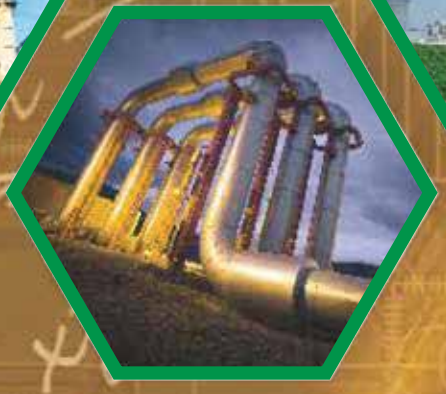
REPL
AUSTRALIA Pvt Ltd.

Technical Catalogue Expansion Joints





Engineering Solutions

CONTENTS

CONTENTS

RATNAFLEX Engineering Private Limited (REPL) is a company specialised in design & manufacturer of Metallic & Non-Metallic Expansion Joints including critical FCCU – RFCC Bellows for refineries to meet global requirements. REPL incorporated under the companies ACT 2013, it has its manufacturing base in Indrad – Gujarat – INDIA. The company is promoted by the members of Sanghvi family the promoters of RATNAMANI Metals & Tubes Limited.

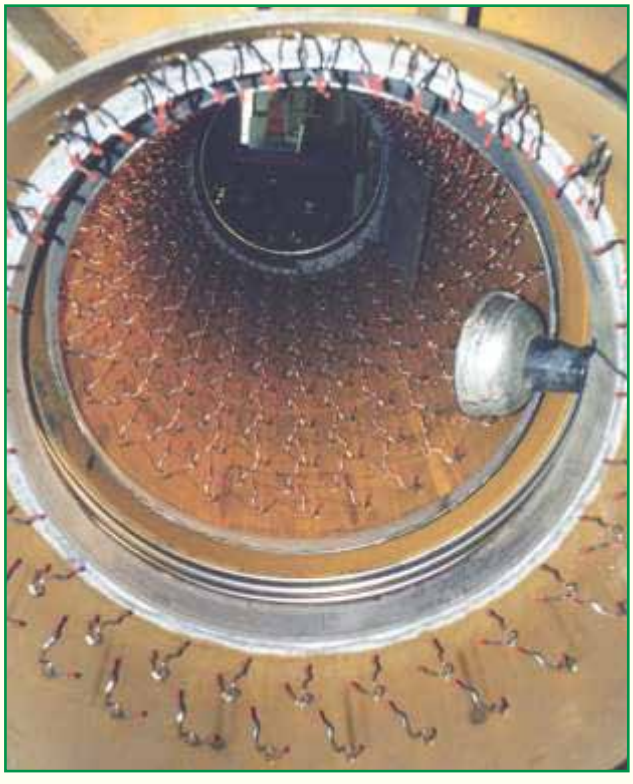
WORKSHOP AREA

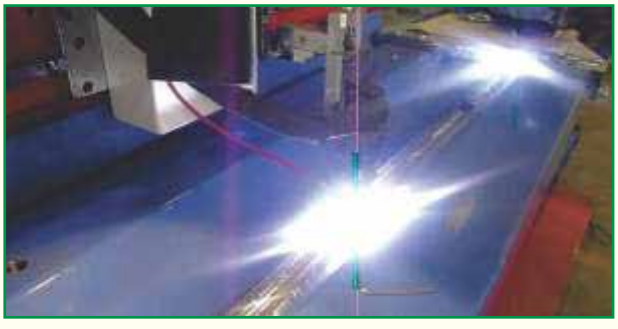
OFFICE AREA

REPL occupies a large manufacturing facility of 14,000m² total area & 10,000 m² built-up area located in Indrad – Chhatral in the state of Gujarat – India. Our facility is divided in two large production bays, each equipped with E.O.T cranes. The production bays are segregated for Stainless Steel and Carbon Steel fabrication.

The bellows forming plant equipped with advanced fabrication technology, which includes special purpose designed and manufactured machines by REPL along with general fabrication machinery. The factory has state of the art machines developed for the bellows element specifically longitudinal seam welding (L.S.W).

The ability of manufacturing the majority of components inhouse provides maximum quality control and minimum production time.

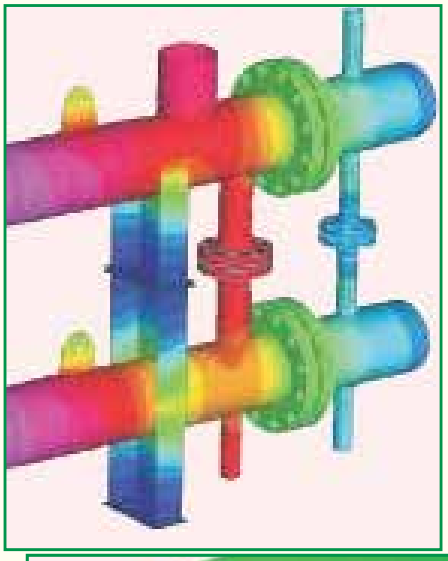


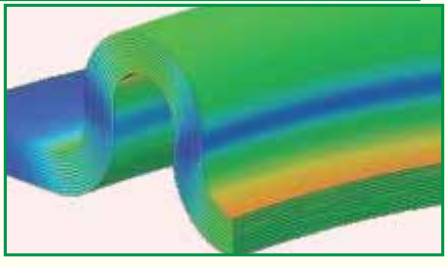


REPL engineers uses the latest design softwares to provide the quickest proposal turnaround and the most efficient use of space and materials. The Expansion Joint design is achieved by a combination of practical experience and technical knowledge.

Finite Element Analysis and Pipe Stress Analysis softwares are used to simulate the loads and resulting stresses that may occur in a design system.

These computer programs help pre-determine engineering design specifications to meet load/stress requirements. REPL can provide units, design, fabricated and tested in accordance to standard codes.





Bellows / Expansion Joint

Bellows: The exible element of an Expansion Joints consisting of one or more convolutions.

Expansion Joint: Any device containing one or more bellows used to absorb dimensional changes, such as those caused by thermal expansion or contraction of a pipe line / duct or vessel.

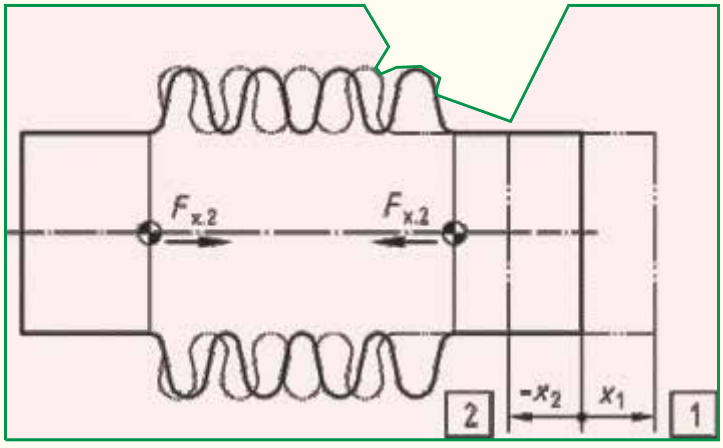
Bellows Movements

There are four movements that can be applied to a bellows / expansion joint. These are Axial, Lateral, Angular and Torsional. The following gures illustrate these movements

Axial Movement (+ or – mm)

Axial movement is the change in dimensional length of the bellows from its free length in a direction parallel to its longitudinal axis.

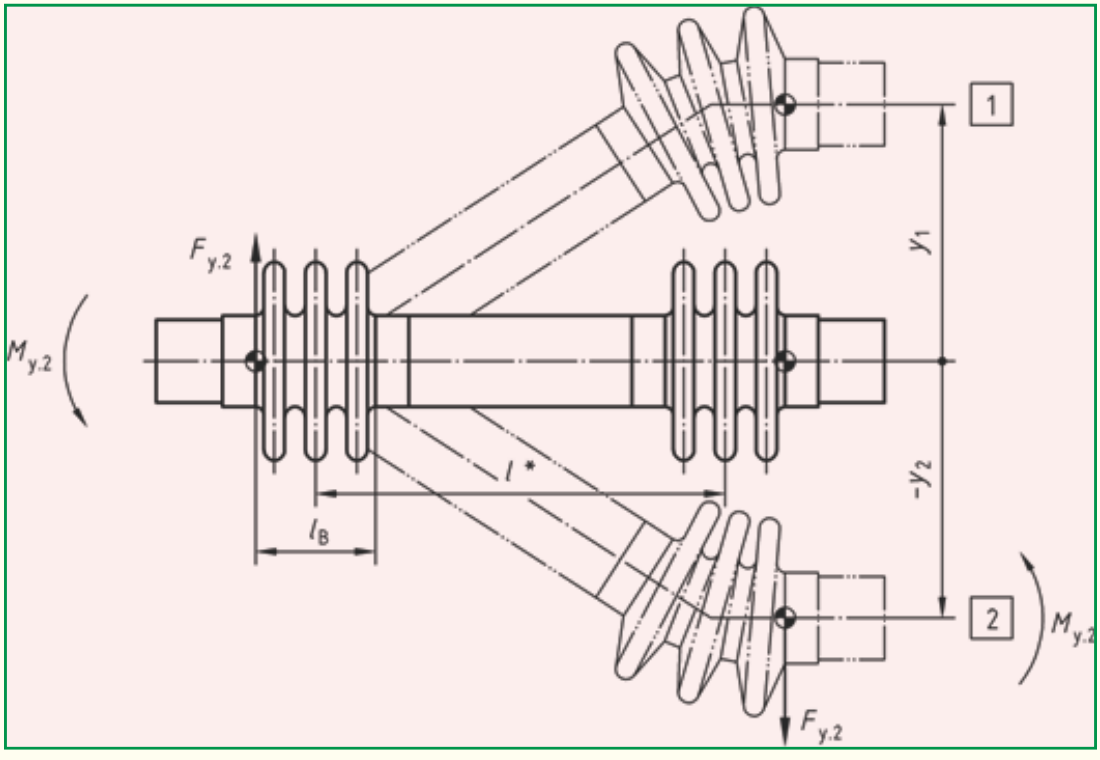
Compression is always expressed as negative (–) and extension as positive (+).



The units for axial spring rates are in N/mm

Lateral Movement (+ or – mm)

Lateral movement is the relative displacement of one end of the bellows to the other end in a direction perpendicular to its longitudinal axis (shear). Lateral movement can be imposed on a single bellow as depicted below but to a limited degree. A better solution is to incorporate two bellows in a universal arrangement as shown. This results in greater offset movements and much lower offset forces.

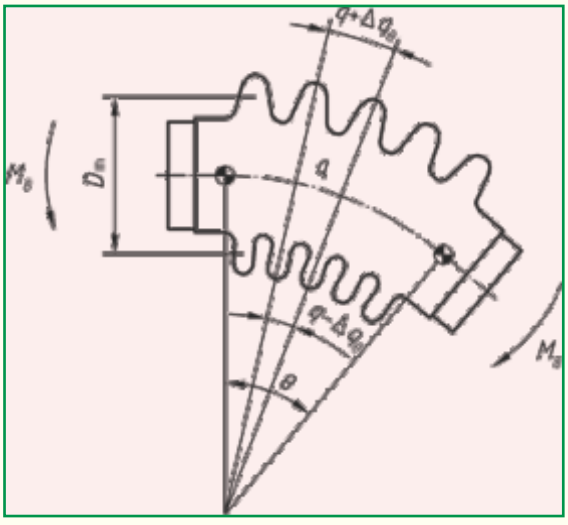


The units for lateral spring rates are in N/mm

Angular Movement (+ or – degrees)

Angular movement is the rotational displacement of the longitudinal axis of the bellows toward a point of rotation. The convolutions at the inner most point are in compression (-) while those furthest away are in extension (+).

The angular capability of a bellows is most often used with second bellows.

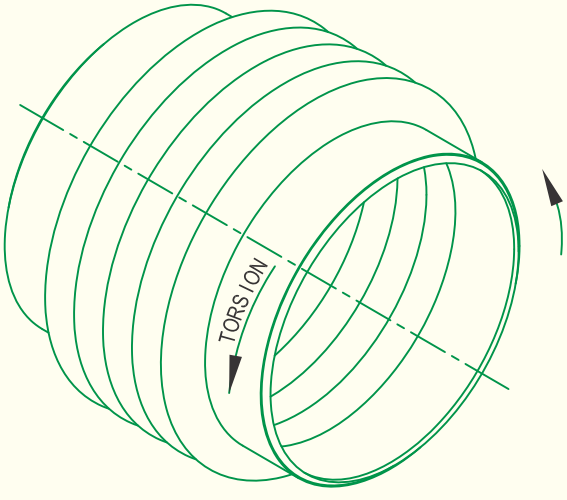


The units for angular spring rates are in Nm/degree

Torsion Movement (+ or – degrees)

Torsional movement is the rotation about the axis through the center of a bellows (twisting). WE DISCOURAGE ANY TORSIONAL ROTATION OF METAL BELLOWS EXPANSION JOINTS.

Torsion destabilizes an expansion joint reducing its ability to contain pressure and absorb movement. If torsion is present in a piping system, hinges, slotted hinges or gimbals are recommended to combat the torsion.



The units for torsional spring rates are in Nm/degree

Torsional spring rates are in Nm/degree and maximum torsional limits in degrees for computational modeling only. The piping software such as CAESAR II and COADE often require these spring rates for nodal input.

Bellows Pressure Thrust Force:

The pressure thrust is present in all pressurized piping systems. It is the gauge pressure times the inside area of the pipe. It acts at changes in direction, such as the elbow, and at changes in pipe – cross section, such as reducers.

Formula:

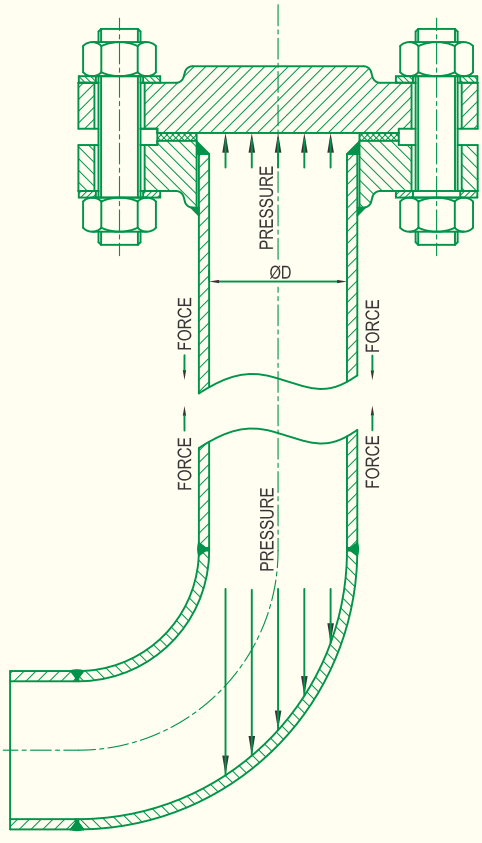
Area of Pipe = $\pi/4 \times D^2$

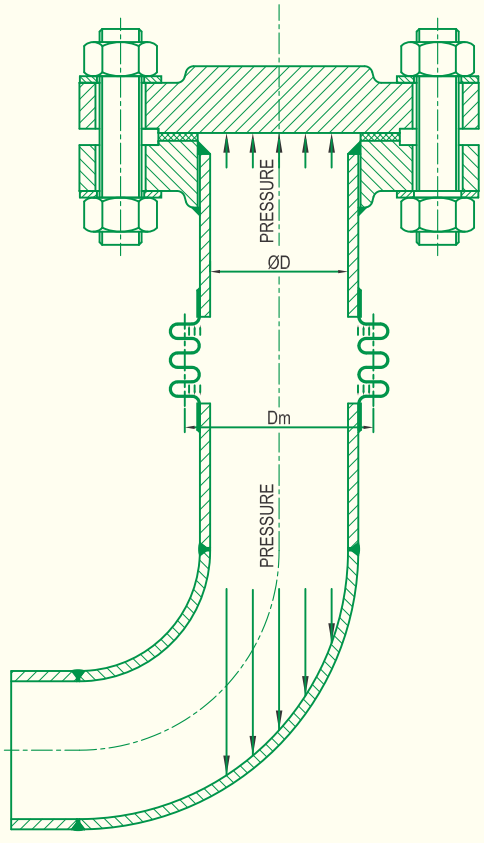
Pressure Thrust = Pressure x Area

Formula:

Effective Area of Bellows $\pi/4 \times Dm^2$

Pressure Thrust = Pressure x Effective Area





When a pipe without an expansion joint is pressurized the whole system will not move as the pipe is resisting the pressure thrust force in tension. Whereas, if an unrestrained expansion joint is installed in the system the pressure thrust force tends to pull the ends

away from the expansion joint. Therefore, the pressure thrust must be con tained with either strong anchors or restrained expansion joints (Tie Rods, Hinge, Gimbal etc.) to prevent causing damage to the whole system as well as the bellows.

Bellows Spring Rate

The force required to deflect an expansion joint within a specific plane. A force equal to the spring force is exerted upon the systems anchors. The magnitude of the spring force is equal to the expansion joints planar spring rate multiplied by the amount trav – eled within that plane.

Example:
Axial Spring Rate = 750 N/mm, Design Movement = 35 mm axial compression,
Axial Spring Force = 750 N/mm X 35 mm = 26250 N

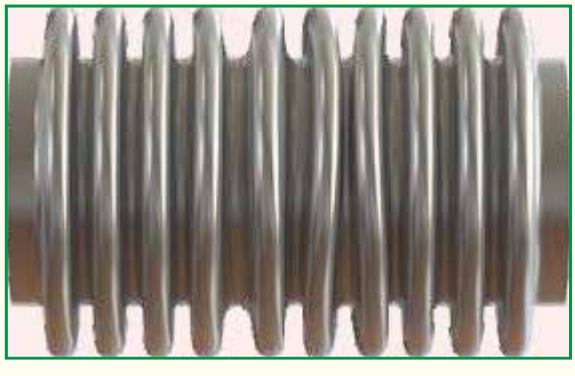
The spring rate of a bellows is entirely dependent on bellows geometry and material properties. To match with customer's required spring rates, we vary the bellows geome – try of convolution such as height, pitch, thickness and number of plies and number of convolutions.

Bellows Stability

A Bellows / Expansion Joint is pressurized internally is similar in many ways to a column loaded in compression. Excessive internal pressure may cause a multiple-con- volution bellows to become unstable and squirm. Squirm is detrimental to bellows per – formance in that it can reduce both fatigue life and pressure capacity.

Therefore our design equations treats squirm conservatively; we recommend a hydro- static test of the complete expansion joint to verify mechanical integrity. In – case of hydrostatic testing, the desired test pressure should be specified at the time of order placement.

Column Squirm



In-plane Squirm

Column Squirm is defined as a gross lateral shift of the center section of bellows. It results in a curvature of the bellows centerline as shown in so in the figure. This condi - tion is most associated with bellows which have a relatively large length-to-diameter ratio and analogues to the buckling of a column under compressive load***It should be noted that external pressure does not produce column squirm.***

In-plane Squirm is defined as a shift or rotation of the plane of one or more convolu tions such that the plane of these convolutions is no longer perpendicular to the axis of unreinforced bellows / expansion joint. It is characterized by tilting or wrapping of one or more convolutions.***It is most common in bellows which have a relatively small length-to-diameter ration***

Material Selection Guidelines

Bellows Material

Selection of the bellows material is the single most important factor to be considered in the design of an expansion joint.

Some of the factors, which influence the selection process, are as follows:

Corrosion Properties

Process media, Surrounding environment &Internal cleaning agents

Mechanical Properties

High temperature service, Cryogenic service &Operating stresses

Manufacturing Properties

Forming & cold working capabilities BELLOWS MATERIAL

Stainless Steel- Type 300 austenitic series

304 (ASTM A240-304)

The material services a wide range of applications. It resists organic chemicals, dye stuff, and a wide variety of inorganic chemicals. Type 304 resists nitric acid and sulfuric acids at moderate temperatures and concentrations. It is used extensively in piping systems conveying petroleum products, compressed air, steam, flue gas, and liquefied gases at cryogenic temperatures. The temperature range varies from 197 to 648 degrees C.

304L (ASTM A240-304L)

The maximum carbon content of 0.03% versus 0.08% for type 304. This lower carbon content eliminates the problem of chromium carbide precipitation and makes it more resistant to intergranular corrosion. It is preferred over 304 for nitric acid service.

316 (ASTM A240-316)

This alloy contains more nickel than the 304 types. The addition of 2% to 3% molybdenum gives it improved corrosion resistance compared to 304 especially in chloride environments that tend to cause pitting. Some typical uses are flue gas ducts, crude oil systems high in sulfur, heat exchangers, and other critical applications in the chemical and petrochemical industries.

316L (ASTM A240-316L)

With its low carbon content of 0.03% maximum, it lends itself to highly corrosive applications where intergranular corrosion is a hazard.

321 (ASTM A240-321)

The addition of titanium to this stainless steel acts as a carbide stabilizing element that prevents carbide precipitation when the material is heated and cooled through the temperature range of 426 to 815 degrees C. 321 finds uses in many of the same applications as Type 304, where the added safeguard from intergranular corrosion is desired. The standard catalog exhaust joints are made from this material because of the high operating temperatures they withstand.

Nickel Alloys

Nickel 200 (ASTM B162-200)

A commercially pure nickel (99.5% Ni), nickel 200 has good mechanical properties and excellent corrosion resistance to salt water attack and chloride cracking.

Alloy 400 (ASTM B127-400)

This copper-nickel alloy (66.5% Ni, 31.5 Cu) is a higher strength material than Nickel 200 with excellent corrosion resistance over a wider range of temperatures and operating conditions.

Alloy 600 (ASTM B168-600)

This nickel-chromium alloy (76% Ni, 15.5% Cr) has very desirable properties for the manufacture of expansion joints. It has a very high strength over a wide range of temperatures and good resistance to a variety of corrosive environments. It finds wide use in steam and salt water services where it is virtually immune to chloride stress corrosion.

Alloy 625 Gr.1 (ASTM B443-625)

This alloy contains a higher chromium content (21.5%) than alloy 600. With the addition of 9% molybdenum, it produces an alloy of superior strength and corrosion resistance over a wider range of temperatures and environments. It is used on many critical applications such as heat exchangers and catalytic cracker expansion joints. When exposed to temperatures above 1000 deg F for prolonged periods, it may become embrittled.

Alloy 625 LCF (ASTM B443-625 LCF)

Similar to straight grade 625, this alloy has a slight change in material composition to enhance low-cyclic fatigue properties at elevated temperatures.

Alloy 800 (ASTM B409-800)

This nickel-iron-chrome alloy is less expensive than alloy 600. It has good corrosion resistance properties and high temperatures strength over a wide variety of difficult service conditions.

Alloy 825 (ASTM B424-825)

This is a copper-chrome nickel alloy that exhibits excellent corrosion resistance to the most severe acids, in particular, hot concentrated sulfuric acid and sulfur bearing environments.

