EXPANSION JOINT

As the Global Leader

ASME

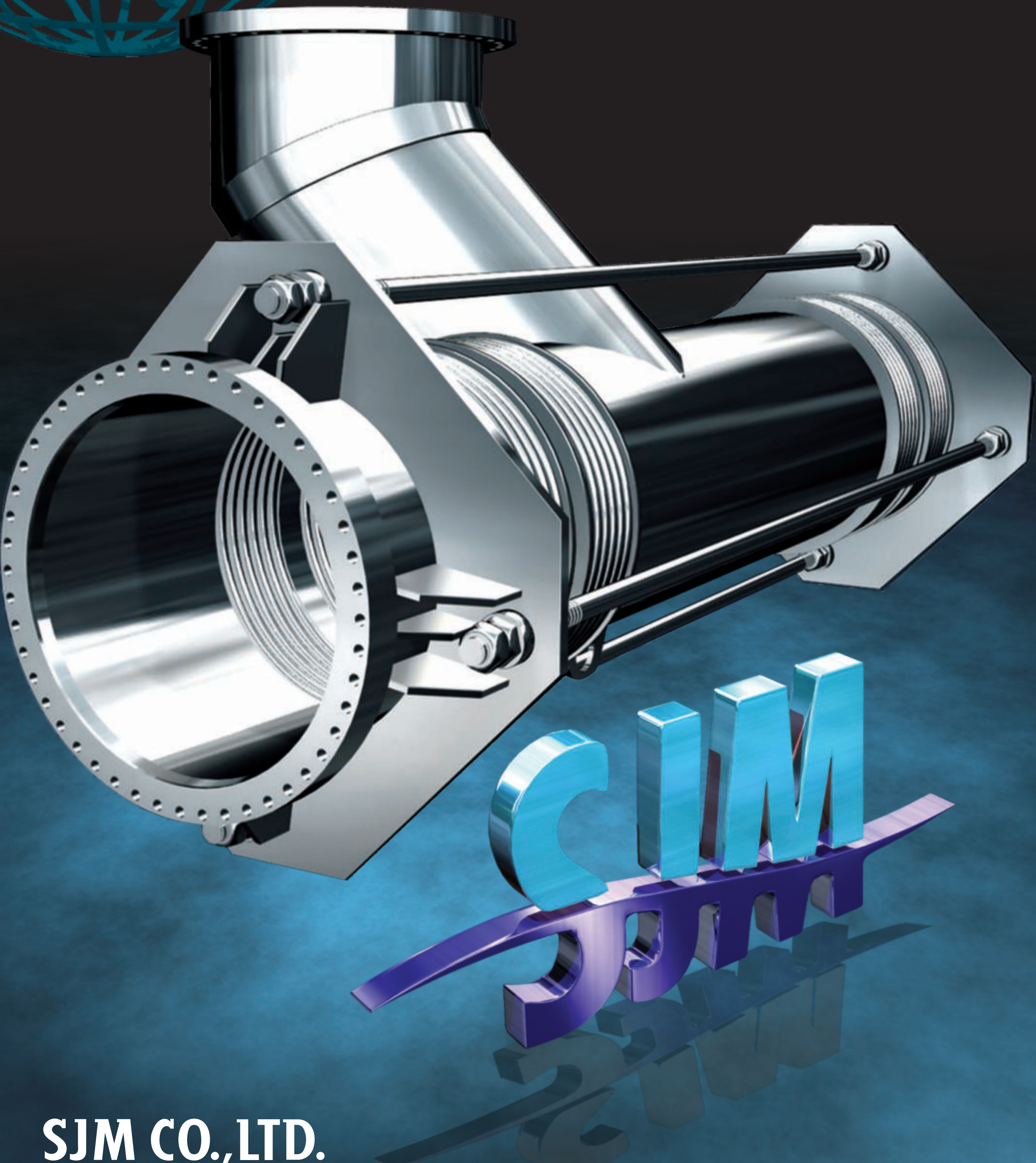
U2

ISO 9001 REGISTERED

DNV

MGMT. SYS.
RvA C024

DNV Certification B.V., The Netherlands



SJM CO.,LTD.

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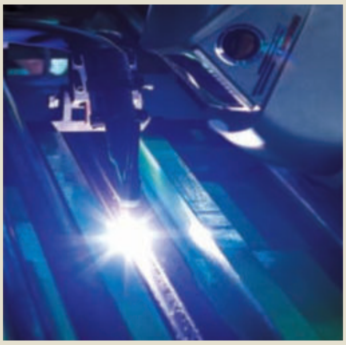
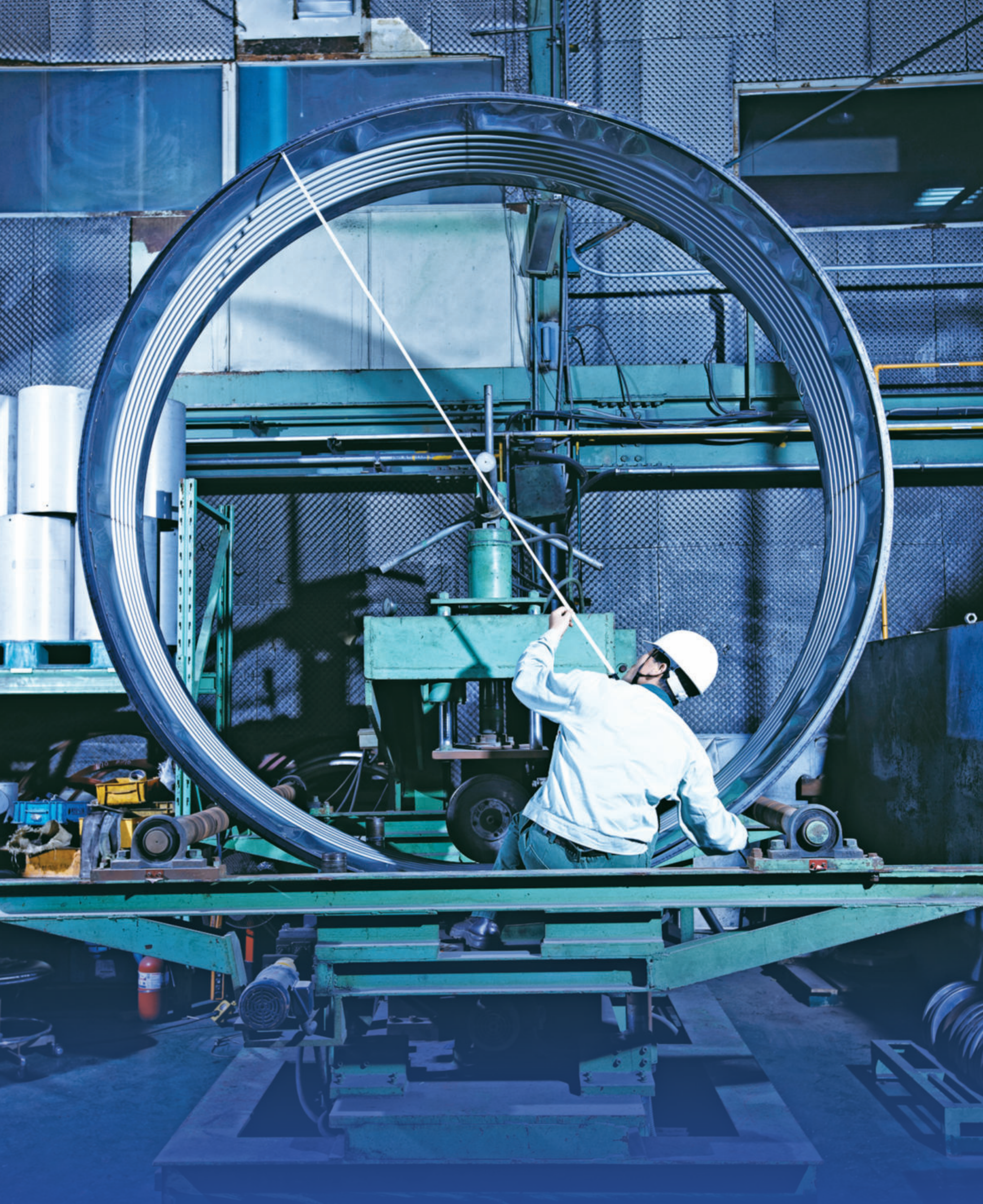




COMPANY HISTORY

1975. Foundation of Sung Jin Machinery Co., Ltd.
1980. Supply of Expansion Joint for marine applications to United States, United Kingdom.
1982. Acquisition of KS (Korean Industrial Standard)
1985. Production of Flexible Couplings for automotive industry
1990. Localization of the Expansion Joint (Q-Class) for nuclear power plants
1991. Completion of the second factory in Banwol industrial complex
1991. Establishment of the joint-venture company, SJM Flex (M) Sdn. Bhd in Malaysia
1993. Completion of the third factory in Shihwa industrial complex
1993. Awarding a prize of the 5 million dollars export
1996. Renaming of company to SJM CO., LTD.
1996. ISO 9001 certification
1997. Listing on stock exchange
1997. Establishment of SJM FLEX SA (Pty) Ltd. in South Africa
1997. Establishment of SJM GmbH in Germany
1997. Acquisition of Seohwa Telecom Co., Ltd.
1997. QS 9000 certification
2001. Registration Seohwa Telecom Co. Ltd. at KOSDAQ
2001. Establishment of SJM North America, INC. in USA
2002. BV Type Approval 〈LNG〉
GTT Approval
2004 ABS / DNN Type Approval 〈LNG〉
2005 LR Type Approval 〈LNG〉
2007. KR Type Approval 〈LNG〉
2013. U2 Approval "U2" stamps from ASME

“SJM” will proceed with innovative management, fostering of talent, customer care, reserch & development and globalization to fulfill the vision of our company.

We will diversify our business structure through the development of new products in high-end plant models, aviation precision mechanics and electric industry, and also through the development of new automobile related projects.

CLASSIFICATION OF EXPANSION JOINTS

Single Expansion Joint

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

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

MODIFY CYCLE LIFE

The catalog movements are based on a cycle life of 3000 using the Expansion Joint Manufacturer Association's calculation method. If a higher cycle life is required, the available catalog movements should be reduced by the following amount before the above calculation is performed.

Desired Cycle Life	3,000	5,000	7,000	10,000
Catalog Movement Reduction Factor	1	0.905	0.801	0.741

MODIFY SPRING RATE

If spring rate is the limiting design factor, select the convolution count that results in a total force that is less than the required amount for lateral and axial movements. Keep in mind that pressure thrust must be added to the axial spring force for a single expansion joint that has axial compression even if limit rods are specified. To calculate the pressure thrust force, multiply the area of the bellows times the operating pressure. The effective area for any design is located under the pressure class on each page of design data.

Universal Expansion Joint

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

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

MODIFY CYCLE LIFE

The catalog movements are based on a cycle life of 3000 using the Expansion Joint Manufacturer Association's calculation method. If a higher cycle life is required, the available catalog movements should be reduced by the following amount before the above calculation is performed.

Desired Cycle Life	3,000	5,000	7,000	10,000
Catalog Movement Reduction Factor	1	0.905	0.801	0.741

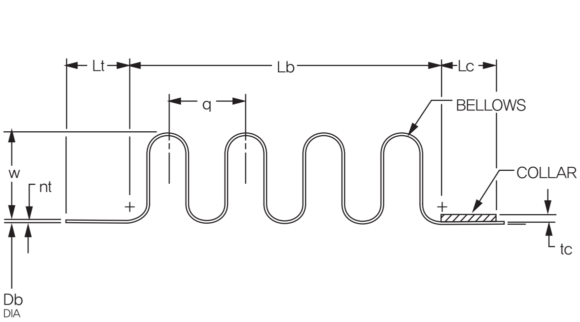
MODIFY SPRING RATE

If spring rate is the limiting design factor, select the length that results in a total force that is less than the required amount for lateral and axial movements. Keep in mind that pressure thrust must be added to the axial spring force for a universal expansion joint that has axial compression even if limit rods are specified. To calculate the pressure thrust force, multiply the area of the bellows times the operating pressure. The effective area for any design is located under the pressure class on each page of design data.

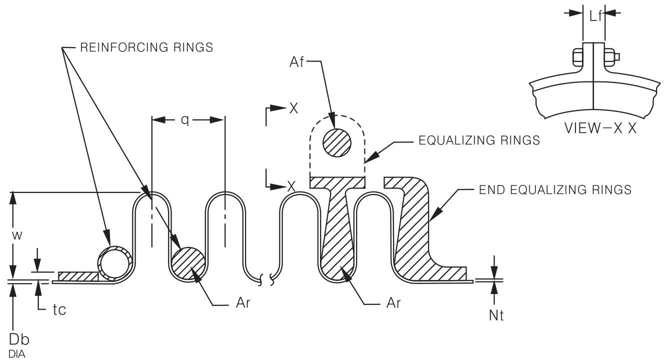
Standard material specifications for bellows shown in this catalog

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

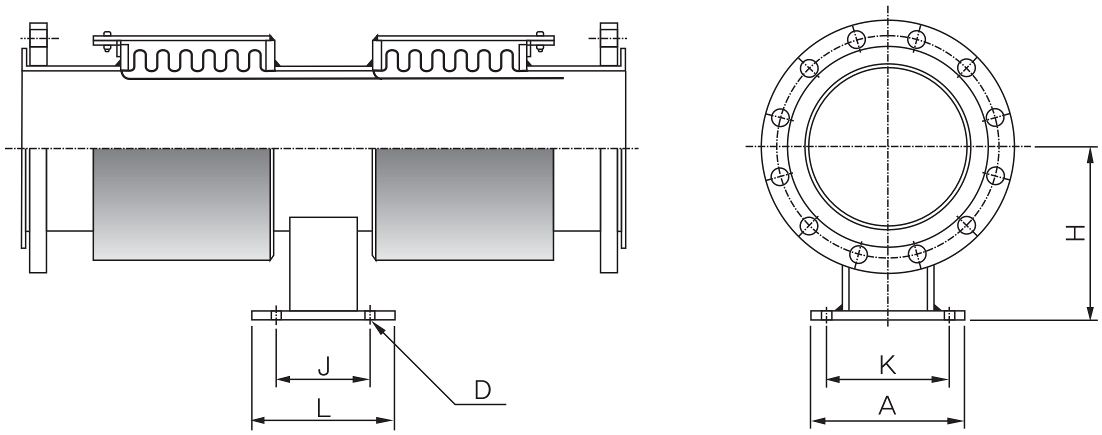
UNREINFORCED BELLOWS (UNREIN)



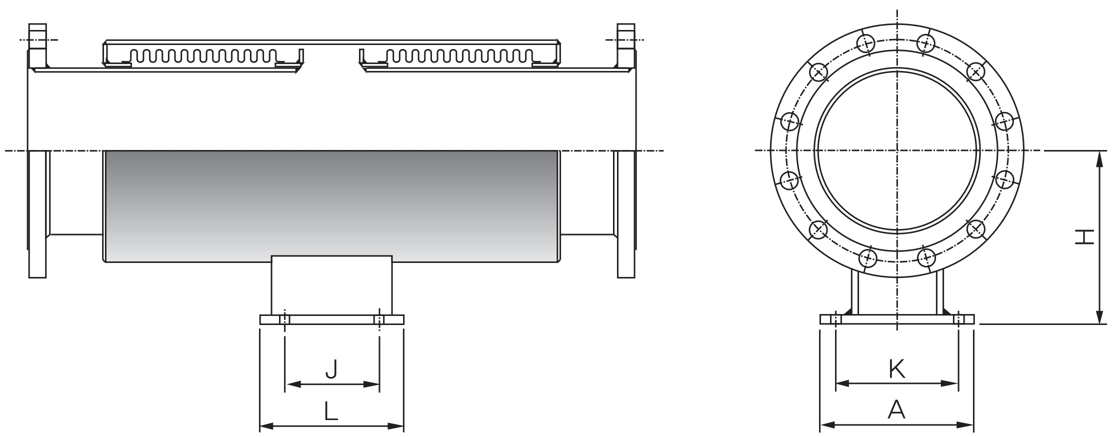
REINFORCED BELLOWS (REIN)



