two convolution profiles. The application and operating conditions will dictate the correct choice of convolution shape and corner configuration. Typical convolution geometry and corner construction details are shown below.

Corner Configuration

Single Miter Corner

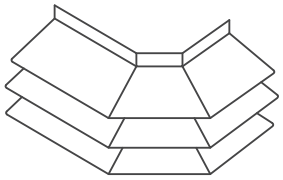
This is the most common and economical type used to compensate for thermal expansion, and can readily be bolted or welded into the connecting duct work. These are preferred in low cycle and vibration free applications.



Single Miter Corner

Double Miter Corner

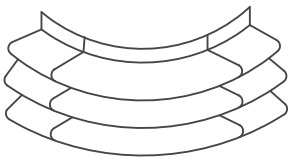
This type is slightly more expensive to manufacture than the single miter design. However, they do provide a greater cycle life under the same set of operating conditions.



Double Miter Corner

Rounded Corner

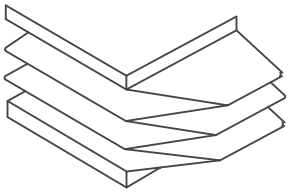
This type is used in applications where vibration and cycle life are important factors. Rounded corners are the most costly to manufacture though, it has advantage of lowering corner stress.



Rounded Corner

Camera Corner

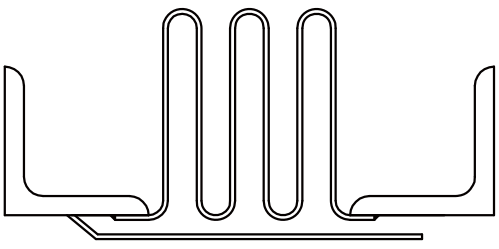
This type is used mainly on low pressure applications. They have good cycle life characteristics and are less costly than the double miter corner design. Camera corners have disadvantage of reduction in movement because convolutions are overlapped at the corner. Kurbo does not recommend this type of joint.



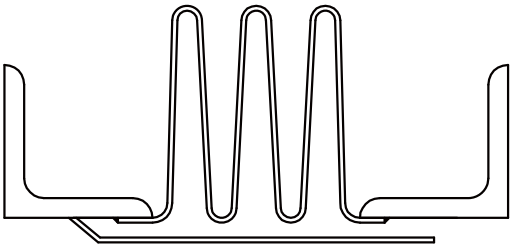
Camera Corner

Convolution Profile

There are two types of convolution: V-shaped and U-shaped. "V' profile is used for low pressure applications and "U" profile is preferred for higher pressure applications up to 2bars. The "V" convolution profile will be supplied with single miter corners, unless otherwise specified. Round corner bellows will always be constructed using the "U" convolution profile.



"U" Profile



"V" Profile

Other Types of Expansion Joint

Diesel (Engine) Expansion Joint

This type of exhaust expansion joints are installed very close to the engines and are subjected to severe conditions of temperature, movements and vibrations. The design of this type of expansion joints requires a thorough expertise due to the challenging demands on them like:

- High temperatures in manifold area, more than 400 deg C
- Absorption of high thermal expansion and severe vibrations, thereby resulting in stress relief
- Temperature peaks according to engine output.
- Compact overall dimensions due to space restrictions
- Easy and quick dismantling and assembly to avoid engine down-time

These expansion joints can be supplied with the required end connections matching to adjacent pipe. Also one flange can be supplied in rotary condition to properly align the flange holes with the mating flange at site of installation

Heat Exchanger Expansion Joint

The expansion joints used as an integral part of heat exchanger are designed to provide flexibility for thermal expansion and also to function as a pressure containing element. The bellows consist of formed flexible elements with multiple or single convolutions and will be of the unreinforced or reinforced type depending upon operating pressure. Bellows are fabricated of austenitic stainless steel, Hastelloy, Inconel etc.

Design of this type of expansion joint complies with the standards of both ASME SectionⅧ and EJMA latest edition.

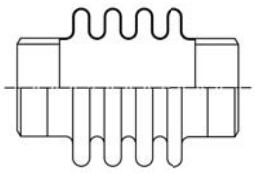
STANDARD EXPANSION JOINT DESIGN DATA

- **Single Bellows Unit**
- **Double Bellows Unit**
- **Externally Pressurized Unit**

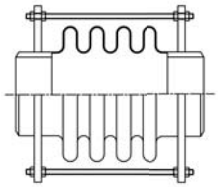
This data sheets list only Kurbo standard metal expansion joints. For a design not included in this catalogue, please contact Kurbo at kurbo@kurbo.co.kr or at 82. 51. 831. 1291
The specifications in this data sheets are subject to change for product improvement

SINGLE BELLOWS UNIT (SEJ, TSEJ, HEJ, GEJ)

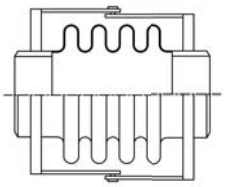
Types of Expansion Joints



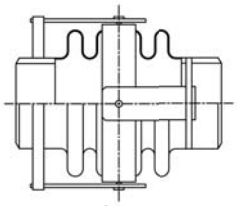
SEJ



TSEJ

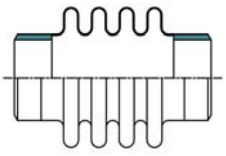


HEJ

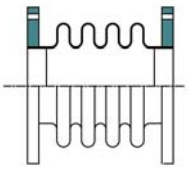


GEJ

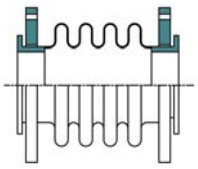
End Connections



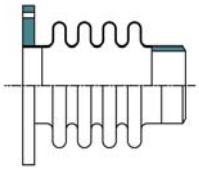
Weld End
WW



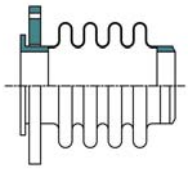
Flange
FF



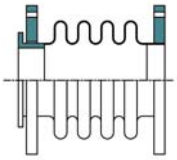
Van Stone Flange
VV



Flange / Weld End
FW



Van Stone / Weld End
VW



Van Stone / Flange
VF

Pressure: 75 PSI / 5 Bar

Nominal Size		Non-Concurrent Movement			Spring Rate			Overall Length and Weight			
								WW		FF	
mm	inch	Axial (mm)	Lateral (mm)	Angular (deg.)	Axial (kg/mm)	Lateral (kg/mm)	Angular (kg·m/deg.)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
50	2	19	2	6	2.6	33.1	0.09	152	0.5	108	3.6
		38	5	10	1.3	4.1	0.05	203	0.5	152	3.6
65	2.5	19	2	6	11.3	48.8	0.13	152	0.9	114	5.0
		38	7	12	5.6	6.1	0.07	203	0.9	165	5.0
80	3	19	3	6	4.3	31.6	0.14	184	1.8	127	4.5
		38	10	12	2.1	3.9	0.07	241	1.8	184	5.0
100	4	20	3	7	8.6	46.1	0.38	229	2.7	152	6.8
		41	12	14	4.3	5.8	0.20	305	3.2	229	6.8
125	5	30	3	5	12.3	82.7	0.74	235	4.1	165	10.0
		61	12	10	6.1	10.3	0.37	318	4.5	248	10.4
150	6	32	3	6	12.2	91.2	1.18	248	5.4	184	11.8
		64	13	12	6.1	11.4	0.59	343	5.9	279	12.2
200	8	36	4	7	21.5	215.6	3.41	254	8.6	203	20.0
		73	16	12	10.8	26.9	1.70	356	9.5	305	20.9
250	10	38	4	6	16.5	261.2	4.15	273	12.2	229	28.6
		76	15	12	8.7	32.6	2.07	394	12.7	349	29.0
300	12	25	2	2	54.1	3757.4	14.83	267	18.6	152	34.0
		41	5	6	32.5	686.3	8.89	311	20.4	197	36.3
350	14	25	1	2	64.3	7222.4	20.16	273	20.9	159	44.0
		41	4	5	38.6	954.7	12.10	318	22.7	203	46.7
400	16	25	2	2	54.2	4888.3	23.04	279	23.6	165	54.9
		44	4	5	32.5	684.7	13.82	330	25.9	216	57.6

Nominal Size		Non-Concurrent Movement			Spring Rate			Overall Length and Weight			
		Axial	Lateral	Angular	Axial	Lateral	Angular	WW		FF	
mm	inch	(mm)	(mm)	(deg.)	(kg/mm)	(kg/mm)	(kg·m/deg.)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
450	18	25	1	2	51.4	6768.4	27.4	279	26.3	178	74.8
		44	3	4	30.9	935.4	16.4	330	29.5	229	78.0
500	20	25	2	2	58.5	9024.6	36.0	292	29.5	203	98.0
		44	4	4	35.1	1264.9	21.6	343	32.7	254	101.6
550	22	25	2	2	61.1	11375.6	44.6	292	31.8	191	97.1
		44	3	4	36.6	1563.9	26.8	343	34.5	241	99.8
600	24	25	2	2	63.2	13630.9	54.7	292	34.9	191	101.6
		44	3	3	37.9	1880.5	32.8	343	38.1	241	104.8
650	26	25	2	2	127.5	14324.5	121.0	292	37.6	191	129.7
		44	3	3	76.5	1976.4	72.6	343	40.8	241	135.2
700	28	25	1	2	137.7	14911.8	131.8	292	40.8	191	134.3
		44	3	3	82.6	260.7	79.1	343	44.5	241	137.9
750	30	25	1	2	147.3	26321.7	188.6	292	44.9	191	161.9
		44	3	3	88.4	3696.7	113.2	343	47.6	241	166.0
800	32	25	2	2	157.0	26979.7	218.0	292	46.3	191	194.1
		44	3	4	94.2	3800.2	130.8	343	50.8	241	211.4
850	34	25	1	1	167.2	37676.4	250.7	292	55.8	191	204.1
		44	3	2	100.3	5846.4	150.5	343	59.9	241	208.7
900	36	25	1	1	172.0	41402.7	306.7	292	59.4	191	249.5
		44	3	2	103.2	6027.2	184.0	343	63.1	241	254.0
950	38	25	1	1	181.6	42437.7	351.4	292	61.2	191	250.4
		44	3	2	108.9	6208.0	210.8	343	66.7	241	255.4
1000	40	25	1	1	191.3	44984.0	430.5	292	66.7	191	264.4
		44	2	2	114.8	8687.8	258.3	343	70.3	241	269.9
1050	42	25	1	2	191.3	58544.8	467.9	292	67.1	191	310.3
		44	2	4	114.8	9193.5	280.8	343	75.8	241	316.2
1100	44	25	1	2	206.3	80872.3	488.7	292	72.6	203	328.9
		44	2	4	123.8	12151.9	293.2	343	76.2	254	332.5
1150	46	25	1	2	215.6	86034.4	518.9	292	84.8	203	328.0
		44	2	4	132.6	13066.6	311.3	343	88.9	254	336.6
1200	48	25	1	2	225.0	91525.9	686.9	292	89.8	216	401.0
		44	2	4	135.0	13484.8	412.1	343	93.9	267	414.6

Part Numbering System Example :

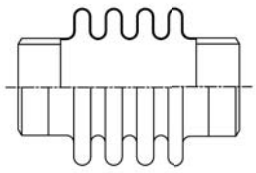
150	SEJ	WW	5	L
ND/DN	TYPE	END	PRESS	LINER

Notes

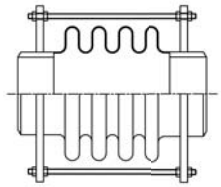
1. Rated cycle life is 5000 cycles for any one movement tabulated per EJMA.
2. To obtain greater movement or cycle life, contact Kurbo
3. Maximum axial extension movement is half of tabulated axial value
4. Standard materials for flange, pipe and attachment are carbon steel
5. Standard bellows materials in SS 304,316 and 321.
6. For higher pressure, temperature, movement and cycle ratings, contact Kurbo.
7. Correct anchoring and guiding must be used.
8. Multi ply, Toroidal bellow are also available.