Alloy 20 or 20Cb-3 (ASTM B463)

This nickel-iron-chrome alloy was specifically designed to resist hot sulfuric acid. It is able to resist intergranular corrosion in the as welded condition and is practically immune to chloride stress corrosion cracking.

Other Materials

In addition to the materials listed above, we can manufacture bellows from Hastelloy C22 and C276, Corten, AL6XN, duplex 2205, alloys 230, 253 MA, 330, 617, 718, 800H/HT, 3CR12, HR120 and others. Many grades of "SA" and "SB" materials are stocked for expansion joints requiring ASME partial data reports.

We must know if the customer requires annealing of the material after forming. Occasionally, annealing will enhance material properties or corrosion resistance. We discourage post-formed annealing because it hinders the bellow's ability to contain pressure and may also lower cycle life.

Corrosion

It can significantly reduce the service life of bellows / expansion joint. The design and operating condition may subject to corrosive attack. However, it may not affect pipe & fittings of similar material due to sufficient thickness and corrosion allowance.

Stress Corrosion is evidence by a cracking of the material as the result of a combination of stress and corrosive environment.

Intergranular Corrosion is characterized by a preferential attack along the grain boundaries in metal.

Pitting Corrosion is localized attack on metals, general corrosion or the gradual eating away of the metal in a system

Impingement and corrosion-erosion associated with the impact of a liquid or a gas medium on the surface of the material under attack. Elevated temperature oxidation is another form of material degradation most commonly encountered in hot air and exhaust lines.

The Occurrence of all type of corrosion depends upon the material type and condition, as well as its initial surface condition. Selection of the material type should be such that there is no possibility of corrosion occurring or that it is not affected by corrosion to an extent greater than 0.05 mm penetration per year.

Effect of Alloying Element In Heat Resistant Alloy

Aluminum (Al)	Strength in a small amount, oxidation in the range 1-5%. Ferritizer, promotes sigma
Boron (B)	Strengthening element from 0.0005 to 0.005%. Improves hot Workability, decreases weldability .
Carbon (C)	A Strengthening element, used 0.04 to 0.4% in wrought and to 0.75% in cast alloys. C is an austenitizing element, retards sigma Formation
Cerium (Ce)	Improves oxidation resistance, as do the other rate earth La, Y.
Chromium (Cr)	The basis for oxidation resistance is forms the protective chromium oxide Scale formed at high temperature. Cr adds strength and car-burization Resistance, and promotes sigma.
Cobalt (Co)	Solid solution strengthener. Austenitizer.
Columbium (Cb)	Strengthener, both as carbide and solid solution, Quite Detrimental to oxidation resistance around 1800F (1000C) and above
Iron (Fe)	Present from 0 to 75% in heat resistance alloys. A ferritizing element.
Molybdenum (Mo)	Solid solution strengthener. High levels can lead to catastrophic Oxidation, promotes intermetallic phase formation
Nickel (Ni)	From 8 to 80% Ni is in all austenitic heat resistance alloys. Ni improves Adherence of the Cr2O3 scale, hence oxidation resistance and reduce carburization. Ni reduces sigma formation. High Ni alloys may be susceptible to sulphidation.
Nitrogen (N)	Strengthening element used up to about 0.25%, more commonly Around 0.15%. N is an austenitizing element, retards sigma forma tion.

Phosphorus (P)	Very detrimental to weldability of nickel alloys. Austenitic weld Fillers must have less than 0.015%P.
Silicon (Si)	improves oxidation and carburization resistance. Si is a ferritizer, Promotes sigma.
Sulphur (S)	Easily removed by Argon Oxygen Decarburization furnace, Detrimental effects no longer an issue. In stainless plate around 0.02% may be used to improve machinability.
Titanium (Ti)	Strengthening element as carbide former. In higher amounts Forms gamma prime ferritizer , promotes sigma.
Tungsten (W)	Solid solution strengthener.
Zirconium (Zr)	Strengthener, carbide former. Adds resistance to grain growth.

Typical Causes of Expansion Joint Failure

Bellows expansion joints will give many years of satisfactory services when they are properly designed and manufactured for specified piping system condition. Failures can occur for many reasons, but experience has shown that certain causes of failure fall into fairly distinct categories. The following are some typical causes.

a. Shipping & handling damage.

- Denting or gouging of bellows from being struck by hard object (tools, chain, falls, forklifts, adjacent structures, etc.)
- Improper stacking for shipping or storage.
- Insufficient protection from weather or other adverse environmental conditions.

b. Improper installation and insufficient protection during and after installation

- Joints with internal liners installed in reverse direction with respect to flow.
- Installing a joint in a location other than as prescribed by installation drawings.
- Premature removal of shipping devices.

- Springing of bellows to make up for piping misalignment.
- Insufficient protection from mechanical damage due to work in the surrounding area.
- Insufficient protection of bellows during nearby welding operations.
- Failure to remove shipping devices before system operation

c. Improper anchoring, guiding, supporting the piping system.

d. Anchor failure in service.

e. Bellows Corrosion: Improper selection of bellows material for the flowing medium and/or adverse external environment. Specifically, chlorides leaching from insulation has frequently been the cause of stainless steel bellows corrosion. Stress corrosion cracking.

f. System over-pressurization (in-service or hydrotest)

g. Bellows vibration (mechanical or flow induced) resulting in fatigue failure

h. Excessive bellows movement (axial, lateral, and angular greater than design)

i. Bellows erosion: Without internal liner installed in a system having a very high velocity and/or erosive flowing medium.

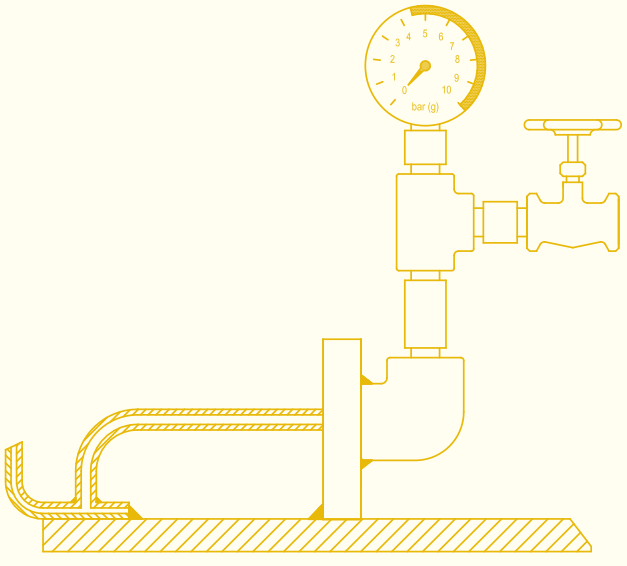
j. Packing of the particular matter in bellows convolutions which inhibit proper movement of the bellows.

Redundant – Testable Ply, Expansion Joint Assembly:

Most expansion joints in oil refineries, especially FCC units use two-ply bellows, but they are also ideal for regenerated catalyst standpipe, spent catalyst standpipe, recirculation cooled catalyst flue gas piping and hot gas expanded piping. Regardless of your application, downtime cost money. a two-ply testable bellows element is designed to provide you with the comfort of predictability.

In a two-ply testable bellows, each ply is designed to retain the full line pressure and temperature, providing a safety barrier in the event a leak is formed in the inner ply. Furthermore, by attaching a monitoring system to the outer ply, one can evaluate the status of the inner ply.

If the monitoring system shows full pressure on the pressure gauge, it indicates a leak in the inner ply. This is a tell tale sign to schedule maintenance in lieu of an unannounced shutdown.



Product Testing & Quality Assurance

Testing and Quality Assurance

REPL is a dedicated to provide quality products and services backed with a complete guarantee. With one of the most comprehensive quality assurance programs in the industry, our products are inspected and evaluated extensively through each stage of production. REPL is capable of performing all types of non-destructive testing : such as Radiography, Ultrasound, Mass Spectrometer, Magnetic Particle, Hydrostatic and Liquid Penetrant.

REPL can also provide cycle testing, meridional yield – rupture, spring rate testing, hardness testing, impact testing, ferrite count, pneumatic testing, helium leak detection and positive material identification (PMI) as part of our program. Our group inspectors are certified to ASNT-TC-1A with multiple Level II and III inspectors ingroup.

Anchors:

The force generated by expansion joint must be absorbed by anchors adequate to take the anticipated loads. At the same time it is possible to use anchors to divide a complex piping system into series of much simpler section that can be considered more easily.

Main Anchors:

A pipe anchor support is a rigid device that completely restricts pipe movement in all three dimensions while bearing the weight, side, and thrust loads. It is designed to prevent essentially all pipe rotation and displacement at the point of application.

Intermediate Anchors:

An intermediate anchor is one that divides a pipeline into individual expanding pipe sections containing multiple expansion devices of the same pipe size. Such an anchor must be designed to withstand the forces and moments imposed upon it by each of the pipe sections to which it is attached.
Although, intermediate anchors need not be designed to absorb pressure thrust force but they must be capable of absorbing all other forces generated in the system.

Directional or Planar Anchors:

Directional or planar anchors are designed to limit movement in either one or two planes but not in other planes.
They can be main or intermediated anchors, depending on the pipe layout and the type of expansion joints being used. The use of directional anchors can make a significant reduction in the number of expansion joints in a line.

Guides and Supports:

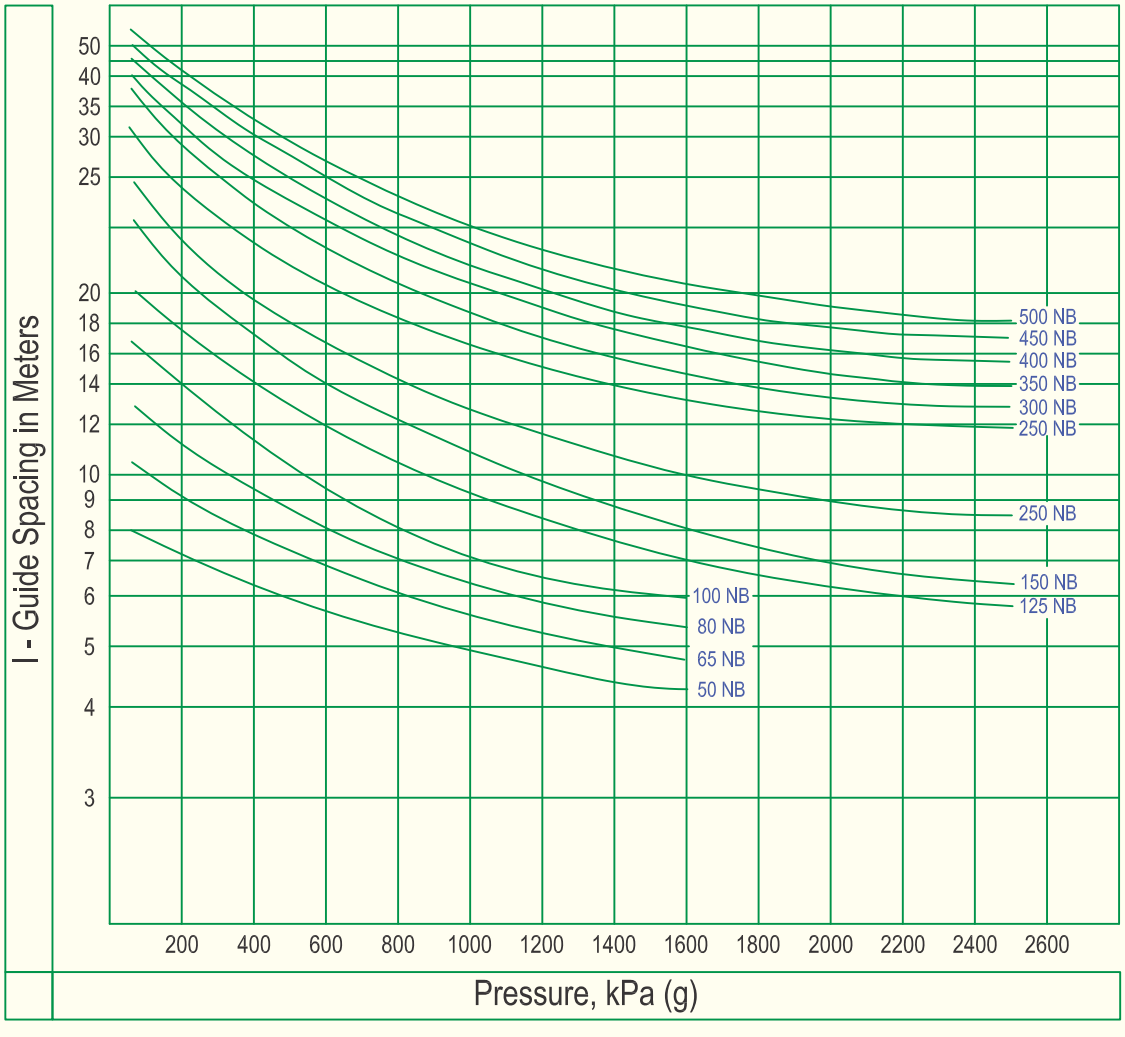
It is essential that pipe system containing bellows or expansion joints are correctly guided and supported, otherwise movement will be imposed on the joint of which they are not designed and premature failure may result.
A line containing an expansion joint is like a column and strut with only end fixed which means guides are required to prevent instability. The free end (nearest the expansion joint) needs more guiding then the fix end (nearest the anchor) and the usual rule is that:

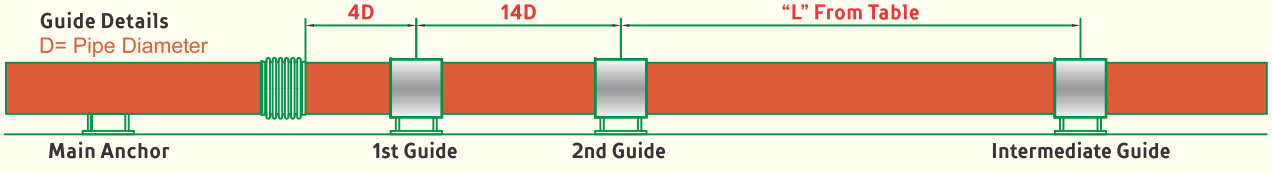
The guide nearest the expansion joint must be positioned not more than four times the pipe diameters from expansion joint.

The next guide should be not more than fourteen times pipe diameters from the first guide.

The remaining guides should be positioned according to pressure and pipe diameter as shown in the Guide Spacing Graph.

The force imposed on pipe guides depends on several factors which prevent simple analysis of the loads.





01. Single Expansion Joints (SEJ)

Bellows Material: SA 240 Gr. 304 or Equivalent

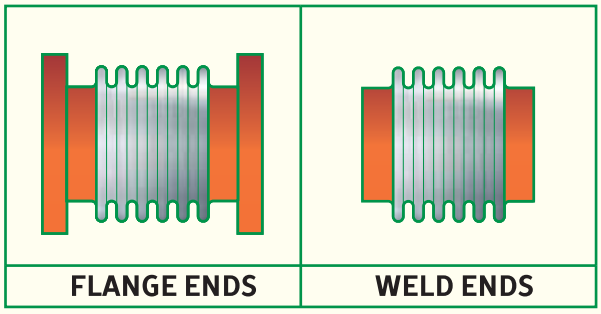
Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends

Optionals Limit Rods: shall be provided on request



Sr. No	Bellows Size	Overall Length		Convo-lutions	Design Pressure	Non Concurrent Movement			Spring Rate		
		FF	WW		kPa (g)	Axial	Lateral	Angular	Axial	Lateral	Angular
		mm	mm			mm	mm	Deg.	N/mm	N/mm	Nm/Deg.
1	50 NB	155	205	5	350	10	2	10	140	365	2
2	50 NB	120	210	5	1000	10	2	10	140	365	2
3	50 NB	115	205	5	2000	5	1	8	565	365	5
4	65 NB	125	205	5	350	10	2	10	165	590	3
5	65 NB	125	205	5	1000	10	2	10	165	590	3
6	65 NB	125	205	5	2000	5	1	8	620	2215	10
7	80 NB	130	210	5	350	12	2	10	155	670	4
8	80 NB	130	210	5	1000	6	1	10	585	2530	10
9	80 NB	130	210	5	2000	6	1	8	585	2530	10
10	90 NB	135	215	5	350	13	2	10	140	670	4
11	90 NB	135	215	5	1000	8	1	10	530	2510	15
12	90 NB	135	215	5	2000	8	1.5	8	530	2510	15
13	100 NB	135	215	5	350	15	2	8	155	910	5
14	100 NB	135	215	5	1000	8	1.5	8	590	3450	20
15	100 NB	140	220	5	2000	8	1	6	915	4690	30
16	125 NB	160	220	5	350	15	2.5	8	155	1150	5
17	125 NB	160	220	5	1000	10	1.5	8	585	4385	30
18	125 NB	160	220	5	2000	5	1	6	1130	8455	60
19	150 NB	165	225	5	350	18	2.5	8	150	1350	10
20	150 NB	165	225	5	1000	10	1.5	8	570	5160	40
21	150 NB	175	235	5	2000	8	1.4	6	1300	9395	99
22	200 NB	175	235	5	350	23	3	8	135	1565	15
23	200 NB	175	235	5	1000	12	1.5	8	515	5980	60
24	200 NB	175	235	5	2000	12	1.5	6	1025	12025	125
25	250 NB	160	220	4	350	20	1.5	8	175	4290	30
26	250 NB	230	290	8	350	40	5	8	85	535	15
27	250 NB	160	220	4	1000	10	0.8	6	1295	31975	240
28	250 NB	230	290	8	1000	18	3.4	7	645	3995	120
29	250 NB	170	345	4	2000	14	1	7	1650	30780	315
30	250 NB	255	320	8	2000	22	4	6	825	3845	155
31	300 NB	200	250	5	350	20	2	7	465	8330	120
32	300 NB	200	250	5	1000	20	1.9	7	935	16725	240
33	300 NB	200	250	5	2000	15	1.4	6	1795	32260	265
34	350 NB	215	265	5	350	25	2.5	7	340	5595	105
35	350 NB	215	265	5	1000	15	1.7	7	1120	18360	350

01. Single Expansion Joints (SEJ)

Sr. No	Bellows Size	Overall Length		Convo-lutions	Design Pressure	Non Concurrent Movement			Spring Rate		
		FF	WW		kPa (g)	Axial	Lateral	Angular	Axial	Lateral	Angular
		mm	mm			mm	mm	Deg.	N/mm	N/mm	Nm/Deg.
36	350 NB	215	265	5	2000	15	1.7	6	2240	36985	710
37	400 NB	220	270	5	350	27	2.7	7	340	6655	135
38	400 NB	220	270	5	1000	15	1.4	7	2175	42315	885
39	400 NB	230	270	5	2000	15	1.4	6	4345	85065	1780
40	450 NB	225	275	5	350	30	2.7	7	340	7655	170
41	450 NB	225	275	5	1000	15	1	7	2165	48710	1105
42	450 NB	270	350	5	2000	22	2	5	2540	40750	1330
43	500 NB	225	275	5	350	28	2.4	6	375	10345	235
44	500 NB	225	275	5	1000	15	1	2	2400	65935	1495
45	500 NB	294	310	5	2000	20	2	4	5440	94345	3510
46	550 NB	225	275	5	350	30	2	5	415	13600	305
47	550 NB	225	275	5	1000	25	1.7	4	1595	52570	1190
48	550 NB	310	320	5	2000	20	2	4	5085	94005	3950
49	600 NB	245	285	5	350	35	2	5	360	12080	320
50	600 NB	245	285	5	1000	28	2	5	1385	46670	1235
51	600 NB	312	310	5	2000	20	1.5	3	6510	159210	5925
52	650 NB	240	290	5	350	36	2	6	350	12740	360
53	650 NB	250	290	5	1000	30	1.5	3	1345	49205	1400
54	650 NB	260	310	5	2000	18	1	2	7035	199945	7445
55	700 NB	240	290	5	350	36	2	5	375	15765	450
56	700 NB	280	290	5	1000	28	0.2	0.5	1445	60920	1735
57	700 NB	260	310	5	2000	20	0.08	0.1	7560	247325	9200
58	750 NB	240	290	5	350	36	1.5	3	405	19415	550
59	750 NB	260	290	5	1000	25	1	3	2650	127360	3630
60	750 NB	275	325	5	2000	28	0.5	1	4365	138860	6180
61	800 NB	240	290	5	350	36	0.6	1	425	23175	660
62	800 NB	250	290	5	1000	25	1	3	2710	147635	4205
63	850 NB	240	290	5	350	30	1	3	870	53315	1515
64	850 NB	260	290	5	1000	25	0.1	0.1	2990	182995	5125
65	900 NB	240	290	5	350	30	1	3	920	62940	1790
66	900 NB	280	310	5	1000	25	1	3	4130	218385	8130
67	950 NB	240	290	5	350	30	1	3	970	73655	2100
68	950 NB	280	310	5	1000	25	1	3	4360	255330	9505
69	1000 NB	240	290	4	350	36	0.5	1	665	56585	1610
70	1000 NB	300	260	4	1000	32	1	2	2985	196270	7305
71	1050 NB	220	270	4	350	26	0	0.01	1095	137625	2880
72	1100 NB	220	270	4	350	24	0.5	2	1960	269645	5645
73	1150 NB	220	270	4	350	24	0.5	2	2045	306845	6425
74	1200 NB	240	270	4	350	24	0.4	1	2130	347305	7270
75	1250 NB	240	270	4	350	24	0.1	0.3	2215	391155	8190
76	1250 NB	240	390	8	350	45	0.4	0.5	1105	48890	4095
77	1300 NB	260	290	4	350	25	0.5	2	2835	400290	11410
78	1300 NB	400	430	8	350	50	3	4	1420	50030	5705
79	1350 NB	260	290	4	350	25	0.5	2	2940	446760	12765
80	1350 NB	400	430	8	350	50	3	4	1470	55840	6365
81	1400 NB	260	310	4	350	34	1	2	2065	259725	9670
82	1400 NB	440	470	8	350	66	4	5	1030	32460	4835
Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only											

02. Universal Expansion Joints (UEJ)

Bellows Material: SA 240 Gr. 304 or Equivalent

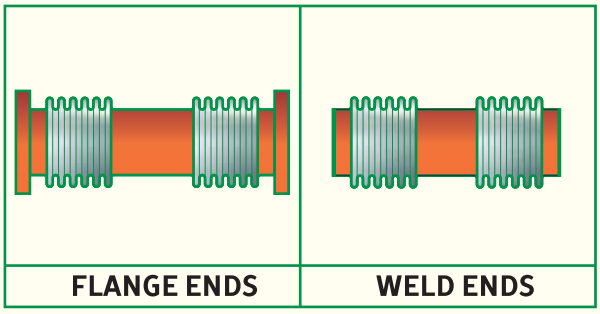
Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends

Optionals Limit Rods: shall be provided on request



Sr. No.	Bellows Size	Overall Length		Convo-lutions	Design pressure	Non Concurrent Movements		Spring Rate	
		FF	WW		kPa (g)	Axial	Lateral	Axial	Lateral
		mm	mm			mm	mm	N/mm	N/mm
1	50 NB	410	500	5	200	20	80	105	3
2	65 NB	420	500	5	200	20	65	120	5
3	80 NB	420	500	5	200	20	55	130	8
4	90 NB	430	510	5	200	25	60	115	9
5	100 NB	430	510	5	200	30	60	115	10
6	125 NB	460	520	5	200	30	50	125	15
7	150 NB	470	530	5	200	40	55	110	20
8	200 NB	490	550	5	200	50	55	100	25
9	250 NB	500	560	5	200	55	45	100	40
10	300 NB	520	570	5	200	65	45	95	54
11	350 NB	550	600	5	200	90	60	65	40
12	400 NB	550	600	5	200	95	55	65	55
13	450 NB	550	600	5	200	65	30	255	269
14	500 NB	560	610	5	200	65	30	280	340
15	550 NB	560	610	5	200	65	25	309	450
16	600 NB	590	630	5	200	70	30	265	435
17	650 NB	580	630	5	200	40	15	695	1090
18	700 NB	580	630	5	200	60	20	390	805
19	750 NB	580	630	5	200	60	20	415	985
20	800 NB	580	630	5	200	60	20	440	1185
21	850 NB	580	630	5	200	60	15	460	1385
22	900 NB	580	630	5	200	60	15	495	1670
23	950 NB	580	630	5	200	75	15	530	1955
24	1000 NB	1050	1100	3	100	75	55	345	265
25	1050 NB	1050	1100	3	100	55	35	565	455
26	1100 NB	1050	1100	3	100	55	35	590	525
27	1150 NB	1050	1100	3	100	55	35	615	595

02. Universal Expansion Joints (UEJ)

Sr. No.	Bellows Size	Overall Length		Convo-lutions	Design pressure	Non Concurrent Movements		Spring Rate	
		FF	WW		kPa (g)	Axial	Lateral	Axial	Lateral
		mm	mm			mm	mm	N/mm	N/mm
28	1200 NB	1050	1200	3	100	55	30	640	675
29	1250 NB	1150	1200	3	100	55	35	665	610
30	1300 NB	1150	1200	3	100	55	35	690	685
31	1350 NB	1150	1200	3	100	55	30	720	765
32	1400 NB	1150	1200	3	100	55	30	745	850
33	1450 NB	1150	1200	3	100	50	30	770	940
34	1500 NB	1150	1200	3	100	95	50	345	485
35	1550 NB	1150	1200	3	100	95	50	355	535
36	1600 NB	1150	1200	3	100	95	45	365	585
37	1650 NB	1150	1200	3	100	95	45	375	640
38	1700 NB	1150	1200	3	100	95	45	385	700
39	1800 NB	1150	1200	3	100	95	40	410	825
40	1900 NB	1150	1200	3	100	95	40	430	965
41	2000 NB	1650	1700	3	100	95	60	450	475
42	2150 NB	1650	1700	3	100	95	55	485	585
43	2200 NB	1650	1700	3	100	95	55	495	925
44	2300 NB	1650	1700	3	100	95	55	490	680
45	2400 NB	1650	1700	3	100	85	45	765	1145
46	2500 NB	1650	1700	3	100	85	40	795	1290
47	3000 NB	2150	2200	3	100	75	45	1290	1650
48	3400 NB	2150	2200	3	100	60	30	2500	4500
49	3800 NB	2150	2200	3	100	50	20	5390	11010
50	4000 NB	2150	2200	3	100	50	20	5670	12810
51	4200 NB	2150	2200	3	100	50	20	5670	12810
52	4400 NB	2150	2200	3	100	50	20	5945	14795
53	4500 NB	2150	2200	3	100	50	15	6495	19360
54	4600 NB	2150	2200	3	100	50	15	6770	21955
55	5000 NB	2150	2200	3	100	50	15	7040	24775
Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only									

03. Tied Single Expansion Joints (TSEJ)

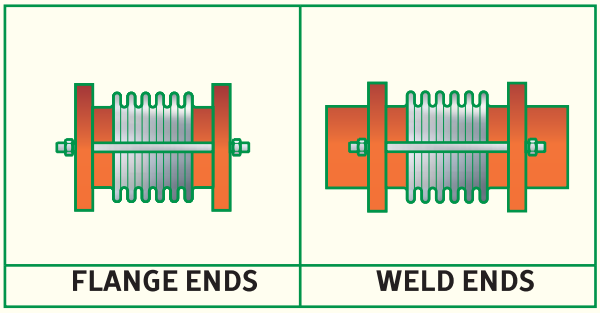
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



Sr. No.	Bellows Size	Overall Length		Convo-lutions	Design Pressure	Non Concurrent Movement			Spring Rate		
		FF	WW		kPa (g)	Axial	Lat-	Ang.	Axial	Lat.	Ang.
		mm	mm			mm	mm	Deg.	N/mm	N/mm	Nm/Deg.
1	50 NB	170	260	10	350	20	10	18	70	45	1
2	50 NB	170	260	10	1000	20	10	18	70	45	1
3	50 NB	170	260	10	2000	10	5	15	260	165	3
4	65 NB	180	260	10	350	20	10	20	80	70	1
5	65 NB	180	260	10	1000	20	9	17	80	70	1
6	65 NB	180	260	10	2000	10	5	13	310	275	5
7	80 NB	190	270	10	350	25	10	20	75	80	2
8	80 NB	190	270	10	1000	15	5	14	290	315	7
9	80 NB	190	270	10	2000	15	5	10	290	315	7
10	90 NB	200	280	10	350	30	10	10	70	80	2
11	90 NB	200	280	10	2000	18	5	11	265	310	8
12	90 NB	200	280	10	2000	18	5	11	265	310	8
13	100 NB	200	280	10	350	30	10	15	75	110	3
14	100 NB	280	200	10	1000	15	6	13	295	430	10
15	100 NB	210	290	10	2000	15	5	10	455	430	10
16	125 NB	230	290	10	350	30	10	15	75	140	4
17	125 NB	230	290	10	1000	20	5	12	290	545	15
18	125 NB	230	290	10	2000	15	4	9	565	1055	30
19	150 NB	240	300	10	350	40	10	15	75	170	6
20	150 NB	240	300	10	1000	20	5	11	285	640	20
21	150 NB	260	320	10	2000	19	5	9	650	1175	49
22	200 NB	260	320	10	350	50	10	15	65	195	8
23	200 NB	260	320	10	1000	29	5	10	255	745	30
24	200 NB	260	320	10	2000	29	5	10	510	1500	60
25	250 NB	230	290	8	350	40	5	13	85	535	16
26	250 NB	230	290	8	1000	20	3	7	645	3995	120
27	250 NB	255	320	8	2000	20	4	8	825	3845	155

03. Tied Single Expansion Joints (TSEJ)

Sr. No.	Bellows Size	Overall Length		Convo-lutions	Design Pressure	Non Concurrent Movement			Spring Rate		
		FF	WW		kPa (g)	Axial	Lat-	Ang.	Axial	Lat.	Ang.
		mm	mm			mm	mm	Deg.	N/mm	N/mm	Nm/Deg.
28	300 NB	300	350	10	350	40	8	12	230	1040	60
29	300 NB	300	350	10	1000	40	7	11	465	2090	120
30	300 NB	300	350	10	2000	30	5	8	895	4030	235
31	350 NB	330	380	10	350	55	10	13	170	700	54
32	350 NB	330	380	10	1000	35	7	8	560	2295	175
33	350 NB	330	380	10	2000	35	7	8	1120	4610	355
34	400 NB	340	390	10	350	55	11	12	170	830	70
35	400 NB	340	390	10	1000	30	5	7	650	5290	440
36	400 NB	340	390	10	2000	30	5	7	2170	10630	890
37	450 NB	350	400	10	350	64	11	12	170	955	85
38	450 NB	350	400	10	1000	30	5	7	1080	6085	550
39	450 NB	450	350	10	2000	45	9	9	1270	5090	665
40	500 NB	350	450	10	350	60	9	10	185	1290	115
41	500 NB	350	400	10	1000	30	4	4.5	1200	8240	745
42	500 NB	420	470	100	2000	40	8	7	2720	11790	1755
43	550 NB	350	400	10	350	60	9	10	205	1700	155
44	550 NB	350	400	10	1000	50	7	8	795	6570	590
45	550 NB	440	490	10	2000	45	8	7	2540	11750	1975
46	600 NB	380	420	10	350	70	10	10	180	1510	160
47	600 NB	380	420	10	1000	55	8	8	690	5830	615
48	600 NB	430	470	10	2000	40	6	6	3255	19900	2960
49	650 NB	380	430	10	350	75	10	10	175	1590	180
50	650 NB	380	430	10	1000	60	6	6	670	6150	700
51	700 NB	380	430	10	350	75	9	9	185	1970	225
52	700 NB	420	430	10	1000	60	1	1	20	7615	865
53	750 NB	380	430	10	350	75	6	6	200	2425	275
54	750 NB	400	430	10	1000	50	6	6	1325	15920	1815
55	800 NB	380	430	10	350	75	2	2	210	2895	330
56	800 NB	400	430	10	1000	55	6	6	1355	18450	2100
57	850 NB	380	430	10	350	60	6	7	435	6665	760
58	850 NB	420	430	10	1000	50	0.5	0.5	1495	22870	2605
59	900 NB	400	430	10	350	60	6	6	460	7865	895
60	900 NB	460	470	10	1000	50	6	6	2065	27295	4065
61	950 NB	400	430	10	350	60	5	6	485	9200	1050
62	950 NB	460	470	10	1000	50	5	5	2175	31915	4750
63	1000 NB	470	500	10	350	95	3	2	265	3620	645
64	1000 NB	560	550	10	1000	85	6	4	1195	12560	2920

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

04. Tied Universal Expansion Joints (TUEJ)

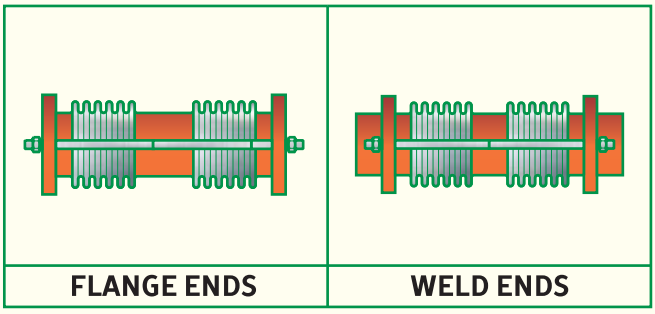
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



FLANGE ENDS | WELD ENDS

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Lateral Movement	Spring rate
		FF	WW		kPa (g)	mm	Lateral
		mm	mm				N/mm
1	50 NB	410	550	5	350	80	3
2	50 NB	410	550	5	1000	75	3
3	50 NB	420	560	5	2000	55	9
4	65 NB	420	550	5	350	65	5
5	65 NB	420	550	5	1000	65	5
6	65 NB	430	560	5	2000	45	15
7	80 NB	420	550	5	350	55	8
8	80 NB	420	550	5	1000	55	8
9	80 NB	430	560	5	2000	35	25
10	90 NB	430	560	5	350	60	9
11	90 NB	430	560	5	1000	55	9
12	90 NB	430	560	5	2000	35	30
13	100 NB	430	560	5	350	60	40
14	100 NB	430	560	5	1000	30	40
15	100 NB	430	560	5	2000	25	55
16	125 NB	460	570	5	350	50	15
17	125 NB	460	570	5	1000	30	60
18	125 NB	460	620	5	2000	25	90
19	150 NB	470	580	5	350	50	20
20	150 NB	470	580	5	1000	30	75
21	150 NB	410	550	5	2000	25	165
22	200 NB	410	550	5	350	50	25
23	200 NB	420	560	5	1000	25	150
24	200 NB	420	550	5	2000	25	325
25	250 NB	420	550	5	350	45	40
26	250 NB	430	560	5	1000	15	535
27	250 NB	420	550	5	2000	25	520

04. Tied Universal Expansion Joints (TUEJ)

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Lateral Movement	Spring rate
		FF	WW		kPa (g)	mm	Lateral
		mm	mm				N/mm
28	300 NB	420	550	5	350	25	205
29	300 NB	430	560	5	1000	15	685
30	300 NB	430	560	5	2000	15	840
31	350 NB	430	560	5	350	35	155
32	350 NB	430	560	5	1000	20	515
33	350 NB	430	560	5	2000	25	1010
34	400 NB	430	560	5	350	35	210
35	400 NB	430	560	5	1000	15	1330
36	400 NB	460	570	5	2000	15	1350
37	450 NB	460	570	5	350	30	265
38	450 NB	460	620	5	1000	15	1705
39	450 NB	470	580	5	2000	15	3320
40	500 NB	470	580	5	350	30	340
41	500 NB	560	710	5	1000	15	1880
42	500 NB	560	760	5	2000	15	4240
43	550 NB	560	710	5	350	25	450
44	550 NB	590	740	5	1000	10	4430
45	550 NB	620	820	5	2000	15	5420
46	600 NB	580	720	5	350	25	615
47	600 NB	590	730	5	1000	10	5700
48	600 NB	630	820	5	2000	15	6970
49	650 NB	580	730	5	320	15	1090
50	650 NB	660	810	5	1000	10	5055
51	700 NB	580	730	5	350	20	805
52	700 NB	580	730	5	1000	15	5350
53	750 NB	580	730	5	350	15	1395
54	750 NB	580	730	5	1000	10	6530
55	800 NB	580	730	5	350	15	2295
56	800 NB	580	780	5	1000	10	870
57	850 NB	580	730	5	350	15	2735
58	850 NB	580	780	5	1000	10	18155
59	900 NB	580	730	5	350	10	3230
60	900 NB	580	780	5	1000	5	21440
61	950 NB	580	730	5	350	10	6470
62	1000 NB	1050	1200	3	350	35	875
63	1050 NB	1050	1200	3	350	25	1515
64	1100 NB	1050	1200	3	350	20	1735

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

05. Hinged Single Expansion Joints (HSEJ)

Bellows Material: SA 240 Gr. 304 or Equivalent

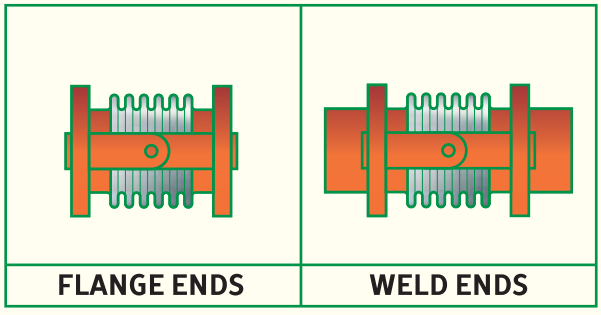
Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends

Optional : Slotted Hinge available for Axial Movement



Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Angular Movement	Spring rate
		FF	WW		kPa (g)	Degree	Angular
		mm	mm				Nm/Degree
1	50 NB	170	260	10	350	10	1
2	50 NB	170	260	10	1000	10	1
3	50 NB	170	260	10	2000	10	3
4	65 NB	180	260	10	350	10	1
5	65 NB	180	260	10	1000	10	1
6	65 NB	180	260	10	2000	10	5
7	80 NB	190	270	10	350	10	2
8	80 NB	190	270	10	1000	10	7
9	80 NB	190	270	10	2000	10	7
10	90 NB	200	280	10	350	10	2
11	90 NB	200	280	10	2000	10	8
12	90 NB	200	280	10	2000	10	8
13	100 NB	200	280	10	350	10	3
14	100 NB	280	200	10	1000	10	10
15	100 NB	210	290	10	2000	10	10
16	125 NB	230	290	10	350	10	4
17	125 NB	230	290	10	1000	10	15
18	125 NB	230	290	10	2000	9	30
19	150 NB	240	300	10	350	10	6
20	150 NB	240	300	10	1000	10	50
21	150 NB	260	320	10	2000	9	45
22	200 NB	260	320	10	350	10	8
23	200 NB	260	320	10	1000	10	30
24	200 NB	260	320	10	2000	10	60
25	250 NB	230	290	8	350	10	15
26	250 NB	230	290	8	1000	7	12
27	250 NB	255	320	8	2000	8	155

05. Hinged Single Expansion Joints (HSEJ)

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Angular Movement	Spring rate
		FF	WW		kPa (g)	Degree	Angular
		mm	mm				Nm/Degree
28	300 NB	300	350	10	350	10	60
29	300 NB	300	350	10	1000	10	120
30	300 NB	300	350	10	2000	8	235
31	350 NB	330	380	10	350	10	50
32	350 NB	330	380	10	1000	8	175
33	350 NB	330	380	10	2000	8	355
34	400 NB	340	390	10	350	10	70
35	400 NB	340	390	10	1000	7	440
36	400 NB	370	390	10	2000	7	890
37	450 NB	350	400	10	350	10	85
38	450 NB	350	400	10	1000	7	550
39	450 NB	440	450	10	2000	9	665
40	500 NB	350	400	10	350	10	115
41	500 NB	350	400	10	1000	4.5	745
42	500 NB	470	470	10	2000	7	1755
43	550 NB	350	400	10	350	10	150
44	550 NB	360	400	10	1000	8	595
45	550 NB	520	490	10	2000	7	1975
46	600 NB	380	420	10	350	10	160
47	600 NB	400	420	10	1000	8	615
48	600 NB	500	470	10	2000	6	2960
49	650 NB	380	430	10	350	10	180
50	650 NB	400	430	10	1000	6	700
51	700 NB	380	430	10	350	9	225
52	700 NB	450	430	10	1000	1	865
53	750 NB	380	430	10	350	6	275
54	750 NB	450	430	10	1000	6	1810
55	800 NB	380	430	10	350	2	330
56	800 NB	450	430	10	1000	6	2100
57	850 NB	380	430	10	350	7	760
58	850 NB	450	430	10	1000	0.5	2605
59	900 NB	390	430	10	350	6	895
60	900 NB	480	470	10	1000	6	4065
61	950 NB	440	470	10	1000	5	4750
62	1000 NB	450	500	10	350	2	645
63	1050 NB	420	450	10	350	0.01	1150
64	1100 NB	420	450	10	350	5	2255
Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only							

06. Hinged Universal Expansion Joints (HUEJ)

Bellows Material: SA 240 Gr. 304 or Equivalent

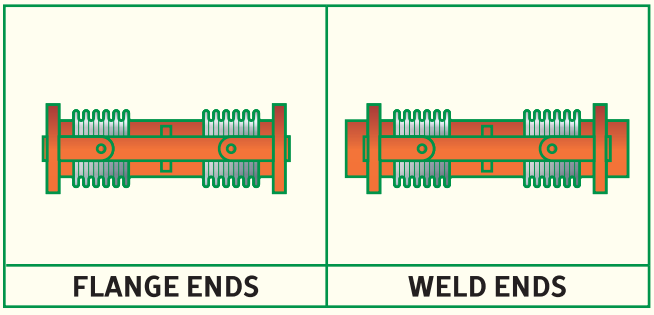
Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends

Optional : Slotted Hinge available for Axial Movement



Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Lateral Movement	Spring rate
		FF	WW		kPa (g)	mm	Lateral
		mm	mm				N/mm
1	50 NB	410	550	5	350	80	3
2	50 NB	410	550	5	1000	75	3
3	50 NB	420	560	5	2000	55	9
4	65 NB	420	550	5	350	65	5
5	65 NB	420	550	5	1000	65	5
6	65 NB	430	560	5	2000	45	15
7	80 NB	420	550	5	350	55	8
8	80 NB	420	550	5	1000	55	8
9	80 NB	430	560	5	2000	35	25
10	90 NB	430	560	5	350	60	9
11	90 NB	430	560	5	1000	55	9
12	90 NB	430	560	5	2000	35	30
13	100 NB	430	560	5	350	60	40
14	100 NB	430	560	5	1000	30	40
15	100 NB	430	560	5	2000	25	5
16	125 NB	460	570	5	350	50	15
17	125 NB	460	570	5	1000	30	60
18	125 NB	460	620	5	2000	25	90
19	150 NB	470	580	5	350	50	20
20	150 NB	470	580	5	1000	30	75
21	150 NB	410	550	5	2000	25	165
22	200 NB	410	550	5	350	50	25
23	200 NB	420	560	5	1000	25	150
24	200 NB	420	550	5	2000	25	325
25	250 NB	420	550	5	350	45	40
26	250 NB	430	560	5	1000	15	535
27	250 NB	420	550	5	2000	25	520

06. Hinged Universal Expansion Joints (HUEJ)

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Lateral Movement	Spring rate
		FF	WW		kPa (g)	mm	Lateral
		mm	mm				N/mm
28	300 NB	420	550	5	350	25	205
29	300 NB	430	560	5	1000	15	685
30	300 NB	430	560	5	2000	15	840
31	350 NB	430	560	5	350	35	155
32	350 NB	430	560	5	1000	20	515
33	350 NB	430	560	5	2000	25	1010
34	400 NB	430	560	5	350	35	210
35	400 NB	430	560	5	1000	15	1330
36	400 NB	460	570	5	2000	15	1350
37	450 NB	460	570	5	350	30	265
38	450 NB	460	620	5	1000	15	1705
39	450 NB	470	580	5	2000	15	3320
40	500 NB	470	580	5	350	30	340
41	500 NB	560	710	5	1000	15	1875
42	500 NB	560	760	5	2000	15	4240
43	550 NB	560	710	5	350	25	450
44	550 NB	590	740	5	1000	10	4430
45	550 NB	620	820	5	2000	15	5420
46	600 NB	580	720	5	350	25	615
47	600 NB	590	730	5	1000	10	5700
48	600 NB	630	820	5	2000	15	6970
49	650 NB	580	730	5	320	15	1090
50	650 NB	660	810	5	1000	10	5055
51	700 NB	580	730	5	350	20	805
52	700 NB	580	730	5	1000	15	5350
53	750 NB	580	730	5	350	15	1390
54	750 NB	580	730	5	1000	10	6530
55	800 NB	580	730	5	350	15	2295
56	800 NB	580	780	5	1000	10	7870
57	850 NB	580	730	5	350	15	2735
58	850 NB	580	780	5	1000	10	18155
59	900 NB	580	730	5	350	10	3230
60	900 NB	580	780	5	1000	5	21440
61	950 NB	580	730	5	350	10	6470
62	1000 NB	1050	1200	3	350	35	875
63	1050 NB	1050	1200	3	350	25	1515
64	1100 NB	1050	1200	3	350	20	1730

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

07. Gimbal Single Expansion Joints (GSEJ)

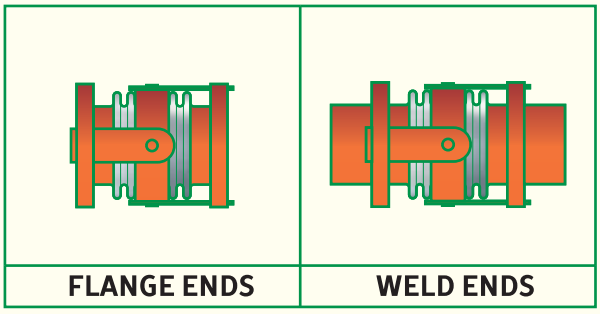
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