Internal pressure type



EXternal pressure type

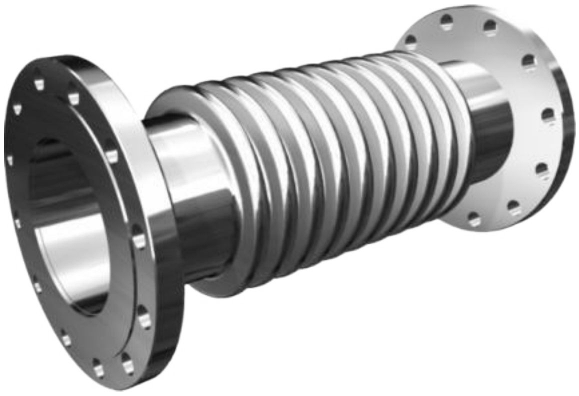


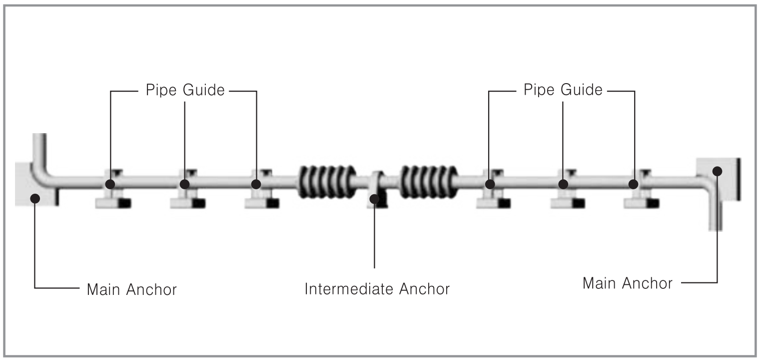
Anchor foot dimensional data

	50A	65A	80A	100A	125A	150A	200A	250A	300A	350A	400A	450A	500A	550A	600A
A	110	150	150	190	190	230	280	350	360	410	480	550	600	Custom Design	
K	80	100	110	130	150	180	220	280	300	350	400	450	500	Custom Design	
L	130	160	160	160	160	220	220	250	260	310	380	450	500	Custom Design	
J	100	120	120	120	120	160	160	180	200	250	300	350	400	Custom Design	
D	15	15	15	19	19	23	25	27	27	33	33	39	39	Custom Design	
H	130	140	150	170	200	220	250	300	350	450	500	550	600	Custom Design	

Single Type Expansion Joint (JBF)

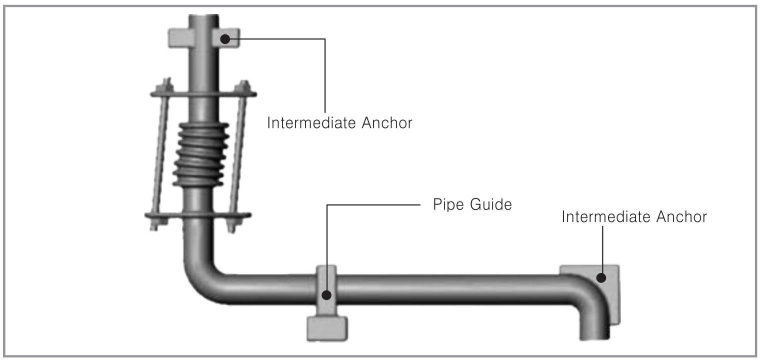
This is the simplest type of Expansion Joint having single bellows construction, for the purpose of absorbing the thermal expansion, or contraction, from the adjacent pipelines. Depending upon the pressure rating. SJM can provide the reliable bellows design, i.e, un-reinforced, or reinforced type adapting reinforcing ring or equalizing ring outside the root of bellows convolution. This type used to require the rigid fix point designed to withstand the thrust force and reaction spring force while operation.





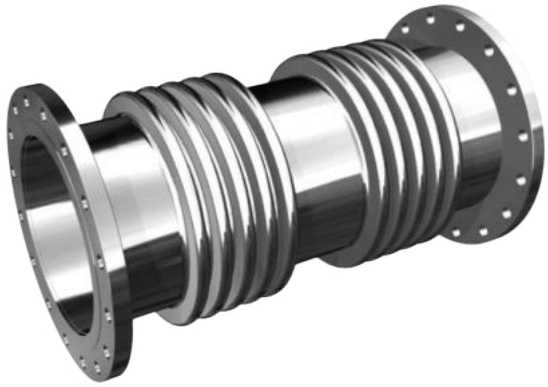
Tied Single Expansion Joint (JBF-T)

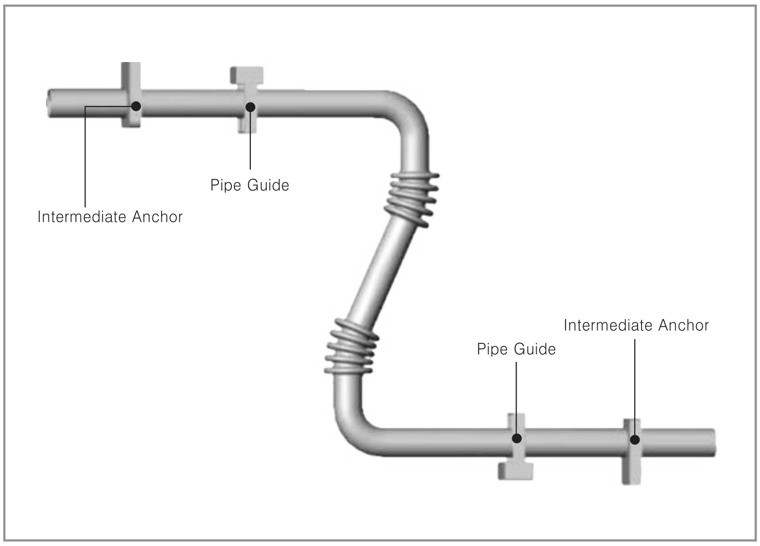
The restraints, tie-rods, are additionally considered on single type expansion joint to permit bellows to absorb only lateral offset on piping-configuration in one-plane. Basically, tie-rods should continuously withstand the full bellows pressure thrust during normal operation.



UNIVERSAL TYPE EXPANSION JOINT (JBU)

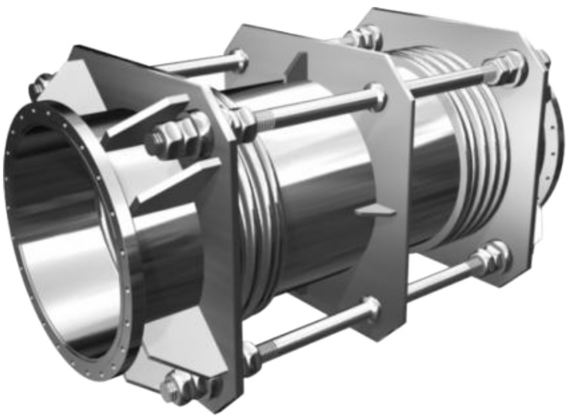
In the structure, this type is containing two bellows joined by a center spool pipe and usually perform the function for the absorbing any combination of the three basic movements, i.e, axial movement, lateral offset and angular rotation. In hardware device, control rods used to be considered on design for the purpose of distributing the movement between the two bellows of this Expansion Joint and not subjected to the bellows pressure thrust.

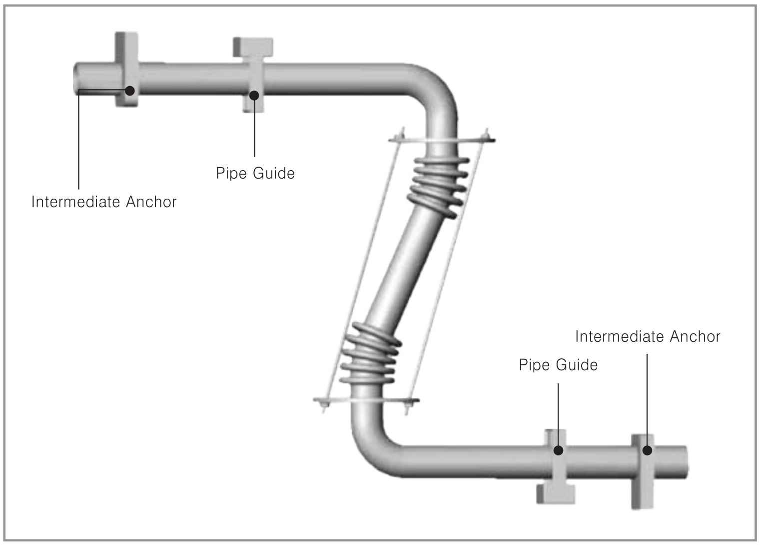




TIED UNIVERSAL EXPANSION JOINT (JBU-T)

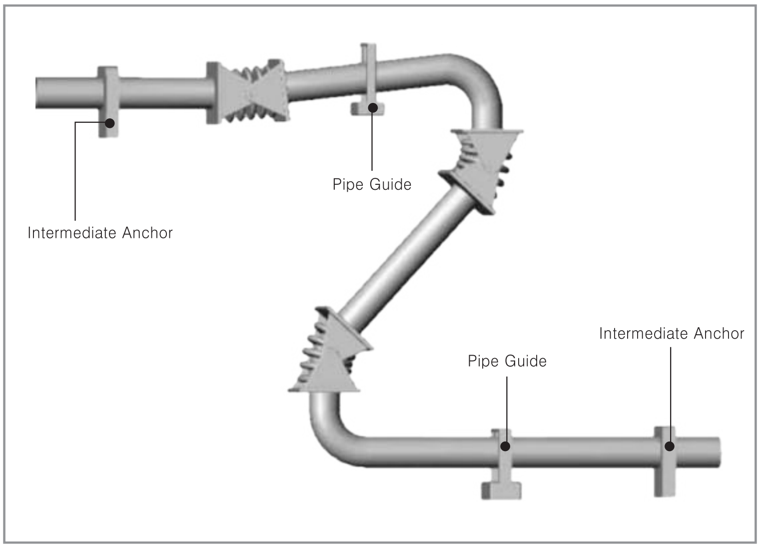
In a whole construction view point, this type of Expansion Joint is very similar with the universal Expansion Joint except for the adapting of tie-rod assemblies, which permit the combination of two bellows to absorb lateral offset only. In case high temperature is applied on design, SJM considers the axial thermal growth from the intermediate & end shell pipe, which are the constituent units of this type of expansion joint, in the bellows membrane strength calculation. Inside lock nuts are also recommended as part of tie-rod assemblies to eliminate the damage which could be happened on other vessel, or equipment from bellows pressure thrust.





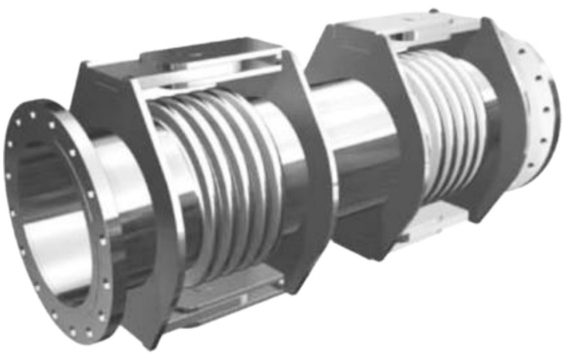
Single Hinged Expansion Joint (JBHS)

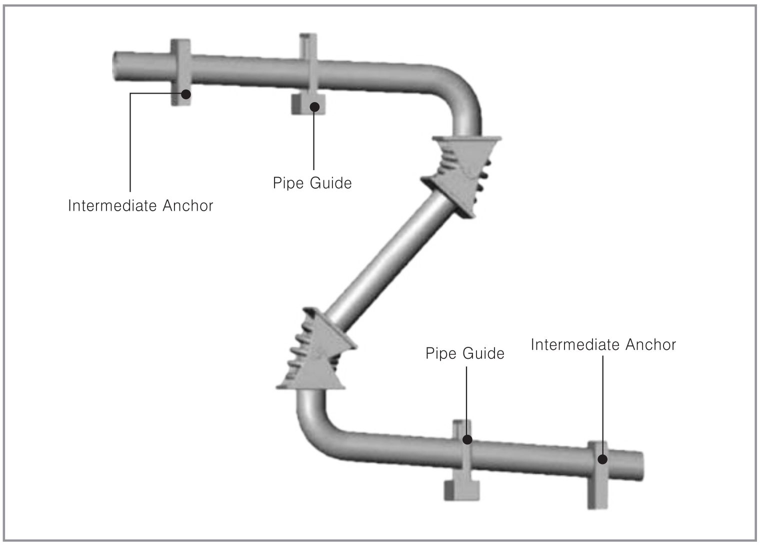
The hinged type restraints the bellows pressure thrust by the hinge arms and pins mounted on the both sides of bellows and only low spring forces are transmitted to the fix point or equipment. These hinge hardware including arms & pins permit bellows to absorb the angular rotation on one plane. To properly function this type of Expansion Joint on piping-work, two or three sets of hinged Expansion Joint must be considered as figures below.



Double Hinged Expansion Joint (JBHD)

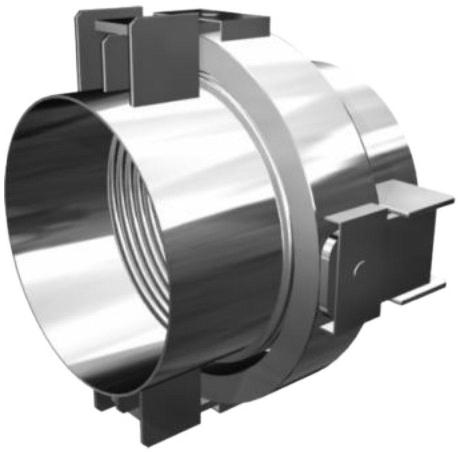
This type of Expansion Joint is constructed with two hinged Expansion Joints for the purpose of absorbing lateral displacement with each bellows's bending action, so that large lateral displacement is permitted by lengthening the intermediate shell pipe. If the absorbing of thermal growth from intermediate pipe is required within this type of Expansion Joint itself on high temperature application in piping stress analysis, SJM can provide the specially designed hinge hardware assembly with long hinge plate as much as the distance between the center line of each bellows, which perform the function like as swing bar. Also, the weight of intermediate shell pipe is supported by the hinge arm so that it does not affect the bellows.

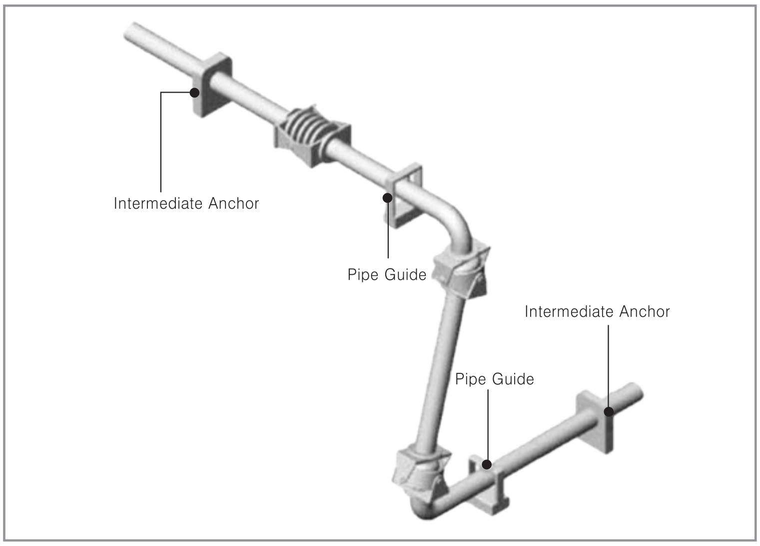




SINGLE GIMBAL EXPANSION JOINT (JBGS)

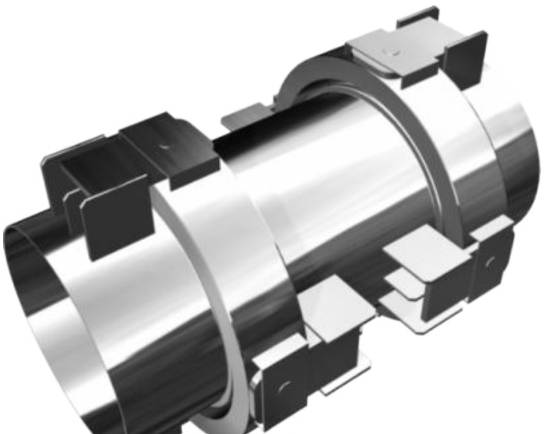
On the construction and function, this type of Expansion Joint is very close similar with the hinged Expansion Joint. Basically, Gimbal structure assembled with floating gimbal ring, pin & arms must be designed to withstand against for bellows pressure thrust and extraneous force. Also, it should have a structure permitting bellows to absorb the angular rotation in any plane. To properly function this type of Expansion Joint on piping-work, pair of single gimbal expansion joint, or additionally with one hinged expansion joint, must be united to absorb a large movement in similar with single hinged conjugated system.