SINGLE BELLOWS UNIT (SEJ, TSEJ, HEJ, GEJ)

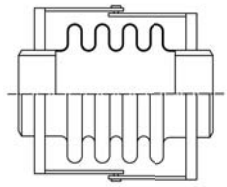
Types of Expansion Joints



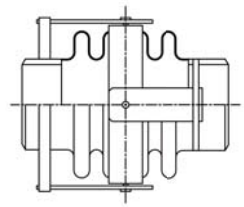
SEJ



TSEJ

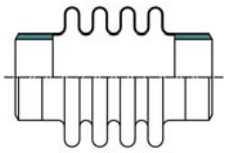


HEJ

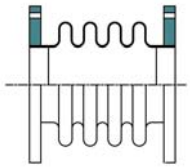


GEJ

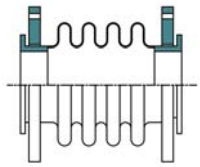
End Connections



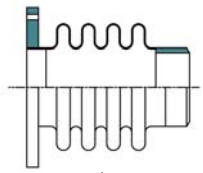
Weld End
WW



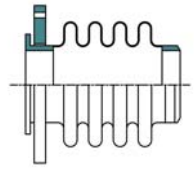
Flange
FF



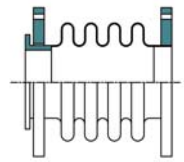
Van Stone Flange
VV



Flange / Weld End
FW



Van Stone / Weld End
VW



Van Stone / Flange
VF

Pressure: 150 PSI / 10 Bar

Nominal Size		Non-Concurrent Movement			Spring Rate			Overall Length and Weight			
		Axial	Lateral	Angular	Axial	Lateral	Angular	WW		FF	
mm	inch	(mm)	(mm)	(deg.)	(kg/mm)	(kg/mm)	(kg·m/deg.)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
50	2	19	2	5	5.1	61.3	0.16	152	0.5	108	4.1
		38	5	10	2.6	7.7	0.08	203	0.5	152	4.1
65	2.5	19	2	5	11.3	83.9	0.25	152	1.4	114	5.9
		38	6	10	5.6	10.5	0.13	203	1.4	165	5.9
80	3	16	2	4	8.9	75.2	0.23	184	2.3	127	7.3
		32	6	8	4.4	9.4	0.12	241	2.3	184	7.7
100	4	17	2	5	17.3	109.3	0.76	229	2.7	152	11.8
		32	8	10	8.6	13.7	0.38	305	3.2	229	12.2
125	5	25	2	5	20.2	156.7	1.38	235	4.5	165	15.0
		51	9	10	10.1	19.6	0.69	318	4.5	248	15.4
150	6	32	3	5	22.5	189.7	2.14	248	5.9	184	19.1
		64	10	10	11.3	23.7	1.07	343	6.4	279	19.1
200	8	32	2	5	35.0	434.0	5.60	254	10.0	203	30.8
		64	9	9	17.5	54.3	2.80	356	10.9	305	31.8
250	10	32	3	4	32.0	571.9	7.56	273	13.6	229	43.5
		64	12	9	16.0	71.5	3.78	394	14.5	349	44.5
300	12	21	1	2	93.8	9506.6	25.61	267	19.5	184	64.0
		34	4	4	56.3	1395.1	15.37	311	21.8	229	66.7
350	14	21	1	2	109.8	11863.6	34.56	273	21.8	197	88.0
		35	3	4	65.9	1782.4	20.74	318	24.5	241	91.2
400	16	19	2	2	93.8	11280.7	38.88	279	24.5	216	96.2
		38	3	4	56.3	1369.4	23.33	330	27.7	267	99.8

Nominal Size		Non-Concurrent Movement			Spring Rate			Overall Length and Weight			
		Axial	Lateral	Angular	Axial	Lateral	Angular	WW		FF	
mm	inch	(mm)	(mm)	(deg.)	(kg/mm)	(kg/mm)	(kg·m/deg.)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
450	18	19	1	2	150.0	22279.4	77.8	279	29.0	222	127.9
		38	3	4	90.0	3118.1	46.7	330	33.6	273	132.9
500	20	19	1	1	166.1	29799.9	103.7	292	32.2	248	156.0
		38	3	3	99.6	4130.6	62.2	343	37.2	298	161.5
550	22	19	1	1	169.8	36377.0	125.3	292	37.6	254	179.2
		38	3	3	101.9	4998.5	75.2	343	43.1	305	184.6
600	24	19	1	2	174.1	43712.8	148.3	292	41.3	267	212.3
		38	3	3	104.5	5962.9	89.0	343	47.6	318	218.6
650	26	19	1	2	187.5	45024.2	151.8	292	44.5	Customer's Specification	
		38	3	3	112.5	6207.2	91.1	343	51.3		
700	28	19	1	1	200.9	46825.1	163.9	292	48.5	Customer's Specification	
		38	3	3	120.5	6982.6	98.3	343	55.8		
750	30	19	1	1	295.7	52643.4	377.3	292	51.7	Customer's Specification	
		38	3	3	177.4	7393.3	226.4	343	59.4		
800	32	19	1	1	313.9	53906.9	399.9	292	72.1	Customer's Specification	
		38	2	3	188.4	7615.1	240.0	343	88.9		
850	34	19	1	1	334.3	81221.3	459.9	292	70.8	Customer's Specification	
		38	2	2	200.6	11692.7	275.9	343	81.6		
900	36	19	1	1	344.0	84605.5	613.4	292	72.6	Customer's Specification	
		38	2	2	206.4	12054.4	368.1	343	81.6		
950	38	19	1	1	363.2	86382.2	773.2	292	79.8	Customer's Specification	
		38	2	2	217.9	12331.6	463.9	343	86.2		
1000	40	19	1	1	382.5	103371.0	842.3	292	84.4	Customer's Specification	
		38	2	2	229.5	19289.4	505.4	343	90.7		
1050	42	19	1	1	393.8	119007.7	935.9	292	86.6	Customer's Specification	
		38	2	2	236.3	18370.8	561.5	343	95.3		
1100	44	19	1	1	412.5	144527.2	949.4	292	83.5	Customer's Specification	
		38	2	2	247.5	24590.9	569.6	343	99.8		
1150	46	28	1	1	424.9	160586.4	959.4	292	89.8	Customer's Specification	
		44	2	2	254.9	26232.8	575.6	343	104.3		
1200	48	19	1	1	450.0	166410.8	1082.9	292	98.9	Customer's Specification	
		38	1	2	270.0	26969.6	649.7	343	115.7		

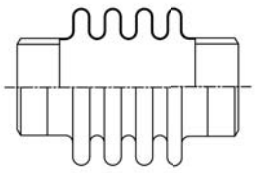
Part Numbering System Example : 150 ND/DN | SEJ TYPE | WW END | 10 PRESS | L LINER

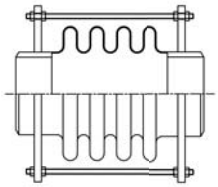
Notes

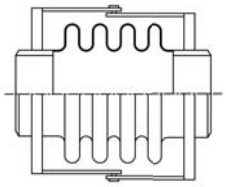
1. Rated cycle life is 5000 cycles for any one movement tabulated per EJMA.
2. To obtain greater movement or cycle life, contact Kurbo
3. Maximum axial extension movement is half of tabulated axial value
4. Standard materials for flange, pipe and attachment are carbon steel
5. Standard bellows materials in SS 304,316 and 321.
6. For higher pressure, temperature, movement and cycle ratings, contact Kurbo.
7. Correct anchoring and guiding must be used.
8. Multi ply, Toroidal bellow are also available.

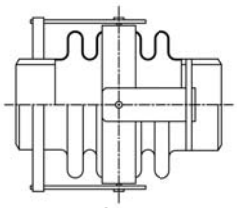
SINGLE BELLOWS UNIT (SEJ, TSEJ, HEJ, GEJ)

Types of Expansion Joints

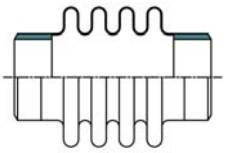

SEJ

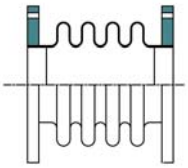

TSEJ

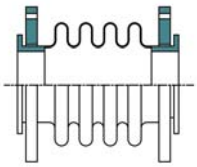

HEJ

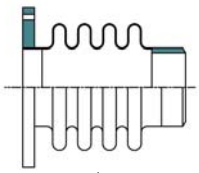

GEJ

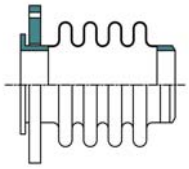
End Connections

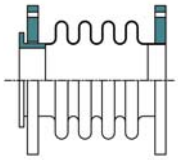

Weld End
WW


Flange
FF


Van Stone Flange
VV


Flange / Weld End
FW


Van Stone / Weld End
VW


Van Stone / Flange
VF

Pressure: 300 PSI / 20 Bar

Nominal Size		Non-Concurrent Movement			Spring Rate			Overall Length and Weight			
		Axial	Lateral	Angular	Axial	Lateral	Angular	WW		FF	
mm	inch	(mm)	(mm)	(deg.)	(kg/mm)	(kg/mm)	(kg·m/deg.)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
50	2	16	1	4	13.7	101.7	0.37	152	0.5	127	5.9
		32	5	8	6.9	12.7	0.18	203	0.9	165	5.9
65	2.5	16	1	4	29.6	122.0	0.55	152	1.4	127	9.1
		32	4	8	14.8	15.2	0.28	203	1.8	178	9.5
80	3	13	1	3	44.0	313.4	1.11	184	2.3	152	12.2
		25	4	6	22.0	39.2	0.55	241	2.3	210	12.7
100	4	13	2	4	32.2	235.4	1.47	229	3.2	178	20.4
		25	6	8	16.1	29.4	0.74	305	3.6	254	20.9
125	5	19	2	3	34.6	340.9	2.63	235	5.0	191	27.2
		38	6	6	17.3	42.6	1.31	318	5.4	273	27.7
150	6	19	2	4	41.8	349.6	3.99	248	6.4	210	37.6
		38	7	8	20.9	43.7	1.99	343	6.8	305	38.1
200	8	19	2	4	102.9	1491.5	16.54	254	11.8	235	58.1
		38	6	7	51.4	185.8	8.27	356	13.2	337	59.4
250	10	19	2	3	93.2	1861.7	21.77	273	15.9	267	80.3
		38	6	7	46.6	232.7	10.89	394	17.7	387	82.1
300	12	16	1	1	157.0	18883.0	43.20	267	20.4	216	111.1
		25	3	3	94.2	2780.5	25.92	311	23.6	260	115.2
350	14	16	1	2	128.6	13912.9	41.05	273	24.5	235	159.7
		25	2	4	77.1	1912.6	24.60	318	28.6	279	164.7
400	16	19	1	2	109.5	13160.9	44.64	279	27.7	254	183.7
		38	3	4	65.7	1555.8	26.78	330	32.7	305	189.6

Nominal Size		Non-Concurrent Movement			Spring Rate			Overall Length and Weight			
		Axial	Lateral	Angular	Axial	Lateral	Angular	WW		FF	
mm	inch	(mm)	(mm)	(deg.)	(kg/mm)	(kg/mm)	(kg·m/deg.)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
450	18	19	1	2	180.0	25287.4	93.2	279	33.6	267	243.1
		38	2	4	108.0	3439.5	55.9	330	40.8	318	250.8
500	20	19	1	1	200.4	32902.1	124.4	292	39.9	292	296.2
		38	3	4	120.2	4580.7	74.6	343	47.6	343	304.8
550	22	19	1	1	340.2	64804.2	249.1	292	40.8	305	350.2
		38	2	3	204.1	9193.5	149.5	343	48.1	356	357.4
600	24	19	1	1	348.2	87425.7	298.0	292	44.5	305	446.8
		38	2	3	208.9	11941.8	178.8	343	52.2	356	454.5

Part Numbering System Example :

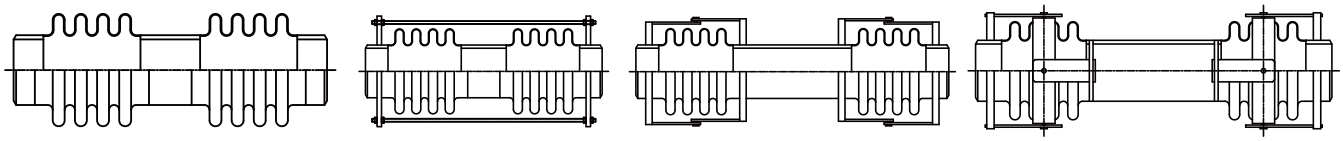
150	SEJ	WW	20	L
ND/DN	TYPE	END	PRESS	LINER

Notes

1. Rated cycle life is 5000 cycles for any one movement tabulated per EJMA.
2. To obtain greater movement or cycle life, contact Kurbo
3. Maximum axial extension movement is half of tabulated axial value
4. Standard materials for flange, pipe and attachment are carbon steel
5. Standard bellows materials in SS 304,316 and 321.
6. For higher pressure, temperature, movement and cycle ratings, contact Kurbo.
7. Correct anchoring and guiding must be used.
8. Multi ply, Toroidal bellow are also available.