FLANGE ENDS | WELD ENDS

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Angular Movement	Spring rate
		FF	WW		kPa (g)	Degree	Angular
		mm	mm				Nm/Degree
1	50 NB	170	260	10	350	18	1
2	50 NB	170	260	10	1000	18	1
3	50 NB	170	260	10	2000	15	3
4	65 NB	180	260	10	350	20	1
5	65 NB	180	260	10	1000	15	1
6	65 NB	180	260	10	2000	13	5
7	80 NB	190	270	10	350	20	2
8	80 NB	190	270	10	1000	14	7
9	80 NB	190	270	10	2000	10	7
10	90 NB	200	280	10	350	20	2
11	90 NB	200	280	10	2000	14	8
12	90 NB	200	280	10	2000	11	8
13	100 NB	200	280	10	350	15	3
14	100 NB	280	200	10	1000	13	10
15	100 NB	210	290	10	2000	10	10
16	125 NB	230	290	10	350	15	4
17	125 NB	230	290	10	1000	12	15
18	125 NB	230	290	10	2000	9	30
19	150 NB	240	300	10	350	15	5
20	150 NB	240	300	10	1000	11	20
21	150 NB	260	320	10	2000	9	45
22	200 NB	260	320	10	350	15	8
23	200 NB	260	320	10	1000	10	30
24	200 NB	260	320	10	2000	10	60
25	250 NB	230	290	8	350	13	15
26	250 NB	230	290	8	1000	7	120
27	250 NB	255	320	8	2000	8	155

07. Gimbal Single Expansion Joints (GSEJ)

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Angular Movement	Spring rate
		FF	WW		kPa (g)	Degree	Angular
		mm	mm				Nm/Degree
28	300 NB	300	350	10	350	12	60
29	300 NB	300	350	10	1000	11	120
30	300 NB	300	350	10	2000	8	230
31	350 NB	330	380	10	350	13	50
32	350 NB	330	380	10	1000	8	175
33	350 NB	330	380	10	2000	8	350
34	400 NB	340	390	10	350	12	70
35	400 NB	340	390	10	1000	7	440
36	400 NB	370	390	10	2000	7	890
37	450 NB	350	400	10	350	12	85
38	450 NB	350	400	10	1000	7	550
39	450 NB	440	450	10	2000	9	665
40	500 NB	350	400	10	350	10	115
41	500 NB	350	400	10	1000	4.5	740
42	500 NB	470	470	10	2000	7	1750
43	550 NB	350	400	10	350	10	150
44	550 NB	360	400	10	1000	8	595
45	550 NB	520	490	10	2000	7	1975
46	600 NB	380	420	10	350	10	160
47	600 NB	400	420	10	1000	8	615
48	600 NB	500	470	10	2000	6	2960
49	650 NB	380	430	10	350	10	180
50	650 NB	400	430	10	1000	6	700
51	700 NB	380	430	10	350	9	220
52	700 NB	450	430	10	1000	1	865
53	750 NB	380	430	10	350	6	275
54	750 NB	450	430	10	1000	6	1810
55	800 NB	380	430	10	350	2	330
56	800 NB	450	430	10	1000	6	2100
57	850 NB	380	430	10	350	7	760
58	850 NB	450	430	10	1000	0.5	2605
59	900 NB	390	430	10	350	6	895
60	900 NB	480	470	10	1000	6	4060
61	950 NB	440	470	10	1000	5	4750
62	1000 NB	450	500	10	350	2	645
63	1050 NB	420	450	10	350	0.01	1150
64	1100 NB	420	450	10	350	5	2255

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

08. Gimbal Universal Expansion Joints (GUEJ)

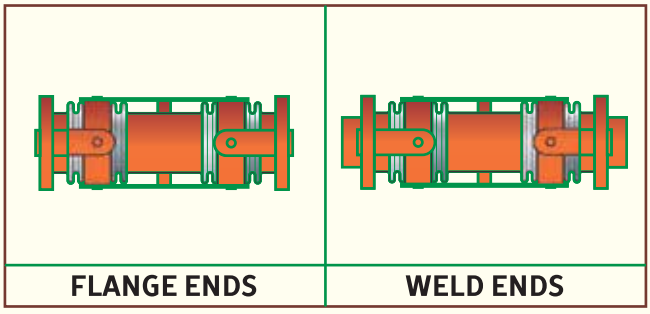
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Lateral Movement	Spring rate
		FF	WW		kPa (g)	mm	Lateral
		mm	mm				N/mm
1	50 NB	410	550	5	350	80	3
2	50 NB	410	550	5	1000	75	3
3	50 NB	420	560	5	2000	55	9
4	65 NB	420	550	5	350	65	5
5	65 NB	420	550	5	1000	65	5
6	65 NB	430	560	5	2000	45	15
7	80 NB	420	550	5	350	55	8
8	80 NB	420	550	5	1000	55	8
9	80 NB	430	560	5	2000	35	25
10	90 NB	430	560	5	350	60	9
11	90 NB	430	560	5	1000	55	9
12	90 NB	430	560	5	2000	35	30
13	100 NB	430	560	5	350	60	40
14	100 NB	430	560	5	1000	30	40
15	100 NB	430	560	5	2000	25	55
16	125 NB	460	570	5	350	50	15
17	125 NB	460	570	5	1000	30	60
18	125 NB	460	620	5	2000	25	90
19	150 NB	470	580	5	350	50	20
20	150 NB	470	580	5	1000	30	75
21	150 NB	410	550	5	2000	25	165
22	200 NB	410	550	5	350	50	25
23	200 NB	420	560	5	1000	25	150
24	200 NB	420	550	5	2000	25	325
25	250 NB	420	550	5	350	45	40
26	250 NB	430	560	5	1000	15	535
27	250 NB	420	550	5	2000	25	520

08. Gimbal Universal Expansion Joints (GUEJ)

Sr. No.	Bellows Size	Overall Length		Convolutions	Design Pressure	Lateral Movement	Spring rate
		FF	WW		kPa (g)	mm	Lateral
		mm	mm				N/mm
28	300 NB	420	550	5	350	25	205
29	300 NB	430	560	5	1000	15	685
30	300 NB	430	560	5	2000	15	840
31	350 NB	430	560	5	350	35	155
32	350 NB	430	560	5	1000	20	515
33	350 NB	430	560	5	2000	25	1010
34	400 NB	430	560	5	350	35	210
35	400 NB	430	560	5	1000	15	1330
36	400 NB	460	570	5	2000	15	1350
37	450 NB	460	570	5	350	30	265
38	450 NB	460	620	5	1000	15	1705
39	450 NB	470	580	5	2000	15	3320
40	500 NB	470	580	5	350	30	340
41	500 NB	560	710	5	1000	15	1880
42	500 NB	560	760	5	2000	15	4240
43	550 NB	560	710	5	350	25	450
44	550 NB	590	740	5	1000	10	4430
45	550 NB	620	820	5	2000	15	5420
46	600 NB	580	720	5	350	25	615
47	600 NB	590	730	5	1000	10	5700
48	600 NB	630	820	5	2000	15	6965
49	650 NB	580	730	5	320	15	1090
50	650 NB	660	810	5	1000	10	5050
51	700 NB	580	730	5	350	20	805
52	700 NB	580	730	5	1000	15	5350
53	750 NB	580	730	5	350	15	1390
54	750 NB	580	730	5	1000	10	6530
55	800 NB	580	730	5	350	15	2290
56	800 NB	580	780	5	1000	10	7870
57	850 NB	580	730	5	350	15	2730
58	850 NB	580	780	5	1000	10	18150
59	900 NB	580	730	5	350	10	3220
60	900 NB	580	780	5	1000	5	21440
61	950 NB	580	730	5	350	10	6470
62	1000 NB	1050	1200	3	350	35	870
63	1050 NB	1050	1200	3	350	25	1515
64	1100 NB	1050	1200	3	350	20	1730
Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only							

09. Pressure Balanced Single Expansion Joints (PBSEJ)

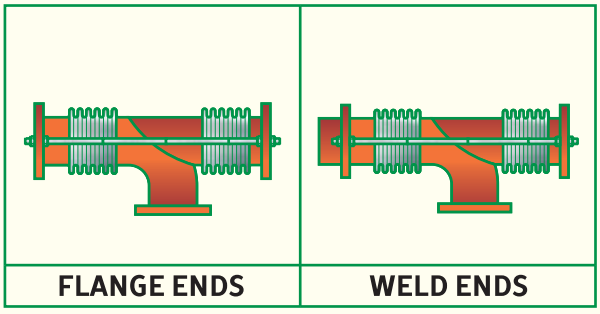
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



Sr. No	Bellows Size	Length "L" Elbow Center		Height "H" Elbow Center		Convo-lutions	Design Pressure	Non Concurrent Movement		Spring rate	
		FF	WW	FF	WW	Nos.	kPa (g)	Axial	Lat.	Axial	Lat.
		mm	mm	mm	mm			mm	mm	N/mm	N/mm
1	50 NB	285	385	150	125	10	350	-22	10	140	45
2	50 NB	285	385	150	125	10	1000	-20	10	140	45
3	50 NB	285	385	150	125	10	2000	-10	7	520	165
4	65 NB	308	408	173	148	10	350	-20	10	165	70
5	65 NB	308	408	173	148	10	1000	-20	9	165	70
6	65 NB	308	408	173	148	10	2000	-10	5	620	275
7	80 NB	340	440	195	170	10	350	-25	10	155	80
8	80 NB	340	440	195	170	10	1000	-15	6	585	315
9	80 NB	340	440	195	170	10	2000	-15	5	585	315
10	90 NB	365	465	210	185	10	350	-30	10	140	80
11	90 NB	365	465	210	185	10	1000	-15	7	530	310
12	90 NB	365	465	210	185	10	2000	-15	6	530	310
13	100 NB	380	480	225	200	10	350	-30	10	155	110
14	100 NB	380	480	225	200	10	1000	-15	6	590	430
15	100 NB	390	490	225	200	10	2000	-16	5.5	915	430
16	125 NB	428	528	263	238	10	350	-30	10	155	140
17	125 NB	428	528	263	238	10	1000	-20	6	585	545
18	125 NB	428	528	263	238	10	2000	-15	4.5	1130	1055
19	150 NB	475	575	300	275	10	350	-40	10	150	165
20	150 NB	475	575	300	275	10	1000	-20	6	570	640
21	150 NB	595	645	345	300	10	2000	-15	5	1300	1175
22	200 NB	570	670	375	350	10	350	-50	12	130	195
23	200 NB	570	670	375	350	10	1000	-25	7	510	740
24	200 NB	570	670	375	350	10	2000	-25	6	1025	1500
25	250 NB	619	719	450	425	8	350	-40	7	170	535
26	250 NB	619	719	450	425	8	350	-20	3.4	1295	3995
27	250 NB	743	793	495	450	8	1000	-20	4	1650	3845

09. Pressure Balanced Single Expansion Joints (PBSEJ)

Sr. No	Bellows Size	Length "L" Elbow Center		Height "H" Elbow Center		Convo-lutions	Design Pressure	Non Concurrent Movement		Spring rate	
		FF	WW	FF	WW	Nos.	kPa (g)	Axial	Lat.	Axial	Lat.
		mm	mm	mm	mm			mm	mm	N/mm	N/mm
28	300 NB	750	850	525	500	10	350	-40	8	465	1040
29	300 NB	850	900	570	525	10	1000	-40	7	930	2090
30	300 NB	850	900	570	525	10	2000	-30	5.5	1795	4030
31	350 NB	855	955	600	575	10	350	-55	11	340	700
32	350 NB	955	1005	645	600	10	1000	-35	7	1120	2295
33	350 NB	955	1005	645	600	10	2000	-35	7	2240	4610
34	400 NB	940	1040	675	650	10	350	-55	11	340	830
35	400 NB	1040	1090	720	675	10	1000	-30	5	2175	5290
36	400 NB	1040	1090	720	675	10	2000	-30	5	4345	10630
37	450 NB	1025	1125	750	725	10	350	-60	11	340	955
38	450 NB	1125	1175	795	750	10	1000	-30	5	2165	6085
39	450 NB	1175	1225	795	750	10	2000	-45	9	2540	5090
40	500 NB	1200	1250	870	825	10	350	-60	9	375	1290
41	500 NB	1200	1250	870	825	10	1000	-30	4	2400	8040
42	550 NB	1275	1325	945	900	10	350	-60	9	410	1700
43	550 NB	1275	1325	945	900	10	1000	-50	7	1595	6570
44	600 NB	1370	1420	1020	975	10	350	-70	10	360	1500
45	600 NB	1370	1420	1020	975	10	1000	-55	8	1385	5830
46	650 NB	1455	1505	1095	1050	10	350	-75	10	350	1590
47	650 NB	1455	1505	1095	1050	10	1000	-60	6	1345	6450
48	700 NB	1530	1580	1170	1125	10	350	-75	9	375	1970
49	700 NB	1530	1580	1170	1125	10	1000	-60	1	1445	7610
50	750 NB	1605	1655	1245	1200	10	350	-75	6	405	2425
51	750 NB	1605	1655	1245	1200	10	1000	-50	6	2650	15920
52	800 NB	1680	1730	1320	1275	10	350	-75	2	425	2895
53	850 NB	1755	1805	1395	1350	10	350	-60	6	870	6665
54	900 NB	1830	1880	1470	1425	10	350	-60	6	920	7865
55	950 NB	1905	1955	1545	1500	10	350	-60	5	970	9205
56	1000 NB	2050	2100	1620	1575	10	350	-95	3	530	3620
57	1050 NB	2075	2125	1695	1650	10	350	-70	0.01	875	8805
58	1100 NB	2150	2200	1770	1725	10	350	-60	5	1570	17525
59	1150 NB	225	2275	1845	1800	10	350	-60	4	1635	19635
60	1200 NB	2300	2350	1920	1875	10	350	-60	2	1705	22225
61	1250 NB	2315	2365	1995	1950	8	350	-45	0.4	2215	48895
62	1300 NB	2430	2480	2070	2025	8	350	-50	3	2840	50035
63	1350 NB	2505	2555	2145	2100	8	350	-50	3	2940	55845
64	1400 NB	2620	2670	2220	2175	8	350	-65	4	2065	32465
Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only											

10. Pressure Balanced Universal Expansion Joints (PBUEJ)

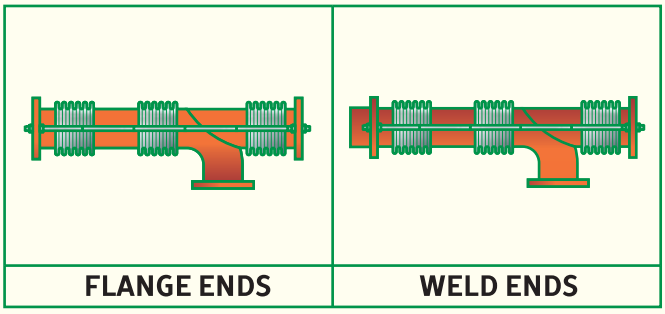
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



Sr. No	Bellows Size	Length "L" Elbow Center		Height "H" Elbow Center		Convo-lutions	Design Pressure	Non Concurrent Movement		Spring rate	
		FF	WW	FF	WW	Nos.	kPa (g)	Axial	Lat.	Axial	Lat.
		mm	mm	mm	mm			mm	mm	N/mm	N/mm
1	50 NB	525	625	150	125	5	350	-20	80	320	3
2	50 NB	525	625	150	125	5	1000	-20	75	320	3
3	50 NB	535	635	150	125	5	2000	-15	55	920	9
4	65 NB	547.5	647.5	173	148	5	350	-20	65	370	5
5	65 NB	547.5	647.5	173	148	5	1000	-20	65	370	5
6	65 NB	557.5	657.5	173	148	5	2000	-15	45	1100	15
7	80 NB	570	670	195	170	5	350	-20	55	390	8
8	80 NB	570	670	195	170	5	1000	-20	55	390	8
9	80 NB	580	680	195	170	5	2000	-15	35	1310	25
10	90 NB	595	695	210	185	5	350	-25	60	350	9
11	90 NB	595	695	210	185	5	1000	-25	55	350	9
12	90 NB	595	695	210	185	5	2000	-15	35	1325	30
13	100 NB	610	710	225	200	5	350	-30	60	1325	40
14	100 NB	610	710	225	200	5	1000	-15	30	1295	40
15	100 NB	610	710	225	200	5	2000	-15	25	1870	55
16	125 NB	657.5	757.5	263	238	5	350	-30	50	345	15
17	125 NB	657.5	757.5	263	238	5	1000	-15	30	1460	60
18	125 NB	657.5	757.5	263	238	5	2000	-15	25	2065	90
19	150 NB	705	805	300	275	5	350	-40	50	335	20
20	150 NB	705	805	300	275	5	1000	-20	30	1275	76
21	150 NB	825	875	345	300	5	2000	-15	25	2910	165
22	200 NB	800	900	375	350	5	350	-50	50	300	25
23	200 NB	800	900	375	350	5	1000	-25	25	1620	150
24	200 NB	940	990	375	350	5	2000	-20	25	3920	325
25	250 NB	885	985	450	425	5	350	-55	45	310	40
26	250 NB	885	985	450	425	5	1000	-20	15	3965	535
27	250 NB	1085	1135	495	450	5	2000	-30	25	4900	520

10. Pressure Balanced Universal Expansion Joints (PBUEJ)

Sr. No	Bellows Size	Length "L" Elbow Center		Height "H" Elbow Center		Convo-lutions	Design Pressure	Non Concurrent Movement		Spring rate	
		FF	WW	FF	WW	Nos.	kPa (g)	Axial	Lat.	Axial	Lat.
		mm	mm	mm	mm			mm	mm	N/mm	N/mm
28	300 NB	970	1070	525	500	5	350	-35	25	1125	205
29	300 NB	1070	1120	570	525	5	1000	-25	15	3710	680
30	300 NB	1160	1210	570	525	5	2000	-30	15	5790	840
31	350 NB	1075	1175	600	575	5	350	-55	35	705	155
32	350 NB	1175	1225	645	600	5	1000	-35	20	2510	515
33	350 NB	1175	1225	645	600	5	2000	-35	25	4885	1010
34	400 NB	1150	1250	675	650	5	350	-55	35	770	205
35	400 NB	1250	1300	720	675	5	1000	-30	15	4875	1330
36	400 NB	1250	1300	720	675	5	2000	-40	15	4920	1350
37	450 NB	1225	1325	750	725	5	350	-60	30	765	265
38	450 NB	1325	1375	795	750	5	1000	-30	15	4850	1705
39	450 NB	1325	1375	795	750	5	2000	-35	15	9385	3320
40	500 NB	1410	1460	870	825	5	350	-60	30	845	340
41	500 NB	1410	1460	870	825	5	1000	-35	15	4610	1880
42	550 NB	1485	1535	945	900	5	350	-60	25	925	450
43	550 NB	1515	1565	945	900	5	1000	-30	10	9895	4430
44	600 NB	1580	1630	1020	975	5	350	-60	25	1140	615
45	600 NB	1590	1640	1020	975	5	1000	-30	10	10775	5700
46	650 NB	1655	1705	1095	1050	5	350	-40	15	2080	1090
47	650 NB	1735	1785	1095	1050	5	1000	-30	10	11635	5050
48	700 NB	1730	1780	1170	1125	5	350	-60	20	1165	805
49	700 NB	1730	1780	1170	1125	5	1000	-40	15	7720	5345
50	750 NB	1805	1855	1245	1200	5	350	-55	15	1765	1390
51	750 NB	1805	1855	1245	1200	5	1000	-40	10	8250	6530
52	800 NB	1880	1930	1320	1275	5	350	-50	15	2265	2295
53	850 NB	1955	2005	1395	1350	5	350	-50	15	2720	2735
54	900 NB	2030	2080	1470	1425	5	350	-50	10	2875	3230
55	950 NB	2105	2155	1545	1500	5	350	-40	10	5185	6470
56	1000 NB	2650	2700	1620	1575	3	350	-45	35	3415	875
57	1050 NB	2725	2775	1695	1650	3	350	-35	25	5595	1515
58	1100 NB	2800	2850	1770	1725	3	350	-35	20	5855	1730
59	1150 NB	2875	2925	1845	1800	3	350	-35	15	6110	1970
60	1200 NB	2950	3000	1920	1875	3	350	-35	5	6365	2230
61	1250 NB	3125	3175	1995	1950	3	350	-25	15	12790	3905
62	1300 NB	3200	3250	2070	2025	3	350	-25	15	13285	4380
63	1350 NB	3275	3325	2145	2100	3	350	-25	15	13780	4890
64	1400 NB	3350	3400	2220	2175	3	350	-25	15	14275	5440

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

11. Externally Pressurized Single Expansion Joints (EPUEJ)

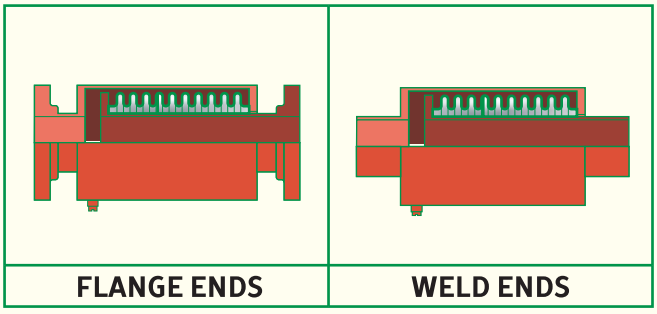
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



FLANGE ENDS | WELD ENDS

Sr No	Bellows Type	Overall Length	Design Pressure	Convolutions	Movement	Spring rate	Effective Area
		FF/WW	kPa (G)		Axial	Axial	mm2
		mm			mm	N/mm	
1	40 NB	596	1000	18	100	40	1690
2	40 NB	830	1000	25	150	25	4810
3	50 NB	596	1000	18	100	50	6360
4	50 NB	830	1000	25	150	30	6500
5	65 NB	614	1000	18	100	60	8805
6	65 NB	830	1000	25	150	40	8890
7	80 NB	614	1000	18	100	65	11045
8	80 NB	830	1000	25	150	45	11140
9	100 NB	640	1000	12	100	120	17525
10	100 NB	860	1000	18	150	80	17525
11	125 NB	640	1000	12	100	155	29160
12	125 NB	860	1000	18	150	100	29160
13	150 NB	640	1000	12	100	185	40610
14	150 NB	860	1000	18	150	120	40610
15	200 NB	676	1000	12	100	240	69460
16	200 NB	914	1000	18	150	160	69460
17	250 NB	670	1000	10	100	300	97810
18	250 NB	914	1000	15	150	200	97810
19	300 NB	700	1000	10	100	415	116960
20	300 NB	940	1000	15	150	275	116960
21	350 NB	700	1000	10	100	445	150260
22	350 NB -XB-1000	940	1000	15	150	295	150260
23	400 NB-XB-1000	720	1000	10	100	515	186650
24	400 NB-XB-1000	940	1000	15	150	340	186650
25	450 NB-XB-1000	720	1000	8	100	630	229785
26	450 NB-XB-1000	940	1000	12	150	420	229785
27	500 NB-XB-1000	720	1000	8	100	525	275160