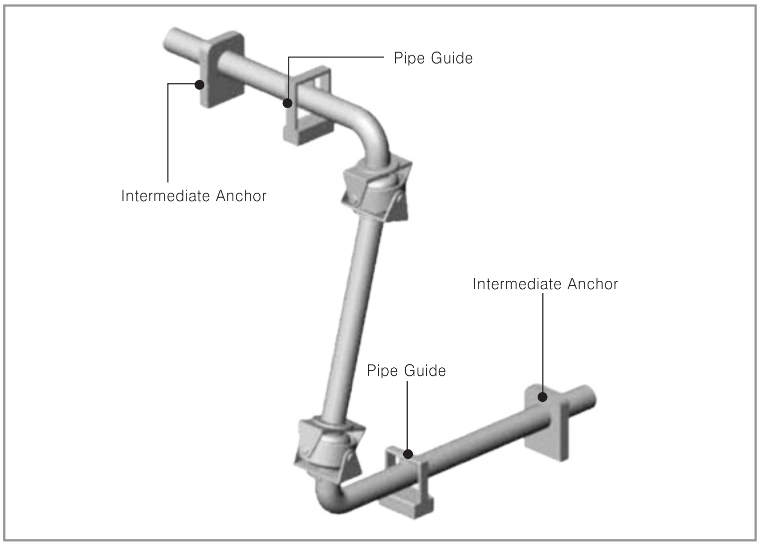




DOUBLE GIMBAL EXPANSION JOINT (JBGD)

This type of Expansion Joint is constructed with two Gimbal Expansion Joints for the purpose of absorbing lateral displacement in multi plane system. As the same as double hinged Expansion Joint, lengthening the intermediate pipe shell can mark it become available to absorb more large lateral displacement. Also, if the thermal growth from intermediate shell pipe is desired to be absorbed within this type of Expansion Joint itself, SJM is able to show a fitted design solution as well.





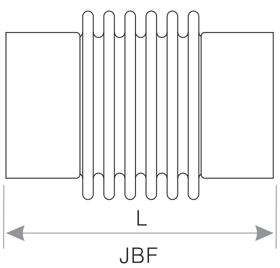
DESIGN DATA SINGLE TYPE (JBF, JBF-T, JBHS, JBGS)

1. Rated cycle life is 3000 cycles per EJMA latest edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movement, refer to page 8.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements of cycle life, refer to page 8.
5. Catalog pressure ratings are based upon a maximum bellows temperature 800° F.
   Actual operating temperature should always be specified.
6. Maximum test pressure : 1.5 x maximum working pressure.
7. The overall length may be revised in accordance with the type of Expansion Joint and other attachment.

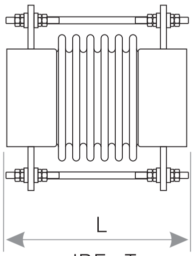
Nominal Diameter	Pressure (bar)	No.of Convol-utions	Non-Concurrent			Spring Rate			Effective Area (㎠)	Overall Length (mm)	Unrein-or Rein-Type
			Axial (mm)	Lateral (mm)	Angular (Deg.)	Axial (N/mm)	Lateral (N/mm)	Angular (N.M/Deg)			
100A	5	4	14	2.6	12.4	376.6	1616.2	14.5	138.1	275	UNREIN
		6	21	5.8	18.6	251.1	567.8	9.6		310	
	10	4	14	2.6	12.4	815.5	4186.7	31.6	139.4	275	UNREIN
		6	21	5.8	18.6	543.7	1240.5	21.0		310	
	20	4	10	1.9	9.2	1732.3	8946.4	67.5	140.2	275	UNREIN
		6	16	4.3	13.8	1154.8	2650.8	45.0		310	
125A	5	4	18	3.6	14.1	421.7	1845.1	20.8	177.4	290	UNREIN
		6	27	8.1	21.2	281.1	546.7	13.9		335	
	10	4	19	3.8	15.1	561	2407.2	27.1	173.7	290	UNREIN
		6	29	8.7	22.6	374.7	713.2	18.1		335	
	20	4	14	2.8	11.0	1325.5	5631.3	63.4	172.3	290	UNREIN
		6	21	6.3	16.4	883.7	1668.5	42.3		335	
150A	5	4	18	3.3	12.3	528.7	2862.8	35.2	240	295	UNREIN
		6	20	7.4	18.5	352.5	848.2	23.5		340	
	10	4	21	3.8	14.4	592.3	3185.1	39.2	238.3	295	UNREIN
		6	32	8.7	21.6	394.8	943.7	26.1		340	
	20	4	14	2.5	9.7	1901.2	10436.9	128.5	243.3	295	UNREIN
		6	22	5.8	14.5	1267.5	3092.4	85.7		340	
200A	5	4	24	4.1	11.9	702.5	3871.3	81.1	415.5	320	UNREIN
		6	36	9.3	17.9	468.4	1147.1	54.1		380	
	10	4	28	4.9	14.2	799.8	4430.1	92.8	417.7	320	UNREIN
		6	43	11.2	21.4	533.2	1312.6	61.9		380	
	20	4	19	3.3	9.7	2257.2	12590.0	263.7	420.6	320	UNREIN
		6	29	7.6	14.5	1504.8	3730.4	175.8		380	
250A	5	4	33	5.4	13.4	531.5	3303.6	94.2	637.9	340	UNREIN
		6	49	12.2	20.1	354.3	978.8	62.8		410	
	10	4	33	5.4	13.3	1060.2	6637.0	189.2	642.4	340	UNREIN
		6	50	12.2	20.0	706.8	1966.5	126.1		410	
	20	4	22	3.6	8.9	3084.6	19444.2	554.3	646.9	340	UNREIN
		6	33	8.1	13.3	2056.4	5761.3	369.5		410	
300A	5	4	39	6.9	13.2	730.9	3939.4	185.6	914.3	380	UNREIN
		6	59	15.5	19.8	487.3	1167.2	123.8		470	
	10	4	36	6.4	12.4	1493.8	7854	370.1	892.0	380	UNREIN
		6	54	14.6	18.6	995.9	2327.1	246.7		470	
	20	4	25	4.5	8.6	3855.3	20391.1	960.9	897.3	380	UNREIN
		6	27	7.5	9.6	5363.8	12683.4	1344.8		470	
350A	5	4	48	8.4	14.5	715.5	3966.9	230.8	1161.1	500	UNREIN
		6	73	19.0	21.8	477.0	1175.4	153.9		600	
	10	4	45	7.9	13.6	1353.3	7266.8	422.8	1124.6	500	UNREIN
		6	67	17.8	20.5	902.2	2153.1	281.8		600	
	20	4	30	5.3	9.2	4183.3	22891.8	1331.8	1146.1	500	UNREIN
		6	46	12.0	13.8	2788.9	6782.7	887.9		600	

DESIGN DATA

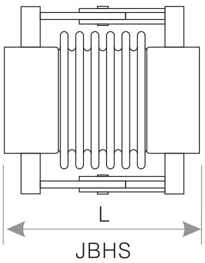
SINGLE TYPE (JBF, JBF-T, JBHS, JBGS)



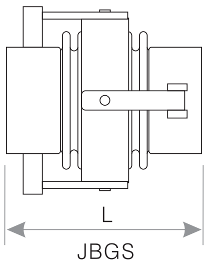
JBF



JBF－T



JBHS



JBGS

Nominal Diameter	Pressure (bar)	No.of Convol-utions	Non-Concurrent			Spring Rate			Effective Area (㎠)	Overall Length (mm)	Unrein-or Rein-Type
			Axial (mm)	Lateral (mm)	Angular (Deg.)	Axial (N/mm)	Lateral (N/mm)	Angular (N.M/Deg)			
400A	5	4	48	7.4	12.8	784.4	5527.9	321.6	1475.9	500	UNREIN
		6	73	16.8	19.3	523.0	1637.9	214.4		600	
	10	4	46	7.2	12.5	1431.2	9804.2	570.4	1434.7	500	UNREIN
		6	70	16.3	18.7	954.2	2905.0	380.3		600	
	20	4	30	4.7	8.1	4623.2	32205.1	1873.6	1459.0	500	UNREIN
		6	45	10.6	12.1	3082.1	9542.3	1249.1		600	
450A	5	4	48	6.6	11.4	859.2	7626.2	443.7	1858.9	500	UNREIN
		6	73	15.0	17.1	572.8	2259.6	295.8		600	
	10	4	45	6.3	10.8	1647.6	14199.5	826.1	1805.0	500	UNREIN
		6	73	14.9	17.1	1143.3	4537.8	594.0		600	
	20	4	25	3.6	6.2	3306.5	28094.3	1634.5	1779.5	500	UNREIN
		6	38	8.1	9.3	2204.4	8824.2	1089.6		600	
500A	5	4	48	6.0	10.4	925.6	9879.3	574.8	2235.4	500	UNREIN
		6	72	13.6	15.6	617.1	2927.2	383.2		600	
	10	4	45	5.7	9.8	1749.3	18177.2	1057.5	2176.3	500	UNREIN
		6	73	13.6	15.6	1231.9	5876.5	769.2		600	
	20	4	26	3.3	5.7	3445.7	35343.4	2056.2	2147.3	500	REIN
		6	39	7.5	8.6	2297.1	10472.1	1370.8		600	
550A	5	4	53	7.2	10.3	1044.1	9780.8	819.4	2738.6	540	UNREIN
		6	79	16.2	15.5	718.1	2898.0	546.3		660	
	10	4	53	7.2	10.3	2150.3	19624.8	1644.1	2752.5	540	UNREIN
		6	79	13.1	15.4	1433.5	5814.8	1096.1		660	
	20	4	37	5.0	7.2	2860.9	25951.6	2174.1	2735.8	540	REIN
		6	55	11.3	10.7	1907.2	7689.4	1449.4		660	
600A	5	4	52	6.5	9.4	1139.8	12253.0	1026.5	3442.2	540	UNREIN
		6	79	14.7	14.1	759.9	3630.5	684.3		660	
	10	4	52	6.5	9.4	2275.8	24579.9	2059.2	3257.3	540	UNREIN
		6	86	16.0	15.3	770.5	3733.0	703.7		660	
	20	4	37	4.7	6.9	2978.9	31993.3	2680.3	3239.2	540	REIN
		6	56	10.6	10.1	1985.9	9479.5	1786.8		660	
650A	5	4	52	6.0	8.7	1195.8	14761.8	1236.7	3723.0	540	UNREIN
		6	78	13.7	13.1	797.2	4373.9	824.5		660	
	10	4	52	6.0	8.7	2388.0	29607.5	2480.4	3739.3	540	UNREIN
		6	88	15.3	14.6	794.2	4414.3	831.2		660	
	20	4	37	4.3	6.2	3103.4	38277.3	3206.7	3419.8	540	REIN
		6	56	9.8	9.4	2069.0	11341.4	2137.8		660	
700A	5	4	79	8.5	12.1	896.9	12929.4	1083.2	4347.5	540	UNREIN
		6	118	19.1	18.2	598.0	3831.0	722.1		660	
	10	4	60	6.4	9.2	1236.6	18017.5	1509.4	4394.3	540	REIN
		6	90	14.5	13.8	824.4	5338.5	1006.3		660	
	20	4	40	4.2	6.1	3623.1	52860.3	4428.4	4400.2	540	REIN
		6	60	9.6	9.1	2415.4	15662.3	2952.3		660	

Nominal Diameter	Pressure (bar)	No.of Convol-utions	Non-Concurrent			Spring Rate			Effective Area (㎠)	Overall Length (mm)	Unrein- or Rein- Type
			Axial (mm)	Lateral (mm)	Angular (Deg.)	Axial (N/mm)	Lateral (N/mm)	Angular (N.M/Deg)			
750A	5	4	79	7.9	11.4	929.0	15290.5	1281.0	4963.9	540	UNREIN
		6	119	17.9	17.1	619.3	4530.5	854.0		660	
	10	4	60	6.0	8.7	1284.8	21359.0	1789.4	5014.0	540	REIN
		6	91	13.7	13.0	856.5	6328.6	1192.9		660	
	20	4	39	3.9	5.7	3811.2	63441.1	5314.8	5020.3	540	REIN
		6	59	8.9	8.5	2540.8	18797.3	3543.2		660	
800A	5	4	66	6.2	8.9	1547.2	29274.6	2452.5	5706.6	540	UNREIN
		6	99	14.0	13.3	1031.4	8674.0	1635.0		660	
	10	4	60	5.6	8.1	1343.1	25628.1	2147.0	5754.9	540	REIN
		6	91	12.7	12.1	895.4	7593.5	1431.3		660	
	20	4	39	3.6	5.2	4042.6	77230.2	6470.0	5761.6	540	REIN
		6	58	8.2	7.9	2695.1	22883.0	4313.4		660	
850A	5	4	66	5.8	8.4	1605.7	33825.6	2833.8	6353.3	540	UNREIN
		6	99	13.2	12.6	1070.5	10022.4	1889.2		660	
	10	4	60	5.3	7.6	1391.7	29551.3	2475.7	6404.2	540	REIN
		6	90	12.0	11.5	927.8	8756.0	1650.5		660	
	20	4	39	3.4	4.9	4233.4	89994.1	7539.3	6411.3	540	REIN
		6	58	7.7	7.4	2822.3	26664.9	5026.2		660	
900A	5	4	65	5.5	8.0	1658.3	38271.4	3206.2	6960.5	540	UNREIN
		6	98	12.5	12.0	1105.5	11339.7	2137.5		660	
	10	4	60	5.1	7.3	1435.4	33380.3	2796.5	7013.8	540	REIN
		6	90	11.5	11.0	956.9	9890.5	1864.3		660	
	20	4	38	3.2	4.6	4403.5	102515.4	8588.3	7021.2	540	REIN
		6	57	7.3	7.0	2935.7	30374.9	5725.5		660	
950A	5	4	65	5.2	7.5	1722.3	44172.1	3700.6	7735.1	540	UNREIN
		6	98	11.8	11.3	1148.2	13088.0	2467.0		660	
	10	4	65	5.2	7.6	1257.3	32609.9	2731.9	7822.6	540	REIN
		6	90	10.9	10.4	992.5	11395.0	2147.9		660	
	20	4	38	3.0	4.4	4609.6	119202.3	9986.3	7799.1	540	REIN
		6	57	6.9	6.6	3073.1	35319.2	6657.5		660	
1000A	5	4	64	4.9	7.1	1800.5	51438.9	4309.3	8616.2	540	UNREIN
		6	97	11.1	10.6	1200.4	15241.2	2872.9		660	
	10	4	65	5.0	7.2	1306.9	3735.8	3161.4	8708.6	540	REIN
		6	90	10.3	9.8	1030.9	13180.3	2484.4		660	
	20	4	38	2.8	4.1	4831.3	139107.2	11653.8	8683.8	540	REIN
		6	57	6.5	6.2	3220.9	41217.0	7769.2		660	
1100A	5	4	74	5.2	7.4	1473.6	50787.7	4254.8	10394.1	640	UNREIN
		6	112	11.7	11.1	982.4	15048.2	2836.5		760	
	10	4	63	4.3	6.2	1830.7	63509.9	5320.6	10462.9	640	REIN
		6	94	9.8	9.4	1220.5	18817.7	3547.1		760	
1200A	5	4	76	4.8	6.9	1837.3	76082.6	6373.9	12488.8	640	UNREIN
		6	115	10.9	10.4	1224.9	22543.0	4249.3		760	
	10	4	62	3.9	5.6	1968.5	80638.8	6755.6	12354.5	640	REIN
		6	93	8.9	8.5	1312.4	23893.0	4503.7		760	
1300A	5	4	75	4.4	6.3	1971.8	95114.3	7968.3	14548.1	640	UNREIN
		6	113	10.0	9.5	1314.5	28182.0	5312.2		760	
	10	4	61	3.6	5.2	2105.9	100569.9	8425.3	14403.1	640	REIN
		6	92	8.1	7.8	1403.9	29798.5	5616.9		760	

SINGLE TYPE (JBF, JBF-T, JBHS, JBGS)