DOUBLE BELLOWS UNIT (UEJ, TUEJ, DHEJ, DGEJ)

Types of Expansion Joints



UEJ TUEJ DHEJ DGEJ

Pressure: 75 PSI / 5 Bar

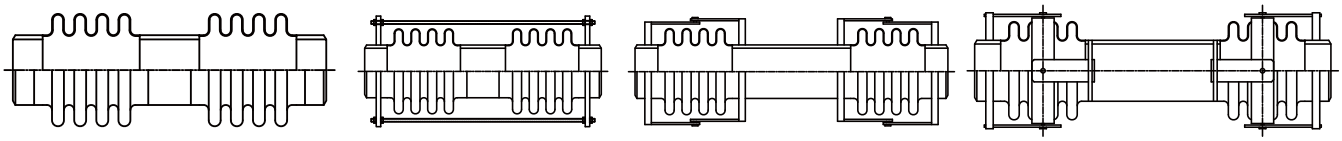
Nominal Size		Movement		Spring Rate		Overall Length and Weight			
						WW		FF	
mm	inch	Axial (mm)	Lateral (mm)	Axial (kg/mm)	Lateral (kg/mm)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
50	2	38	76	1.3	0.1	495	2.7	394	6.8
65	2.5	38	66	5.6	0.2	508	3.9	406	10.0
80	3	38	89	2.1	0.1	597	5.9	508	12.5
100	4	41	102	3.9	0.3	610	8.6	559	17.7
125	5	61	94	6.1	0.7	660	11.8	584	22.2
150	6	64	79	6.1	0.9	686	15.9	622	27.7
200	8	73	86	10.8	2.6	762	28.1	648	44.9
250	10	76	76	8.2	3.1	699	39.0	635	63.1
300	12	51	76	27.1	6.3	775	54.4	711	92.1
350	14	51	69	32.1	8.6	775	60.3	711	118.4
400	16	51	69	27.1	7.1	864	72.6	800	149.7
450	18	51	69	25.7	8.6	864	81.6	813	158.8
500	20	51	69	29.2	10.2	914	97.5	864	181.4
550	22	51	64	30.5	12.0	914	115.7	889	240.4
600	24	51	58	31.6	14.5	914	117.9	889	274.4
650	26	51	64	63.8	42.0	1245	143.3	1130	229.5
700	28	51	64	68.8	47.3	1245	147.9	1130	242.2
750	30	51	64	73.7	28.4	1143	181.4	1143	421.8
800	32	51	64	78.5	27.2	1143	208.7	1143	526.2
850	34	51	53	83.6	25.7	1143	222.3	1143	553.4
900	36	51	53	86.0	46.3	1143	235.9	1143	544.3
950	38	51	56	90.8	47.8	1245	276.7	1219	585.1
1000	40	51	56	95.6	49.3	1245	317.5	1143	589.7
1050	42	51	51	95.7	58.8	1219	294.8	1245	900.4
1100	44	51	51	103.1	65.7	1295	328.0	1321	950.3
1150	46	51	51	107.8	69.1	1295	344.3	1321	975.2
1200	48	51	51	112.5	72.5	1295	360.6	1321	1000.2

Notes

1. Rated cycle life is 5000 cycles for any one movement tabulated per EJMA.
2. To obtain greater movement or cycle life, contact Kurbo
3. Maximum axial extension movement is half of tabulated axial value
4. Standard materials for flange, pipe and attachment are carbon steel
5. Standard bellows materials in SS 304,316 and 321.
6. For higher pressure, temperature, movement and cycle ratings, contact Kurbo.
7. Correct anchoring and guiding must be used.
8. Multi ply, Toroidal bellow are also available.

DOUBLE BELLOWS UNIT (UEJ, TUEJ, DHEJ, DGEJ)

Types of Expansion Joints



UEJ TUEJ DHEJ DGEJ

Pressure: 150 PSI / 10 Bar

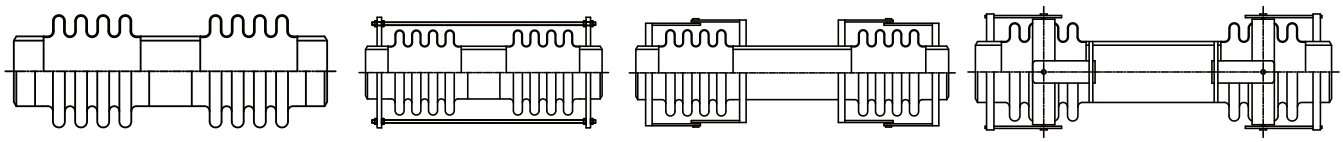
Nominal Size		Movement		Spring Rate		Overall Length and Weight			
						WW		FF	
mm	inch	Axial (mm)	Lateral (mm)	Axial (kg/mm)	Lateral (kg/mm)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
50	2	38	58	2.6	0.3	495	2.7	394	6.8
65	2.5	38	51	5.6	0.4	508	3.9	406	10.0
80	3	31	53	4.4	0.3	597	5.9	508	12.5
100	4	31	56	8.6	0.7	610	9.1	559	19.1
125	5	51	69	10.1	1.3	660	12.7	584	23.1
150	6	64	61	11.3	1.7	686	16.8	622	28.1
200	8	64	53	17.5	4.5	737	29.9	635	46.7
250	10	64	51	16.0	6.0	699	41.7	610	66.2
300	12	42	51	46.9	11.1	762	57.2	699	97.5
350	14	42	46	54.9	15.2	762	63.1	686	122.0
400	16	38	46	46.9	12.7	838	77.1	787	154.2
450	18	38	51	75.0	25.4	838	90.7	800	165.6
500	20	38	53	83.0	27.9	889	108.9	864	220.0
550	22	38	48	84.9	34.2	889	120.2	864	249.5
600	24	38	46	87.1	40.9	889	131.5	876	288.0
650	26	38	51	93.8	49.1	1168	175.1	1092	338.4
700	28	38	51	100.5	52.1	1245	193.2	1181	367.9
750	30	38	56	147.9	56.8	1143	224.5	1143	467.2
800	32	38	56	157.0	58.3	1143	256.3	1143	551.1
850	34	38	48	167.2	55.0	1245	272.2	1143	592.9
900	36	38	48	172.0	92.6	1245	288.0	1143	635.0
950	38	38	51	181.6	98.5	1245	323.4	1207	734.8
1000	40	38	51	191.3	104.5	1245	358.3	1207	834.6
1050	42	38	46	196.5	125.0	1321	353.8	1245	870.9
1100	44	38	46	206.3	136.4	1397	391.5	1321	972.1
1150	46	38	46	212.5	142.2	1397	386.5	1321	1022.4
1200	48	38	46	225.0	147.9	1397	428.7	1321	1072.8

Notes

1. Rated cycle life is 5000 cycles for any one movement tabulated per EJMA.
2. To obtain greater movement or cycle life, contact Kurbo
3. Maximum axial extension movement is half of tabulated axial value
4. Standard materials for flange, pipe and attachment are carbon steel
5. Standard bellows materials in SS 304,316 and 321.
6. For higher pressure, temperature, movement and cycle ratings, contact Kurbo.
7. Correct anchoring and guiding must be used.
8. Multi ply, Toroidal bellow are also available.

DOUBLE BELLOWS UNIT (UEJ, TUEJ, DHEJ, DGEJ)

Types of Expansion Joints



UEJ TUEJ DHEJ DGEJ

Pressure: 300 PSI / 20 Bar

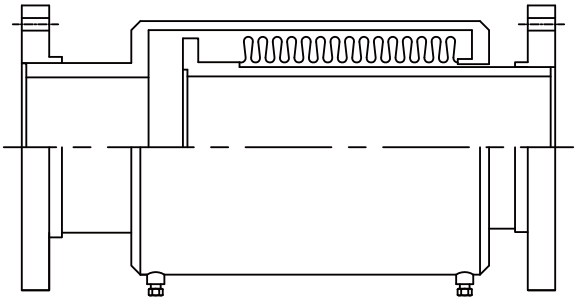
Nominal Size		Movement		Spring Rate		Overall Length and Weight			
						WW		FF	
mm	inch	Axial (mm)	Lateral (mm)	Axial (kg/mm)	Lateral (kg/mm)	OAL (mm)	WT (kg)	OAL (mm)	WT (kg)
50	2	31	38	6.9	0.8	495	3.6	406	8.2
65	2.5	31	38	14.8	1.0	508	3.9	432	11.8
80	3	25	36	22.0	1.3	584	6.4	508	16.3
100	4	25	46	16.1	1.3	635	10.0	584	28.6
125	5	38	43	17.3	2.4	686	12.7	610	35.8
150	6	38	48	20.9	3.3	686	17.7	635	46.3
200	8	38	43	51.4	13.5	724	33.6	660	75.8
250	10	38	41	46.6	17.9	686	47.2	635	104.8
300	12	42	43	78.5	19.4	749	60.8	711	148.3
350	14	31	61	64.3	17.1	775	83.9	737	211.8
400	16	38	74	32.9	14.4	851	99.8	838	272.2
450	18	38	64	90.0	30.1	864	124.7	838	331.1
500	20	38	43	100.2	33.7	914	145.2	914	399.2
550	22	38	48	170.1	69.0	889	161.0	914	455.9
600	24	38	46	174.1	82.4	889	174.6	927	591.9

Part Numbering System Example : 200 ND/DN | UEJ TYPE | FF END | 20 PRESS | L LINER

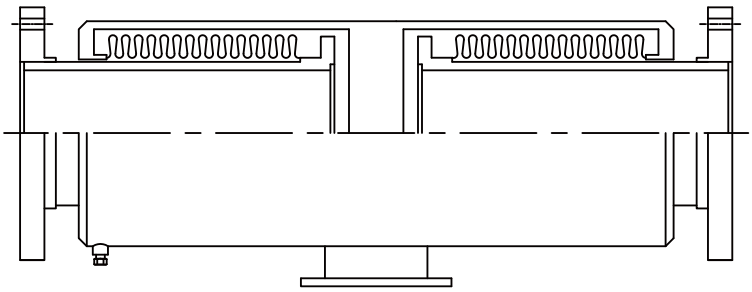
Notes

1. Rated cycle life is 5000 cycles for any one movement tabulated per EJMA.
2. To obtain greater movement or cycle life, contact Kurbo
3. Maximum axial extension movement is half of tabulated axial value
4. Standard materials for flange, pipe and attachment are carbon steel
5. Standard bellows materials in SS 304,316 and 321.
6. For higher pressure, temperature, movement and cycle ratings, contact Kurbo.
7. Correct anchoring and guiding must be used.
8. Multi ply, Toroidal bellow are also available.

EXTERNALLY PRESSURIZED EXPANSION JOINT



SXP



DXP

Pressure: 150 PSI / 10 Bar					
Nominal Size		Type	Axial Movement (mm)	Length FF & WW (mm)	Pressure Thrust (kg)
mm	inch				
50	2	SXP	100	700	918
			150	900	918
			200	1100	918
		DXP	300	1800	918
			400	2200	918
65	2.5	SXP	100	700	1224
			150	900	1224
			200	1100	1224
		DXP	300	1800	1224
			400	2200	1224
80	3	SXP	100	700	1530
			150	900	1530
			200	1100	1530
		DXP	300	1800	1530
			400	2200	1530
100	4	SXP	100	700	2447
			150	900	2447
			200	1100	2447
		DXP	300	1800	2447
			400	2200	2447
125	5	SXP	100	700	3671
			150	900	3671
			200	1100	3671
		DXP	300	1800	3671
			400	2200	3671
150	6	SXP	100	700	6526
			150	900	6526
			200	1100	6526
		DXP	300	1800	6526
			400	2200	6526

Pressure: 300 PSI / 20 Bar					
Nominal Size		Type	Axial Movement (mm)	Length FF & WW (mm)	Pressure Thrust (kg)
mm	inch				
50	2	SXP	100	700	1835
			150	900	1835
			200	1100	1835
		DXP	300	1800	1835
			400	2200	1835
65	2.5	SXP	100	700	2447
			150	900	2447
			200	1100	2447
		DXP	300	1800	2447
			400	2200	2447
80	3	SXP	100	700	3059
			150	900	3059
			200	1100	3059
		DXP	300	1800	3059
			400	2200	3059
100	4	SXP	100	700	4895
			150	900	4895
			200	1100	4895
		DXP	300	1800	4895
			400	2200	4895
125	5	SXP	100	700	7342
			150	900	7342
			200	1100	7342
		DXP	300	1800	7342
			400	2200	7342
150	6	SXP	100	700	13052
			150	900	13052
			200	1100	13052
		DXP	300	1800	13052
			400	2200	13052

Pressure: 150 PSI / 10 Bar					
Nominal Size		Type	Axial Movement (mm)	Length FF & WW (mm)	Pressure Thrust (kg)
mm	inch				
200	8	SXP	100	700	9585
			150	900	9585
			200	1100	9585
		DXP	300	1800	9585
			400	2200	9585
250	10	SXP	100	700	14684
			150	900	14684
			200	1100	14684
		DXP	300	1800	14684
			400	2200	14684

Pressure: 300 PSI / 20 Bar					
Nominal Size		Type	Axial Movement (mm)	Length FF & WW (mm)	Pressure Thrust (kg)
mm	inch				
200	8	SXP	100	700	19170
			150	900	19170
			200	1100	19170
		DXP	300	1800	19170
			400	2200	19170
250	10	SXP	100	700	29367
			150	900	29367
			200	1100	29367
		DXP	300	1800	29367
			400	2200	29367