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

12. Externally Pressurized Universal Expansion Joints (EPUEJ)

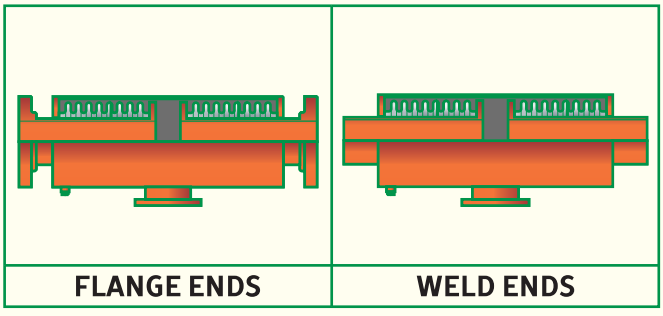
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



FLANGE ENDS | WELD ENDS

Sr No	Bellows Type	Overall Length FF/WW mm	Design Pressure kPa (G)	Convolutions	Mounting Foot Type	Movement Axial mm	Spring rate Axial N/mm	Effective Area mm2
1	40 NB	1052	1000	18	A	200	20	4690
2	40 NB	1520	1000	25	A	300	15	4815
3	50 NB	1052	1000	18	A	200	20	6360
4	50 NB	1520	1000	25	A	300	15	6500
5	65 NB	1088	1000	18	A	200	30	8805
6	65 NB	1520	1000	25	A	300	20	8890
7	80 NB	1088	1000	18	A	200	30	11045
8	80 NB	1520	1000	25	A	300	23	11140
9	100 NB	1130	1000	12	A	200	60	17530
10	100 NB	1570	1000	18	A	300	40	17530
11	125 NB	1130	1000	12	A	200	75	29160
12	125 NB	1570	1000	18	A	300	50	29160
13	150 NB	1130	1000	12	A	200	90	40610
14	150 NB	1570	1000	18	A	300	60	40610
15	200 NB	1202	1000	12	B	200	120	69465
16	200 NB	1678	1000	18	B	300	80	69465
17	250 NB	1202	1000	10	B	200	150	97810
18	250 NB	1678	1000	15	B	300	100	97810
19	300 NB	1230	1000	10	B	200	205	116960
20	300 NB	1710	1000	15	B	300	135	116960
21	350 NB	1230	1000	10	B	200	220	150260
22	350 NB	1710	1000	15	B	300	145	150260
23	400 NB	1270	1000	10	B	200	255	186655
24	400 NB	1770	1000	15	B	300	170	186655
25	450 NB	1270	1000	8	B	200	315	229785
26	450 NB	1770	1000	12	B	300	210	229785
27	500 NB	1270	1000	8	C	200	345	275160

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

13. Rectangular Single Expansion Joints (RSEJ 1.0)

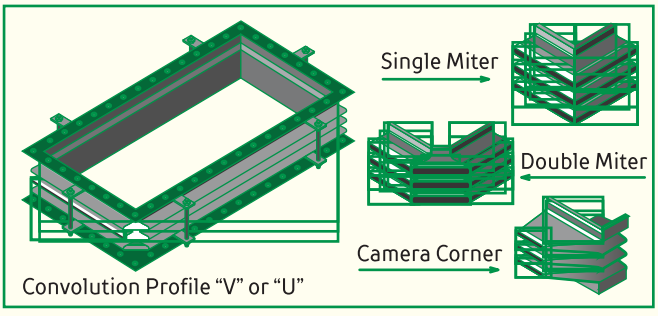
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions	Design Pressure	Axial Movement	Spring Rate	Effective Area
	Width x Height	FF	WW		kPa (g)	mm	Axial	mm2
	mm	mm	mm				N/mm	
1	1000 x 1000	130	280	1	100	15	530	1166300
		210	360	2		30	265	
		290	440	3		40	175	
2	2000 x 2000	130	280	1	100	15	1020	4326300
		210	360	2		30	510	
		290	440	3		10	340	
3	3000 x 3000	130	280	1	100	15	1515	948630
		210	360	2		30	760	
		290	440	3		40	505	
4	4000 x 4000	130	280	1	100	15	2005	166464300
		210	360	2		30	1000	
		290	440	3		45	670	
5	5000 x 5000	130	280	1	100	15	2500	25806300
		210	360	2		30	1245	
		290	440	3		40	830	
6	6000 x 6000	130	280	1	100	15	2990	36966300
		210	360	2		30	1495	
		290	440	3		40	995	
7	7000 x 7000	130	280	1	100	15	3485	50126300
		210	360	2		30	1740	
		290	440	3		40	1160	
8	8000 x 8000	130	280	1	100	15	3980	65286450
		210	360	2		30	1985	
		290	440	3		40	1320	
9	9000 x 9000	130	280	1	100	15	4470	82446300
		210	360	2		30	2230	
		290	440	3		40	1485	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

14. Rectangular Single Expansion Joints (RSEJ 1.5)

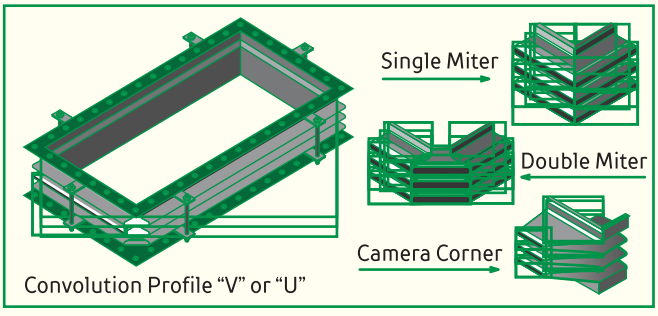
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions	Design Pressure	Axial Movement	Spring Rate	Effective Area
	Width x Height	FF	WW		kPa (g)	mm	Axial	mm2
	mm	mm	mm				N/mm	
1	1000 x 1000	130	280	1	100	10	1790	1166300
		210	360	2		20	895	
		290	440	3		30	595	
2	2000 x 2000	130	280	1	100	10	3455	4326300
		210	360	2		20	1725	
		290	440	3		30	1150	
3	3000 x 3000	130	280	1	100	10	5115	948630
		210	360	2		20	2580	
		290	440	3		30	1700	
4	4000 x 4000	130	280	1	100	10	6780	166464300
		210	360	2		20	3385	
		290	440	3		30	2255	
5	5000 x 5000	130	280	1	100	10	845	25806300
		210	360	2		20	4215	
		290	440	3		30	2815	
6	6000 x 6000	130	280	1	100	10	10105	36966300
		210	360	2		20	5050	
		290	440	3		30	3365	
7	7000 x 7000	130	280	1	100	10	11765	50126300
		210	360	2		20	5580	
		290	440	3		30	3920	
8	8000 x 8000	130	280	1	100	10	13420	65286450
		210	360	2		20	6710	
		290	440	3		30	4475	
9	9000 x 9000	130	280	1	100	10	15090	82446300
		210	360	2		20	7540	
		290	440	3		30	5025	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

15. Rectangular Universal Expansion Joints (RUEJ 1.0)

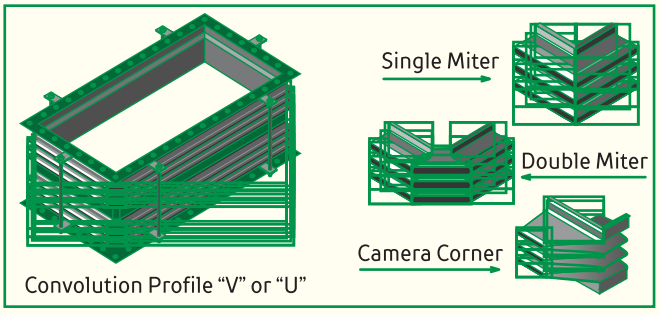
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Swivel Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions	Design Pressure	Axial Mov.	Lateral Mov.	Spring Rate		Effective Area
	Width x Height	FF	WW		kPa (g)	mm	mm	Axial	Lateral	mm2
	mm	mm	mm					N/mm	N/mm	
1	1000 x 1000	460	610	1 x 1	100	-15	11	265	1279	1166300
		620	770	2 x 2		-38	24	130	410	
		780	930	3 x 3		-64	38	85	192	
2	2000 x 2000	460	610	1 x 1	100	-11	6	510	9081	4326300
		620	770	2 x 2		-24	16	255	2891	
		780	930	3 x 3		-34	26	172	1318	
3	3000 x 3000	460	610	1 x 1	100	-10	5	760	29351	9486300
		620	770	2 x 2		-18	10	380	9370	
		780	930	3 x 3		-28	18	250	4261	
4	4000 x 4000	460	610	1 x 1	100	-5	5	1002	67920	166464300
		620	770	2 x 2		-14	9	500	21493	
		780	930	3 x 3		-24	14	331	9837	
5	5000 x 5000	460	610	1 x 1	100	-10	3	1250	131705	25806300
		620	770	2 x 2		-15	6	623	41640	
		780	930	3 x 3		-24	11	415	18985	
6	6000 x 6000	460	610	1 x 1	100	-18	2	1499	229684	36966300
		620	770	2 x 2		-12	7	746	71125	
		780	930	3 x 3		-22	9	496	32551	
7	7000 x 7000	460	610	1 x 1	100	-12	3	1741	358750	50126300
		620	770	2 x 2		-14	5	870	112590	
		780	930	3 x 3		-14	9	580	50975	
8	8000 x 8000	460	610	1 x 1	100	-5	3	1992	527544	65286300
		620	770	2 x 2		-24	5	994	169461	
		780	930	3 x 3		-15	9	662	75691	
9	9000 x 9000	460	610	1 x 1	100	-29	2	2234	777175	82446300
		620	770	2 x 2		-12	3	1117	236915	
		780	930	3 x 3		-14	8	746	107530	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

16. Rectangular Universal Expansion Joints (RUEJ 1.5)

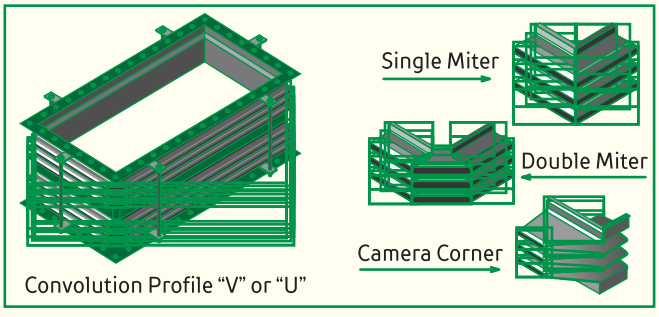
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions Nos.	Design Pressure	Axial Mov.	Lateral Mov.	Spring rate		Effective Area
	Width x Height	FF	WW		kPa (g)	mm	mm	Axial	Lateral	mm2
	mm	mm	mm					N/mm	N/mm	
1	1000 x 1000	460	610	1 x 1	100	-13	10	895	4295	1166300
		620	770	2 x 2		-25	20	445	1390	
		780	930	3 x 3		-50	30	295	630	
2	2000 x 2000	460	610	1 x 1	100	-10	5	1725	30555	4326300
		620	770	2 x 2		-20	10	860	9725	
		780	930	3 x 3		-40	20	570	4475	
3	3000 x 3000	460	610	1 x 1	100	-15	3	2555	99990	9486300
		620	770	2 x 2		-18	10	1275	31395	
		780	930	3 x 3		-25	14	850	14310	
4	4000 x 4000	460	610	1 x 1	100	-15	2	3385	233515	166464300
		620	770	2 x 2		-15	6	1690	77990	
		780	930	3 x 3		-20	11	1125	33090	
5	5000 x 5000	460	610	1 x 1	100	-10	2	4220	445880	25806300
		620	770	2 x 2		-15	5	2110	140545	
		780	930	3 x 3		-18	10	1400	63745	
6	6000 x 6000	460	610	1 x 1	100	-3	2	5050	756280	36966300
		620	770	2 x 2		-18	4	2525	241855	
		780	930	3 x 3		-10	8	1680	108500	
7	7000 x 7000	460	610	1 x 1	100	-22	1	5880	1227870	50126300
		620	770	2 x 2		-25	3	2935	386240	
		780	930	3 x 3		-23	6	1955	174025	
8	8000 x 8000	460	610	1 x 1	100	-16	1	6715	1813735	65286300
		620	770	2 x 2		-16	3	3355	566950	
		780	930	3 x 3		-27	5	2235	259760	
9	9000 x 9000	460	610	1 x 1	100	-13	1	7545	2561970	82446300
		620	770	2 x 2		-8	3	3770	796630	
		780	930	3 x 3		-16	5	2510	364040	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

17. Rectangular Single Expansion Joints-Round Corner (RSEJ-R 1.0)

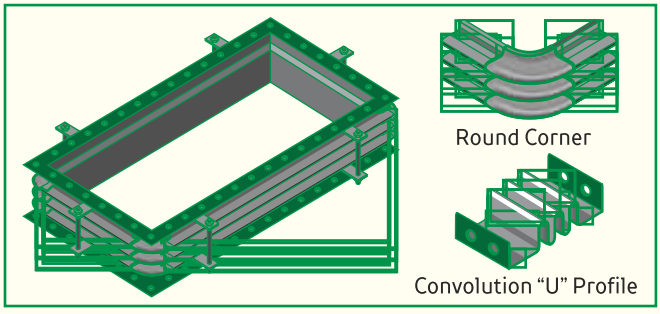
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions	Design Pressure	Axial Movement	Spring Rate	Effective Area
	Width x Height	FF	WW		kPa (g)	mm	Axial	mm2
	mm	mm	mm				N/mm	
1	1000 x 1000	130	210	1	100	10	975	1119300
		190	270	2		20	485	
		250	330	3		35	320	
2	2000 x 2000	130	210	1	100	10	1895	4235300
		190	270	2		20	945	
		250	330	3		35	630	
3	3000 x 3000	130	210	1	100	10	2815	9351300
		190	270	2		20	1405	
		250	330	3		35	935	
4	4000 x 4000	130	210	1	100	10	3735	16467300
		190	270	2		20	1865	
		250	330	3		35	1245	
5	5000 x 5000	130	210	1	100	10	4660	25583300
		190	270	2		20	230	
		250	330	3		35	1550	
6	6000 x 6000	130	210	1	100	10	5580	36699300
		190	270	2		20	2785	
		250	330	3		35	1855	
7	7000 x 7000	130	210	1	100	10	6500	49815300
		190	270	2		20	3250	
		250	330	3		35	2160	
8	8000 x 8000	130	210	1	100	10	7420	64931300
		190	270	2		20	3705	
		250	330	3		35	2465	
9	9000 x 9000	130	210	1	100	10	8345	82083500
		190	270	2		20	4170	
		250	330	3		35	2775	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

18. Rectangular Single Expansion Joints-Round Corner (RSEJ-R 1.5)

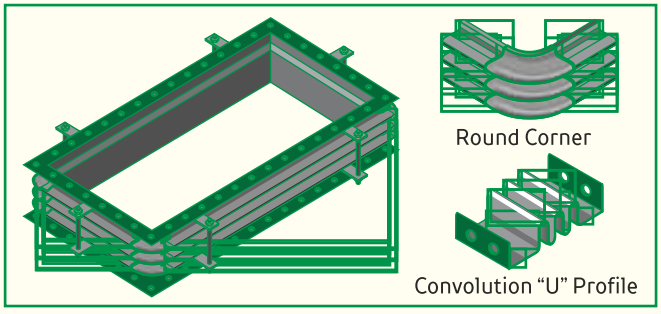
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions	Design Pressure	Axial Movement	Spring Rate	Effective Area
	Width x Height	FF	WW		kPa (g)	mm	Axial	mm2
	mm	mm	mm				N/mm	
1	1000 x 1000	130	210	1	100	10	3290	1119300
		190	270	2		20	1645	
		250	330	3		35	1095	
2	2000 x 2000	130	210	1	100	10	6400	4235300
		190	270	2		20	3200	
		250	330	3		35	2130	
3	3000 x 3000	130	210	1	100	10	9510	9351300
		190	270	2		20	4755	
		250	330	3		35	3170	
4	4000 x 4000	130	210	1	100	10	12625	16467300
		190	270	2		20	6310	
		250	330	3		35	4205	
5	5000 x 5000	130	210	1	100	10	15735	25583300
		190	270	2		20	7865	
		250	330	3		35	5245	
6	6000 x 6000	130	210	1	100	10	18845	36699300
		190	270	2		20	9420	
		250	330	3		35	6280	
7	7000 x 7000	130	210	1	100	10	21955	49815300
		190	270	2		20	10975	
		250	330	3		35	7315	
8	8000 x 8000	130	210	1	100	10	25065	64931300
		190	270	2		20	12530	
		250	330	3		35	8350	
9	9000 x 9000	130	210	1	100	10	28180	82083500
		190	270	2		20	14090	
		250	330	3		35	8755	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

19. Rectangular Universal Expansion Joints-Round Corner (RUEJ-R 1.0)

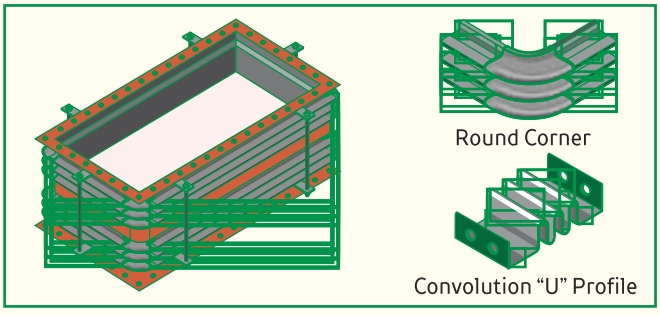
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions Nos.	Design Pressure	Axial Mov.	Lateral Mov.	Spring Rate		Effective Area
	Width x Height	FF	WW		kPa (g)	mm	mm	Axial	Lateral	mm2
	mm	mm	mm					N/mm	N/mm	
1	1000 x 1000	440	520	1 x 1	100	10	8	485	2545	1119300
		560	640	2 x 2		10	12	240	870	
		680	760	3 x 3		10	20	160	420	
2	2000 x 2000	440	520	1 x 1	100	10	4.5	945	18740	4235300
		560	640	2 x 2		10	7	470	6415	
		680	760	3 x 3		10	20	315	3090	
3	3000 x 3000	440	520	1 x 1	100	10	3	1405	61495	9351300
		560	640	2 x 2		10	7	705	21055	
		680	760	3 x 3		10	12	470	10145	
4	4000 x 4000	440	520	1 x 1	100	10	3	1870	82259	16467300
		560	640	2 x 2		10	7	935	30800	
		680	760	3 x 3		10	12	620	18865	
5	5000 x 5000	440	520	1 x 1	100	10	2.5	4660	159290	25583300
		560	640	2 x 2		10	6	2330	59645	
		680	760	3 x 3		10	11	1550	30730	
6	6000 x 6000	440	520	1 x 1	100	10	2.5	2790	176890	36699300
		560	640	2 x 2		10	6	1395	70020	
		680	760	3 x 3		10	11	930	37720	
7	7000 x 7000	440	520	1 x 1	100	10	2.5	3250	279745	49815300
		560	640	2 x 2		10	5	1625	110740	
		680	760	3 x 3		10	9	1080	59655	
8	8000 x 8000	440	520	1 x 1	100	10	2	3710	416295	64931300
		560	640	2 x 2		10	4	1855	164795	
		680	760	3 x 3		10	8	1235	88770	
9	9000 x 9000	440	520	1 x 1	100	10	1.5	4175	591315	82083500
		560	640	2 x 2		10	4	2085	234075	
		680	760	3 x 3		10	7	1390	126095	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

20. Rectangular Universal Expansion Joints-Round Corner (RUEJ-R 1.5)

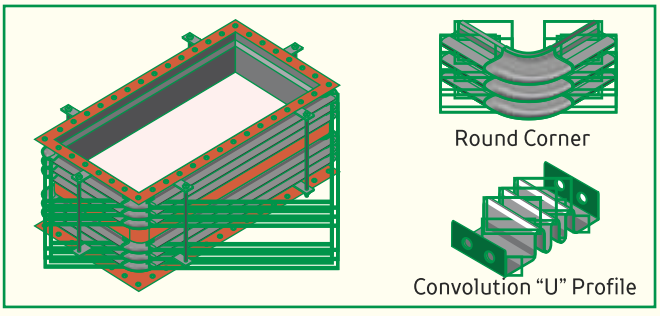
Bellows Material: SA 240 Gr. 304 or Equivalent

Hardware Material: Carbon Steel

Design Temperature: 400 degree Celsius

Minimum Fatigue Cycles: 3500 Nos.

Connections: Flange, Weld Ends



Sr. No	Bellow Size Inside Dimension	Overall Length		Convo-lutions	Design Pressure	Axial Mov.	Lateral Mov.	Spring Rate		Effective Area
	Width x Height	FF	WW	Nos.	kPa (g)	mm	mm	Axial	Lateral	mm2
	mm	mm	mm					N/mm	N/mm	
1	1000 x 1000	440	520	1 x 1	100	10	9	1645	8595	1119300
		560	640	2 x 2		10	12	820	820	
		680	760	3 x 3		10	20	545	6170	
2	2000 x 2000	440	520	1 x 1	100	10	4	3200	63260	4235300
		560	640	2 x 2		10	7	1600	45910	
		680	760	3 x 3		10	20	1065	10435	
3	3000 x 3000	440	520	1 x 1	100	10	3	4755	207545	9351300
		560	640	2 x 2		10	7	2375	71070	
		680	760	3 x 3		10	12	1585	34240	
4	4000 x 4000	440	520	1 x 1	100	10	3	6310	277625	16467300
		560	640	2 x 2		10	7	3155	103960	
		680	760	3 x 3		10	12	2100	53560	
5	5000 x 5000	440	520	1 x 1	100	10	2.5	7865	537605	25583300
		560	640	2 x 2		10	6	3930	201310	
		680	760	3 x 3		10	11	2620	103715	
6	6000 x 6000	440	520	1 x 1	100	10	2.5	9420	597010	36699300
		560	640	2 x 2		10	6	4710	236330	
		680	760	3 x 3		10	11	3140	127310	
7	7000 x 7000	440	520	1 x 1	100	10	2.5	10975	944145	49815300
		560	640	2 x 2		10	5	5490	373750	
		680	760	3 x 3		10	9.5	3660	201330	
8	8000 x 8000	440	520	1 x 1	100	10	2	12530	1404995	64931300
		560	640	2 x 2		10	4.5	6265	556185	
		680	760	3 x 3		10	8.5	4175	299610	
9	9000 x 9000	440	520	1 x 1	100	10	1.8	28180	1995690	82083500
		560	640	2 x 2		10	4	14090	7900010	
		680	760	3 x 3		10	7.5	9390	425570	

Other Sizes Are Available Upon Request : Above Values Are Reference Purpose Only

On-site installation services

As a growing company in the Expansion Joint industry, REPL can also provide on-site services comparable to American or European vendors. Our service group consists of highly qualified technicians and engineers specialised in solving Expansion Joint installation and application problems.