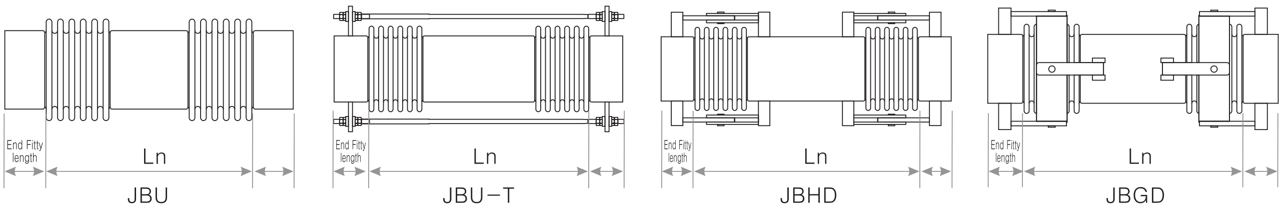
Nominal Diameter	Pressure (bar)	No.of Convol-utions	Non-Concurrent			Spring Rate			Effective Area (㎠)	Overall Length (mm)	Unrein-or Rein-Type
			Axial (mm)	Lateral (mm)	Angular (Deg.)	Axial (N/mm)	Lateral (N/mm)	Angular (N.M/Deg)			
1400A	5	4	75	4.1	5.9	2107.9	116850.5	9789.2	16718.6	640	UNREIN
		6	112	9.2	8.8	1405.3	34622.4	6526.2		760	
	10	4	60	3.3	4.8	2240.0	123019.8	10306.1	16563.1	640	REIN
		6	91	7.5	7.2	1493.4	36450.3	6870.7		760	
1500A	2	4	119	6.1	8.7	703.2	44278.7	3709.5	18991.1	640	UNREIN
		6	178	13.7	13.1	468.8	13119.6	2473.0		760	
	5	4	74	3.8	5.5	2246.9	141668.7	11868.4	19015.6	640	UNREIN
		6	112	8.6	8.2	1497.9	41975.9	7912.3		760	
1600A	2	4	117	5.6	8.1	746.1	53668.9	4496.2	21694.6	640	UNREIN
		6	176	12.7	12.1	497.4	15901.9	2997.4		760	
	5	4	78	3.8	5.4	1391.6	99383.1	8325.9	21538.3	640	REIN
		6	126	8.5	8.1	927.8	29446.9	5550.6		760	
1700A	2	4	116	5.2	7.5	789.1	63554.8	5324.4	24383.8	640	UNREIN
		6	175	11.9	11.3	524.1	18831.0	3550.0		760	
	5	4	78	3.5	5.1	1464.9	117630.4	9854.6	24218.0	640	REIN
		6	125	8.0	7.6	976.6	34853.5	6569.7		760	
1800A	2	4	115	4.9	7.1	724.8	74227.0	6218.4	27142.4	640	UNREIN
		6	173	11.2	10.6	550.0	21993.2	4145.6		760	
	5	4	77	3.3	4.7	1535.8	137322.6	11504.3	26967.5	640	REIN
		6	124	7.5	7.1	1023.8	40688.2	7669.5		760	
1900A	2	4	114	4.6	6.6	870.5	88337.5	7400.6	30604.4	640	UNREIN
		6	171	10.4	9.9	580.4	26714.1	4933.7		760	
	5	4	93	3.7	5.4	1158.6	117447.6	9839.3	30573.4	640	REIN
		6	139	8.5	8.1	772.4	34799.3	6559.5		760	
2000A	2	4	113	4.3	6.2	909.4	101675.0	8517.9	33718.6	640	UNREIN
		6	170	9.8	9.4	606.3	30125.9	5678.6		760	
	5	4	92	3.5	5.1	1210.3	135184.7	11325.2	33686.1	640	REIN
		6	138	8.0	7.6	806.9	40054.7	7550.1		760	
2100A	2	4	113	4.1	6.0	947.0	115267.3	9596.6	36711.4	640	UNREIN
		6	170	9.4	9.0	631.3	34153.3	6437.7		760	
	5	4	92	3.4	4.8	1260.2	153258.7	12839.4	36677.5	640	REIN
		6	138	7.6	7.3	840.2	45410.0	8560.0		760	
2200A	2	4	113	4.0	5.7	988.1	131314.8	11001.0	40079.5	640	UNREIN
		6	169	9.0	8.6	658.8	38908.1	7334.0		760	
	5	4	91	3.2	4.6	1315.0	174600.3	14627.3	40044.0	640	REIN
		6	137	7.3	6.9	876.7	51733.4	9751.5		760	
2300A	2	4	112	3.8	5.4	1030.5	149341.9	12511.2	43706.5	640	UNREIN
		6	169	8.6	8.2	687.0	44249.4	8340.8		760	
	5	4	91	3.1	4.4	1317.4	198575.1	16635.8	43669.4	640	REIN
		6	137	6.9	6.6	914.3	58837.1	11090.5		760	
2400A	2	4	112	3.7	5.2	1073.3	169143.1	14170.1	47529.2	640	UNREIN
		6	168	8.2	8.2	715.5	50116.5	9446.7		760	
	5	4	91	2.9	4.2	1428.3	224909.8	18842.0	47490.5	640	REIN
		6	137	6.6	6.3	952.2	66640.0	12561.3		760	
2500A	2	4	105	3.3	4.7	1275.0	217428.4	18215.2	51431.7	640	UNREIN
		6	158	7.4	7.0	850.0	64423.2	12143.5		760	
	5	4	91	2.8	4.0	1484.6	253169.8	21209.5	51431.7	640	REIN
		6	136	6.4	6.1	989.7	75013.3	14139.7		760	

DOUBLE TYPE (JBU, JBU-T, JBHD, JBGD)

1. Rated cycle life is 3000 cycles per EJMA latest edition for any non-concurrent movement tabulated.
2. To combine axial, lateral movement, refer to page 8.
3. Maximum axial extension movement is 50% of tabulated axial value.
4. To obtain greater movements of cycle life, refer to page 8.
5. Catalog pressure ratings are based upon a maximum bellows temperature 800° F.
   Actual operating temperature should always be specified.
6. Maximum test pressure : 1.5 x maximum working pressure.
7. The overall length may be revised in accordance with the type of Expansion Joint and other attachment.

Nominal Diameter	Pressure (bar)	No.of Convol-utions	Axial (mm)	Lateral Movement (mm)					Effective Area (㎠)	Length of End Fitting Length (mm)	Unrein-or Rein-Type
				Lateral Spring Rate (N/mm)							
			(N/mm)	600mm	1000mm	1500mm	2000mm	2500mm			
100A	5	4+4	28 188.3	101 5.9	187 1.9	296 0.8	404 0.5	513 0.3	138.1	100	UNREIN
	10		28 407.8	101 12.9	187 4.2	295 1.8	403 1.0	512 0.6	139.4	100	UNREIN
	20		21 866.1	75 27.6	138 9.0	218 3.8	299 2.1	379 1.3	140.2	100	UNREIN
125A	5	4+4	33 210.8	108 9.0	205 2.9	328 1.2	451 0.7	574 0.4	177.4	100	UNREIN
	10		39 281	116 11.7	219 3.7	350 1.6	482 0.9	614 0.5	173.7	100	UNREIN
	20		28 662.7	84 27.5	160 8.7	255 3.6	351 2.0	447 1.3	172.3	100	UNREIN
150A	5	4+4	37 264.3	93 15.5	178 4.9	285 2.0	392 1.1	500 0.7	234	100	UNREIN
	10		43 296.1	109 17.2	208 5.4	333 2.3	459 1.2	585 0.8	238.3	100	UNREIN
	20		29 950.6	73 56.4	140 17.8	224 7.4	308 4.0	393 2.5	243.3	100	UNREIN
200A	5	4+4	48 351.3	81 39.5	162 11.9	265 4.9	369 2.6	473 1.6	415.5	100	UNREIN
	10		57 399.9	97 45.2	194 13.7	317 5.6	441 3.0	565 1.9	417.7	100	UNREIN
	20		39 1128.6	66 128.5	132 38.8	215 15.8	299 8.5	384 5.3	1128.6	100	UNREIN
250A	5	4+4	66 265.7	85 49.5	174 14.5	289 5.8	405 3.1	521 1.9	637.9	100	UNREIN
	10		66 530.1	84 99.4	174 29.1	288 11.7	404 6.3	520 3.9	642.4	100	UNREIN
	20		44 1542.3	56 291.2	116 85.1	192 34.2	269 18.3	346 11.4	646.9	100	UNREIN
300A	5	4+4	78 365.5	71 113.6	157 31.1	269 12.1	383 6.4	497 3.9	914.3	100	UNREIN
	10		72 746.9	67 226.6	147 62.1	253 24.2	359 12.8	467 7.9	892.0	100	UNREIN
	20		51 1927.7	47 588.2	103 161.2	177 62.8	251 33.1	326 20.4	897.3	100	UNREIN
350A	5	4+4	97 357.8	73 152.6	166 40.5	288 15.5	41.3 8.1	539 5.0	1161.1	150	UNREIN
	10		90 676.7	68 279.5	155 74.2	271 28.4	388 14.9	506 9.1	1124.6	150	UNREIN
	20		61 2091.7	46 880.5	105 233.3	183 89.6	262 46.9	1342 28.8	1146.1	150	UNREIN

DOUBLE TYPE (JBU, JBU-T, JBHD, JBGD)



Nominal Diameter	Pressure (bar)	No.of Convol-utions	Axial (mm) (N/mm)	Lateral Movement (mm) / Lateral Spring Rate (N/mm) 600mm	1000mm	1500mm	2000mm	2500mm	Effective Area (㎠)	Length of End Fitting Length (mm)	Unrein- or Rein- Type
400A	5	4+4	97 392.2	64 212.6	146 56.4	255 21.6	365 11.3	447 7.0	1475.9	150	UNREIN
	10		93 715.6	63 377.1	142 100.0	248 38.4	355 20.1	463 12.3	1434.7	150	UNREIN
	20		60 2311.6	40 1238.7	92 328.6	160 126.1	230 66.0	299 40.5	1459.0	150	UNREIN
450A	5	4+4	97 429.6	57 293.3	130 77.8	227 29.9	325 15.6	424 9.6	1858.9	150	UNREIN
	10		91 823.8	54 546.1	124 144.9	215 55.6	308 29.1	402 17.9	1805.0	150	UNREIN
	20		51 1653.3	31 1080.6	70 286.7	122 110.0	176 57.6	229 35.3	1779.5	150	REIN
500A	5	4+4	97 462.8	52 378.0	119 100.8	206 38.7	296 20.2	386 12.4	2235.4	150	UNREIN
	10		90 874.7	49 699.1	111 185.5	194 71.1	278 37.3	363 22.9	2176.3	150	UNREIN
	20		52 1722.8	29 1359.4	65 360.7	114 138.3	164 72.4	214 44.4	2148.3	150	REIN
550A	5	4+4	106 538.6	44 630.1	107 157.3	193 58.4	281 30.1	369 18.3	2738.6	150	UNREIN
	10		106 1075.1	44 1266.1	107 315.7	192 117.3	280 60.5	369 36.8	2752.5	150	UNREIN
	20		74 1430.4	31 1674.3	75 417.5	134 155.1	196 80.0	258 48.6	2735.8	150	REIN
600A	5	4+4	105 569.9	40 790.5	98 197.1	176 73.2	256 37.7	337 22.9	3242.2	150	UNREIN
	10		105 1137.9	40 1585.8	97 395.4	175 146.9	255 75.7	336 46.0	3257.3	150	UNREIN
	20		75 1489.4	29 2064.1	70 514.6	126 191.2	184 98.5	242 60.0	3239.2	150	REIN
650A	5	4+4	104 597.9	37 952.4	90 237.5	163 88.2	237 45.5	312 27.6	3723.0	150	UNREIN
	10		105 1194.0	37 1910.2	90 476.3	163 176.9	237 91.2	312 55.4	3739.3	150	UNREIN
	20		75 1551.7	27 2469.5	65 615.7	117 228.7	170 117.9	225 71.7	3719.8	150	REIN
700A	5	4+4	157 448.5	52 534.2	126 208.0	227 77.3	331 39.8	436 24.2	4347.5	150	UNREIN
	10		103 982.2	34 1847.6	82 460.7	148 171.1	251 88.2	284 53.6	4396.7	150	REIN
	20		80 1811.5	26 3410.3	63 850.3	114 315.8	166 162.8	219 99.0	4400.2	150	REIN

Nominal Diameter	Pressure (bar)	No.of Convol-utions	Axial (mm) (N/mm)	Lateral Movement (mm) Lateral Spring Rate (N/mm) 600mm	1000mm	1500mm	2000mm	2500mm	Effective Area (㎠)	Length of End Fitting Length (mm)	Unrein- or Rein- Type
750A	5	4+4	158 464.5	49 986.5	119 246.0	214 91.4	311 47.1	410 28.6	4963.9	150	UNREIN
	10		103 1028.3	32 2207.0	77 550.3	138 204.4	237 105.4	265 64.1	5016.5	150	REIN
	20		79 1905.6	24 4093.0	59 1020.5	107 379.0	155 195.4	205 118.3	5020.3	150	REIN
800A	5	4+4	132 773.6	38 1888.7	92 470.9	166 174.9	242 90.2	319 54.8	5706.6	150	UNREIN
	10		103 1080.2	29 2660.8	72 663.4	129 246.4	221 127.0	247 77.2	5757.6	150	REIN
	20		78 2021.3	22 4982.6	55 1242.3	98 461.4	143 237.9	188 144.6	5716.6	150	REIN
850A	5	4+4	132 802.9	36 2182.3	87 544.1	157 202.1	229 104.2	301 63.3	6353.3	150	UNREIN
	10		103 1123.1	28 3078.5	68 767.6	122 285.1	209 147.0	234 89.4	6407.0	150	REIN
	20		78 2116.7	21 5806.1	51 1447.6	92 537.7	134 277.2	177 168.5	6411.3	150	REIN
900A	5	4+4	131 829.1	34 2469.1	83 615.6	149 228.7	218 117.9	286 71.7	6960.5	150	UNREIN
	10		103 1161.5	27 3486.7	65 869.4	116 322.9	119 166.5	233 101.2	7016.8	150	REIN
	20		77 2201.8	20 6613.9	48 1649.0	87 612.5	127 315.8	168 192.0	7021.2	150	REIN
950A	5	4+4	131 861.1	32 2849.8	78 710.5	141 263.9	205 136.1	271 82.7	7735.1	150	UNREIN
	10		113 1022.4	28 3423.1	67 853.5	121 317.0	206 163.4	233 99.4	7825.7	150	REIN
	20		76 2304.8	19 7690.5	46 1917.5	82 712.2	120 367.2	158 223.2	2304.8	150	REIN
1000A	5	4+4	129 900.3	30 3318.6	74 827.4	132 307.3	193 158.4	254 96.3	8616.2	150	UNREIN
	10		112 1070.0	26 3987.9	63 994.3	114 369.3	196 190.4	219 115.8	8711.9	150	REIN
	20		76 2415.6	17 8974.7	43 2237.7	77 831.1	112 428.5	148 260.5	8683.8	150	REIN
1100A	5	4+4	149 736.8	32 3276.6	77 817.0	139 303.4	202 156.4	267 95.1	10394.1	200	UNREIN
	10		126 915.3	27 4097.4	65 1021.6	117 379.5	170 195.6	224 118.9	10462.9	200	REIN
1200A	5	4+4	153 918.7	30 4908.6	72 1223.9	130 454.6	189 234.3	250 142.5	12488.8	200	UNREIN
	10		124 984.3	24 5202.5	59 1297.1	106 481.8	154 248.4	203 151.0	12354.5	200	REIN
1300A	5	4+4	151 985.9	27 6136.4	66 1530.0	119 568.3	173 293.0	228 178.1	14548.1	410	UNREIN
	10		123 1052.9	22 6488.4	54 1617.8	97 600.9	141 309.8	186 188.3	14403.1	520	REIN

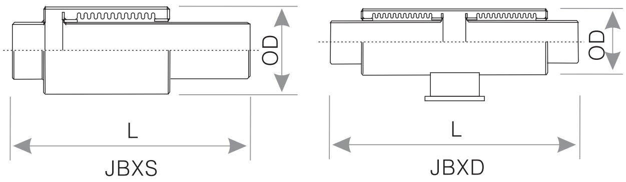
DESIGN DATA

DOUBLE TYPE(JBU, JBU-T, JBHD, JBGD)