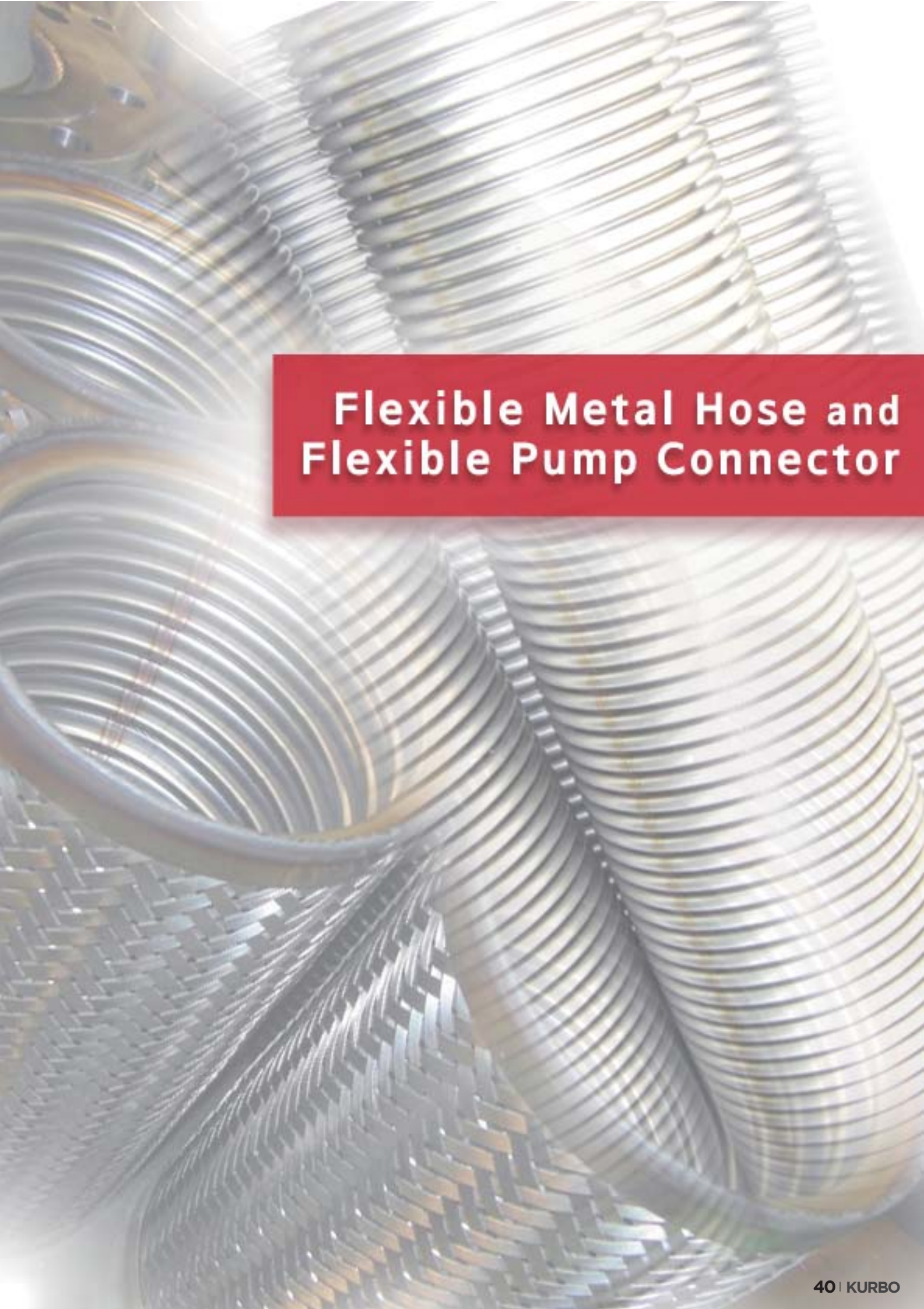
Part Numbering System Example : **150-SXP-WW-10-100-D**

150	SXP	WW	10	100	D
ND	TYPE	END	PRESS	MOVT	OPTION

D: Drain connection
P: Purge connection

Notes

1. Rated cycle life is 5000 cycles for non-concurrent movement tabulated per EJMA.
2. Maximum test pressure is 1.5 times the rated pressure
3. For special component, please specify and contact Kurbo



Flexible Metal Hose and Flexible Pump Connector

FLEXIBLE METAL HOSE

Flexible metal hoses are widely used in systems like water, steam, hot oil and gas with their resistance to pressure and excellent flexibility:

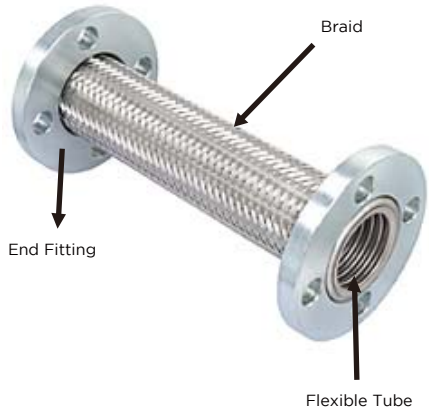
- To absorb heat or pressure-induced expansion of piping system
- To correct problems of misalignment.
- To provide flexibility in manual handling operations.
- To compensate for regular or constant movement.
- To absorb vibration and noise.

Typical Construction of Flexible Metal Hose

Flexible metal hose is generally fabricated of three parts: flexible tube, braid and end fittings such as flanges, unions, nipples, sockets

Flexible Tube

A flexible metal tube, made of stainless steel thin wall pipe, has a good flexibility, high strength, heat resistance and pressure containment. There are two types of flexible tubes-Spiral type and Annular type. Spiral type flexible tube is a helically corrugated hose and is usually used in medium and low pressure application. Annular type flexible tube has annular corrugation so that it does not tend to be twisted when subjected to elongation and contraction. Consequently it is suitable for use in high pressure application.



Braid

A flexible wire sheath surrounding a metal hose that prevents the hose from elongation due to internal pressure. Braid is composed of a number of wires wrapped helically around the hose while at the same time going under and over each other in a basket weave fashion.

End Fitting

Extensive range of end fitting is available. End fitting may have male or female threads. In addition to conventional flanges, unions, nipples, special designs or custom connectors are available. The attachment method: welding, soldering, silver brazing or mechanical, is determined by the appropriate type of hose, alloy and temperature. Contact Kurbo for custom fitting information

Specification of Flexible Tube

Spiral Tube

Spirally corrugated tube, fabricated of stainless steel type 304, 316L, 321 and other alloys.

Nominal Size		Dimension(mm)			Bend Redius (mm)	Weight(kg/m)		Burst Pressure (bar)
DN	Inch	ID	OD	Thick.		Tube	Braid	
8	1/4	7.0	11.7	0.20	80	0.13	0.10	570
10	3/8	10.2	15.6	0.25	95	0.20	0.15	350
15	1/2	12.3	18.6	0.30	130	0.23	0.20	280
20	3/4	18.9	26.0	0.30	160	0.30	0.30	200
25	1	25.4	33.2	0.30	190	0.55	0.30	160
32	1 1/4	31.0	41.5	0.40	240	0.78	0.33	140
40	1 1/2	38.0	49.0	0.40	290	1.13	0.63	110
50	2	50.0	62.0	0.40	340	1.45	0.70	100
65	2 1/2	62.7	78.1	0.40	395	1.88	0.81	80
80	3	76.2	92.5	0.50	440	2.50	0.85	62
100	4	97.0	121.0	0.50	480	3.60	1.12	52

Note : Burst pressure is based on braided tube

Annular Tube

Annularly corrugated tube, fabricated of stainless steel type 304, 316L, 321 and other alloys

Nominal Size		Dimension(mm)			Bend Redius (mm)	Weight(kg/m)		Burst Pressure (bar)
DN	Inch	ID	OD	Thick.		Tube	Braid	
25	1	27.0	38.5	0.35	170	0.48	0.50	170
32	1 1/4	32.5	46.5	0.35	180	0.60	0.63	160
40	1 1/2	41.0	54.5	0.35	200	0.65	0.67	120
50	2	53.5	70.5	0.35	225	1.30	0.75	120
65	2 1/2	67.0	86.5	0.40	250	1.74	0.80	90
80	3	78.5	100.5	0.40	275	2.06	1.10	65
100	4	103.0	126.5	0.40	350	2.90	1.30	55
125	5	128.5	153.5	0.45	425	3.60	1.60	45
150	6	152.0	180.5	0.45	500	4.60	1.90	38
200	8	203.0	233.0	0.50	750	8.00	3.20	35
250	10	251.0	285.0	0.60	900	11.90	4.00	27
300	12	300.5	336.5	0.70	1200	12.40	6.00	22

Note : Burst pressure is based on braided tube

FLEXIBLE PUMP CONNECTOR

Kurbo flexible pump connectors are primarily used to absorb noise and vibration transmitted by mechanical equipments like pumps and compressors. The flexible metal pump connectors are of all steel construction, thus they permit high pressure and high temperature service while isolating mechanical vibration and reducing system noise to provide perfect pump vibration isolation.

Kurbo flexible metal pump connectors are available in two (2) types: Braided pump connector (known as flexible joint) and Bellows type pump connector.

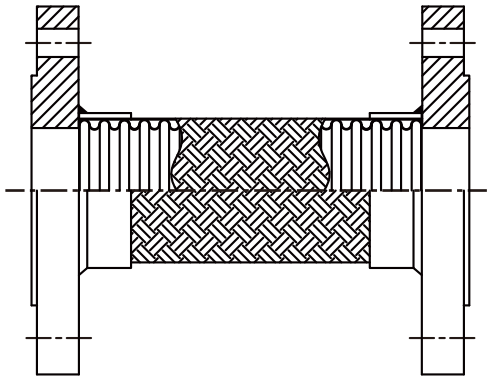
Braided Pump Connector

Construction

Constructed of stainless steel hose and braid, carbon steel flat faced plate flanges as a standard.

Features

- Absorbs mechanical equipment vibrations in the connected piping
- Noise associated with the vibration is eliminated
- Lowers overall operating costs
- Compensates for minor misalignment, resulting in less stresses
- Allows operation at elevated temperature.



Nominal Size		Length	Braid	Max. Working Pressure(bar)		Approx. Weight(kg)
DN	Inch	(L)		Single Braided	Double Braided	
25	1	200	WIRE	24	45	4
32	1 1/4	200	WIRE	20	35	5
40	1 1/2	230	WIRE	20	35	5
50	2	230	WIRE	20	35	6
65	2 1/2	230	WIRE	15	25	8
80	3	230	WIRE	15	25	9
100	4	230	WIRE	15	25	13
125	5	280	WIRE	10	20	16
150	6	280	WIRE	10	20	20
200	8	300	RIBON	10	20	30
250	10	300	RIBON	10	20	50
300	12	300	RIBON	10	20	70

1. Can be manufactured in different lengths

Bellows Type Pump Connector

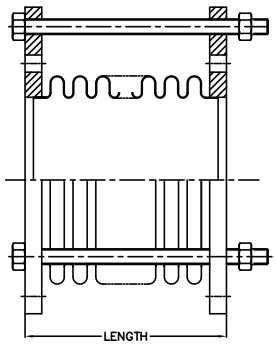
In addition to the benefit and advantage of the braided pump connector, the bellows pump connectors provide the ultimate flexibility combined with low spring rate and internal dampening of vibration which results in pump vibration isolation and high service life without compromising pressure resistance strength.
This type offers ideal solution to vibration and motion isolation when space is at a premium

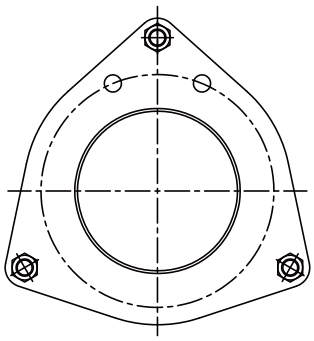
Construction

Constructed of multiple layers of stainless steel bellows, carbon steel flat faced flanges. Isolation of the carbon steel flanges from the flow media can be achieved by the use of vanstone flanges. Tie rods are designed to absorb the full pressure thrust load generated by the internal pressure.

Features

- Absorbs thermal growth motion
- Absorbs mechanical equipment vibrations in the connected piping
- Eliminates noise associated with the vibration
- Provides high flexibility and longer service life due to multiply construction of bellows
- Compensates for minor misalignment, resulting in less stresses
- Allows operation at elevated temperature.