Plant Surveys and Emergency Breakdown Prevention:

Preventing breakdown before if occurs is one of our specialties. Our engineers are dedicated to identify, prevent, and solve problems on-site. Our site people undertake inspection of existing Expansion Joints and identify tell-tale signs we provide the Inspection reports with comments on the actual condition of units together with any recommendations for improvements, repairs or remedial action: including planning for replacement. REPL can assist you to avoid an unplanned emergency breakdown due to Expansion Joints.

CLAMSHELL Technology

Installation of Metallic Expansion Joints and in particular "CLAMSHELL" repair bellows requires skilled and experienced installation staff. Often clients prefer that the manufacturer carries out such installation work to avoid errors and focus responsibility on a single source vendor. Our site team of skilled welders can carry out such work, the team is experienced and familiar with site work including working in confined spaces by complying with site safety procedures.

Refurbish &Repair Existing Expansion Joints

REPL can offer customers to bring existing expansion joints back to an "as-new" condition by removing the existing bellows elements and replacing with new.

This practice allows the cost of manufacturing new pipe work components and any restraining structure to be avoided.

It is often used as a fast solution to get the plant back online quickly when a bellows element in an expansion joint has reached the end of its life.

BEFORE

AFTER

We have dedicated team for Refinery Services, FCCU (Fluid Catalytic Cracking Unit) & RFCC (Residue Fluid Catalytic Cracking)

Our team comprises of the following overseas experts.

Our first expert with 30 years of vast experience in critical refinery application and troubleshooting. He is familiar with all cracking processes from various licensor such as UOP, KBR, SHELL, EXXOON, Technip – Stone & Webster.

Our second expert with 35 years of vast experience in FCCU bellows fabrication, installation of CLAMSHELL Bellows in FCC / RFCC in HOT (online) or COLD condition. We also provide services in plant survey, analysis on probable reasons for bellows failure, recommendation and comments, setting up a monitoring program and maintenance policy, installation and replacement of metallic braid (rope seal) etc.

Our third expert with 13 years of experience and specialises in design and application of all types of Metallic Expansion Joint including FCCU (Hot Walled & Cold Walled), Floating & Semi Floating Hardware, Refractory & Anchor Selection and solving corrosion issues.

Our fourth expert is a Doctorate in Mechanical Engineering with 16 years of experience and specialising in FEA (Finite Element Analysis), CFD (Computational Fluid Dynamics) and mechanical/structural engineering design. He assists the design development, modification and verification processes through application of stress, heat transfer and fluid flow analysis capabilities.

Customer :			Date:	Page:
Project:			Prepared By:	
Item or Tag Number:				
Quantity:				
Size:				
Style or Type (Single, Universal, Hinged, Gimbal, etc.)				
End Connection		Thickness/ Flange Rating		
		Material		
Pressure		Design		
		Operating		
		Test		
Temperature		Design		
		Operating		
		Installation		
Media		Media		
		Flow Velocity		
		Flow Direction		
Movements and Life Cycle	Installation	Axial Extension		
		Axial Compression		
		Lateral		
		Angular		
		Number of Cycles		
	Design	Axial Extension		
		Axial Compression		
		Lateral		
		Angular		
		Number of Cycles		
	Operating	Axial Extension		
		Axial Compression		
		Lateral		
		Angular		
		Number of Cycles		
Materials		Bellows		
		Liner		
		Cover		
Dimensions		Overall Length		
		Maximum O.D.		
		Minimum I.D.		
Spring Rates		Maximum Axial Spring Rate		
		Maximum Lateral Spring Rate		
		Maximum Angular Spring Rate		
Quality Assurance		Bellows Long. Seam Weld		
		Bellows Attachment Weld		
		Piping		
Required Code				
Applicable Codes and Standards: EJMA, ASME B31.1, ASME B31.3, ASME Section VIII, Division 1, Appendix 26				

Customer :		Date:	Page:
Project:		Prepared By:	
Item or Tag Number:			
Quantity:			
Size (Long Side and Short Side):			
Orientation (Horizontal / Vertical / Inclined):			
Style or Type:			
Corner Type:			
End Connection	Thickness/ Flange Rating		
	Material		
Pressure	Design		
	Operating		
Temperature	Design		
	Operating		
	Installation		
Media	Media		
	Flow Velocity		
	Flow Direction		
Movements	Axial Extension		
	Axial Compression		
	Lateral (Parallel to Short Side)		
	Lateral (Parallel to Long Side)		
	Angular (Parallel to Short Side)		
	Angular (Parallel to Long Side)		
Materials	Bellows		
	Liner		
	Cover		
Dimensions	Overall Length		
Maximum Spring Rates	Axial		
	Lateral (Parallel to Short Side)		
	Lateral (Parallel to Long Side)		
	Angular (Parallel to Short Side)		
	Angular (Parallel to Long Side)		
Quality Assurance	Bellows Long. Seam Weld		
	Bellows Attachment Weld		
Required Code			

Guidelines for Selecting Expansion Joints

The correct specification of bellows movement requirements is one of the most essential factors in the successful application of expansion joint. The axial, lateral and angular movement must be realistically stated along with the corresponding cycle life. One of the most common mistakes made is to overstate these values in an attempt to obtain a conservative design. Over emphasis of any parameter can jeopardize other elements of the design as well as result in unnecessary costs. Refer below several good rules:

- Separate the cyclic and noncyclic motions, such as installation displacements. Both should be included, but they obviously have different cycle requirements.
- Distinguish between normal operating movement and upset conditions.
- When comparisons are made to manufacturers rated motions, be sure to distinguish between concurrent and non-concurrent values.
- Realistically state fatigue life requirement. Cycle life is not proportional to rated travel. Small change of displacement can result in substantial cycle life changes, and vice-versa.
- Avoid large lateral offset requirement for single expansion joint – particular for lager diameter bellows.

Expansion Joint Handling, Installation & Safety Recommendations

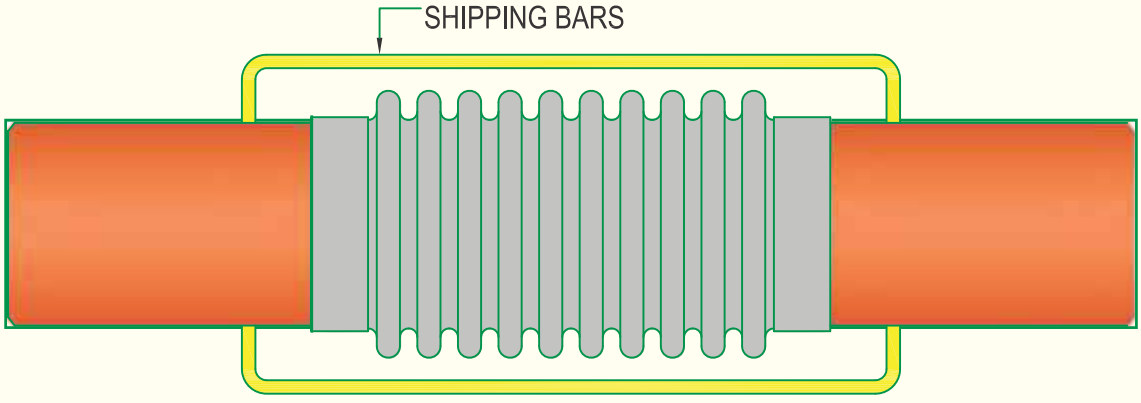
Shipping & Handling

We take every design and manufacturing precaution to assure the user of a reliable product. The installer and the user have the responsibility to handle, store, install, and apply the expansion joint such a way which will not impair the quality build into them.

Shipping Devices

We provides shipping device to maintaining the face-to-face dimension of an expansion joint during shipment and installation. This usually consists of overall bars or angles welded to the flanges or weld ends at the extremities of the expansion joint. The washers or wooden blocks between equalizing rings are also used for this purpose.

Do not remove these shipping devices until all expansion joint, anchors and guides in a system have been installed. Shipping devices manufactured by us. It is usually painted yellow or otherwise distinctively marked as an aid to the installer.



The shipping devices must be removed prior to start-up or testing the system.

Storage

Some conditions of outdoor storage may be detrimental, and where possible, should be avoided; preferably, the storage should be in a clean and dry area. Where this cannot be accomplished, contact us for advice. Care must be taken to avoid mechanical damage such as caused by stacking, bumping or dropping. For this reason, it is strongly suggest - ed that covers be specified on all expansion joint to protect the bellows element. Cer - tain industrial and natural atmospheres can be detrimental to some bellows material. If expansion joints are to be stored or installed in such atmospheric environments, mate - rial should be specified which are compatible with these environments.

Installation Instructions

Our expansion joints are shipped with documents which furnish the installer with instructions covering the installation. These documents should be left with the expan- sion joints until installation is completed.

Installation

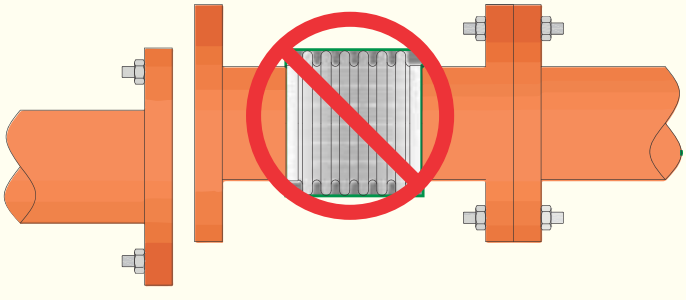
Metallic type expansion joints have been designed to absorb a specified amount of movement by flexing of the thin-gage bellows convolutions. If proper care is not exercised in the installation of the expansion joint, cycle life and pressure capacity could be reduced, leading to premature failure and damage to the piping system.

It is important that the expansion joint be installed at the length specified by the manufacturer. They should neither be extended or compressed in order to make up for deficiencies in length, nor should they be offset to accommodate misaligned pipe. Remember that a bellows is designed to absorb motion by flexing. The bellows element sufficiently thick to withstand the design pressure, while being thin enough to absorb the required flexing. Optimum design will always require a bellows to be of thinner material than any other component in the piping system in which it is installed. The installer must recognize this relative susceptibility to damage of the bellows and take every possible measure to protect it during installations. Avoid denting, weld spatter, arc strikes or the possibility of allowing foreign matter to interfere with the proper flexing of the bellows. **It's highly recommended that a cover be specified for every expansion joints. The small cost of a cover is easily justified when compared to the cost of replacing a damaged bellows element.**With reasonable care during storage, handling and installation, the user will be assured of the reliability designed and built into the expansion joints.

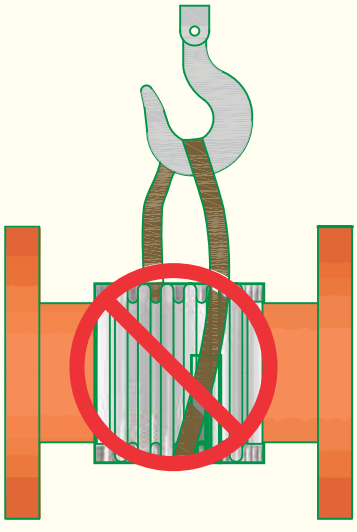
Do's And Don't – Installation & Handling

The following recommendations are included to avoid the most common error that occurs during installation. When in doubt about an installation procedure, please contact us for clarification before attempting to install the expansion joint.

CAUTION: Manufacturer warranty may be void if improper installation procedures have been used



Never force an expansion joint to t the space without prior notication of the manufacturer



Never use chains or other devices directly on the convolutions of bellows element

Do's

Do..... Inspect for damage during shipment such as: dents, broken hardware, water marks on carton, etc.

Do..... Store in a clean, dry area where it will not be exposed to heavy traffic or damaging environment.

Do..... Use only designated lifting lugs when provided.

Do..... Make the piping system fit the expansion bellows. By stretching, compressing or offsetting the bellows to fit the piping. The expansion bellows may be overstressed when the system is in services.

Do..... Leaves one flange loose on the adjacent piping when possible, until the expansion bellows has been lifted into position. Make necessary adjustment of this loose flange before welding.

Do..... Install the bellows with the arrow pointing in the direction of flow.

Do..... Install single van stone liners pointing in the direction of flow. Be sure also to install a gasket between a van stone liner and flange.

Do..... In case of telescoping liner, install the smallest ID. Liner pointing in the direction of flow.

Do..... Remove all shipping devices after the installation is complete and before any pressure test of the fully installed system.

Do..... Remove any foreign material that may have become lodged between the convolutions.

Do..... Refer to proper guide spacing and anchoring recommendations

Don't

Don't.... Drop or strike expansion bellows.

Don't.... Remove the shipping bars until the installation is complete.

Don't.... Remove any moisture-absorbing desiccant bags or protective coating until ready for installation.

Don't.... Use hanger lugs or shipping bars as lifting lugs.

Don't.... Use chains or any lifting device directly in the bellows or bellows cover.

Don't.... Allow weld spatter to hit unprotected bellows.

Don't.... Use cleaning agents which contain chlorides.

Don't.... Force or rotate one end of an expansion bellows for alignment of bolt holes. Bellows are not ordinarily capable of absorbing torsion.

Don't.... Hydrostatic pressure test or evacuate the system before proper installation of all guides and anchor.

Don't.... Use shipping bars to restrain the pressure thrust during testing.

Don't.... Use pipe hangers as guides.

Don't.... Exceed the manufacturers rated test pressure of the expansion bellows.

Don't.... Remove expansion bellows hardware, i.e. tie roads, hinge pins/plates, gimbal pins/plates. If interference exists with other piping components, consult with the expansion bellows manufacturer regarding possible solutions.

Safety Recommendation

This section was prepared in order to better inform the user or those factors which many years of experience have shown to be essential for the successful installation and performance of piping system containing expansion bellows.

Inspection Prior To Start-Up or Pressure Test

Expansion joints are usually considered to be non-repairable itemsand generally do not fall into the category for which maintenance procedure are required. However, immediately after the installation is complete a careful visual inspection should be made of the entire piping system to insure that there is no evidence of damage, with particular emphasis on the following:

- Are anchors, guides and supports installed in accordance with the system drawings?
- Is the proper expansion joint in the proper location?
- Is the expansionjoint flow directions and pre-positioning correct?
- Have all the expansion joints shipping devices been removed?
- If the system has been designed for a gas, and is to be tested with water, has provision been made for proper support of the additional dead weight load on the piping and expansion joint? Some water may remain in the bellows convolutions after the test. If this is detrimental to the bellows or system operation, means should be provided to remove this water.
- Are all guides, pipe supports and the bellows free to permit pipe movement?
- Has any expansion joint been damaged during handling and installation?
- Is any expansion joint misaligned? This can be determine by measuring the bellows overall length, inspection of convolution geometry, and checking clearance at critical points on the expansion joint and at other points in the system.
- Are the bellows and other movable portion free of foreign material?

Inspection During &Immediately After Pressure Test

WARNING: Extreme care must be exercised while inspecting any pressurized system.

- Evidence of leakage or loss of pressure.
- Distortion or yielding of anchors, expansion joint hardware, the bellows and other piping components.
- Any unanticipated movement of the pipe due to pressure.
- Evidence for instability in the bellows.

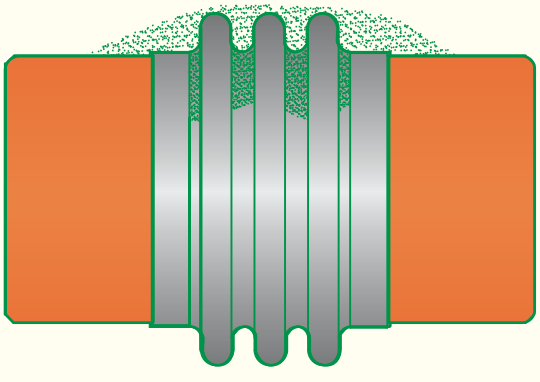
- The guides, expansion bellows and other movable parts of the system should be inspected for evidence of binding.
- Any evidence of abnormality or damage should be reviewed and evaluated by component design authority.

Periodic In-services Inspection

WARNING: Extreme care must be exercised while inspecting any pressurized system or component.

- Immediately after replacing the system in operation, a visual inspection should be conducted to insure that the thermal expansion is being absorbed by the expansion Joint in the manner for which they were designed.
- The expansion joint should be inspected for evidence for unanticipated vibration
  A program of periodic inspection should be planned and conducted throughout
- the operating life of the system. The frequency of these inspection should be determined by the services and environmental conditions involved. Such inspection can spot the more obvious potential problem such as external corrosion, loosening of threaded fasteners, and deterioration of anchors, guides and other hardware.

IT MUST BE UNDERSTOOD THAT THIS INSPECTION PROGRAM, WITHOUT ANY OTHER BACKUP INFORMATION, CANNOT GIVE EVIDENCE OF DAMAGE DUE TO FATIGUE, STRESS CORROSION OR GENERAL INTERNAL CORROSION. THESE CAN BE CAUSE OF SUDDEN FAILURES AND GENERALLY OCCUR WITHOUT ANY VISIBLE OR AUDIBLE WARNING.



Inspect periodically for build-up of debris between the bellows convolutions or any other circumstance which may restrict the free – flexing of the bellows

- When any inspection reveals evidence of malfunction, damage or deterioration, this should be reviewed by competent design authority for resolution. Additionally, any changes in the system operating conditions adversely affect the expansion joint should be reported and evaluated by a competent authority.

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards			PCD	flange dimensions mm			
					bolt		thickness	
	name	rating	out-side dia		no. off	dia	cast iron	steel
25 NPS (1 in)	JIS	10	125	90	4	M16	18	14
		16	125	90	4	M16	18	14
		20	125	90	4	M16	20	16
	ANSI	125/150	108	79	4	M16	11	14
		300	124	89	4	M16	-	17
	AS 2129	A	115	83	4	M12	13	12
		D	115	83	4	M12	13	12
		E	115	83	4	M12	13	12
		F	120	87	4	M16	13	12
		H	120	87	4	M16	19	14
	DIN	6	100	75	4	M10	14	14
		10	115	85	4	M12	16	16
		16	115	85	4	M12	16	16
		25	115	85	4	M12		
		40	115	85	4	M12		
32 NPS (1 1/4 in)	JIS	10	135	100	4	M16	20	16
		16	135	100	4	M16	20	16
		20	135	100	4	M16	20	18
	ANSI	125/150	118	89	4	M16	13	16
		300	133	98	4	M16	-	20
	AS 2129	A	120	87	4	M12	16	12
		D	120	87	4	M12	16	12
		E	120	87	4	M12	16	12
		F	135	98	4	M16	16	13
		H	135	98	4	M16	22	17
	DIN	6	120	90	4	M12	16	16
		10	140	100	4	M16	18	16
		16	140	100	4	M16	18	16
		25	140	100	4	M16		
		40	140	100	4	M16		
40 NPS (1 1/2 in)	JIS	10	140	105	4	M16	20	16
		16	140	105	4	M16	20	16
		20	140	105	4	M16	22	18
	ANSI	125/150	127	98	4	M16	14	18
		300	156	114	4	M20	-	21
	AS 2129	A	135	98	4	M12	16	12
		D	135	98	4	M12	16	12
		E	135	98	4	M12	16	12
		F	140	105	4	M16	16	13
		H	140	105	4	M16	22	17
	DIN	6	130	100	4	M12	16	16
		10	150	110	4	M16	18	16
		16	150	110	4	M16	18	16
		25	150	110	4	M16		
		40	150	110	4	M16		

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards				flange dimensions mm			
					bolt		thickness	
	name	rating	out-side dia	PCD	no. off	dia	cast iron	steel
50 NPS (2 in)	JIS	5	130	105	4	M12	16	14
		10	155	120	4	M16	20	16
		16	155	120	8	M16	20	16
	ANSI	20	155	120	8	M16	22	18
		125/150	152	121	4	M16	18	19
		300	165	127	8	M16	-	22
	AS 2129	A	150	114	4	M16	16	12
		D	150	114	4	M16	17	12
		E	150	114	4	M16	19	12
		F	165	127	4	M16	19	16
		H	165	127	4	M16	25	19
	DIN	6	140	110	4	M12	16	16
		10	165	125	4	M16	20	18
		16	165	125	4	M16	20	18
		25	165	125	4	M16		
		40	165	125	4	M16		
65 NPS (2 1/2 in)	JIS	5	155	130	4	M12	18	14
		10	175	140	4	M16	22	18
		16	175	140	8	M16	22	18
		20	175	140	8	M16	24	20
	ANSI	125/150	178	140	4	M16	18	22
		300	191	149	8	M20	-	25
	AS 2129	A	165	127	4	M16	17	12
		D	165	127	4	M16	17	12
		E	165	127	4	M16	19	12
		F	185	146	8	M16	19	16
		H	185	146	8	M16	25	19
	DIN	6	160	130	4	M12	16	16
		10	185	145	4	M16	20	18
		16	185	145	4	M16	20	18
		25	185	145	8	M16		
		40	185	145	8	M16		
80 NPS (3 in)	JIS	5	180	145	4	M16	18	14
		10	185	150	4	M16	22	18
		16	200	160	8	M20	24	20
		20	200	160	8	M20	26	22
	ANSI	125/150	191	152	4	M16	19	24
		300	210	168	8	M20	-	29
	AS 2129	A	185	146	4	M16	17	12
		D	185	146	4	M16	19	12
		E	185	146	4	M16	19	12
		F	205	165	8	M16	19	16
		H	205	165	8	M16	29	22
	DIN	6	190	150	4	M16	18	18
		10	200	160	8	M16	22	20
		16	200	160	8	M16	22	20
		25	200	160	8	M16		
		40	200	160	8	M16		

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards				flange diMensions mm			
					bolt		thickness	
	name	rating	out-side dia	PCD	no. off	dia	cast iron	steel
90 NPS (3 1/2 in)	JIS	Not Listed						
	ANSI	125/150	216	178	8	M16	-	24
		300	229	184	8	M20	-	30
	AS 2129	A	205	165	4	M16	-	12
		D	205	165	4	M16	-	12
		E	205	165	8	M16	-	12
		F	215	178	8	M16	-	19
		H	215	178	8	M16	-	22
	DIN	Not Listed						
100 NPS (4 in)	JIS	5	200	165	8	M16	20	16
		10	210	175	8	M16	24	18
		16	225	185	8	M20	26	22
		20	225	185	8	M20	28	24
	ANSI	125/150	229	191	8	M16	24	24
		300	254	200	8	M20	-	16
	AS 2129	A	215	178	4	M16	19	12
		D	215	178	4	M16	19	12
		E	215	178	8	M16	22	13
		F	230	191	8	M16	22	19
		H	230	191	8	M16	32	25
	DIN	6	210	170	4	M16	18	18
		10	220	180	8	M16	24	20
		16	220	180	8	M16	24	20
		25	235	190	8	M20		
		40	235	190	8	M20		
125 NPS (5 in)	JIS	5	235	200	8	M16	20	16
		10	250	210	8	M20	24	20
		16	270	225	8	M22	36	22
		20	270	225	8	M22	30	26
	ANSI	125/150	254	216	8	M20	24	24
		300	279	235	8	M20	-	35
	AS 2129	A	255	210	4	M16	19	13
		D	255	210	8	M16	21	13
		E	255	210	8	M16	22	14
		F	280	235	8	M20	25	22
		H	280	235	8	M20	35	29
	DIN	6	240	200	8	M16	20	20
		10	250	210	8	M16	26	22
		16	250	210	8	M16	26	22
		25	270	220	8	M24		
		40	270	220	8	M24		