Nominal Diameter	Pressure (bar)	No.of Convol-utions	Axial (mm) (N/mm)	Lateral Movement (mm) Lateral Spring Rate (N/mm) 600mm	1000mm	1500mm	2000mm	2500mm	Effective Area (㎠)	Length of End Fitting Length (mm)	Unrein-or Rein-Type
1400A	5		150 1054.0	25 7538.7	61 1879.6	110 698.1	160 259.9	211 218.8	16718.6	200	UNREIN
	10	4+4	121 1120.0	20 7936.8	50 1978.9	89 735.0	130 378.9	171 230.4	16563.1	200	REIN
1500A	2		238 351.6	37 2856.7	91 712.3	164 264.6	238 136.4	314 82.9	18991.1	200	UNREIN
	5		149 1123.5	23 9139.9	57 2278.9	103 846.4	150 436.4	197 265.3	19015.6	200	UNREIN
1600A	2	4+4	235 373.1	35 3462.5	84 863.3	151 320.7	220 165.3	290 100.5	21694.6	200	UNREIN
	5		157 695.8	23 6411.8	56 1598.7	102 593.8	148 306.1	195 186.1	21538.3	200	REIN
1700A	2		233 393.0	32 4100.3	79 1022.3	141 379.7	206 195.8	271 119.0	24383.8	200	UNREIN
	5	4+4	156 732.4	22 7589.1	53 1892.2	95 702.8	138 362.3	182 220.3	24218.0	200	REIN
1800A	2		231 412.4	30 4788.8	74 1194.0	133 443.5	193 228.6	254 139.0	27142.4	200	UNREIN
	5		155 767.9	20 8859.5	49 2208.9	89 820.5	130 423.0	171 257.1	26967.5	200	REIN
1900A	2	4+4	229 435.3	28 5699.2	69 1421.0	124 527.8	181 272.1	238 165.4	30604.4	200	UNREIN
	5		186 579.3	23 7577.3	56 1889.2	101 701.7	147 361.8	193 219.9	30573.4	200	REIN
2000A	2		227 454.7	27 6559.7	65 1635.5	117 607.5	171 313.7	225 190.4	33718.6	200	UNREIN
	5	4+4	185 605.2	22 8721.6	53 2174.6	95 807.7	139 416.4	183 253.1	33686.1	200	REIN
2100A	2		226 473.5	26 7436.6	62 1854.2	112 688.7	163 355.0	215 215.8	36711.4	200	UNREIN
	5		184 630.1	21 9887.7	50 2465.3	91 915.7	132 472.1	175 287.0	36677.5	200	REIN
2200A	2	4+4	226 494.1	24 8471.9	59 2112.3	107 784.6	155 404.5	205 245.9	40079.5	200	UNREIN
	5		183 657.5	20 11264.5	48 2808.6	87 1043.2	126 537.8	167 326.9	40044.0	200	REIN
2300A	2	4+4	225 515.3	23 9635.0	57 2402.3	102 892.3	148 460.0	195 279.6	43706.5	200	UNREIN
	5		183 685.7	19 12811.3	46 3194.2	83 121.0	121 611.6	159 371.8	43669.4	200	REIN
2400A	2	4+4	224 636.6	22 10912.5	54 2720.8	97 1010.6	142 521.0	187 316.7	47529.2	200	UNREIN
	5		182 714.2	18 14510.3	44 3617.9	79 137.0	115 692.7	152 421.2	47490.5	200	REIN
2500A	2	4+4	211 637.5	20 14027.6	49 3497.5	88 1299.1	128 669.7	169 407.1	51431.7	200	UNREIN
	5		182 742.3	17 1665.5	42 4072.44	76 1512.6	110 779.8	146 474.1	51431.7	200	REIN

EXTERNAL PRESSURE TYPE (JBXS, JBXD)

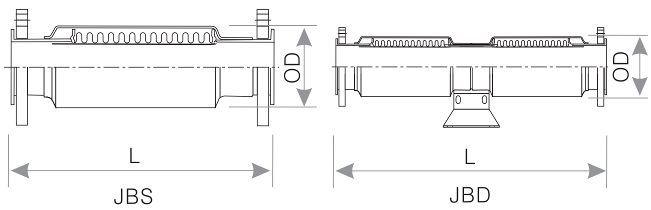
1. Rated cycle life is 3000 cycles per EJMA Latest edtion for any non-concurrent movement tabulated.
2. Catalog pressure ratings are based upon a maximum bellows temperature of 482° F(250℃). Actual operating temperature should be always specified.
3. Maxiamum test pressure : 1.5 × maximum working pressure.



Nominal Diameter	Pressure (bar)	Axial Movement (mm)				Spring Rate (N/mm)		Bellows Effective Area (㎠)	Dimensions				Weight(kg)	
		JBXS		JBXD					Shell OD (mm)	Anchor Height "H" (mm)	Overal Length (mm)		JBXS WW	JBXD WW
		EXT.	COMP.	EXT.	COMP.	JBXS	JBXD				JBXS	JBXD		
50A	10	20	100	40	200	22.1	22.1	79	141.3	130	860	1180	23	39
		40	200	80	400	11.0	11.0				1480	2690	35	64
65A	10	20	100	40	200	29.7	29.7	103	141.3	140	900	1220	30	54
		40	200	80	400	14.8	14.8				1520	2730	50	92
80A	10	20	100	40	200	35.3	35.3	120	168.3	150	900	1220	34	59
		40	200	80	400	17.6	17.6				1520	2730	53	96
100A	10	20	100	40	200	50.6	50.6	173	219.1	170	814	1164	48	84
		40	200	80	400	25.3	25.3				1348	2446	65	118
125A	10	20	100	40	200	50.6	50.6	173	219.1	200	814	1164	59	104
		40	200	80	400	25.3	25.3				1348	2446	76	138
150A	10	20	100	40	200	54.3	54.3	197	273.1	220	814	1164	69	122
		40	200	80	400	27.1	27.1				1348	2446	88	158
200A	10	20	100	40	200	68.5	68.5	249	323.9	250	814	1164	128	218
		40	200	80	400	34.2	34.2				1348	2446	167	296
250A	10	20	100	40	200	88.4	88.4	306	355.6	300	830	1180	159	226
		40	200	80	400	44.2	44.2				1380	2510	194	305
300A	10	20	100	40	200	105.1	105.1	358	406.4	350	830	1180	197	336
		40	200	80	400	52.5	52.5				1380	2510	252	449
350A	10	20	100	40	200	110.4	110.4	392	457.2	450	830	1180	212	363
		40	200	80	400	55.3	55.3				1380	2510	278	494
400A	10	20	100	40	200	170.7	170.7	444	508.0	500	862	1212	209	348
		40	200	80	400	85.4	85.4				1444	2638	315	560
450A	10	20	100	40	200	158.2	158.2	477.5	558.8	550	962	1312	238	398
		40	200	80	400	79.1	79.1				1544	2738	347	615
500A	10	20	100	40	200	373.5	373.5	548	609.6	600	962	1312	266	442
		40	200	80	400	186.8	186.8				1544	2738	400	411
550A	10	20	100	40	200	540.4	540.4	615.5	711.2	-	910	1260	303	509
		40	200	80	400	270.2	270.2				1440	2530	447	795
600A	10	20	100	40	200	540.4	540.4	673	762.0	-	910	1260	340	575
		40	200	80	400	270.2	270.2				1440	2530	492	879

INTERNAL PRESSURE TYPE (JBS, JBD)

1. Rated cycle life is 3000 cycles per EJMA Latest edtion for any non-concurrent movement tabulated.
2. Catalog pressure ratings are based upon a maximum bellows temperature of 482° F. Actual operating temperature should be always specified.
3. Maxiamum test pressure : 1.5 × maximum working pressure.



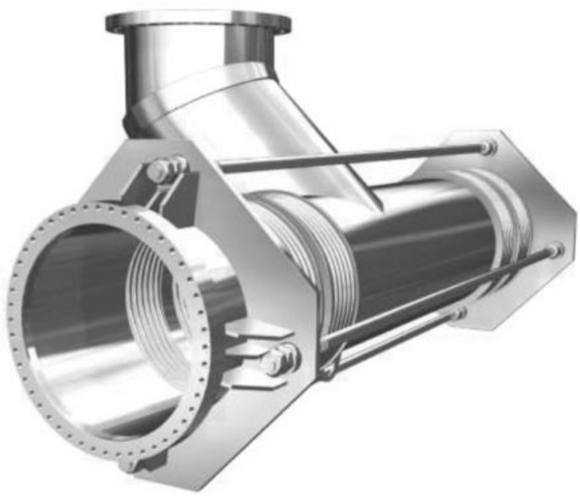
Nominal Diameter	Pressure (bar)	Axial Movement (mm)				Spring Rate (N/mm)	Bellows Effective Area (㎠)	Dimensions				Weight(kg)			
		JBS		JBD				Cover OD (mm)	Anchor Height "H" (mm)	Overal Length (mm)		JBS		JBD	
		EXT.	COMP.	EXT.	COMP.					JBS	JBD	WW	FF	WW	FF
20A	10	10	25	20	50	59.7	6.4	49.6	100	365	680	0.9	2.3	2.1	3.5
25A	10	10	25	20	50	66.7	8.3	54.0	100	365	680	1.0	3.2	2.5	4.5
32A	10	10	25	20	50	32.4	14.3	60.5	120	365	680	1.5	4.4	3.0	5.8
40A	10	10	25	20	50	52.0	17.7	70.0	120	365	680	1.7	4.8	3.5	6.4
50A	10	10	25	20	50	87.6	29.8	90.0	130	365	680	2.0	5.7	4.5	8.0
65A	10	10	25	20	50	93.5	44.4	102.0	140	415	780	3.3	8.4	6.5	11.4
80A	10	10	25	20	50	185.3	68.4	130.0	150	415	780	4.4	9.5	10.0	14.3
100A	10	10	25	20	50	155.0	119.2	155.0	170	415	880	5.5	11.6	15.0	20.6
125A	10	10	25	20	50	125.4	186.0	190.0	200	440	880	7.0	14.1	17.0	24.1
150A	10	10	25	20	50	155.8	257.9	228.0	220	440	930	8.5	21.0	25.0	37.0
200A	10	10	25	20	50	254.6	429.3	286.0	250	465	930	20.0	34.7	70.0	85.1
250A	10	10	25	20	50	483.1	626.4	640.0	300	465	980	30.0	52.2	65.0	87.9
300A	10	10	25	20	50	661.8	975.4	422	350	465	980	35.0	60.3	67.0	92.5
350A	10	10	25	20	50	776.5	1172.6	457.2	450	465	1030	100.0	135.0	182.0	217.0
400A	10	10	25	20	50	831.8	1495.8	508.0	500	490	1030	110.0	160.0	220.0	250.0
450A	10	10	25	20	50	898.1	1873.5	558.3	550	490	1080	174.0	240.0	274.0	340.0
500A	10	10	25	20	50	961.8	2251.4	620.0	600	490	1080	195.0	271.0	377.0	453.0

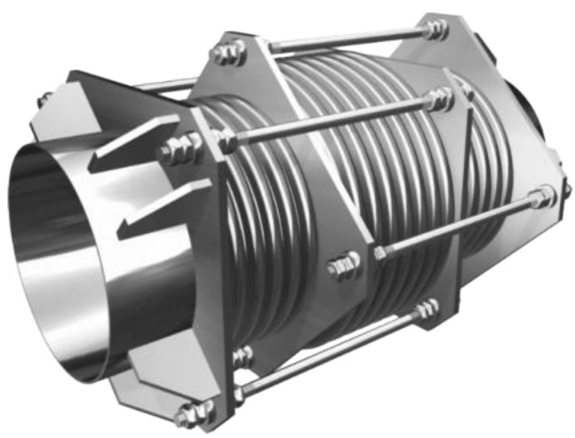
Pressure Balanced Expansion Joint (JBBL, JBBS)

On piping-work, this type of Expansion Joint makes a performance of very peculiar function, i.e, to satisfy both absorbing axial and/or lateral movement and retaining bellows pressure thrust by means of tie-devices interconnecting the flow/line bellows and balancing bellows. In the application, this type used to be designed to the line where turbine casing, or rotational equipment is applied and in the case the installation cost of main anchor is not practical. SJM can provide two kinds of this Expansion Joint Depending on the piping routing, I.e, Elbow Type Pressure Balanced Expansion Joint (JBBL) and In-line Pressure Balanced Expansion Joint (JBBS).

In case of SJM's JBBL model shown on below figure, it is designed and applied on the bend portions of pipeline. Depending upon the force, moment, axial & transverse movement the client demand, SJM's technical department incorporate them into the design on bellows membrane stress, distance between two flow bellows and etc. In SJM's JBBS, the ultimate function is the same as JBBL but it is applied on the straight portion of pipeline, not in the bend portion, and also the number of line/flow and balancing bellows, the position of each bellows in the complete set can be determined as per the various design consideration.

On picture below, it shows the actual application of X-Over Pressure Balanced Expansion Joints installed at 42" cross-over steam piping on SIEMENS Westinghouse's Turbine, which were supplied to Tae-An Thermal Power Plant Unit #5,6 (500MWx2) by SJM.

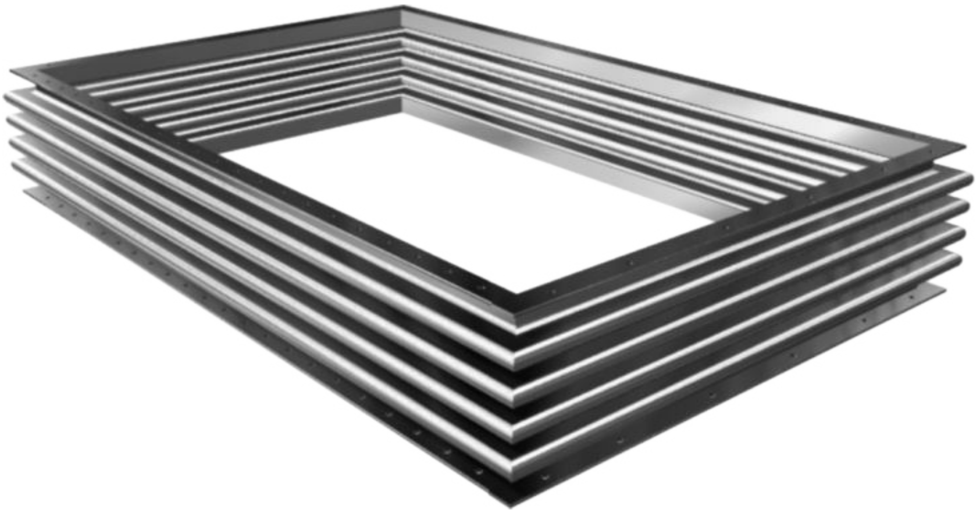




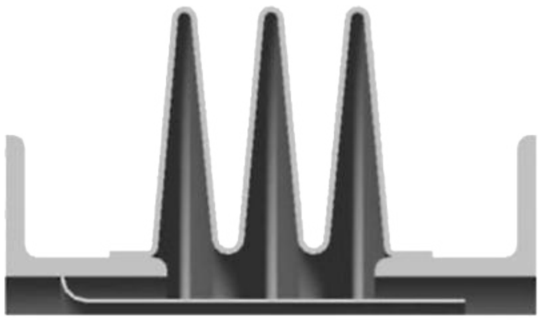
RECTANGULAR EXPANSION JOINT (JBQ-M)

On application, this type of Expansion Joint is mostly considered on large ducting system having low design pressure, including gas turbine exhaust systems, turbine/ condenser connection, flue gas ducting and etc. Ducting systems are always subject to thermal growth due to the temperature variation and surrounding condition. SJM can provide "V" and "U"-profile in the cross sectional shape of bellows. In similar with circular type metal expansion joint, the movement of rectangular bellows can absorb increasing and the stiffness value is also reduced as the number of bellows corrugation become larger, but the stability against for internal pressure become lower.

According to corner configurations, this type of expansion joint is classified to "Rounded Corner", "Single Mitered Corner", "Double Mitered Corner" and"Camera Corner" as shown on figures respectively. If the specification does not mention about the corner shape, SJM prefers to recommend the "Rounded Corner" with "U"-profile in the local stress aspect, which is loaded on this corner area while operating. Above all, camera corner is also having feature minimizing corner stress but it has a relatively smaller capability in absorbing movement and also requires a lot of labor cost on corner construction weld.