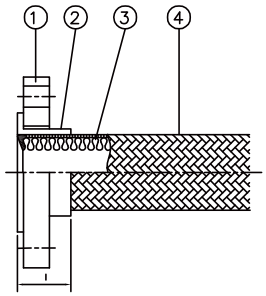


Nominal Size		Overall Length (mm)		Maximum Movement (mm)			Approx. Weight	
DN	Inch	KS / JIS 10K	KS / JIS 20K	Axial Comp.	Axial Ext.	Lateral	KS / JIS 10K	KS / JIS 20K
25	1	100	110	12	5	5	3.3	3.9
32	1.25	100	110	12	5	5	4.2	4.5
40	1.5	100	110	12	5	5	4.4	4.7
50	2	120	130	12	5	5	5.7	5.9
65	2.5	120	130	12	5	5	7.3	7.5
80	3	120	130	12	5	5	7.5	10.5
100	4	120	130	12	5	5	8.6	13.1
125	5	130	140	12	5	5	12.5	20.9
150	6	140	150	12	5	5	16.1	26.2
200	8	200	220	12	5	5	20.1	34.1
250	10	200	220	12	5	5	33.9	58.0
300	12	200	230	12	5	5	38.0	67.5
350	14	200	230	12	5	5	47.6	94.1
400	16	200	240	12	5	5	63.1	126.2
450	18	200	240	12	5	5	79.0	163.5
500	20	200	240	12	5	5	81.6	214.4

1. Can be manufactured in different lengths and different flange
2. Movement are non concurrent movements

FLEXIBLE METAL HOSE CONNECTION

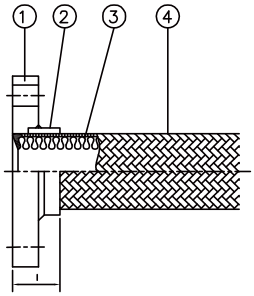
WLF-1



① Loose Flange / CS
② Stub End / CS or SS304
③ Flexible Tube / SS304
④ Braid / SS304

DN	Inch	l	Flange
10	3/8	19	Flange dimensions to the standards such as KS, JIS, ANSI, AWWA, BS, DIN etc.
15	1/2	23	
20	3/4	28	
25	1	33	
32	1 1/4	35	
40	1 1/2	39	
50	2	48	
65	2 1/2	51	
80	3	53	
100	4	60	
125	5	66	
150	6	70	
200	8	75	
250	10	80	
300	12	90	

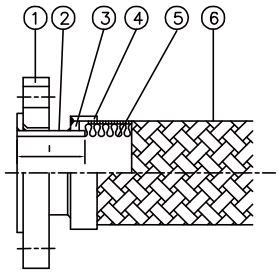
WFF-1



① Fixed Flange / CS
② Braid Band / SS304
③ Flexible Tube / SS304
④ Braid / SS304

DN	Inch	l	Flange
10	3/8	16	Flange dimensions to the standards such as KS, JIS, ANSI, AWWA, BS, DIN etc.
15	1/2	20	
20	3/4	25	
25	1	30	
32	1 1/4	32	
40	1 1/2	36	
50	2	45	
65	2 1/2	47	
80	3	49	
100	4	56	
125	5	62	
150	6	66	
200	8	71	
250	10	75	
300	12	85	

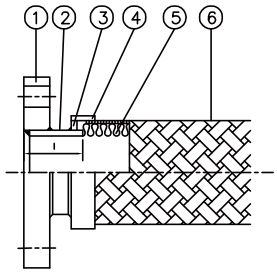
WLF-2



① Loose Flange / CS
② Stub End / CS or SS304
③ Neck Ring / CS or SS304
④ Braid Band / SS304
⑤ Flexible Tube / SS304
⑥ Braid / SS304

DN	Inch	l	Flange
50	2	65	Flange dimensions to the standards such as KS, JIS, ANSI, AWWA, BS, DIN etc.
65	2 1/2	65	
80	3	65	
100	4	70	
125	5	75	
150	6	85	
200	8	107	
250	10	118	
300	12	123	

WFF-2

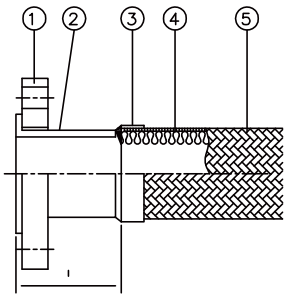


① Fixed Flange / CS
② End Pipe / CS or SS304
③ Neck Ring / CS or SS304
④ Braid Band / SS304
⑤ Flexible Tube / SS304
⑥ Braid / SS304

DN	Inch	l	Flange
50	2	65	Flange dimensions to the standards such as KS, JIS, ANSI, AWWA, BS, DIN etc.
65	2 1/2	65	
80	3	65	
100	4	70	
125	5	75	
150	6	85	
200	8	102	
250	10	113	
300	12	118	

Note: Specifications subject to change without notice

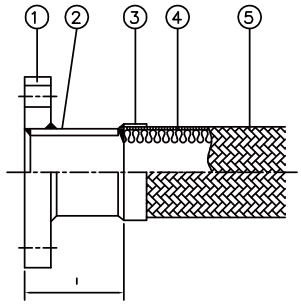
WLF-3



① Loose Flange / CS
② Stub End / CS or SS304
③ Braid Band / SS304
④ Flexible Tube / SS304
⑤ Braid / SS304

Nominal Size		l	Flange
DN	Inch		
10	3/8	45	Flange dimensions to the standards such as KS, JIS, ANSI, AWWA, BS, DIN etc.
15	1/2	49	
20	3/4	54	
25	1	56	
32	1 1/4	60	
40	1 1/2	64	
50	2	70	
65	2 1/2	73	
80	3	80	
100	4	84	
125	5	91	
150	6	95	
200	8	107	
250	10	118	
300	12	123	

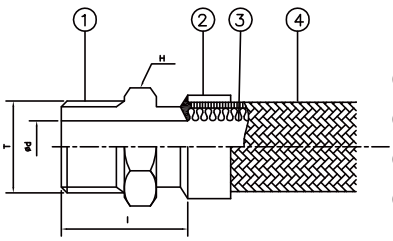
WFF-3



① Fixed Flange / CS
② End Pipe / CS or SS304
③ Braid Band / SS304
④ Flexible Tube / SS304
⑤ Braid / SS304

Nominal Size		l	Flange
DN	Inch		
10	3/8	42	Flange dimensions to the standards such as KS, JIS, ANSI, AWWA, BS, DIN etc.
15	1/2	46	
20	3/4	51	
25	1	53	
32	1 1/4	56	
40	1 1/2	60	
50	2	66	
65	2 1/2	69	
80	3	75	
100	4	79	
125	5	86	
150	6	90	
200	8	102	
250	10	113	
300	12	118	

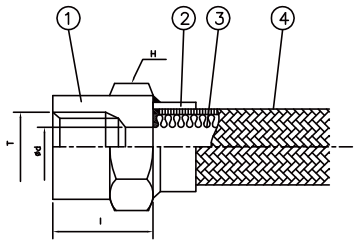
WNP



① Nipple / BMC
② Braid Band / SS304
③ Flexible Tube / SS304
④ Braid / SS304

Nominal Size		T	d	l	H
DN	Inch				
8	1/4	PT 1/4	7	27	Hexagon 17
10	3/8	PT 3/8	9	28	Hexagon 21
15	1/2	PT 1/2	13	33	Hexagon 26
20	3/4	PT 3/4	18	36	Hexagon 32
25	1	PT 1	24	42	Hexagon 38
32	1 1/4	PT 1 1/4	32	44	Hexagon 46
40	1 1/2	PT 1 1/2	37	49	Hexagon 54
50	2	PT 2	48	52	Octagon 63

WSK

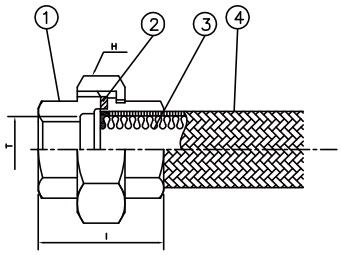


① Socket / CS
② Braid Band / SS304
③ Flexible Tube / SS304
④ Braid / SS304

Nominal Size		T	d	l	H
DN	Inch				
8	1/4	PT 1/4	6	22	Hexagon 21
10	3/8	PT 3/8	10	23	Hexagon 26
15	1/2	PT 1/2	12	28	Hexagon 29
20	3/4	PT 3/4	19	30	Hexagon 35
25	1	PT 1	25	34	Hexagon 50
32	1 1/4	PT 1 1/4	32	37	Octagon 63
40	1 1/2	PT 1 1/2	38	38	Octagon 71
50	2	PT 2	50	43	Octagon 85

Note: Specifications subject to change without notice

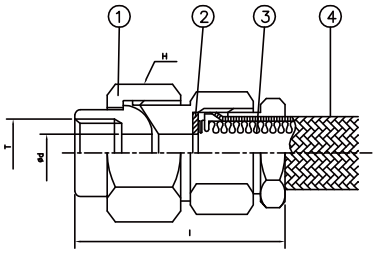
WUN



① Union / BMC
② Packing / PTFE
or Non-Metal Packing
③ Flexible Tube / SS304
④ Braid / SS304

Nominal Size		T	I	H
DN	Inch			
8	1/4	PT 1/4	35	Octagon 32
10	3/8	PT 3/8	38	Octagon 38
15	1/2	PT 1/2	42	Octagon 43
20	3/4	PT 3/4	50	Octagon 49
25	1	PT 1	55	Octagon 49
32	1 1/4	PT 1 1/4	61	Decagon 70
40	1 1/2	PT 1 1/2	68	Decagon 78
50	2	PT 2	74	Decagon 93

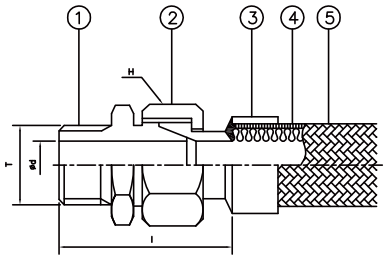
WHU



① HU Fitting / CS
② Packing / PTFE
or Non-Metal Packing
③ Flexible Tube / SS304
④ Braid / SS304

Nominal Size		T	d	I	H
DN	Inch				
8	1/4	PT 1/4	6	62	Hexagon 32
10	3/8	PT 3/8	10	65	Hexagon 35
15	1/2	PT 1/2	12	73	Hexagon 41
20	3/4	PT 3/4	19	81	Hexagon 50
25	1	PT 1	25	98	Octagon 63
32	1 1/4	PT 1 1/4	32	114	Octagon 71
40	1 1/2	PT 1 1/2	38	133	Octagon 85
50	2	PT 2	50	152	Octagon 102

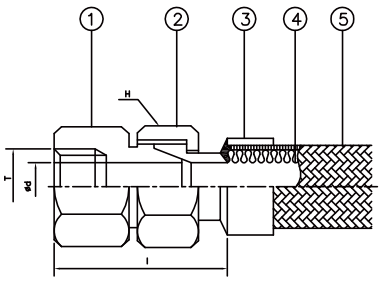
WSN-M



① Nipple / CS
② SN-M Fitting / CS
③ Braid Band / SS304
④ Flexible Tube / SS304
⑤ Braid / SS304

Nominal Size		T	d	I	H
DN	Inch				
8	1/4	PT 1/4	4	41	Hexagon 19
10	3/8	PT 3/8	7	46	Hexagon 21
15	1/2	PT 1/2	10	56	Hexagon 26
20	3/4	PT 3/4	16	61	Hexagon 32
25	1	PT 1	21.5	71	Hexagon 38
32	1 1/4	PT 1 1/4	27.5	80	Hexagon 46
40	1 1/2	PT 1 1/2	33	80	Octagon 54
50	2	PT 2	44	90	Octagon 67

WSN-F

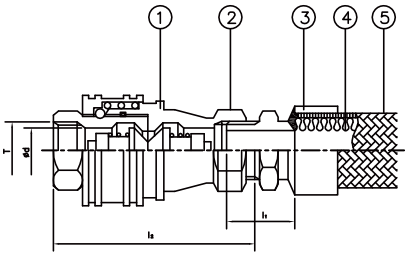


① Swivel Nut / CS
② SN-F Fitting / CS
③ Braid Band / SS304
④ Flexible Tube / SS304
⑤ Braid / SS304

Nominal Size		T	d	I	H
DN	Inch				
8	1/4	PT 1/4	4	38	Hexagon 19
10	3/8	PT 3/8	7	43	Hexagon 21
15	1/2	PT 1/2	10	53	Hexagon 26
20	3/4	PT 3/4	16	57	Hexagon 32
25	1	PT 1	21.5	67	Hexagon 38
32	1 1/4	PT 1 1/4	27.5	76	Hexagon 46
40	1 1/2	PT 1 1/2	33	75	Octagon 54
50	2	PT 2	44	87	Octagon 67

Note : Specifications subject to change without notice

WCP

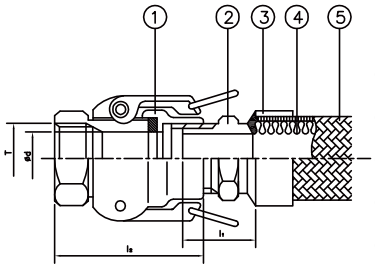


① Coupler
② Nipple / CS
③ Braid Band / SS304
④ Flexible Tube / SS304
⑤ Braid / SS304

Nominal Size		T	d	l_1	l_2
DN	Inch				
8	1/4	PT 1/4	8	22	66
10	3/8	PT 3/8	10	23	72
15	1/2	PT 1/2	15	27	78
20	3/4	PT 3/4	20	29	94
25	1	PT 1	25	37	124
32	1 1/4	PT 11/4	32	40	140
40	1 1/2	PT 11/2	40	43	150
50	2	PT 2	50	47	160