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards				flange diMensions mm			
					bolt		thickness	
	name	rating	out-side dia	PCD	no. off	dia	cast iron	steel
150 NPS (6 in)	JIS	5	265	230	8	M16	22	18
		10	280	240	8	M20	26	22
		16	305	260	12	M22	28	24
		20	305	260	12	M22	32	28
	ANSI	125/150	279	241	8	M20	25	25
		300	318	270	12	M20	-	37
	AS 2129	A	280	235	4	M16	21	13
		D	280	235	8	M16	21	13
		E	280	235	8	M20	22	17
		F	305	260	12	M20	25	22
		H	305	260	12	M20	35	29
	DIN	6	265	225	8	M16	20	20
		10	285	240	8	M20	26	22
		16	285	240	8	M20	26	22
		25	300	250	8	M24		
		40	300	250	8	M24		
200 NPS (8 in)	JIS	5	320	280	8	M20	24	20
		10	330	290	12	M20	26	22
		16	350	305	12	M22	30	26
		20	350	305	12	M22	34	30
	ANSI	125/150	343	299	8	M20	29	29
		300	381	330	12	M22	-	41
	AS 2129	A	335	292	8	M16	22	13
		D	335	292	8	M16	22	13
		E	335	292	8	M20	25	19
		F	370	324	12	M20	29	25
		H	370	324	12	M20	38	32
	DIN	6	320	280	8	M16	22	22
		10	340	295	8	M20	26	24
		16	340	295	12	M20	30	24
		25	360	310	12	M24		
		40	375	320	12	M27		
250 NPS (10 in)	JIS	5	385	345	12	M20	26	22
		10	400	355	12	M22	30	24
		16	430	380	12	M24	34	28
		20	430	380	12	M24	38	34
	ANSI	125/150	406	362	12	M22	30	30
		300	445	387	16	M27	-	48
	AS 2129	A	405	356	8	M20	24	16
		D	405	356	8	M20	25	16
		E	405	356	12	M20	25	22
		F	430	381	12	M24	29	29
		H	430	381	12	M24	41	35
	DIN	6	375	335	12	M16	24	24
		10	395	350	12	M20	28	26
		16	405	355	12	M24	32	26
		25	425	370	12	M27		
		40	450	385	12	M30		

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards				flange diMensions mm			
					bolt		thickness	
	name	rating	out-side dia	PCD	no. off	dia	cast iron	steel
300 NPS (12 in)	JIS	5	430	390	12	M20	28	22
		10	445	400	16	M22	32	24
		16	480	430	16	M24	36	30
		20	480	430	16	M24	40	36
	ANSI	125/150	483	432	12	M22	32	32
		300	521	451	16	M27	-	51
	AS 2129	A	455	406	8	M20	24	19
		D	455	406	12	M20	25	19
		E	455	406	12	M24	29	25
		F	490	438	16	M24	32	32
		H	490	438	16	M24	44	41
	DIN	6	440	395	12	M20	24	24
		10	445	400	12	M20	28	26
		16	460	410	12	M24	32	28
350 NPS (14 in)	JIS	5	480	435	12	M22	30	24
		10	490	445	16	M22	34	26
		16	540	480	16	M30	38	34
		20	540	480	16	M30	44	40
	ANSI	125/150	533	476	12	M27	35	35
		300	584	514	20	M27	-	54
	AS 2129	A	525	470	8	M24	25	22
		D	525	470	12	M24	29	22
		E	525	470	12	M24	32	29
		F	550	495	16	M27	35	35
		H	550	495	16	M27	48	48
	DIN	6	490	445	12	M20	26	26
		10	505	460	16	M20	30	28
		16	520	470	16	M24	36	32
400 NPS (16 in)	JIS	5	540	495	16	M22	30	24
		10	560	510	16	M24	36	28
		16	605	540	16	M30	42	28
		20	605	540	16	M30	50	46
	ANSI	125/150	597	540	16	M27	37	37
		300	648	572	20	M33	-	57
	AS 2129	A	580	521	12	M24	27	22
		D	580	521	12	M24	29	22
		E	580	521	12	M24	32	32
		F	610	552	20	M27	35	41
		H	610	552	20	M27	51	54
	DIN	6	540	495	16	M20	28	28
		10	565	515	16	M24	32	32
		16	580	525	16	M27	38	36

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards				flange diMensions mm			
					bolt		thickness	
	name	rating	out-side dia	PCD	no. off	dia	cast iron	steel
450 NPS (18 in)	JIS	2	605	555	16	M20	28	22
		5	605	555	16	M22	30	24
		10	620	565	20	M24	38	30
		16	675	605	20	M30	46	40
		20	675	605	20	M30	-	48
	ANSI	125/150	635	578	16	M27	40	40
		300	711	629	24	M33	-	60
	AS 2129	A	640	584	12	M24	27	22
		D	640	584	12	M24	32	25
		E	640	584	16	M24	35	35
		F	675	610	20	M30	38	44
		H	675	610	20	M30	54	60
	DIN	6	595	550	16	M20	-	-
		10	615	565	20	M24	32	36
		16	640	585	20	M27	-	-
500 NPS (20 in)	JIS	2	655	605	20	M20	28	22
		5	655	605	20	M22	32	24
		10	675	620	20	M24	40	30
		16	730	660	20	M30	50	42
		20	730	660	20	M30	-	50
	ANSI	125/150	699	635	20	M27	43	43
		300	775	686	24	M33	-	64
	AS 2129	A	705	641	12	M24	29	25
		D	705	641	16	M24	32	29
		E	705	641	16	M24	38	38
		F	735	673	24	M30	41	51
		H	735	673	24	M30	57	62
	DIN	6	645	600	20	M20	30	30
		10	670	620	20	M24	34	38
		16	715	650	20	M30	42	44
550 NPS (22 in)	JIS	2	720	665	20	M22	30	24
		5	720	665	20	M24	32	26
		10	745	680	20	M30	42	32
		16	795	720	20	M36	54	44
	ANSI	Not Listed						
	AS 2129	A	760	699	12	M27	30	25
		D	760	699	16	M27	35	29
		E	760	699	16	M27	38	44
		F	785	724	24	M30	41	54
		H	785	724	24	M30	60	70
	DIN	Not Listed						

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards		flange diMensions mm					
					bolt		thickness	
	name	rating	out-side dia	PCD	no. off	dia	cast iron	steel
600 NPS (24 in)	JIS	2	770	715	20	M22	30	24
		5	770	715	20	M24	32	26
		10	795	730	24	M30	44	32
		16	845	770	24	M36	58	46
		20	845	770	24	M36	1	54
	ANSI	125/150	813	749	20	M33	48	48
		300	914	813	24	M39	-	70
	AS 2129	A	825	756	12	M27	30	25
		D	825	756	16	M27	35	32
		E	825	756	16	M30	41	48
		F	850	781	24	M33	44	57
		H	850	781	24	M33	64	76
	DIN	6	755	705	20	M24	30	32
		10	780	725	20	M27	36	42
		16	840	770	20	M33	48	52
650 NPS (26 in)	JIS	2	825	770	24	M22	30	24
		5	825	770	24	M24	34	26
		10	845	780	24	M30	46	34
	ANSI	Not Listed						
	AS 2129	A	845	781	16	M27	32	25
		D			Not Listed			
		E			Not Listed			
	DIN	Not Listed						
700 NPS (28 in)	JIS	2	875	820	24	M22	30	24
		5	875	820	24	M24	34	26
		10	905	840	24	M30	48	34
	ANSI	Not Listed						
	AS 2129	A	870	806	16	M27	32	25
		D	910	845	20	M27	38	35
		E	910	845	20	M30	44	51
	DIN	6	860	810	24	M24	32	34
		10	895	840	24	M27	40	46
		16	910	840	24	M33	54	58
750 NPS (30 in)	JIS	2	945	880	20	M24	33	24
		5	945	880	20	M30	36	28
		10	970	900	20	M30	50	35
	ANSI	125/150	984	915	28	M33	-	-
		300	-	997	28	M45	-	-
	AS 2129	A	945	883	20	M27	32	25
		D	995	927	20	M30	41	41
		E	995	927	20	M33	48	54
	DIN	Not Listed						

Standard Dimensions of flange & pipe

nom pipe size mm	flange Standards			PCD	flange diMensions mm			
					bolt		thickness	
	name	rating	out-side dia		no. off	dia	cast iron	steel
800 NPS (32 in)	JIS	2	995	930	24	M24	32	24
		5	995	930	24	M30	36	28
		10	1020	950	28	M30	52	36
	ANSI	Not Listed						
	AS 2129	A	1005	940	20	M27	32	25
		D	1060	984	20	M33	41	41
		E	1060	984	20	M33	48	54
	DIN	6	975	920	24	M27	34	38
		10	1015	950	24	M30	44	52
		16	1025	950	24	M36	58	64
850 NPS (34 in)	JIS	2	1045	980	24	M24	32	24
		5	1045	980	24	M30	38	28
		10	1070	1000	28	M30	52	36
	AS 2129	A	1030	965	20	M27	32	29
		D	1090	1016	20	M33	41	44
		E	1090	1016	20	M33	51	57
	DIN	ANSI	Not Listed					
900 NPS (36 in)	JIS	2	1095	1030	24	M24	32	24
		5	1095	1030	24	M30	38	30
		10	1120	1050	28	M30	54	38
	ANSI	125/150	1168	1086	32	M39	-	-
	AS 2129	A	1105	1041	24	M27	35	29
		D	1175	1092	24	M33	44	48
		E	1175	1092	24	M33	51	64
	DIN	6	1075	1020	24	M27	36	42
		10	1115	1050	28	M30	46	56
		16	1125	1050	28	M36	62	72
1000 NPS (40 in)	JIS	2	1195	1130	28	M24	34	26
		5	1195	1130	28	M30	40	34
		10	1235	1160	28	M36	58	40
	ANSI	Not Listed						
	AS 2129	A	1180	1118	24	M27	35	29
		D	1255	1175	24	M33	44	51
		E	1255	1175	24	M36	54	67
	DIN	6	1175	1120	28	M27	35	46
		10	1230	1160	28	M33	50	62
		16	1255	1170	28	M39	66	78
1200 NPS (48 in)	JIS	2	1420	1350	32	M24	36	26
		5	1420	1350	32	M30	46	34
		10	1465	1380	32	M36	66	46
	ANSI	125/150	1511	1422	44	M39	-	-
	AS 2129	A	1415	1353	28	M27	38	32
		D	1490	1410	32	M33	51	60
		E	1490	1410	32	M36	60	79
	DIN	2.5	1375	1320	32	M27	30	36
		6	1405	1340	32	M30	40	56
		10	1455	1380	32	M36	56	74

Thermal Expansion of Pipe Chart

Thermal Expansion of Pipe in MM per Meter												
Temperature		Carbon, C-Mo, 3Cr-Mo, Steel	5CR-Mo Through 9Cr-Mo, Steel	Austenitic Stainless Steel, 18Cr-8Ni	310SS, 25Cr-20Ni	Alloy, 400	Cu-30Ni	Copper	Nickel, 200	Alloy, 800, 825	Alloy 600, 625, 691	Aluminum
°F	°C											
-325	-198	-1.97	-1.85	-3.21	–	-2.18	-2.62	–	–	–	–	-3.90
-300	-184	-1.87	-1.75	-3.02	–	-2.08	-2.39	–	-2.03	–	–	-3.72
-275	-171	-1.76	-1.65	-2.84	–	-1.98	-2.25	–	-1.96	–	–	-3.51
-250	-157	-1.65	-1.55	-2.66	–	-1.88	-2.11	–	-1.77	–	-1.92	-3.31
-225	-143	-1.54	-1.45	-2.47	–	-1.78	-1.97	–	-1.87	–	-1.81	-3.09
-200	-129	-1.42	-1.35	-2.27	–	-1.68	-1.82	–	-3.45	–	-1.70	-2.87
-175	-115	-1.32	-1.25	-2.08	–	-1.58	-1.77	–	-1.52	–	-1.56	-2.63
-150	-101	-1.21	-1.14	-1.89	–	-1.49	-1.62	–	-1.37	–	-1.42	-2.40
-125	-87	-1.08	-1.02	-1.67	–	-1.32	-1.45	–	-1.22	–	-1.28	-2.14
-100	-73	-0.96	-0.90	-1.46	–	-1.15	-1.27	-1.52	-1.07	–	-1.14	-1.89
-75	-59	-0.83	-0.78	-1.25	–	-0.98	-1.11	-1.31	-0.92	–	-0.97	-1.64
-50	-46	-0.70	-0.66	-1.03	–	-0.82	-0.94	-1.09	-0.77	–	-0.81	-1.39
-25	-32	-0.57	-0.52	-0.82	–	-0.64	-0.74	-0.87	-0.62	–	-0.63	-1.10
0	-18	-0.41	-0.38	-0.60	–	-0.47	-0.55	-0.66	-0.47	–	-0.47	-0.81
25	-4	-0.27	-0.25	-0.38	–	-0.31	-0.35	-0.42	-0.30	–	-0.30	-0.52
50	10	-0.12	-0.11	-0.17	–	-0.17	-0.16	-0.18	-0.13	–	-0.11	0.23
70	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	38	0.19	0.18	0.28	0.27	0.23	0.26	0.28	0.21	0.23	0.22	0.38
125	52	0.35	0.33	0.52	0.48	0.43	0.47	0.52	0.39	0.43	0.40	0.71
150	66	0.51	0.48	0.75	0.70	0.62	0.68	0.75	0.57	0.63	0.58	1.02
175	79	0.67	0.63	0.98	0.92	0.82	0.89	0.98	0.77	0.82	0.77	1.35
200	93	0.82	0.78	1.22	1.14	1.02	1.11	1.23	0.96	1.02	0.96	1.67
225	107	1.01	0.94	1.46	1.37	1.22	1.32	1.47	1.15	1.24	1.15	2.01
250	121	1.17	1.11	1.69	1.59	1.42	1.55	1.71	1.34	1.47	1.34	2.36
275	135	1.34	1.27	1.93	1.82	1.63	1.77	1.95	1.54	1.69	1.54	2.70
300	149	1.52	1.42	2.17	2.04	1.84	2.00	2.18	1.73	1.92	1.74	3.06
325	163	1.70	1.58	2.42	2.27	2.03	2.23	2.42	1.93	2.16	1.93	3.41
350	177	1.88	1.75	2.67	2.49	2.23	2.47	2.66	2.13	2.40	2.13	3.77
375	191	2.07	1.92	2.92	2.72	2.42	2.70	2.90	2.33	2.65	2.33	4.12
400	204	2.25	2.08	3.17	2.94	2.71	2.93	3.23	2.54	2.90	2.54	4.49
425	218	2.44	2.27	3.42	3.17	2.93	–	3.47	2.75	3.13	2.74	4.86
450	232	2.63	2.44	3.67	3.39	3.16	–	3.72	2.96	3.37	2.94	5.23
475	246	2.82	2.62	3.92	3.62	3.38	–	3.97	3.17	3.59	3.15	5.60
500	260	3.02	2.79	4.17	3.84	3.61	–	4.22	3.37	3.82	3.35	5.97
525	274	3.22	2.98	4.42	4.07	3.84	–	4.46	3.59	4.06	3.56	6.36
550	288	3.42	3.17	4.68	4.29	4.08	–	4.70	3.80	4.30	3.77	6.75
575	302	3.62	3.35	4.94	4.52	4.32	–	–	4.02	4.53	3.97	7.13
600	316	3.83	3.53	5.20	4.74	4.55	–	–	4.24	4.77	4.18	7.52
625	329	4.05	3.72	5.46	4.97	4.79	–	–	4.46	5.01	4.39	–
650	343	4.26	3.91	5.72	5.19	5.04	–	–	4.68	5.25	4.61	

Thermal Expansion of Pipe Chart

Thermal Expansion of Pipe in MM per Meter												
°F	°C	Carbon, C-Mo, 3Cr-Mo, Steel	5CR-Mo Through 9Cr-Mo, Steel	Austenitic Stainless Steel, 18Cr-8Ni	310SS. 25Cr-20Ni	Alloy, 400	Cu-30Ni	Copper	Nickel, 200	Alloy, 800, 825	Alloy 600, 625, 691	Aluminum
675	357	4.47	4.10	5.98	5.42	5.28	–	–	4.91	5.48	4.82	–
700	371	4.69	4.28	6.25	5.64	5.53	–	–	5.13	5.73	5.04	–
725	385	4.92	4.48	6.52	5.87	5.78	–	–	5.37	5.97	5.26	–
750	399	5.13	4.68	6.79	6.09	6.04	–	–	5.59	6.22	5.47	–
775	413	5.36	4.88	7.06	6.32	6.29	–	–	5.82	6.47	5.70	–
800	427	5.58	5.08	7.33	6.54	6.54	–	–	6.06	6.72	5.92	–
825	441	5.81	5.28	7.61	6.79	6.80	–	–	6.28	6.96	6.15	–
850	454	6.04	5.49	7.88	7.04	7.07	–	–	6.52	7.22	6.39	–
875	468	6.27	5.69	8.16	7.29	7.33	–	–	6.74	7.46	6.62	–
900	482	6.51	5.89	8.43	7.54	7.60	–	–	6.97	7.72	6.86	–
925	496	6.73	6.09	8.72	7.79	7.87	–	–	7.20	7.97	7.10	–
950	510	6.96	6.30	9.00	8.04	8.14	–	–	7.43	8.22	7.33	–
975	524	7.18	6.51	9.28	8.29	8.41	–	–	7.67	8.48	7.57	–
1000	538	7.40	6.72	9.57	8.54	8.68	–	–	7.91	8.74	7.81	–
1025	552	7.64	6.92	9.85	8.79	8.96	–	–	8.14	9.00	8.05	–
1050	566	7.88	7.12	10.13	9.04	9.24	–	–	8.37	9.26	8.28	–
1075	579	8.12	7.33	10.42	9.29	9.52	–	–	8.62	9.52	8.52	–
1100	593	8.37	7.54	10.70	9.54	9.81	–	–	8.86	9.78	8.76	–
1125	607	8.59	7.73	10.98	9.82	10.09	–	–	9.10	10.04	9.00	–
1150	621	8.81	7.93	11.27	10.09	10.39	–	–	9.36	10.32	9.24	–
1175	635	9.02	8.13	11.55	10.37	10.67	–	–	9.58	10.57	9.47	–
1200	649	9.25	8.33	11.83	10.64	10.96	–	–	9.83	10.85	9.72	–
1225	663	9.48	8.55	12.12	10.92	11.25	–	–	10.07	11.13	9.98	–
1250	677	9.72	8.77	12.40	11.19	11.55	–	–	10.32	11.42	10.24	–
1275	691	9.95	8.99	12.68	11.47	11.85	–	–	10.57	11.70	2.17	–
1300	704	10.18	9.22	12.97	11.74	12.15	–	–	10.82	11.99	10.77	–
1325	718	10.42	9.42	13.25	11.99	12.45	–	–	11.07	12.28	11.04	–
1350	732	10.65	9.62	13.53	12.24	12.75	–	–	11.32	12.58	11.30	–
1375	746	10.88	9.83	13.77	12.49	13.05	–	–	11.58	12.87	11.57	–
1400	760	11.12	10.04	14.10	12.74	13.35	–	–	11.83	13.17	11.83	–
1425	774	–	–	14.42	–	–	–	–	12.09	13.47	12.09	–
1450	788	–	–	14.70	–	–	–	–	12.35	13.77	12.36	–
1475	802	–	–	15.07	–	–	–	–	12.61	14.07	12.62	–
1500	816	–	–	15.39	–	–	–	–	12.87	14.37	12.87	–
1525	829	–	–	–	–	–	–	–	13.13	14.67	13.14	–
1550	843	–	–	–	–	–	–	–	13.39	14.98	13.40	–
1575	857	–	–	–	–	–	–	–	13.66	15.29	13.67	–
1600	871	–	–	–	–	–	–	–	13.92	15.61	13.92	

Standard Conversation Table

ACCELERATION		
Muliply	By	To Obtain
Feet / Second²	0.3048	Meter / Second²

ANGLE		
Muliply	By	To Obtain
Degrees	0.01745	Radians

AREA		
Muliply	By	To Obtain
Square Inches	645.2	Square Millimeters
Square Feet	92903	Square Millimeters
Square Feet	0.0929	Square Meters

DENSITY		
Muliply	By	To Obtain
Pounds / Cubic Foot	16.02	Kilograms / Cubic Meter
Pounds / Cubic Inch	27680	Kilograms / Cubic Meter
Pounds / Cubic Inch	27.68	Grams / Cubic Centimeter

FORCE		
Muliply	By	To Obtain
Pounds	0.4536	Kilograms
Pounds	4.448	Newtons
Pounds	444822	Dynes

LENGTH		
Muliply	By	To Obtain
Inches	25.4	Millimeters
Inches	0.0254	Meters
Feet	304.8	Millimeters
Feet	0.3048	Meters

Standard Conversation Table

PRESSURE, MODULUS, STRESS		
Muliply	By	To Obtain
Pounds / Square Inch	0.006895	Newtons / Millimeter Squared
Pounds / Square Inch	0.0007031	Kilograms / Millimeter Squared
Pounds / Square Inch	6895.0	Pascals
Pounds / Square Inch	6.895	Kilopascals
Pounds / Square Inch	0.006895	Megapascals
Pounds / Square Inch	0.06895	Bar

SPRING CONSTANT		
Multiply	By	To Obtain
Pounds / Inch	0.1751	Newtons / Millimetre
Pounds / Inch	175.1	Newtons / Meter
Pounds / Inch	0.01786	Kilograms / Millimeter

TEMPERAATURE		
Multiply	By	To Obtain
Degree Fahrenheit	Degree Centigrade	Substarct 32 & divide by 1.8

TORQUE (MOMENT)		
Multiply	By	To Obtain
Inch - Pounds	113.0	Newton - Millimeters
Foot - Pounds	1356.0	Newton - Millimeters
Foot - Pounds	1.356	Newton - Meters

VELOCITY		
Multiply	By	To Obtain
Feet / Second	304.8	Millimeters / Second
Feet / Second	0.3048	Meters / Second

VOLUME		
Multiply	By	To Obtain
Cubic Inches	16387	Cubic Millimeters
Cubic Inches	16.39	Cubic Centimeters
Cubic Feet	28316850	Cubic Millimeters
Cubic Feet	28317	Cubic Centimeters
Cubic Feet	0.02832	Cubic Meters