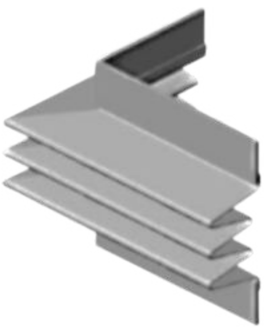


“U” Profile

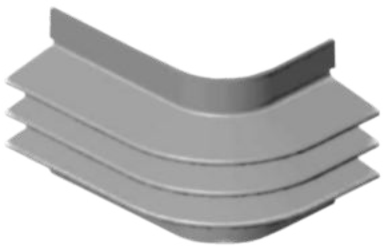


“V” Profile

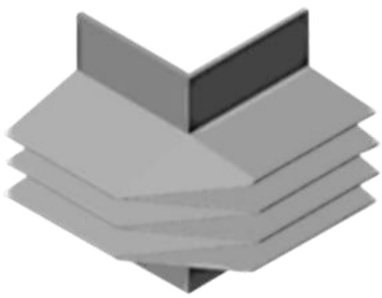
Single miter corner



Rounded corner



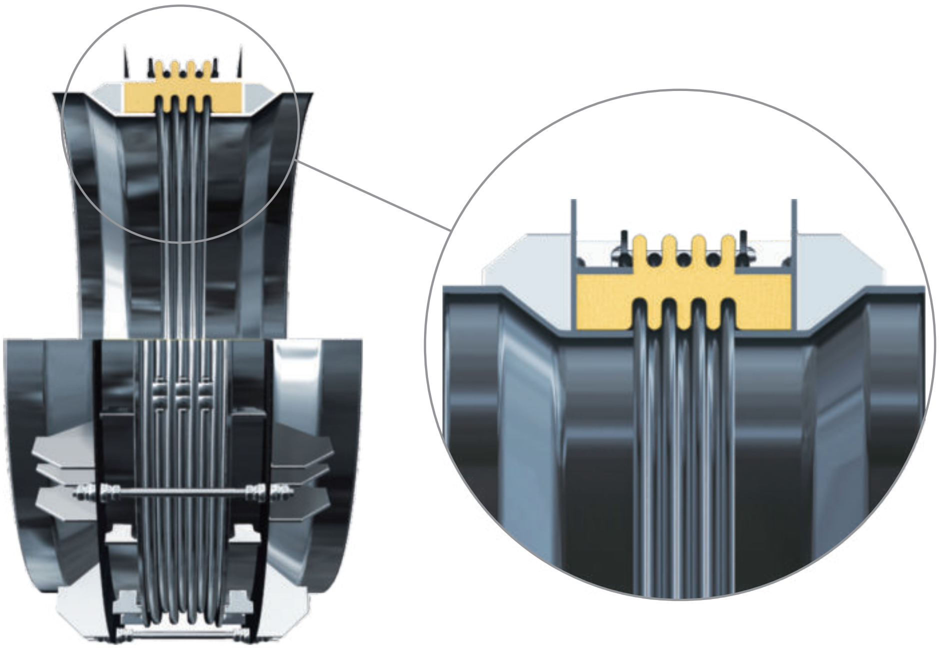
Camera corner

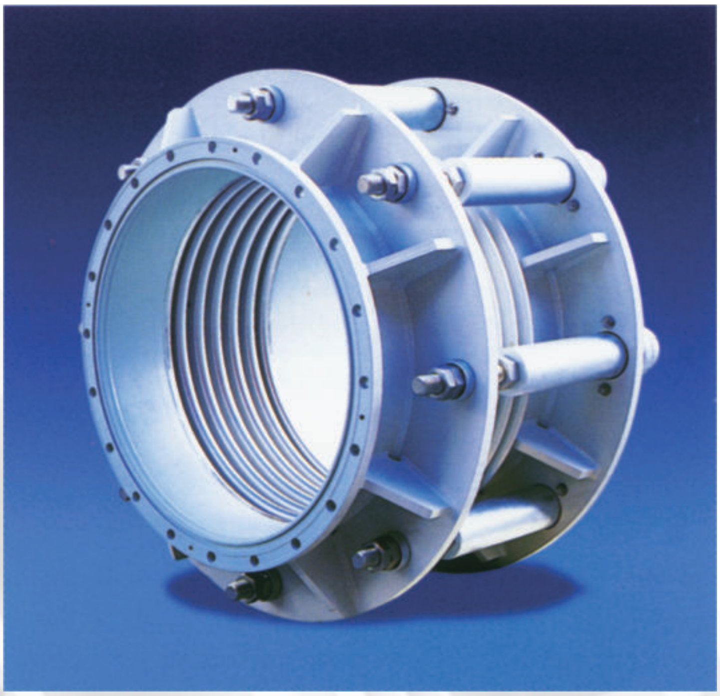


Clam Shell Bellows (JBCSB)

On this special type of Expansion Joint, SJM has accumulated a lot of know-how on designing, manufacturing and site service through the history having complied with the fulfillment of client's emergency requirement. Generally, the quality of the convolution weld make the life expectancy of this bellows more close to the cycles verified theoretically. SJM would provide the expert welder to perform this site mission, if required.

When your bellows has cracks or small leakage problem but you need to operate the line without shut-down, we, SJM, can show you an remedy.
The following picture is showing the view lifting the half splitted clam shell bellows at B/F(Blast Furnance) job site and the site welding on bellows convolutions was accomplished by SJM.





GIS (SF_6 Gas Insulated Switchgear) Bellows

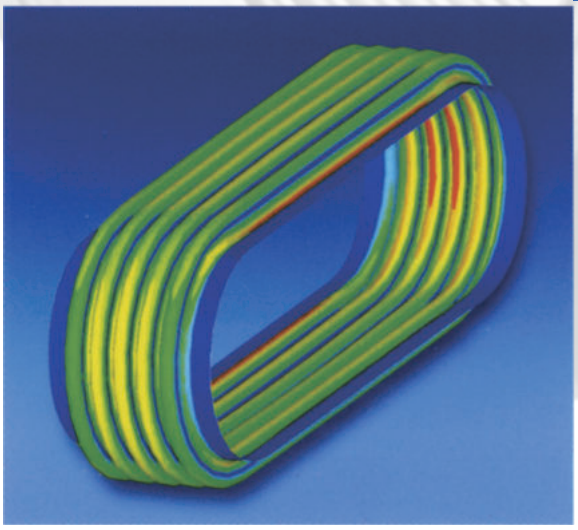
SJM's expansion bellows utilized on GIS substation is an element performing to compensate length variation and deformation due to temperature changes, dismantling, dimensional possible tolerance while assembling and earthquake.

Application : The rated voltage range on which SJM's bellows has been applied.
//25.8kv, 72kv, 84kv, 145kv, 170kv, 362kv, 800kv

Precision Bellows

SJM's precision bellows is widely and essentially applied on the various industrial branches demanding high leveled precision and quality, zero-emission / leakage and the latest modern characteristics.

Application : bellows sealed valve, vacuum interrupter, industrial auto controller, etc.

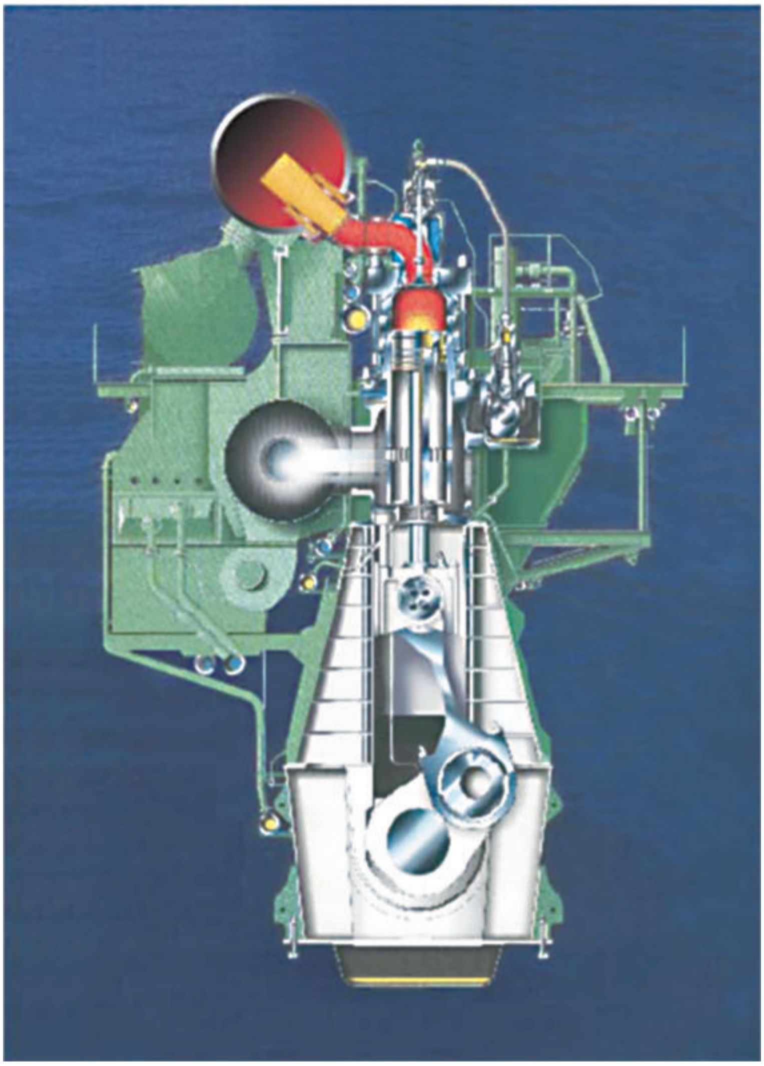


Cubic Bellows Stress Analysis

EXPANSION BELLOWS FOR MARINE DIESEL ENGINE

SJM has experienced on this field more than 20 years since starting on exhaust duct line in marine vessel and currently supply to the engine exhaust turbo charging and charging air line of marine ship diesel engines covering all types of Sulzer and Man B&W.

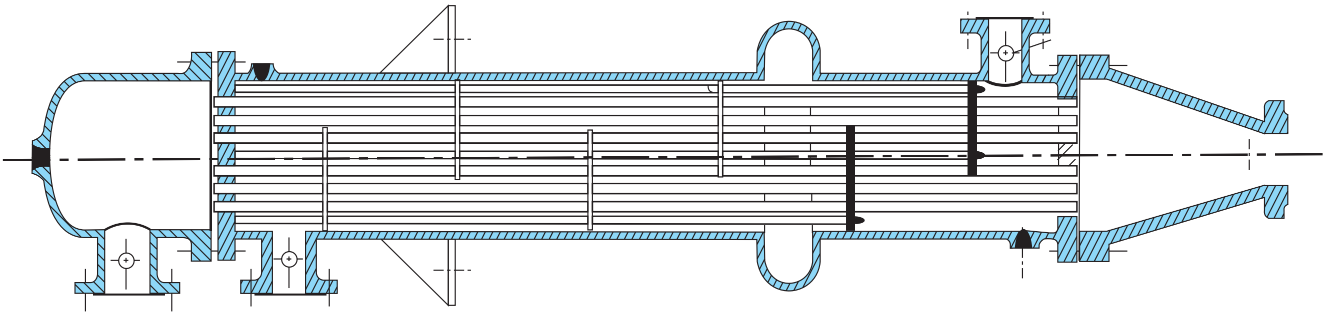
Our engineering know-how has been achieved through a lot of experience. SJM has creatively endeavored to theoretically and realistically resolve the technical matters that this kind of bellows must clarify, such as the reduction of vibration, low stiffess value, absorbing of large thermal growth and the design of internal liner fitted with the high fulid velocity, etc.



EXPANSION BELLOWS FOR HEAT EXCHANGER

The main performance of this type expansion bellows is to relieve the thermal stress loaded on the shell side of heat exchanger, which stress is mainly commenced from the thermal growth difference between shell and tube side of Heat Exchanger

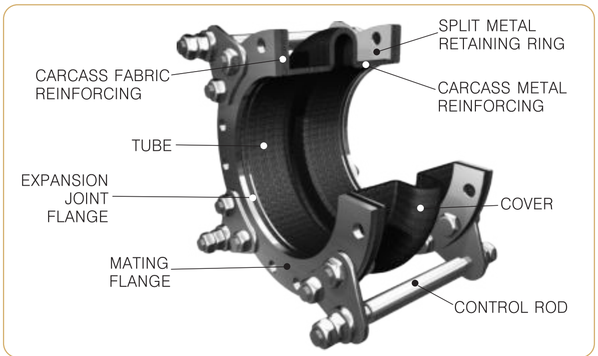
SJM is providing the optimized and computerized design solution by updating and running "EJMA" & "ASME SEC. Ⅷ Div.1 Appendix 26" on U-profiled bellows and "ASME SEC.Ⅷ Div.1 Appendix CC" & TEMA on Flanged and Flued type bellows.
Also, our designing, quality control, material procurement and manufacturing process are accredited at ASME U-Stamp.



Bellows Type

Flanged and Flued Type

RUBBER EXPANSION JOINT



Nominal Size	Length (mm)	Non-Concurrent					Spring Rate			
		Axial		Lateral (mm)	Angular (Deg.)	Torsional (mm)	Axial		Lateral (N/mm)	Angular (N.M/Deg)
		Comp (mm)	Ext (mm)				Comp (N/mm)	Ext (N/mm)		
50A	152.4	11.1	6.4	12.7	14.50	3.0	74.0	96.6	122.5	0.4
65A	152.4	11.1	6.4	12.7	11.50	3.0	92.8	120.6	133.4	0.7
80A	152.4	11.1	6.4	12.7	10.00	3.0	111.1	144.9	144.2	1.1
100A	152.4	11.1	6.4	12.7	7.50	3.0	148.4	193.2	166.6	2.6
125A	152.4	11.1	6.4	12.7	6.00	3.0	185.2	240.8	191.1	5.0
150A	152.4	11.1	6.4	12.7	5.00	3.0	222.4	289.1	216.0	8.7
200A	152.4	17.5	9.5	12.7	5.50	3.0	247.1	321.5	263.6	17.2
250A	203.2	17.5	9.5	12.7	4.50	3.0	309.1	401.8	283.2	32.8
300A	203.2	17.5	9.5	12.7	3.75	3.0	370.7	482.2	331.8	57.0
350A	203.2	17.5	9.5	12.7	3.25	2.0	324.3	421.9	391.0	66.7
400A	203.2	17.5	9.5	12.7	2.75	2.0	370.7	482.2	450.1	103.0
450A	203.2	17.5	9.5	12.7	2.50	1.0	416.9	542.7	497.0	143.6
500A	203.2	20.6	11.1	12.7	2.50	1.0	463.6	602.0	555.8	205.9
600A	254.0	20.6	11.1	12.7	2.00	1.0	556.2	722.8	597.1	371.2
700A	254.0	23.8	12.7	12.7	2.00	1.0	576.8	750.1	683.2	517.6
800A	254.0	23.8	12.7	12.7	1.80	1.0	659.6	857.4	853.3	752.0
900A	254.0	23.8	12.7	12.7	1.50	1.0	216.7	964.7	1107.5	1143.6
1000A	254.0	23.8	12.7	12.7	1.50	1.0	823.9	1071.8	1168.4	1411.8
1100A	304.8	27.0	14.3	12.7	1.50	1.0	816.2	1060.0	1249.9	1720.8
1200A	304.8	27.0	14.3	12.7	1.25	1.0	890.3	1156.5	1358.4	2472.7
1300A	304.8	27.0	14.3	12.7	1.25	1.0	964.7	1254.1	1455.0	2896.8
1400A	304.8	27.0	14.3	12.7	1.25	1.0	1038.9	1350.6	1556.9	3338.5
1500A	304.8	27.0	14.3	12.7	1.00	1.0	1113.1	1447.0	1657.7	4792.4
1800A	304.8	27.0	14.3	12.7	0.90	1.0	1335.7	1736.4	1917.1	7697.3
2100A	304.8	27.0	14.3	12.7	0.80	1.0	1558.3	2025.7	2248.9	117707.9
2400A	304.8	27.0	14.3	12.7	0.70	1.0	1780.9	2315.0	2581.4	182112.5
2550A	304.8	27.0	14.3	12.7	0.66	1.0	1892.2	2459.9	2747.7	22989.0
2700A	304.8	27.0	14.3	12.7	0.62	1.0	2003.5	2604.7	2913.9	29611.8
3000A	304.8	27.0	14.3	12.7	0.56	1.0	2226.1	2894.1	3246.4	40472.9
3300A	304.8	27.0	14.3	12.7	0.51	1.0	2448.7	3183.4	3550.6	45453.5
3600A	304.8	27.0	14.3	12.7	0.47	1.0	2671.4	3472.7	3854.8	58128.8

MOVEMENT CAPABILITY

1. The degree of Angular Movement is based on the maximum extension shown.
2. If greater movements are designed, expansion joints can be supplied with two, three or four arches.
   Relatively longer "Face-To-Face" length dimensions are incorporated into the design of Multiple Arch Type expansion joints.
3. To calculate approximate movement of Multiple Arch Type expansion joints, take the movement shown in the above table and multiply by the number of arches.

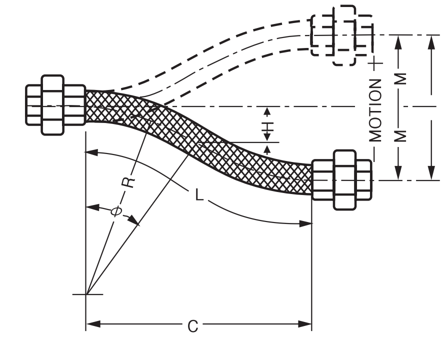
SPRING RATE

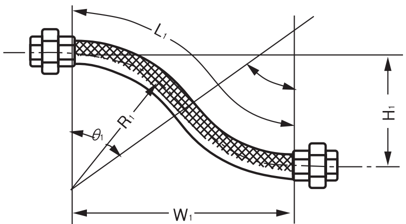
1. Spring rates required to move expansion joints are based on zero pressure conditions and room temperature in the pipe line.