Note: Specifications subject to change without notice

WQC



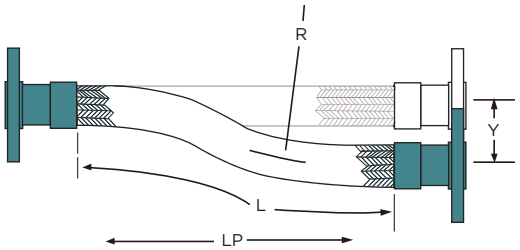
① Quick Coupling
② Nipple / CS
③ Braid Band / SS304
④ Flexible Tube / SS304
⑤ Braid / SS304

Nominal Size		T	d	l_1	l_2
DN	Inch				
15	1/2	PT 1/2	14	27	57
20	3/4	PT 3/4	19	29	59
25	1	PT 1	22	37	80
32	1 1/4	PT 1 1/4	27	40	86
40	1 1/2	PT 1 1/2	35	43	92
50	2	PT 2	45	47	96

MOTION OF FLEXIBLE METAL HOSE

Offset Motion

This type of motion occurs when one end of the hose is deflected in a plane perpendicular to its longitudinal axis with the ends remaining parallel. In offset motion application, the offset should never exceed 25 percent of the centerline bend radius "R"



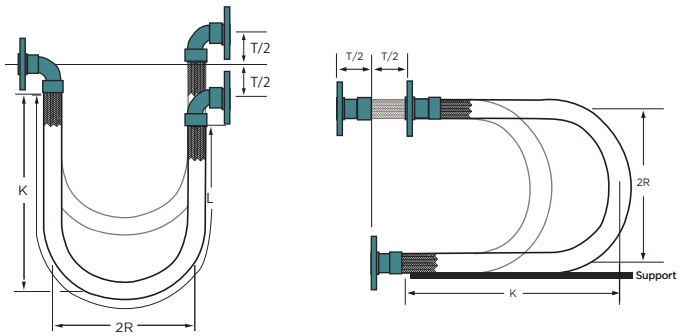
$L = \sqrt{6YR + Y^2}$

$Lp = \sqrt{L^2 - Y^2}$

Vertical Motion

Vertical motion occurs when the center line of a hose assembly is bent in a circular arc and moves in a vertical direction."

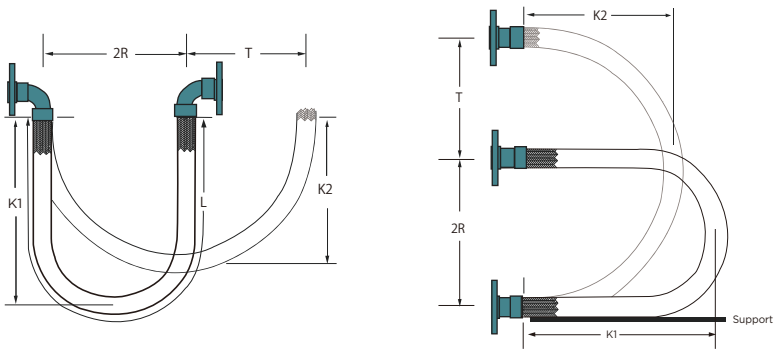
L=4R+T/2
K=1.43R+T/2



Horizontal Motion

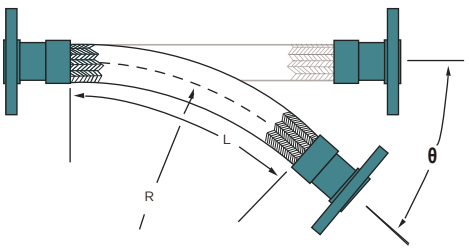
Horizontal motion occurs when the center line of a hose assembly is bent in a circular arc and moves in a horizontal direction

L=4R+1.57T
K1=1.43R+0.785T
K2=1.43R+T/2



Angular Motion

Angular Motion occurs when one end of a hose assembly is deflected in a simple bend with the ends not remaining parallel.



$L = \frac{\pi R\theta}{180}$

Axial Motion

Axial motion means dimension variation of a flexible hose along its longitudinal axis. Braided hose or helically corrugated hose should not be subjected to axial motion. This mode of motion is restricted to unbraided corrugated hose only and is accommodated by travelling loops

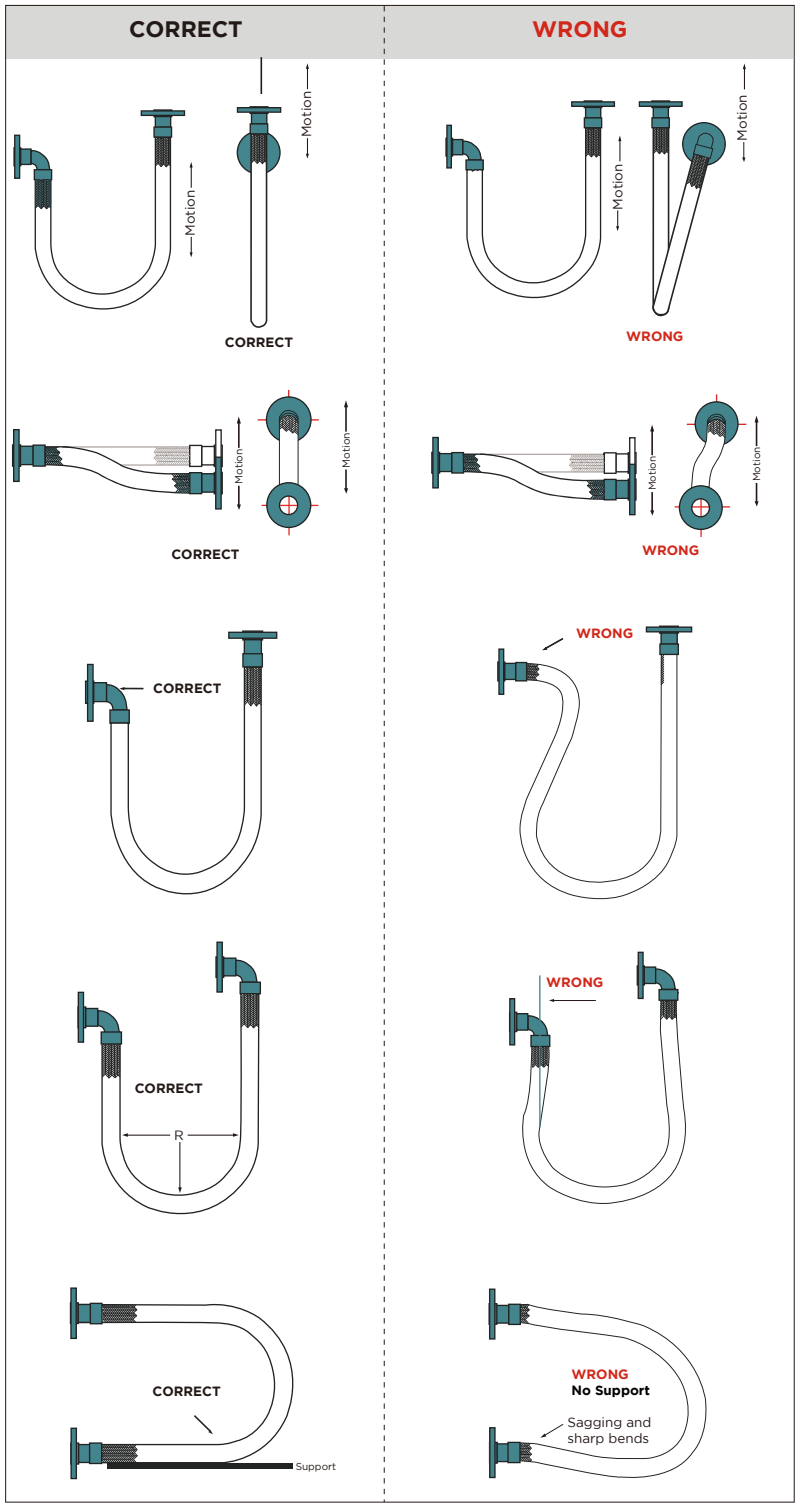
Notation:

L = Live hose length (mm)
Lp = Projected live hose length (mm)
R = Bend radius from center line (mm)
Y = Offset motion to one side of center line (mm)
T = Total travel (mm)
K = Loop length (mm)
θ = Angle of Bend (degrees)

INSTALLATION AND HANDLING PRECAUTIONS

Proper installation in an approved manner are very critical factors so that Kurbo flexible metal hose can fulfill its function perfectly. Kurbo flexible metal hose is engineered to provide maximum service life when properly installed. Improper installation, incorrect flexing or careless handling in an application will reduce the effective service life of the hose and cause premature failure of an assembly.

The following installation and handling precautions should be observed to achieve optimum performance from your hose assemblies.



Do Not Torque

Do not twist hose when aligning bolt holes in a flange or when making up pipe threads. To minimize possible torque damage to flexible hose, the use of loose flange or union will help. Always install flexible hose so that flexing takes place in one plane only.

Avoid Over Bending

Do not over bend a flexible hose. Pre-flexing of flexible hose to limber up should be avoided. Over-bending could cause damage and result in premature failure

Avoid Sharp Bend

As a result of improper installation, flexible hose can be subjected to recurring sharp bend. Avoid sharp bends, especially near the end fittings of the hose

Provide Support

When installed in a horizontal loop, provide support to prevent hose from sagging/drooping.

Reference Data

Contents

BELLOWS MATERIAL SELECTION GUIDE

Material	General Properties and Manufacturing Availability
SS 304	Standard material for manufacture of bellows. Usually this grade is used in water or steam applications. For operating temperatures to 450 ℃
SS 304L	Bellows can be supplied in this material when required, subject to availability of sheet of the required gauge
SS 316	Improved corrosion resistance as compared to the 321, especially with regard to pitting corrosion. Typical uses include high sulphur crude oils, brackish waters, flue gases, food processing and numerous applications in chemical and petro-chemical processing.
SS 321	Adequate corrosion resistance and mechanical properties at ambient and elevated temperatures, 450 ℃ to 815 ℃.
SS 310	This grade is sometimes requested for special purposes. Because of difficulty in obtaining material suitable for bellows manufacture, we usually offer Incoloy 800 as a superior alternative material where necessary.
Incoloy 800	Bellows can be supplied in this material when its good corrosion resistance and high temperature properties are required to meet service conditions.
Inconel 600	Bellows can be manufactured from this material when required. The alloy combines good general corrosion resistance with virtual immunity to chloride stress corrosion and also has good high temperature strength and oxidation resistance.
Inconel 625	One of the more recent nickel-chrome molybdenum alloys combining good high temperature properties with good resistance to chloride stress corrosion and a variety of corrosive environments.
Monel 400	This nickel-copper alloy finds limited use for bellows manufacture in some specialized applications such as chlorine service. However the manufacture of small diameter bellows would be uneconomic, and we advise that an alternative material should be used where the service conditions permit.
Hastelloy C 276	A nickel-chrome molybdenum alloy having outstanding resistance to a wide variety of severely corrosive chemical process environments including: wet chlorine, hypochlorites, chlorine dioxide solutions, hot contaminated mineral acids and acetic acid, sea water and brine. Bellows can be supplied when required, subject to the availability of sheet material.