European Comparable For Common Expansion Joint Material

UNITED STATES	EUROPEAN COMMUNITY		
ASTM Std.	EN Std. / Rematks	Material Number	Steel Name
A240 304	EN 10028 -7 / (Flat products - Stainless Steels)	1.4301	X5CrNi18-10
A240 304 L	EN 10028 -7 / (Flat products - Stainless Steels)	1.4306	X2CrNi19-11
A240 316	EN 10028 -7 / (Flat products - Stainless Steels)	1.4401	X5CrNiMo 17-12-2
A240 316 L	EN 10028 -7 / (Flat products - Stainless Steels)	1.4404	X2CrNiMo 17-12-2
A240 321	EN 10028 -7 / (Flat products - Stainless Steels)	1.4541	X6CrNiTi18-10
A105 CS	EN 10028 -2 / Flat products made of steels for pressure purposes - Part 2 : Non - alloy and alloy steels with specified elevated temperature properties		
A182 F304	EN 10222 - 5 (steel forgings - SS etc)	1.4301	X5CrNi18-10
A182 F316	EN 10222 - 5 (steel forgings - SS etc)	1.4401	X5CrNiMo17-12-2
A182 F11	EN 10222 - 2 (steel forgings - steels for elevated temperatures)	1.7335	13CrMo4-5
A182 F12	EN 10222 - 2 (steel forgings - steels for elevated temperatures)	1.7335	13CrMo4-5
A53 - B (smis)	N		
A106 - B	EN 10216 - 2/ Seamless steels tubes for pressure purpose - Part 2 : Non - alloy and alloy steel tubes with specified elevated temperature properties o EN Std. available		
A312 304	EN 10217 - 2 (welded steel tubes)	1.4301	X5CrNi18-10
A312 316	EN 10217 - 2 (welded steel tubes)	1.4401	X5CrNiMo17-12-2
A335 P11	EN 10216 - 2 (welded steel tubes)	1.7335	13CrMo4-5
A335 P12	EN 10216 - 2 (welded steel tubes)	1.7335	13CrMo4-5

Steam Pressure Table

TEMPERATURE		SATURATED STEAM		TEMPERATURE		SATURATED STEAM	
(F)	(C)	(psig)	(barg)	(F)	(C)	(psig)	(barg)
212	100	0.0	0.000	460	238	451.3	31.124
220	104	2.5	0.172	480	249	550.3	37.952
240	116	10.3	0.710	500	260	664.3	45.814
260	127	20.7	1.428	520	271	795.3	54.848
280	138	34.5	2.379	540	282	945.3	65.193
300	149	52.3	3.607	560	293	1115.0	76.897
320	160	74.9	5.166	580	304	1308.0	90.217
340	171	103.3	7.124	600	316	1525.0	105.172
360	182	138.3	9.538	620	327	1768.0	121.931
380	193	180.9	12.476	640	338	2041.0	140.759
400	204	232.4	16.028	660	349	2346.0	161.793
420	216	293.7	20.255	680	360	2705.0	186.552
440	227	366.1	25.248	700	371	3080.0	212.414

Low Pressure Conversion

1 in. Mercury = 0.4912 psig	1 kPa = 0.145 psig
1 in. Mercury = 13.60 in. of water	1 kPa = 0.01 bar
1 in. Mercury = 0.03386 bar	1 bar = 0.1 Newton / Square millimeter
1 in. Mercury = 3.3864 kPa	1 psig = 0.06895 bar

Standard Pipe Chart

Properties Of PIPE (ASME B36.10M-2004 / ASME B36.19M-2004) – FOR REFERENCE ONLY									
NB	Pipe OD	Pipe Schedule	Wall Thickness	Inside Diemater	Inside Area	Weight per meter	Moment of Inertia	Section Modulus	Radius of Gyration
NPS	mm		mm	mm	mm^2	kg	cm^4	cm^3	mm
15NB (1/2 NPS)	21.3	10S	2.11	17.12	230	1.00	0.6	0.56	6.84
		40	2.77	15.80	196	1.27	0.71	0.67	6.64
		40S	2.77	15.80	196	1.27	0.71	0.67	6.64
		80	3.73	13.87	151	1.62	0.84	0.78	6.36
		80S	3.73	13.87	151	1.62	0.84	0.78	6.36
		160	4.78	11.79	109	1.95	0.92	0.86	6.09
		XXS	7.47	6.40	32	2.55	1.01	0.95	5.57
20NB (3/4 NPS)	26.7	5S	1.65	23.37	429	1.02	1.02	0.76	8.87
		10S	2.11	22.45	396	1.28	1.24	0.93	8.72
		40	2.87	20.93	344	1.69	1.54	1.16	8.48
		40S	2.87	20.93	344	1.69	1.54	1.16	8.48
		80	3.91	18.85	279	2.20	1.86	1.40	8.17
		80S	3.91	18.85	279	2.20	1.86	1.40	8.17
		160	5.56	15.54	190	2.90	2.20	1.65	7.72
		XXS	7.82	11.02	95	3.64	2.41	1.81	7.22
25NB (1 NPS)	33.4	5S	1.65	30.10	712	1.29	2.08	1.25	11.24
		10S	2.77	27.86	610	2.09	3.15	1.89	10.88
		40	3.38	26.64	558	2.50	3.64	2.18	10.68
		40S	3.38	26.64	558	2.50	3.64	2.18	10.68
		80	4.55	24.31	464	3.24	4.40	2.63	10.33
		80S	4.55	24.31	464	3.24	4.40	2.63	10.33
		160	6.35	20.70	337	4.24	5.21	3.12	9.83
		XXS	6.09	15.21	182	5.45	5.85	3.50	9.18
32NB (1¼ NPS)	42.2	5S	1.65	38.86	1186	1.65	4.32	2.05	14.34
		10S	2.77	36.63	1054	2.69	6.68	3.17	13.96
		40	3.56	35.05	965	3.39	8.11	3.85	13.71
		40S	3.56	35.05	965	3.39	8.11	3.85	13.71
		80	4.85	32.46	828	4.47	10.07	4.78	13.30
		80S	4.85	32.46	828	4.47	10.07	4.78	13.30
		160	6.35	29.46	682	5.61	11.82	5.61	12.86
		XXS	9.70	22.76	407	7.77	14.2	6.74	11.98
40NB (1½ NPS)	48.3	5S	1.65	44.96	1587	1.90	6.57	2.72	16.49
		10S	2.77	42.72	1434	3.11	10.28	4.26	16.12
		40	3.68	40.89	1313	4.05	12.9	5.35	15.82
		40S	3.68	40.89	1313	4.05	12.9	5.35	15.82
		80	5.08	38.10	1140	5.41	16.29	6.75	15.37
		80S	5.08	38.10	1140	5.41	16.29	6.75	15.37
		160	7.14	33.99	907	7.25	20.08	8.32	14.76
		XXS	10.15	27.94	613	9.55	23.64	9.80	13.94
50NB (2 NPS)	60.3	5S	1.65	57.02	2554	2.39	13.11	4.35	20.76
		10S	2.77	54.79	2358	3.93	20.78	6.89	20.38
		40	3.91	52.50	2165	5.44	27.72	9.19	20.00
		40S	3.91	52.50	2165	5.44	27.72	9.19	20.00
		80	5.54	49.25	1905	7.48	36.14	11.98	19.47
		80S	5.54	49.25	1905	7.48	36.14	11.98	19.47
		160	8.74	42.85	1442	11.11	48.47	16.07	18.50
		XXS	11.07	38.18	1145	13.44	54.59	18.10	17.85
65NB (2½ NPS)	73	5S	2.11	68.81	3719	3.69	29.56	8.10	25.09
		10S	3.05	66.93	3518	5.26	41.1	11.26	24.77
		40	5.16	62.71	3089	8.63	63.68	17.44	24.07
		40S	5.16	62.71	3089	8.63	63.68	17.44	24.07
		80	7.01	59.00	2734	11.41	80.11	21.94	23.47
		80S	7.01	59.00	2734	11.41	80.11	21.94	23.47
		160	9.53	53.98	2288	14.92	97.95	26.83	22.70
		XXS	14.02	44.98	1589	20.39	119.52	32.73	21.44

Standard Pipe Chart

Properties Of PIPE (ASME B36.10M-2004 / ASME B36.19M-2004) - FOR REFERENCE ONLY									
NB	Pipe OD	Pipe Schedule	Wall Thickness	Inside Diemater	Inside Area	Weight per meter	Moment of Inertia	Section Modulus	Radius of Gyration
NPS	mm		mm	mm	mm^2	kg	cm^4	cm^3	mm
80NB (3 NPS)	88.9	5S	2.11	84.68	5632	4.52	54.17	12.19	30.70
		10S	3.05	82.80	5385	6.46	75.86	17.07	30.38
		40	5.49	77.93	4769	11.29	125.62	28.26	29.56
		40S	5.49	77.93	4769	11.29	125.62	28.26	29.56
		80	7.62	73.66	4261	15.27	162.14	36.48	28.87
		80S	7.62	73.66	4261	15.27	162.14	36.48	28.87
		160	11.13	66.65	3489	21.35	209.8	47.20	27.78
		XXS	15.24	58.42	2680	27.68	249.49	56.13	26.60
90NB (3½ NPS)	101.6	5S	2.11	97.38	7448	5.18	81.59	16.06	35.19
		10S	3.05	95.50	7164	7.41	114.71	22.58	34.86
		40	5.74	90.12	6379	13.57	199.33	39.24	33.96
		40S	5.74	90.12	6379	13.57	199.33	39.24	33.96
		80	8.08	85.45	5734	18.64	261.47	51.47	33.19
		80S	8.08	85.45	5734	18.64	261.47	51.47	33.19
100NB (4 NPS)	114.3	5S	2.11	110.08	9518	5.84	116.98	20.47	39.68
		10S	3.05	108.20	9196	8.37	164.98	28.87	39.35
		40	6.02	102.26	8213	16.08	301.12	52.69	38.35
		40S	6.02	102.26	8213	16.08	301.12	52.69	38.35
		80	8.56	97.18	7417	22.32	400.12	70.01	37.51
		80S	8.56	97.18	7417	22.32	400.12	70.01	37.51
		120	11.13	92.05	6655	28.32	485.54	84.96	36.69
		160	13.49	87.33	5989	33.54	552.53	96.68	35.96
		XXS	17.12	80.06	5034	41.03	636.32	111.34	34.89
125NB (5 NPS)	141.3	5S	2.77	135.76	14476	9.46	289.24	40.94	48.99
		10S	3.40	134.49	14207	11.56	350.78	49.65	48.78
		40	6.55	128.19	12907	21.77	631.26	89.35	47.70
		40S	6.55	128.19	12907	21.77	631.26	89.35	47.70
		80	9.53	122.25	11738	30.97	860.61	121.81	46.72
		80S	9.53	122.25	11738	30.97	860.61	121.81	46.72
		120	12.70	115.90	10550	40.28	1071.3	151.64	45.69
		160	15.88	109.55	9426	49.12	1250.1	176.94	44.70
		XXS	19.05	103.20	8365	57.43	1400.4	198.21	43.75
150NB (6 NPS)	168.3	5S	2.77	162.74	20800	11.31	493.18	58.62	58.53
		10S	3.40	161.47	20477	13.83	599.42	71.24	58.31
		40	7.11	154.05	18639	28.26	1171.7	139.26	57.04
		40S	7.11	154.05	18639	28.26	1171.7	139.26	57.04
		80	10.97	146.33	16817	42.56	1685.8	200.36	55.76
		80S	10.97	146.33	16817	42.56	1685.8	200.36	55.76
		120	14.27	139.73	15334	54.21	2065.5	245.49	54.69
		160	18.26	131.75	13633	67.57	2457.6	292.09	53.44
		XXS	21.95	124.38	12151	79.22	2761.7	328.24	52.32
200NB (8 NPS)	219.1	5S	2.77	213.54	35813	14.78	1100.8	100.50	76.49
		10S	3.76	211.56	35152	19.97	1474.5	134.61	76.15
		20	6.35	206.38	33451	33.32	2403.2	219.40	75.25
		30	7.04	205.00	33008	36.82	2637.6	240.80	75.02
		40	8.18	202.72	32276	42.55	3018	275.52	74.63
		40S	8.18	202.72	32276	42.55	3018	275.52	74.63
		60	10.31	198.45	30931	53.09	3694.5	337.28	73.91
		80	12.70	193.68	29460	64.64	4401.4	401.82	73.11
		80S	12.70	193.68	29460	64.64	4401.4	401.82	73.11
		100	15.09	188.90	28026	75.92	5057.9	461.75	72.33
		120	18.26	182.55	26173	90.44	5857.1	534.72	71.30
		140	20.62	177.83	24836	100.93	6400.1	584.28	70.55
		XXS	22.23	174.63	23950	107.93	6744.1	615.69	70.05
		160	23.01	173.05	23520	111.27	6906.6	630.52	69.80

Standard Pipe Chart

Properties Of PIPE (ASME B36.10M-2004 / ASME B36.19M-2004) – FOR REFERENCE ONLY									
N	Pipe OD	Pipe Schedule	Wall Thickness	Inside Diemater	Inside Area	Weight per meter	Moment of Inertia	Section Modulus	Radius of Gyration
NPS	mm		mm	mm	mm^2	kg	cm^4	cm^3	mm
250NB (10 NPS)	273.1	5S	3.40	266.24	55673	22.61	2621.6	192.02	95.35
		10S	4.19	264.67	55017	27.78	3200.2	234.40	95.08
		20	6.35	260.35	53236	41.76	4734.4	346.78	94.33
		30	7.80	257.45	52059	51.01	5721.4	419.07	93.83
		40	9.27	254.51	50874	60.29	6692	490.17	93.33
		40S	9.27	254.51	50874	60.29	6692	490.17	93.33
		60	12.70	247.65	48169	81.53	8824.4	646.35	92.17
		80	15.09	242.88	46329	95.98	10208	747.71	91.37
		80S	12.70	247.65	48169	81.53	8824.4	646.35	92.17
		100	18.26	236.53	43938	114.71	11926	873.54	90.32
		120	21.44	230.18	41611	133.01	13511	989.64	89.29
		140	25.40	222.25	38795	155.10	15313	1121.64	88.03
		160	28.58	215.90	36610	172.27	16625	1217.71	87.03
300NB (12 NPS)	323.9	5S	3.96	315.93	78390	31.24	5095.6	314.69	113.12
		10S	4.57	314.71	77786	35.98	5846.2	361.05	112.91
		20	6.35	311.15	76038	49.71	7986.4	493.22	112.29
		30	8.38	307.09	74065	65.19	10344	638.82	111.59
		40S	9.53	304.80	72966	73.86	11630	718.23	111.20
		STD	9.53	304.80	72966	73.86	11630	718.23	111.20
		40	10.31	303.23	72214	79.71	12499	771.90	110.93
		80S	12.70	298.45	69958	97.44	15053	929.60	110.11
		60	14.27	295.30	68489	108.93	16671	1029.56	109.58
		80	17.48	288.90	65552	132.05	19805	1223.07	108.51
		100	21.44	280.98	62005	159.87	23406	1445.48	107.20
		120	25.40	273.05	58557	186.92	26715	1649.84	105.91
		140	28.58	266.70	55865	208.08	29167	1801.25	104.90
		160	33.32	257.20	51956	238.69	32522	2008.43	103.40
350NB (14 NPS)	355.6	5S	3.96	347.68	94938	34.34	6768.2	380.66	124.35
		10S	4.78	346.05	94052	41.36	8100.6	455.60	124.06
		10	6.35	342.90	92348	54.69	10629	597.82	123.52
		20	7.92	339.75	90659	67.91	13089	736.17	122.97
		30	9.53	336.55	88959	81.33	15520	872.86	122.42
		40S	9.53	336.55	88959	81.33	15520	872.86	122.42
		40	11.13	333.35	87275	94.55	17882	1005.72	121.87
		80S	12.70	330.20	85634	107.40	20141	1132.78	121.33
		60	15.09	325.43	83175	126.72	23445	1318.60	120.52
		80	19.05	317.50	79173	158.11	28616	1609.44	119.19
		100	23.83	307.95	74482	194.98	34354	1932.16	117.62
		120	27.79	300.03	70698	224.66	38727	2178.11	116.33
		140	31.75	292.10	67012	253.58	42767	2405.32	115.06
		160	35.71	284.18	63426	281.72	46491	2614.77	113.81
400NB (16 NPS)	406.4	5S	4.19	398.02	124422	41.56	10713	527.19	142.23
		10S	4.78	396.85	123693	47.34	12153	598.09	142.02
		10	6.35	393.70	121737	62.65	15974	786.10	141.48
		20	7.92	390.55	119797	77.83	19703	969.65	140.93
		30	9.53	387.35	117842	93.27	23402	1151.67	140.38
		40S	9.53	387.35	117842	93.27	23402	1151.67	140.38
		40	12.70	381.00	114010	123.31	30474	1499.69	139.28
		80S	12.70	381.00	114010	123.31	30474	1499.69	139.28
		60	16.66	373.08	109316	160.13	38817	1910.28	137.94
		80	21.44	363.53	103791	203.54	48189	2371.52	136.33
		100	26.19	354.03	98437	245.57	56807	2795.62	134.76
		120	30.96	344.48	93198	286.66	64799	3188.92	133.21
		140	36.53	333.35	87275	333.21	73307	3607.63	131.42
		160	40.49	325.43	83175	365.38	78870	3881.40	130.18

Standard Pipe Chart

Properties Of PIPE (ASME B36.10M-2004 / ASME B36.19M-2004) - FOR REFERENCE ONLY									
NB	Pipe OD	Pipe Schedule	Wall Thickness	Inside Diemater	Inside Area	Weight per meter	Moment of Inertia	Section Modulus	Radius of Gyration
NPS	mm		mm	mm	mm^2	kg	cm^4	cm^3	mm
450NB (18 NPS)	457	5S	4.19	448.82	158209	46.79	15306	669.53	160.19
		10S	4.78	447.65	157387	53.31	17372	759.94	159.99
		10	6.35	444.50	155180	70.57	22863	1000.12	159.44
		20	7.92	441.35	152988	87.71	28238	1235.26	158.89
		30	11.13	434.95	148583	122.38	38813	1697.85	157.78
		40S	9.53	438.15	150778	105.17	33583	1469.09	158.33
		40	14.27	428.65	144311	155.81	48774	2133.58	156.70
		80S	12.70	431.80	146439	139.16	43848	1918.10	157.24
		60	19.05	419.10	137952	205.75	63061	2758.55	155.08
		80	23.83	409.55	131736	254.57	76403	3342.23	153.47
		100	29.36	398.48	124708	309.64	90749	3969.79	151.64
		120	34.93	387.35	117842	363.58	104006	4549.68	149.83
		140	39.67	377.85	112132	408.28	114457	5006.85	148.30
		160	45.24	366.73	105627	459.39	125734	5500.15	146.55
500NB (20 NPS)	508	5S	4.78	498.45	195135	59.32	23905	941.15	177.95
		10S	5.54	496.93	193943	68.89	27595	1086.41	177.68
		10	6.35	495.30	192676	78.56	31493	1239.90	177.40
		20	9.53	488.95	187768	117.15	46358	1825.13	176.29
		30	12.70	482.60	182922	155.13	60655	2388.00	175.20
		40S	9.53	488.95	187768	117.15	46358	1825.13	176.29
		40	15.09	477.83	179320	183.43	71041	2796.90	174.38
		80S	12.70	482.60	182922	155.13	60655	2388.00	175.20
		60	20.62	466.75	171104	247.84	93958	3699.11	172.49
		80	26.19	455.63	163045	311.19	115394	4543.06	170.62
		100	32.54	442.93	154082	381.55	138018	5433.77	168.52
		120	38.10	431.80	146439	441.52	156301	6153.57	166.70
		140	44.45	419.10	137952	508.15	175514	6909.98	164.66
		160	50.01	407.98	130725	564.85	190969	7518.46	162.91
550NB (22 NPS)	559	10	6.35	546.10	234226	86.55	42062	1505.42	195.36
		20	9.53	539.75	228811	129.14	62021	2219.79	194.25
		30	12.70	533.40	223459	171.10	81289	2909.40	193.15
		60	22.23	514.35	207783	294.27	135099	4835.32	189.90
		80	28.58	501.65	197648	373.85	167804	6005.84	187.76
		100	34.93	488.95	187768	451.45	198116	7090.76	185.65
		120	41.28	476.25	178140	527.05	226157	8094.36	183.58
		140	47.63	463.55	168766	600.67	252042	9020.80	181.53
		160	53.98	450.85	159645	672.30	275884	9874.14	179.52
600NB (24 NPS)	610	5S	5.54	598.53	281357	82.58	47946	1573.01	213.61
		10S	6.35	596.90	279830	94.53	54763	1796.69	213.32
		10	6.35	596.90	279830	94.53	54763	1796.69	213.32
		20	9.53	590.55	273908	141.12	80866	2653.08	212.21
		30	14.27	581.05	265167	209.65	118374	3883.66	210.57
		40S	9.53	590.55	273908	141.12	80866	2653.08	212.21
		40	17.48	574.65	259357	255.43	142631	4679.50	209.47
		80S	12.70	584.20	268049	187.07	106140	3482.28	211.11
		60	24.61	560.38	246632	355.28	193883	6360.98	207.03
		80	30.96	547.68	235579	442.11	236305	7752.79	204.90
		100	38.89	531.83	222141	547.74	285265	9359.06	202.27
		120	46.02	517.55	210376	640.07	325769	10687.93	199.94
		140	52.37	504.85	200178	720.19	359095	11781.31	197.90
		160	59.54	490.53	188979	808.27	393786	12919.47	195.64

Standard Sheet Gauge

STANDARD AVAILABLE SHEET GAUGES								
GAUGE	STAINLESS STEEL				NICKEL ALLOYS			
			WEIGHT		THICKNESS		WEIGHT	
		(mm)	(LB/Sq.Ft.)	(Kg/Sq.M)	(In.)	(mm)	(LB/Sq.Ft.)	(Kg/Sq.M)
7	0.1874	4.76	7.871	38.43	0.187	4.750	8.590	41.94
8	0.1650	4.19	6.930	33.84	-	-	-	-
10	0.1350	3.43	5.670	27.68	0.140	3.560	6.431	31.40
11	0.1200	3.05	5.040	24.61	0.125	3.180	5.742	28.04
12	0.1054	2.68	4.427	21.62	0.109	2.770	5.007	24.45
13	0.0900	2.29	3.780	18.46	0.093	2.360	4.272	20.86
14	0.0751	1.91	3.154	15.40	0.078	1.980	3.583	17.49
16	0.0595	1.51	2.499	12.20	0.062	1.570	2.848	13.91
18	0.0480	1.22	2.016	9.84	0.050	1.270	2.297	11.22
19	0.0420	1.07	1.764	8.61	0.043	1.090	1.975	9.64
20	0.0355	0.90	1.491	7.28	0.037	0.940	1.700	8.30
22	0.0293	0.74	1.231	6.01	0.031	0.787	1.424	6.95
24	0.0235	0.60	0.987	4.82	0.025	0.635	1.148	5.61
26	0.0178	0.45	0.748	3.65	0.018	0.457	0.827	

NOTE

NOTE

REPL
AUSTRALIA Pvt Ltd.

PO Box 1543, CHATSWOOD NSW 2067

+61 2 800 62807
+61 404 822 976

sales@repl-australia.com

www.repl-australia.com

Sales Office: Australia | France | India | Norway | USA

Factories: Australia | India