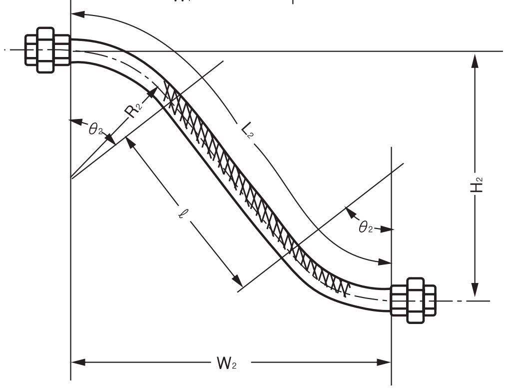
METAL FLEXIBLE HOSE

Required length of tube in piping flexible tubes

OFFSET PIPING







$L_1 = 2R_1 \theta_1$ .... (1)

$W_1 = 2R_1 \mathrm{Sin}\, \theta_1$ .... (2)

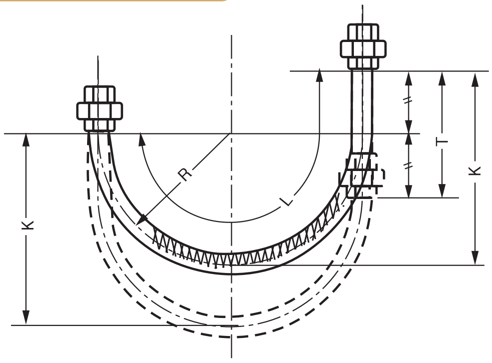
$H_1 = 2R_1 (1 - \mathrm{Cos}\, \theta)$ .... (3)

$L_2 = 2R_2 \theta_2 + \ell$ .... (4)

$W_2 = 2R_2 \mathrm{Sin}\, \theta_2 + \ell\, \mathrm{Cos}\, \theta$ .... (5)

$H_2 = 2R_2 (1 - \mathrm{Cos}\, \theta_2) + \ell\, \mathrm{Sin}\, \theta_2$ .... (6)

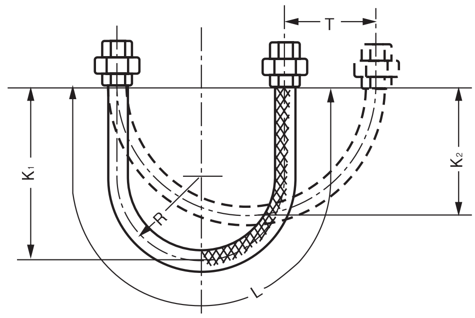
U-BEND PIPING(1)



$L = 4R + \frac{T}{2}$ .... (7)

$K = 1.43R + \frac{T}{2}$ .... (8)

U-BEND PIPING(2)



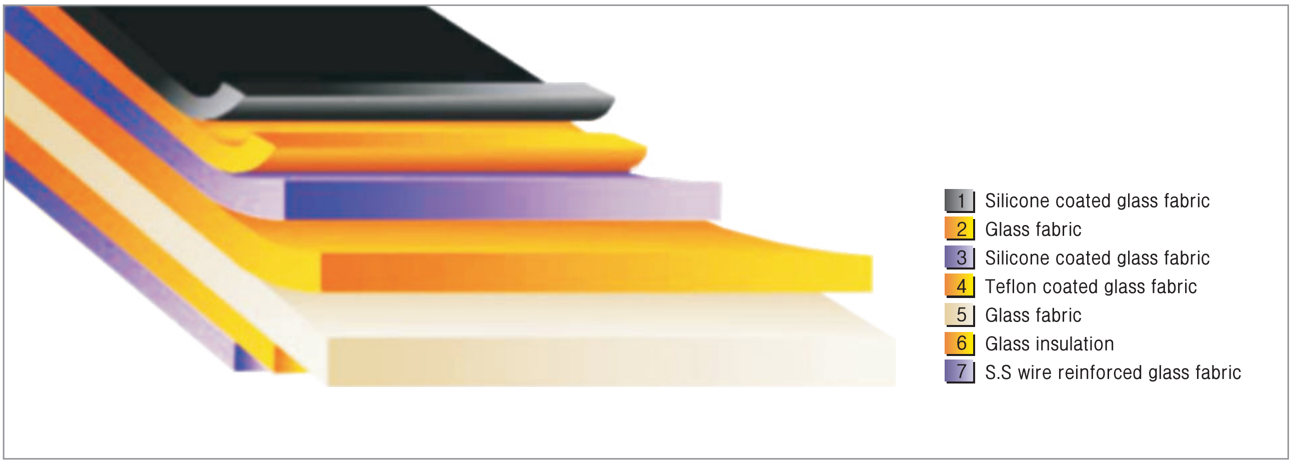
$L = 4R + 1.57T$ .... (9)

$K_1 = 1.43R + 0.785T$ .... (10)

$K_2 = 1.43R + \frac{T}{2}$ .... (11)

NON-METAL EXPANSION JOINT

CONSTRUCTION ATTRIBUTES



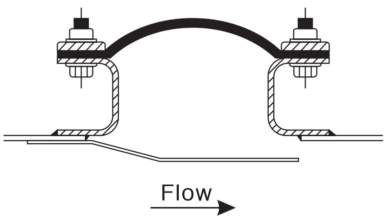
Fabric Expansion Joint(JBQ-N)

The use of Fabric Expansion Joint has been virtually expanded into every industry conveying gases due to the various characteristics which metal type expansion joint does not have, i.e, the absorbing of large movement, low loads required to move this type of joint, corrosion resistance, sound and vibration elimination, lower piping system design cost etc.

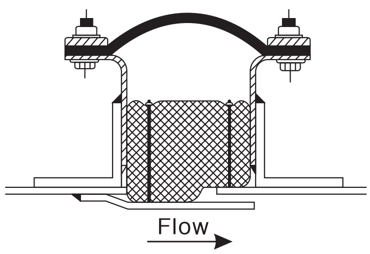
In order to provide for an optimum life and operating reliability of this type of expansion joint, SJM need engineering data in relevant with service fluid, design pressure and temperature, movement, duct geometry, scope of design etc.

Following figures are showing various typical cross sectional construction complying with each particular design condition with which SJM has experienced.

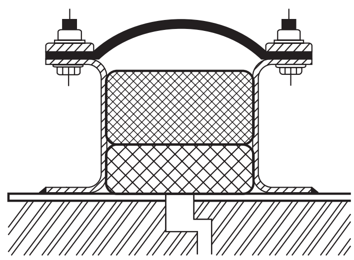
JBQNB-200



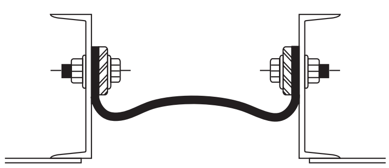
JBQNB-500



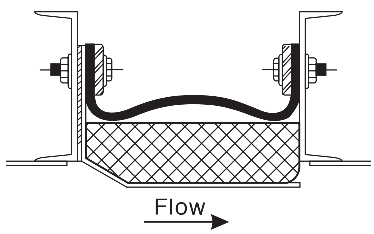
JBQNB-1000



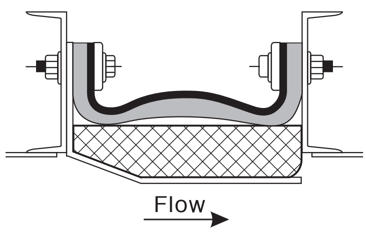
JBQNF-200



JBQNF-350

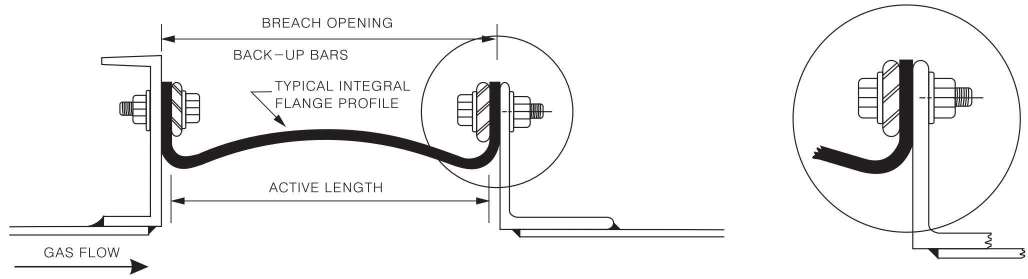


JBQNF-500

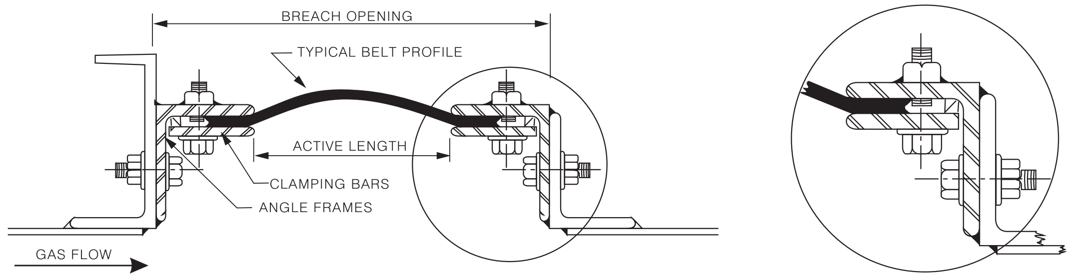


NON-METAL EXPANSION JOINT

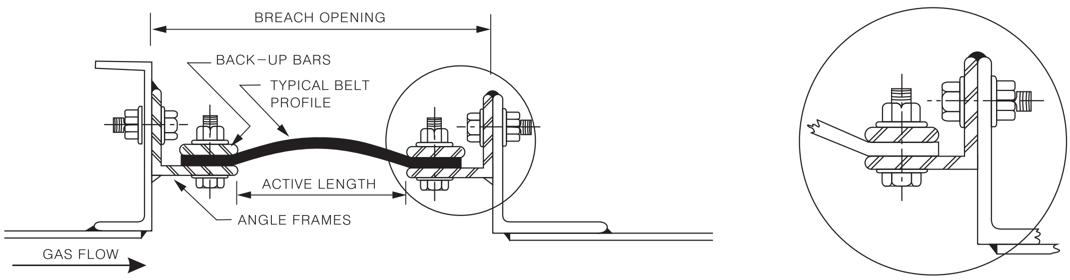
EXTERNALLY INSTALLED - BOLTED BACK-UP BARS



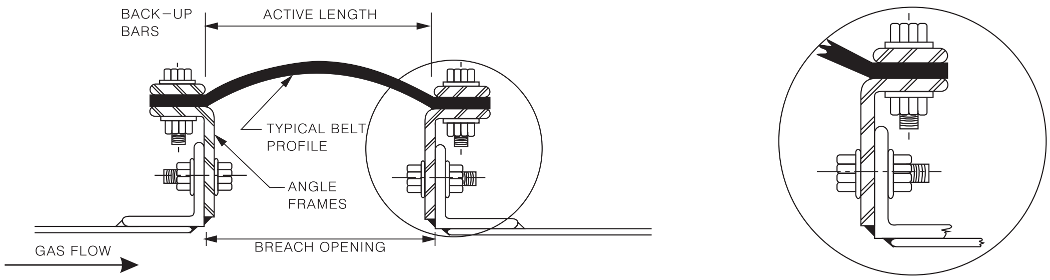
INTERNALLY INSTALLED - CLALMP-IN ATTACHMENT



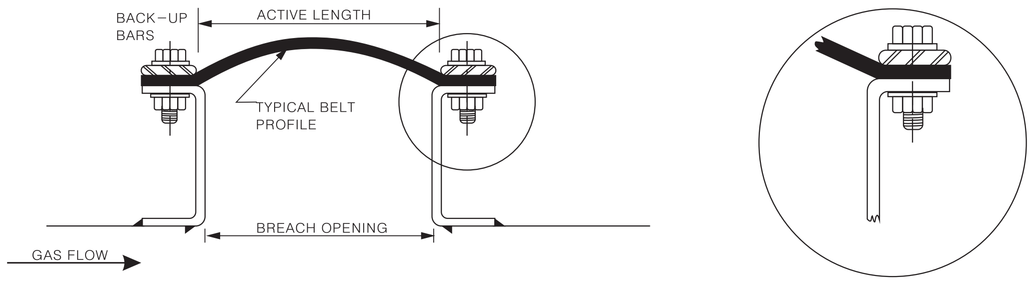
EXTERNALLY INSTALLED - BOLTED BACK-UP BARS



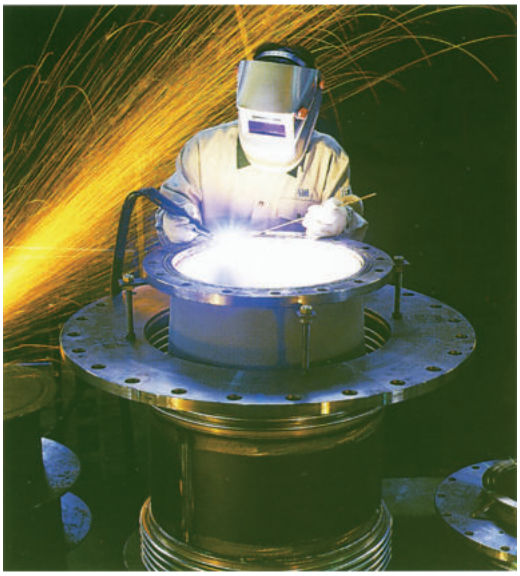
EXTERNALLY INSTALLED - BOLTED BACK-UP BARS



EXTERNALLY INSTALLED - BOLTED BACK-UP BARS



FABRICATION AND QUALITY ASSURANCE



Industries that use the "SJM" Advantage include:

- Petrochemicals and Refining
- Cogeneration, Cryogenics
- District Heating, Cooling, Steam Distribution
- Hot Metal Processing
- Iron & Steel Mill Plant
- Heating, Ventilating and Air Conditioning(HVAC)
- Nuclear Power Generation
- LNG Carries Engine Manifolds, Shipbuilding and Repair
- Heat Exchangers, Hot or Cold Piping

Welding Qualifications - All weld procedures and welders are qualified at ASME Section IX : Sub ARC, ARC, Pulse ARC, TIG, MIG, Core Wire, Resistance, Tube Welding, Track Welding, Large Turm Tables, Rolls.

Fabrication

Bridge Crane Capacity	20 ton
Maximum Hook Height	11 M
Fork LIFT Capacity	15 ton
Plate Roll	25mm Thickness
Plate Shear	0.1mm through 25mm
Flame and Plasma Cutting	4-touch computer controlled water table
Radial Expanders	20mm through 2500mm
Press Brake	
Abrasive Blasting machine	
Lathes and Milling machines	
Acid Pickling Solution equipment	
Heat treatment equipment	
Painting and finishing equipment	

Bellows Forming

SJM is accomplishing all recognized bellows forming technologies as the major metal expansion joint manufacture, including hydraulic forming. one pith forming, mechanicalo roll forming.

1) Hydraulic formaing from 50mm to 2,500mm diameter.
   (Press: 75, 500, 1000 TON)
2) One pith forming from 15mm to 100mm diameter.
3) Automatic forming machine from 20mm to 150mm diameter.
4) Mechanical roll forming from 1500mm to 6000mm diameter.

Quality Assurance

SJM Quality Assurance System has been certified to ISO 9001 & ASME section Ⅷ (U, U2 Stamp) and in compliance with ASME B31. 1, B 31. 3, AWS B1.1, AISI, ASIC, and Stoomwezen.
X ray 300KV - 10 MA and 5 MA Magnetic Particle
Ultrasonic and Eddy Current Testing
Dye Penetrant
Helium and Halogen Leak Detection
Pneumatic Testing
Hydro Testing
Cycle Testing
Spring Rate Testing
Hardness Testing
Dead Weight Testing

Test Program and Design Verification Tests

Ambient Temperature Bellows Fatigue Testing
Seismic Analysis of Fabricated Components
Bellows Spring Rate Testing
Expansion Joint Deflection Testing
Bellows Torsion Testing
Burst Testing

Modulus of Elasticity of Commonly Used Bellows Material – psi

(Modulus tabulated value by 10^6)

Temp. Degrees F.	Carbon Steel C≤0.3%	Carbon Steel C> 0.3%	Alloy 800	Alloy 825	Aluminum	Alloy 400	Aust. Stainless Steel	Alloy 200	Alloy 600	Alloy 625
-325	30.0	31.0	30.6	-	11.3	26.8	30.4	-	-	-
-200	29.5	30.6	-	-	11.1	26.6	29.9	-	-	-
-100	29.0	30.4	-	-	10.9	26.4	29.4	-	-	-
70	27.5	29.9	28.4	28.0	10.6	26.0	28.3	29.7	29.9	30.1
200	27.7	29.5	27.7	27.3	10.4	26.0	27.7	29.1	29.4	29.6
300	27.4	29.0	27.1	26.9	10.2	25.8	27.1	28.7	28.9	-
400	27.0	28.3	26.6	26.6	9.5	25.6	26.6	28.2	28.5	28.7
500	26.4	27.4	26.0	26.2	8.5	25.4	26.1	27.9	28.0	-
600	25.7	26.7	25.4	25.9	-	24.7	25.4	27.4	27.6	27.8
700	24.8	25.4	24.9	25.5	-	23.1	24.8	26.9	27.1	-
800	23.4	23.8	24.4	24.9	-	21.0	24.1	26.4	26.6	26.9
900	18.5	21.5	24.0	24.4	-	18.6	21.0	25.8	26.1	-
1000	15.4	18.8	23.4	23.8	-	16.0	18.6	25.2	25.6	25.9
1100	13.0	15.0	22.9	-	-	14.3	16.0	24.5	25.1	-
1200	-	11.0	22.3	-	-	13.0	14.3	23.8	24.5	24.7
1300	-	-	21.7	-	-	-	13.0	-	23.9	-
1400	-	-	21.1	-	-	-	-	-	23.3	23.3

Notes: This table is for information only. It is not to be implied that materials are suitable for all the temperature ranges shown. Data on Alloy 600, 625 and Alloy 800 and 825 from Huntington Alloy Products Division – The Internation Nickel Company, Inc. Balance of data from ASME SECTION Ⅷ – DIV.1, ANSI B31.1 OR ANSI B31.3.