CORROSION RESISTANCE GUIDE

This "Corrosion Resistance Guide" is to be used only as a guide in selecting the most satisfactory material for resistance to various chemical solutions. If in question, contact Kurbo with application details

Compatibility Rating

A - Suitable for continuous service
B - Usually suitable for limited service
C - Not recommended

Notes

1 - Susceptible to intergranular corrosion
2 - May cause explosive reaction
3 - Susceptible to stress corrosion cracking
4 - Susceptible to pitting type corrosion

Flowing Media/Chemical	CUPRO NICKEL 706	MONEL 400	INCONEL 625	SS 321	SS 316
Acetaldehyde	A	A	A	A	A
Acetanilide	B	B	B	B	B
Acetic Acid	B	B	A	B1	A1
Acetic Anhydride	B	B	A	B	B
Acetone	A	A	A	B	B
Acetophenone	A	A	A	B	B
Acetylene	C	A	A	A	A
Acrylates	B	B	B	B	B
Acrylic acid	B	B	A	B	B
Acrylonitrile	A	A	A	A	A
Alcohols	A	A	A	A	A
Alum	B	B	A	B	B
Alumina	A	A	A	A	A
Aluminum Acetate	B	B	B	B	B
Aluminum Chloride(dry)	B	A	A	A	A
Aluminum Chloride(moist)	C	B	A	C3,4	C3
Aluminum Fluoride	B	B	C	C	C
Aluminum Hydroxide	A	B	B	B	B
Aluminum Sulfate	B	B	B	B1,3	A3
Ammonia (dry)	A	A	A	A	A
Ammonia (moist)	C	C	B	A	A
Ammonium Acetate	B	A	A	A	A
Ammonium Bromide	C	B	B	C4	C4
Ammonium Chloride(dry)	C	A	A	A	A
Ammonium Chloride(moist)	C	B	B	C3,4	C3
Ammonium Hydroxide	C	A	A	B	B
Ammonium Nitrate	C	C2	B	B3	B3
Ammonium Sulfate	C	B	C	C1	B
Amyl Acetate	A	A	A	A	A
Amyl Alcohol	A	A	A	A	A
Amyl Chloride(dry)	C	A	A	A	A
Amyl Chloride(moist)	C	B	C	C3,4	C3
Aniline	C	A	B	B	B
Aniline Dyes	C	A	B	B	B
Asphalt	A	A	A	A	A
Atmosphere(industrial)	A	A	A	B4	A4
Atmosphere(marine)	A	A	A	B4	B4
Atmosphere(rural)	A	A	A	A	A

Flowing Media/Chemical	CUPRO NICKEL 706	MONEL 400	INCONEL 625	SS 321	SS 316
Barium Carbonate	A	B	B	B	B
Barium Chloride(dry)	B	A	A	A	A
Barium Chloride(moist)	C	B	C	C3,4	C3
Barium Hydroxide	A	B	B	B	A
Barium Sulfate	B	B	B	B	B
Barium Sulfide	C	C	B	B	B
Beer	A	A	A	A	A
Beet Sugar Liquors	A	A	A	A	A
Benzaldehyde	A	B	B	B	B
Benzene(benzol)	A	A	A	A	A
Benzoic Acid	A	B	A	A	A
Benzylamine	C	B	B	B	B
Benzyl Chloride(dry)	A	A	A	A	A
Benzyl Chloride(moist)	B	B	B	C3,4	C3
Black Liquor	C	A	B	B	B
Bleaching Powder(dry)	A	A	A	A	A
Bleaching Powder(moist)	B	B	B	C1,3,4	C3,4
Borax	A	A	A	A	A
Bordeaux Mixture	A	A	A	A	A
Boric Acid	A	B	A	A	A
Boron trichloride(dry)	B	B	B	B	B
Boron trichloride(moist)	B	B	C	C3,4	C3
Boron trifluoride(dry)	A	B	A	B	B
Brine	A	B	B	C3,4	C3
Bromic acid	C	C	C	C	C
Bromine(dry)	A	A	A	B	B
Bromine(moist)	B	B	B	C	C
Butadiene	A	A	A	A	A
Butane	A	A	A	A	A
Butanol(butyl alcohol)	A	A	A	A	A
Butyl phenols	B	A	B	B	B
Butyl Amine	B	A	A	A	A
Butyric Acid	A	B	A	B	B
Cadmium chloride(dry)	A	A	A	A	A
Cadmium chloride(moist)	B	B	B	C3,4	C3
Cadmium sulfate	A	A	A	A	A
Calcium Bisulfite	B	B	B	B1	B
Calcium Bromide	A	B	A	C3	C3
Calcium Chloride(dry)	A	A	A	A	A
Calcium Chloride(moist)	A	B	A	C3,4	C3

Flowing Media/Chemical	CUPRO NICKEL 706	MONEL 400	INCONEL 625	SS 321	SS 316
Calcium Fluoride	B	B	B	C	C
Calcium Hydroxide	A	B	A	B	B
Calcium Hypochlorite(dry)	A	A	A	A	A
Calcium Hypochlorite(moist)	B	B	B	C3,4	C3,4
Calcium Nitrate	B	B	A	B1	B
Calcium Oxide	A	A	A	A	A
Cane Sugar syrups	A	A	A	A	A
Carbolic Acid(phenol)	B	B	B	B	B
Carbon Dioxide(Dry)	A	A	A	A	A
Carbon Dioxide(moist)	B	A	A	A	A
Carbonated water	B	A	A	A	A
Carbon Disulfide	B	B	B	B	B
Carbon Tetrachloride(dry)	A	A	A	A	A
Carbon Tetrachloride(moist)	B	B	B	C3,4	C4
Castor Oil	A	A	A	A	A
Chloric acid	C	C	C	C3	C3
Chlorine (dry)	A	A	A	A	A
Chlorine (moist)	C	B	C	C3,4	C3
Chloroacetic Acid	B	B	B	C3,4	C3
Chlorine dioxide(dry)	B	A	A	A	A
Chlorine dioxide(moist)	C	B	B	C3,4	C3
Chloroform(dry)	A	A	A	A	A
Chloroform(moist)	B	B	B	C3,4	C3
Chromic Acid	C	C	B	C1,4	C
Chromic fluoride	C	B	B	C	C
Chromic hydroxide	B	B	B	B	B
Chromium Sulfate	B	B	B	B	B
Cider	A	A	A	A	A
Citric Acid	A	B	A	B	B
Coffee	A	A	A	A	A
Copper Chloride(dry)	A	A	A	A	A
Copper Chloride(moist)	C	B	C	C3,4	C3
Copper Nitrate	C	C	B	A	A
Copper Sulfate	B	B	B	B1	B
Corn Oil	A	A	A	A	A
Cottonseed Oil	A	A	A	A	A
Creosote	A	A	A	A	A
Crude Oil	B	A	A	C1	B
Cyclohexane	B	B	B	B	B
D.D.T.	B	B4	B	B	B
Dichloroethane(dry)	A	A	A	A	A
Dichloroethane(moist)	B	B	B	C4	C4
Dichloroethylene(dry)	A	A	A	A	A
Dichloroethylene(moist)	B	B	B	C4	C4
Dichlorophenol	B	B	B	B3	B3
Dimethyl Sulfate	B	B	A	B	B
Disocyanate	A	A	A	A	A
Epichlorohydrine(dry)	A	A	A	A	A
Epichlorohydrine(moist)	B	B	B	C3,4	C3
Ethane	A	A	A	A	A
Ether	A	A	A	A	A
Ethyl Acetate	A	B	A	B	B
Ethyl Alcohol	A	A	A	A	A
Ethyl Benzene	B	B	A	B3	B
Ethyl Chloride(dry)	A	A	A	A	A
Ethyl Chloride(moist)	B	B	B	C3,4	C3
Ethylene	A	A	A	A	A
Ethylene chlorohydrin(dry)	A	A	A	A	A

Flowing Media/Chemical	CUPRO NICKEL 706	MONEL 400	INCONEL 625	SS 321	SS 316
Ethylene chlorohydrin(moist)	B	B	B	C4	C4
Ethylene Diamine	B	B	A	B	B
Ethylene Glycol	A	A	A	A	A
Ethylene Oxide	C	B	B	B	B
Fatty Acids	B	B	B	B1,4	A
Ferric Chloride(dry)	A	A	A	A	A
Ferric Chloride(moist)	C	B	B	C1,3,4	C3,4
Ferric Nitrate	C	C	B	B	B
Ferric Sulfate	C	C	B	B1	A
Ferrous Chloride(dry)	A	A	A	A	A
Ferrous Chloride(moist)	C	B	B	C3,4	C3
Ferrous Sulfate	B	A	B	B4	B
Fluorine (dry)	A	A	A	A	A
Fluorine (moist)	C	B	C	C	C
Formaldehyde	A	A5	B	B	B
Formic Acid (Formylic Acid)	A	B	A	B1	A
Freon	A	A	A	A	A
Fruit Juice	B	A	A	A	A
Fuel Oil	A	A	A	A	A
Furfural (Furfurol)	A	A	B	A	A
Gasoline	A	A	A	A	A
Gelatine	A	A	A	A	A
Glucose	A	A	A	A	A
Glue	A	A	A	A	A
Glutamic acid	B	B	A	B3,4	B3,4
Glycerin	A	A	A	A	A
Glycerol	A	A	A	A	A
Heptane	A	A	A	A	A
Hexachloroethane(dry)	A	A	A	A	A
Hexachloroethane(moist)	B	B	B	C4	C4
Hydrazine	C	C	A	A	A
Hydrobromic Acid	C	C	B	C4	C
Hydrocarbons (pure)	A	A	A	A	A
Hydrochloric Acid	C	B	C	C4	C4
Hydrocyanic Acid	C	B	B	B1	B
Hydrofluoric Acid	C	B	B	C1,3	C
Hydrofluorsilicic Acid	B	B	B	C	C
Hydrogen	A	A	A	A	A
Hydrogen Chloride(dry)	A	A	A	A	A
Hydrogen Chloride(moist)	C	B	C	C4	C4
Hydrogen Peroxide	B	B	A	A	A
Hydrogen Sulfide (dry)	A	A	A	A	A
Hydrogen Sulfide (moist)	C	B	B	B4	A
Hydroquinone	B	B	B	B	B
Kerosene (Kerosine)	A	A	A	A	A
Lacquers	A	A	A	A	A
Lacquer Solvents	A	A	A	A	A
Lactic Acid	A	B	B	B1,4	B1
Lime	A	A	A	A	A
Lime Sulfur	C	B	B	B	B
Linseed Oil	B	A	A	A	A
Lithum chloride(dry)	A	A	A	A	A
Lithum chloride(moist)	C	B	B	C3,4	C3
Lithum hydroxide	B	B	B	B	B
Magnesium Chloride(dry)	A	A	A	A	A
Magnesium Chloride(moist)	B	B	B	C3,4	C3
Magnesium Hydroxide	A	A	A	A	A
Magnesium Sulfate	A	A	A	B	A

A-Suitable for continuous service **B-Usually Suitable for limited service** **C-Not recommended**

Flowing Media/Chemical	CUPRO NICKEL 706	MONEL 400	INCONEL 625	SS 321	SS 316
Maleic Acid	C	B	B	B1	B
Mercuric Chloride(dry)	C	A	A	A	A
Mercuric Chloride(moist)	C	B	A	C3,4	C3
Mercurous Nitrate	C	B3	B	B	B
Mercury	C	B3	B	B	B
Methane	A	A	A	A	A
Methyl Alcohol	A	A	A	A	A
Methyl Chloride(dry)	A	A	A	A	A
Methyl Chloride(moist)	B	B	B	C3,4	C3
Methyl Ethyl Ketone	A	B	A	B	B
Milk	A	A	A	A	A
Mineral water	C	B	A	B	B
Naphthalene (Naphthaline)	B	B	A	A	A
Natural Gas	A	A	A	A	A
Nickel Chloride(dry)	A	A	A	A	A
Nickel Chloride(moist)	B	B	B	C3,4	C3
Nitric Acid	C	C	B	A	A
Nitrotoluene	B	B	B	B	B
Nitrogen	A	A	A	A	A
Oleic Acid	B	A	B	B4	B
Oleum(fuming H_2SO_4)	C	C	B	B	B
Oxalic Acid	A	B	B	C1	B1
Oxygen	A	A	A	A	A
Palmitic Acid	B	A	A	A	A
paraffins	A	A	A	A	A
Pentane	B	B	B	B	B
Phosphoric Acid	B	B	B	C1	B1
Phthalic acid	B	B	B	B1	B
Picric Acid	C	C	B	B	B
Potassium Bromide	A	B	B	C	C
Potassium Carbonate	A	A	A	A	A
Potassium Chloride(dry)	A	A	A	A	A
Potassium Chloride(moist)	B	B	B	C3,4	C3
Potassium Chromate	A	B	A	B	B
Potassium Cyanide	C	B	B	B	B
Potassium Dichromate	C	A	A	A	A
Potassium fluoride	C	B	B	C	C
Potassium Hydroxide	B	B3	A	B3	B3
Potassium Nitrate	A	B	A	B	A
Potassium Permanganate	B	B	B	B	B
Potassium Sulfate	A	B	A	B	B
Propane	A	A	A	A	A
Propylene	A	A	A	A	A
Propylene Dichloride(dry)	A	A	A	A	A
Propylene Dichloride(moist)	B	B	B	C4	C4
Pyridine	B	B	B	B	B
Pyrrolidine	B	B	A	B	A
Quinine	B	B	A	B	B
Rosin	A	A	A	A	A
Sea Water	A	B	A	C3,4	C3
Sewage	A	A	A	A	A
Silver salts	C	A	A	B	B
Silver Nitrate	C	C	A	B	B
Soap Solutions	A	A	A	A	A
Sodium	A	A	A	A	A
Sodium Acetate	B	B	B	B4	B
Sodium Bicarbonate	A	A	A	A	A
Sodium Bisulfate	B	B	B	B1,4	B
Sodium Bisulfite	B	B4	B	B	B
Sodium Bromides	C	B	B	C	C
Sodium Carbonate	A	A	A	A	A
Sodium Chlorate(dry)	A	A	A	A	A