Thermal Expansion of Pipe in Inches per 100 Feet

Temp. Degrees F.	Carbon C-Mo 3Cr-Mo Steels	SCr-Mo through 9Cr-Mo Steels	Austenitic Stainless Steels 18Cr-8Ni	310SS 20Cr-20Ni	Alloy 400	Cu-30Ni	Copper	Nickel 200	Alloy 800, 825	Alloy 600, 625, 691	Aluminum	Temp Degrees F.
-325	-23.7	-2.22	-3.85	•••	-2.62	-3.15	•••		•••	•••	-4.86	-325
-300	-2.24	-2.10	-3.63	•••	-2.50	-2.87	•••	-2.44	•••	•••	-4.46	-300
-275	-2.11	-1.98	-3.41	•••	-2.38	-2.70	•••	-2.35	•••	•••	-4.21	-275
-250	-1.98	-1.86	-3.19	•••	-2.26	-2.53	•••	-2.25	•••	-2.30	-3.97	-250
-225	-1.85	-1.74	-2.96	•••	-2.14	-2.36	•••	-2.13	•••	-2.17	-3.71	-225
-200	-1.71	-1.62	-2.73	•••	-2.02	-2.19	•••	-2.01	•••	-2.04	-3.44	-200
-175	-1.58	-1.50	-2.50	•••	-1.90	-2.12	•••	-1.83	•••	-1.87	-3.16	-175
-150	-1.45	-1.37	-2.27	•••	-1.79	-1.95	•••	-1.65	•••	-1.70	-2.88	-150
-125	-1.30	-1.23	-2.01	•••	-1.59	-1.74	•••	-1.47	•••	-1.54	-2.57	-125
-100	-1.15	-1.08	-1.75	•••	-1.38	-1.53	-1.83	-1.29	•••	-1.37	-2.27	-100
-75	-1.00	-0.98	-1.50	•••	-1.18	-1.33	-1.57	-1.11	•••	-1.17	-1.97	-75
-50	-0.84	-0.79	-1.24	•••	-0.98	-1.13	-1.31	-0.93	•••	-0.97	-1.67	-50
-25	-0.68	-0.63	-0.98	•••	-0.77	-0.89	-1.05	-0.75	•••	-0.76	-1.32	-25
0	-0.49	-0.46	-0.72	•••	-0.57	-0.66	-0.79	-0.56	•••	-0.56	-0.97	0
25	-0.32	-0.30	-0.46	•••	-0.37	-0.42	-0.51	-0.36	•••	-0.36	-0.63	25
50	-0.14	-0.13	-1.21	•••	-0.20	-0.19	-0.22	-0.16	•••	-0.16	-0.28	50
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70
100	0.23	0.22	0.34	0.32	0.28	0.31	0.34	0.25	0.28	0.26	0.46	100
125	0.42	0.40	0.62	0.58	0.52	0.56	0.62	0.47	0.52	0.48	0.85	125
150	0.61	0.58	0.90	0.84	0.75	0.82	0.90	0.69	0.76	0.70	1.23	150
175	0.80	0.76	1.18	1.10	0.99	1.07	1.18	0.92	0.99	0.92	1.62	175
200	0.99	0.94	1.46	1.37	1.22	1.33	1.48	1.15	1.23	1.15	2.00	200
225	1.21	1.13	1.75	1.64	1.46	1.59	1.77	1.38	1.49	1.38	2.41	225
250	1.40	1.33	2.03	1.91	1.71	1.86	2.05	1.61	1.76	1.61	2.83	250
275	1.61	1.52	2.32	2.18	1.96	2.13	2.34	1.85	2.03	1.85	3.24	275
300	1.82	1.71	2.61	2.45	2.21	2.40	2.62	2.08	2.30	2.09	3.67	300
325	2.04	1.90	2.90	2.72	2.44	2.68	2.91	2.32	2.59	2.32	4.09	325
350	2.26	2.10	3.20	2.99	2.68	2.96	3.19	2.56	2.88	2.56	4.52	350
375	2.48	2.30	2.50	3.26	2.91	3.24	3.48	2.80	3.18	2.80	4.95	375
400	2.70	2.50	3.80	3.53	3.25	3.52	3.88	3.05	3.48	3.05	5.39	400
425	2.93	2.72	4.10	3.80	3.52	•••	4.17	3.30	3.76	3.29	5.83	425
450	3.16	2.93	4.41	4.07	3.79	•••	4.47	3.55	4.04	3.53	6.28	450
475	3.39	3.14	4.71	4.34	4.06	•••	4.76	3.80	4.31	3.78	6.72	475
500	3.62	3.3	5.01	4.61	4.33	•••	5.06	4.05	4.59	4.02	7.17	500
525	3.86	3.58	5.31	4.88	4.61	•••	5.35	4.31	4.87	4.27	7.63	525
550	4.11	3.80	5.62	5.15	4.90	•••	5.64	4.56	5.16	4.52	8.10	550
757	4.35	4.02	5.93	5.42	5.18	•••	•••	4.83	5.44	4.77	8.56	575
600	4.60	4.24	6.24	5.69	5.46	•••	•••	5.09	5.72	5.02	9.03	600
625	4.76	4.47	6.55	5.96	5.75	•••	•••	5.35	4.01	5.27	•••	625
650	5.11	4.69	6.87	6.23	6.05	•••	•••	5.62	6.30	5.63	•••	650

Thermal Expansion of Pipe in Inches per 100 Feet

Temp. Degrees F.	Carbon C-Mo 3Cr-Mo Steels	SCr-Mo through 9Cr-Mo Steels	Austenitic Stainless Steels 18Cr-8Ni	310SS 20Cr-20Ni	Alloy 400	Cu-30Ni	Copper	Nickel 200	Alloy 800, 825	Alloy 600, 625, 691	Aluminum	Temp Degrees F.
675	5.37	4.92	7.18	6.50	6.34	•••	•••	5.89	6.58	5.79	•••	6.75
700	5.63	5.14	7.50	6.77	6.64	•••	•••	6.16	6.88	6.05	•••	700
725	5.90	5.38	7.82	7.04	6.94	•••	•••	6.44	7.17	6.31	•••	725
750	6.16	5.62	8.15	7.31	7.25	•••	•••	6.71	7.47	6.57	•••	750
755	6.43	5.86	8.47	7.58	7.55	•••	•••	6.99	7.76	6.84	•••	775
800	4.70	6.10	8.80	7.85	7.85	•••	•••	7.27	8.06	7.10	•••	800
850	7.25	6.59	9.46	8.45	8.84	•••	•••	7.82	8.66	7.67	•••	850
875	7.53	6.83	9.79	8.75	8.80	•••	•••	8.09	8.95	7.95	•••	875
900	7.81	7.07	10.12	9.05	9.12	•••	•••	8.37	9.26	8.23	•••	900
925	8.08	7.31	10.46	9.35	9.44	•••	•••	8.64	9.56	8.52	•••	925
950	8.35	7.56	40.80	9.65	9.77	•••	•••	8.92	9.87	8.80	•••	950
975	8.62	7.81	11.14	9.95	10.09	•••	•••	9.20	10.18	9.09	•••	975
1000	8.89	8.06	11.48	10.25	10.42	•••	•••	9.49	10.49	9.37	•••	1000
1025	9.17	8.30	11.82	10.55	10.75	•••	•••	9.77	10.80	9.66	•••	1025
1050	9.46	8.55	12.16	10.85	11.09	•••	•••	10.05	11.11	9.94	•••	1050
1075	9.75	8.80	12.50	11.15	11.43	•••	•••	10.34	11.42	10.23	•••	1075
1100	10.04	9.05	12.84	11.45	11.77	•••	•••	10.63	11.74	10.51	•••	1100
1125	10.31	9.28	13.18	11.78	12.11	•••	•••	10.92	12.05	10.80	•••	1125
1150	10.57	9.52	13.52	12.11	12.47	•••	•••	11.21	12.38	11.09	•••	1150
1175	10.83	9.76	13.86	12.44	12.81	•••	•••	11.50	12.69	11.37	•••	1175
1200	11.10	10.00	14.20	12.77	13.15	•••	•••	11.80	13.02	11.66	•••	1200
1225	11.38	10.26	14.54	13.10	13.50	•••	•••	12.09	13.36	11.98	•••	1225
1250	11.66	11.53	14.88	13.43	13.86	•••	•••	12.39	13.71	12.29	•••	1250
1275	11.94	10.79	15.22	13.76	14.22	•••	•••	12.69	14.04	12.61	•••	1275
1300	12.22	11.06	15.56	14.09	14.58	•••	•••	12.99	14.39	12.93	•••	1300
1325	12.50	11.30	15.90	14.39	14.94	•••	•••	13.29	14.74	13.25	•••	1325
1350	12.78	11.55	16.24	14.69	15.39	•••	•••	13.59	15.10	13.56	•••	1350
1375	13.06	11.80	16.58	14.99	15.66	•••	•••	13.90	15.44	13.88	•••	1375
1400	13.34	12.05	16.92	15.29	16.02	•••	•••	14.20	15.80	14.20	•••	1400
1425	•••	•••	17.30	•••	•••	•••	•••	14.51	16.16	14.51	•••	1425
1450	•••	•••	17.69	•••	•••	•••	•••	14.82	16.53	14.83	•••	1450
1475	•••	•••	18.08	•••	•••	•••	•••	15.13	16.88	15.14	•••	1475
1500	•••	•••	18.47	•••	•••	•••	•••	15.44	17.25	15.45	•••	1500
1525	•••	•••	•••	•••	•••	•••	•••	15.76	17.61	15.77	•••	1525
1550	•••	•••	•••	•••	•••	•••	•••	16.07	17.98	16.08	•••	1550
1575	•••	•••	•••	•••	•••	•••	•••	16.39	18.35	16.40	•••	1575
1600	•••	•••	•••	•••	•••	•••	•••	16.71	18.73	16.71	•••	1600

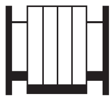
Notes: 1. Abore table shows expansion resulting from the change in temperature from 70° F to indicated temperature.
2. This table is for information only and it is not to be implied that materials are suitable for all the temperature ranges shown.
3. The thermal expansion values in this table may be interpolated to determine values for intermediate temperatures.

STANDARD EXPANSION JOINT SPECIFICATION SHEET

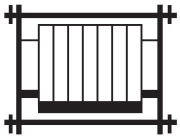
Company:	Date / / /
	Sheet of
Project:	Inquiry No.
	Job No.

	Item No. / EJ Tag No.					
1	Quantity					
2	Nominal Size/I. D./O. D. (mm)					
3	Expansion Joint Type					
4a	Fluid Information	Medium Gas/Liquid				
4b		Velocity (Ft./Sec.)				
4c		Flow Direction				
5	Disign Pressure, psig.					
6	Test Pressure, psig					
7a	Temperature	Design (℃)				
7b		Max./Min.(℃)				
7c		Installation (℃)				
8a	Maximum Installation Movement	Axial Compression (mm)				
8b		Axial Extension (mm)				
8c		Lateral (mm)				
8d		Angular (deg.)				
9a	Maximum Design Movements	Axial Compression (mm)				
9b		Axial Extension (mm)				
9c		Lateral (mm)				
9d		Angular (deg.)				
9e		No. Of Cycles				
10a	Operating Fluctuations	Axial Compression (mm)				
10b		Axial Extension (mm)				
10c		Lateral (mm)				
10d		Angular (deg.)				
10e		No. Of Cycles				
11a	Materials of Construction	Bellows				
11b		Liners				
11c		Cover				
11d		Pipe Specification				
11e		Flange Specification				
12	Rods (Tie/Limit/Control)					
13	Pantographic Linkage					
14	Anchor Bass (Main/Intermediate)					
15a	Dimensional Limitations	Overall Length (mm)				
15b		Outside Diameter (mm)				
15c		Inside Diameter (mm)				
16a	Spring Rate Limitions	Axial (kgf/mm)				
16b		Lateral (kgf/mm)				
16c		Angular (kgf/mm/deg.)				
17	Installation Position Horiz/Vert.					
18a	Quality Assurance Requirements	Bellows	Long. Seam			
18b		Weld NDE	Attach.			
18c		Pipe NDE				
18d		Design Code Required.				
18e		Partial Data Required.				
18f						
18g						
19	Vibration Amplitude/Frequency					

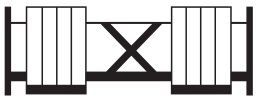
Key To Symbols Used



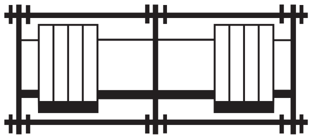
SINGLE EXPANSION JOINT



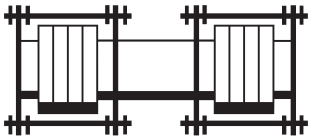
SINGLE EXPANSION JOINT
WITH TIE RODS



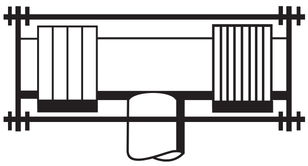
DOUBLE EXPANSION JOINT
WITH INTERMEDIATE
ANCHOR



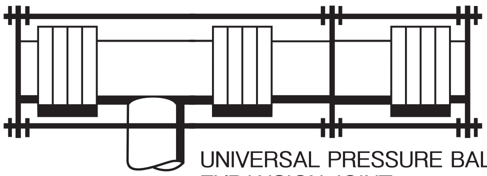
UNIVERSAL EXPANSION
JOINT WITH OVERALL TIE
RODS



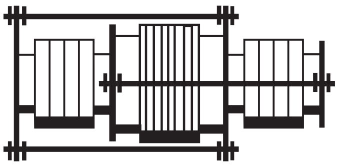
UNIVERSAL EXPANSION
JOINT WITH SHORT TIE
RODS



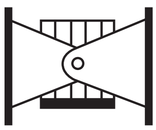
PRESSURE BALANCED
EXPANSION JOINT



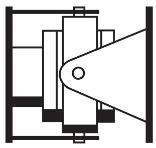
UNIVERSAL PRESSURE BALANCED
EXPANSION JOINT



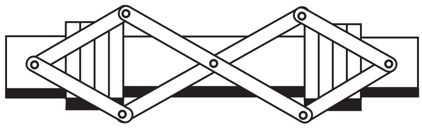
INLINE PRESSURE
BALANCED EXPANSION
JOINT



HINGED EXPANSION JOINT



GIMBAL EXPANSION JOINT



UNIVERSAL PANTOGRAPH EXPANSION JOINT

MA

MAIN ANCHOR

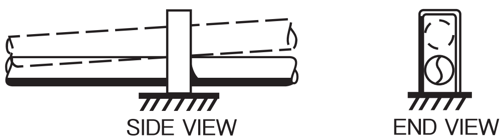
DMA

DIRECTIONAL MAIN ANCHOR

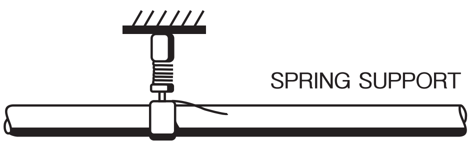
INTERMEDIATE ANCHOR

PIPE ALIGNMENT GUIDE

DIRECTIONAL INTERMEDIATE
ANCHOR WITH GUIDE



PLANAR PIPE ALIGNMENT GUIDE



SPRING SUPPORT

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