Flowing Media/Chemical	CUPRO NICKEL 706	MONEL 400	INCONEL 625	SS 321	SS 316
Sodium Chlorate(moist)	B	B	B	C3,4	C3
Sodium Chloride(dry)	A	A	A	A	A
Sodium Chloride(moist)	A	B	A	C3,4	C3
Sodium Chloromate	B	B	B	B	B
Sodium Citrate	B	B	B	B	B
Sodium Cyanide	C	B	B	B	B
Sodium Dichromate	C	B	B	B	B
Sodium Fluoride	B	B	B	C4	C
Sodium Hydroxide	B3	B3	A	B3	B3
Sodium Hypochlorite(dry)	A	A	A	A	A
Sodium Hypochlorite(moist)	C	B	B	C1,4	C4
Sodium Metasilicate	A	A	A	A	A
Sodium Nitrate	A	A	A	A	A
Sodium Nitrite	B	B	B	B	B
Sodium Peroxide	B	B	B	B	B
Sodium Phosphates	A	A	B	B	B
Sodium Silicates	A	A	A	A	A
Sodium Sulfates	A	A	A	B3	B
Sodium Sulfide	C	B	B	B4	B
Sodium Sulfites	B	B	B	B	B
Sodium Thiosulfate	C	B	B	B	B
Stannic Chloride(dry)	A	A	A	A	A
Stannic Chloride(moist)	C	B	B	C3,4	C3
Stannous Chloride(dry)	A	A	A	A	A
Stannous Chloride(moist)	C	B	B	C3,4	C3
Steam	A	A3	A	A	A
Stearic Acid	B	B	B	B	B
Strontium nitrate	B	B	B	B	B
Sulfate black liquor	B	B	B	B	B
Sulfate green liquor	B	B	B	B3	B3
Sugar solution	A	A	A	A	A
Sulfur(dry)	B	A	A	A	A
Sulfur(molten)	C	B	A	A	A
Sulfur Chloride(dry)	A	A	A	A	A
Sulfur Chloride(moist)	B	B	B	C3,4	C3
Sulfur Dioxide(dry)	B	B	B	C1	B
Sulfur Dioxide(moist)	C	C	C	C1	B
Sulfur Trioxide (Dry)	A	A	A	A	A
Sulfuric Acid, 95-100%	B	B	A	A	A
Sulfuric Acid, 80-95%	B	B	B	B	B
Sulfuric Acid, 40-80%	C	C	B	C1	C1
Sulfuric Acid, 40%	B	C	B	C1	C1
Sulfurous Acid	C	B	B	C1,4	C1,4
Tall Oil	B	B	B	B	B
Tannic Acid	B	B	B	B	B
Tar	A	A	A	A	A
Tartaric Acid	B	B	B	B	B
Tetraphosphoric acid	C	C	B	B	B
Toluene	A	A	A	A	A
Trichloroacetic Acid	B	B	B	C3,4	C4
Trichloroethane(dry)	A	A	A	A	A
Trichloroethane(moist)	B	B	B	C4	C4
Trichloroethylene(dry)	A	A	A	A	A
Trichloroethylene(moist)	B	B	B	C4	C4
Turpentine	A	A	A	A	A
Varnish	A	A	A	A	A
Vinegar	B	B	B	B	B
Water(portable)	A	A	A	A	A
Xylene	A	A	A	A	A
Zinc Chloride(dry)	A	A	A	A	A
Zinc Chloride(moist)	C	B	B	C3,4	C3
Zinc Sulfate	B	B	B	B	A

UNIT CONVERSION

Pressure

Atm.	Bar	Kg/cm²	PSI	MPa	Mercury		Water Column		
					mmHg	inHg	mAq	inAq	ftAq
1	1.013	1.033	14.70	0.10133	760.0	29.9	10.3	406.8	33.9
0.98692	1	1.01972	14.50	0.10000	750.1	29.5	10.2	401.5	33.5
0.96784	0.98067	1	14.22	0.09807	735.6	29.0	10.0	393.7	32.8
0.06805	0.06895	0.07031	1	0.00689	51.7	2.0	0.7	27.7	2.3
9.87	10.00	10.19	145.05	1	$7.50X10^3$	$2.95X10^2$	$1.02X10^2$	$4.01X10^3$	$3.35X10^2$
0.00132	0.00133	0.00136	0.01934	0.00013	1	0.039	0.014	0.535	0.045
0.03342	0.03386	0.03453	0.49115	0.00339	25.4	1	0.345	13.6	1.133
0.09678	0.09807	0.10000	1.42233	0.00981	73.6	2.896	1	39.4	3.281
0.00246	0.00249	0.00254	0.03613	0.00025	1.9	0.074	0.025	1	0.083
0.02950	0.02989	0.03048	0.43353	0.00299	22.4	0.883	304.8	12.0	1

Metric to PSI

bar	MPa	PSI	bar	MPa	PSI
1	0.1	14.5	21	2.1	304.6
2	0.2	29.0	22	2.2	319.1
3	0.3	43.5	23	2.3	333.6
4	0.4	58.0	24	2.4	348.1
5	0.5	72.5	25	2.5	362.6
6	0.6	87.0	26	2.6	377.1
7	0.7	101.5	27	2.7	391.6
8	0.8	116.0	28	2.8	406.1
9	0.9	130.5	29	2.9	420.6
10	1.0	145.0	30	3.0	435.1
11	1.1	159.5	31	3.1	449.6
12	1.2	174.0	32	3.2	464.1
13	1.3	188.5	33	3.3	478.6
14	1.4	203.1	34	3.4	493.1
15	1.5	217.6	35	3.5	507.6
16	1.6	232.1	36	3.6	522.1
17	1.7	246.6	37	3.7	536.6
18	1.8	261.1	38	3.8	551.1
19	1.9	275.6	39	3.9	565.6
20	2.0	290.1	40	4.0	580.2

Kg/cm²	MPa	PSI	Kg/cm²	MPa	PSI
1	0.10	14.2	21	2.06	298.7
2	0.20	28.4	22	2.16	312.9
3	0.29	42.7	23	2.26	327.1
4	0.39	56.9	24	2.35	341.4
5	0.49	71.1	25	2.45	355.6
6	0.59	85.3	26	2.55	369.8
7	0.69	99.6	27	2.65	384.0
8	0.78	113.8	28	2.75	398.3
9	0.88	128.0	29	2.84	412.5
10	0.98	142.2	30	2.94	426.7
11	1.08	156.5	31	3.04	440.9
12	1.18	170.7	32	3.14	455.1
13	1.27	184.9	33	3.24	469.4
14	1.37	199.1	34	3.33	483.6
15	1.47	213.4	35	3.43	497.8
16	1.57	227.6	36	3.53	512.0
17	1.67	241.8	37	3.63	526.3
18	1.77	256.0	38	3.73	540.5
19	1.86	270.2	39	3.82	554.7
20	1.96	284.5	40	3.92	568.9

Length

m	cm	in	ft
1	100	39.37	3.2808
0.01	1	0.3937	0.0328
0.0254	2.54	1	0.0833
0.3048	30.48	12	1

Area

m^2	cm^2	in^2	ft^2
1	10000	1550	10.76
0.00010	1	0.155	0.00108
0.00065	6.45	1	0.00694
0.09290	929.03	144	1

Spring Rate

kg/mm	kg/cm	N/mm	lb/in
1	10	9.81	56
0.1	1	0.981	5.6
0.10197	1.0197	1	5.7
0.01786	0.1786	0.1751	1

Force

kg	lb	N	poundal
1	2.20	9.81	70.93
0.45359	1	4.45	32.17
0.10197	0.22481	1	7.23
0.01410	0.03108	0.13826	1

Torque

kg-m	in-lb	ft-lb	Nm
1	86.80	7.23	9.81
0.01152	1	0.08333	0.11299
0.13826	12	1	1.36
0.10197	8.85	0.7376	1

PSI to Metric

PSI	bar	MPa	PSI	bar	MPa
10	0.69	0.07	210	14.48	1.45
20	1.38	0.14	220	15.17	1.52
30	2.07	0.21	230	15.86	1.59
40	2.76	0.28	240	16.55	1.65
50	3.45	0.34	250	17.24	1.72
60	4.14	0.41	260	17.93	1.79
70	4.83	0.48	270	18.62	1.86
80	5.52	0.55	280	19.31	1.93
90	6.21	0.62	290	19.99	2.00
100	6.89	0.69	300	20.68	2.07
110	7.58	0.76	350	24.13	2.41
120	8.27	0.83	400	27.58	2.76
130	8.96	0.90	450	31.03	3.10
140	9.65	0.97	500	34.47	3.45
150	10.34	1.03	550	37.92	3.79
160	11.03	1.10	600	41.37	4.14
170	11.72	1.17	700	48.26	4.83
180	12.41	1.24	800	55.16	5.52
190	13.10	1.31	900	62.05	6.21
200	13.79	1.38	1000	68.95	6.89

Velocity

m/s	km/h	ft/s	ft/h	mile/h
1	3.6	3.3	11811	2.23694
0.27778	1	0.91134	3280.8	0.62137
0.30480	1.10	1	3600	0.68182
0.00009	0.00031	0.00028	1	0.00019
0.44704	1.61	1.47	5280	1

Volume

m^3	cm^3	in^3	ft^3	gal
1	1000000	61023.74	35.31	264.17
0.000001	1	0.061024	0.000035	0.000264
0.000016	16.39	1	0.000579	0.004329
0.028317	28316.85	1728	1	7.48
0.003785	3785.41	231	0.133681	1

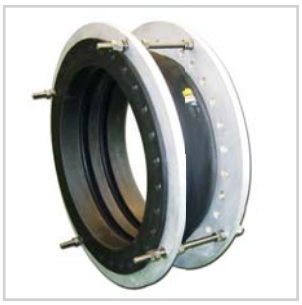
Volume Flow Rate

m^3/s	ℓ/s	ℓ/min	m^3/h	ft^3/s
1	1000	60000	60	35.3
0.001	1	60	3.6	0.03531
0.000017	0.01666	1	0.06	0.00059
0.000277	0.27778	16.67	1	0.00981
0.028320	28.32	1698.33	101.9	1

KURBO
METAL EXPANSION JOINT
SPECIFICATION SHEET

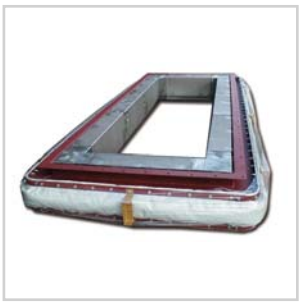
YOUR COMPANY	Company Name				
	Mailing Address				
	Name of Person	Email			
YOUR CUSTOMER	Date		Page of		
	Project Name				
	Delivery Required				
	Item / Tag No.		Item / Tag No.		Item / Tag No.
	Q'ty Required		Q'ty Required		Q'ty Required
SIZE	Nominal Diameter		mm	mm	mm
	Overall Length (maximum or required)		mm	mm	mm
ENDS	Type of Expansion Joint (Single, Universal, Hinge, Gimbal etc.)				
	End Connection (WW,FF,VV, FW,VW etc. See catalog page 29)				
	Weld End Preparation (bevel/angle or square cut)				
PRESS.	Design Pressure (external or internal)		bar	bar	bar
	Operating Pressure		bar	bar	bar
	Test Pressure		bar	bar	bar
TEMP.	Maximum Temperature		˚C	˚C	˚C
	Minimum Temperature		˚C	˚C	˚C
	Installation Temperature		˚C	˚C	˚C
MOVEMENT/ SPRING RATE	Design Cycle Life				
	Axial Movement		mm	mm	mm
	Lateral Deflection		mm	mm	mm
	Angular Rotation in degrees		°	°	°
	Axial Spring Rate		kg/mm	kg/mm	kg/mm
	Lateral Spring Rate		kg/mm	kg/mm	kg/mm
	Angular Spring Rate		kg·m/deg	kg·m/deg	kg·m/deg
MEDIUM	Flowing Medium				
	Flow Velocity		m/sec	m/sec	m/sec
	Flow Direction				
MATERIAL	Bellows Material				
	Pipe Specification and Pipe Material				
	Flange Specification and Flange Material				
	Internal Liner Material				
	External Cover Material				
	Tie Rods Material, if required				
OTHERS	Maximum Outside Diameter		mm	mm	mm
	Installation Position (horizontal, vertical)				
	Hydrostatic Test of Expansion Joint Required		yes or no	yes or no	yes or no
	NDE Required (PT, RT, UT, MT etc)				
COMMENTS					

Complete Line of Kurbo Expansion Joints



Rubber Expansion Joint

Metal Expansion Joint



Fabric Expansion Joint

PTFE Lined Expansion Joint

PTFE Expansion Joint

Flexible Joint

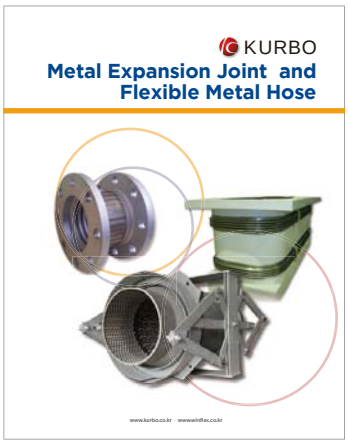
Flexible Metal Hose

Memo

Memo

Memo

winflex



KURBO

Specialist of Rubber Expansion Joint, Metal Expansion Joint, Fabric Expansion Joint, PTFE Expansion Joint, Flexible Metal Hose and other flexible products

Kurbo Company Limited
1504-8 Songjeong-dong, Gangseo-gu, Busan 618-817, Korea
Tel +82-51-831 1291 / Fax +82-51-831 1295
www.kurbo.co.kr www.winflex.co.kr Email: kurbo@kurbo.co.kr

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