JB-13, 14 Type Bellows Expansion Joint

for Building・Air Conditioning Equipments, Factory Equipments, etc.

Compliant with JIS

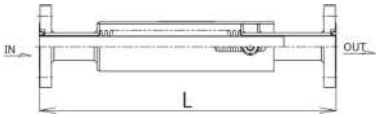
JIS B 2352 Bellows Type Expansion Joint (mainly for piping of air conditioning and sanitary systems).
Absorb expansion or contraction by temperature changes in the axial direction of pipe.

JB-13 Type

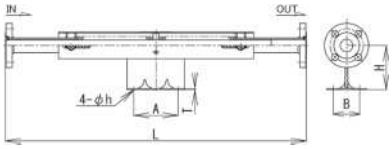
JB-14 Type

CONSTRUCTION

JB-13 Type



JB-14 Type



Note:
1.Depending on size, the structure may vary.
2.The size up to 400mm is available upon your request (see the following table for max. working pressure and test pressure).

(MPa)

Size	Applicable pressure	Pressure test
350(14″)	1.0	1.5
400(16″)	0.8	1.2

FEATURES

- Stainless steel bellows with internal pipe manufactured using exclusive formation and fixing method; highly durable and corrosion resistant.
- 20~40% lighter than prior products.

SPECIFICATIONS

Model name(Type)	JB-13(Single)	JB-14(Double)
Code name	JB13-N	JB14-N
Applicable fluid	Steam, air, inert gases, cold or hot water & oils	
Fluid temperature	Max. 220℃	
Applicable pressure	Max. 1.0MPa	
End connection	Flanged JIS 10KRF	
Materials	Flange(Mild steel), External sleeve(Carbon steel or Mild steel), Internal sleeve & Bellows(Stainless steel)	
Pressure test	Hydraulic 1.5MPa	
Expansion amount	35mm	70mm

DIMENSIONS JB-13 Type (Single Type)

(mm)

Size	L	Expansion amount		Mass(kg)
		Expansion	Contraction	
20(¾″)	365	10	25	4
25(1″)	365	10	25	4
32(1¼″)	365	10	25	5.5
40(1½″)	365	10	25	5.5
50(2″)	365	10	25	7.5
65(2½″)	415	10	25	10.5
80(3″)	415	10	25	12
100(4″)	415	10	25	16
125(5″)	440	10	25	22
150(6″)	440	10	25	29
200(8″)	440	10	25	49
250(10″)	465	10	25	59
300(12″)	465	10	25	95

Flange code JIS 10KRF

DIMENSIONS JB-14 Type (Double Type)

(mm)

Size	L	Expansion amount		H	A	B	T	h	Mass(kg)
		Expansion	Contraction						
20(¾″)	680	20	50	100	100	60	3.2	12	6
25(1″)	680	20	50	100	100	60	3.2	12	6
32(1¼″)	680	20	50	120	100	70	3.2	12	9
40(1½″)	680	20	50	120	100	70	3.2	12	9
50(2″)	680	20	50	130	100	80	3.2	15	12
65(2½″)	780	20	50	140	120	100	3.2	15	17
80(3″)	780	20	50	150	120	110	4.5	15	20
100(4″)	880	20	50	170	120	130	4.5	19	30
125(5″)	880	20	50	200	120	150	4.5	19	35
150(6″)	930	20	50	220	160	180	6.0	23	62
200(8″)	930	20	50	250	160	220	6.0	25	91
250(10″)	980	20	50	300	180	280	6.0	27	103
300(12″)	980	20	50	350	200	300	19	28	198

Flange code JIS 10KRF

POINTS FOR INSTALLATION

- The arrow mark on the main body should match with the flow of fluid.
- Make sure no torsional stress is applied on bellows.
- Remove nut for fixing faces and washers after piping is completed.

AXIAL DIRECTION LOAD ON MAIN FIXING POINT

Items \ Size(mm)		20	25	32	40	50	65	80	100	125	150	200	250	300
Bellows' effective area	Ae(mm²)	880	880	1960	1960	3130	4950	6570	11100	17700	24400	42900	62700	92100
Spring constant	K(N/mm)	28	28	54	54	68	90	91	185	255	372	590	648	1240
Load by max. working pressure at 1.0MPa	Fp(N)	880	880	1960	1960	3130	4950	6570	11100	17700	24400	42900	62700	92100
Load by max. contraction at 25mm	Fe(N)	700	700	1350	1350	1700	2250	2280	4630	6380	9300	14750	16200	31000
Total load by max. working pressure	Fm=Fp+Fe(N)	1580	1580	3310	3310	4830	7200	8850	15730	24080	33700	57650	78900	123100
Load by hydraulic test pressure at 1.5MPa	(N)	1320	1320	2940	2940	4700	7430	9860	16650	26550	36600	64350	94050	138150

DATA/JB Type Bellows Expansion Joint

■ ABOUT BELLOWS MATERIAL SUS316L (Stainless steel)

The JIS B 2352 Bellows Type Expansion Joint recommends SUS304, SUS304L, SUS316, SUS 316L, and others for making bellows. To ensure durability and corrosion resistance, which are extremely important parameters for high grade bellows, we selected SUS316L for making bellows and all parts that contact with fluid. With higher performance than SUS304, SUS316L is considered having the same or even higher characteristics than SUS304L. See the following table for characteristics of SUS316L and SUS304L.

■ COMPARISON BETWEEN SUS316L AND SUS304L

TABLE1. CHEMICAL COMPOSITION (%)

Type	Carbon C	Silicon Si	Manganese Mn	Phosphor P	Sulfur S	Nickel Ni	Chrome Cr	Molybdenum Mo
SUS316L	0.030 or less	1.00 or less	2.00 or less	0.045 or less	0.030 or less	12.00~15.00	16.00~18.00	2.00~3.00
SUS304L	0.030 or less	1.00 or less	2.00 or less	0.045 or less	0.030 or less	9.00~13.00	18.00~20.00	—

TABLE2. MECHANICAL PROPERTY

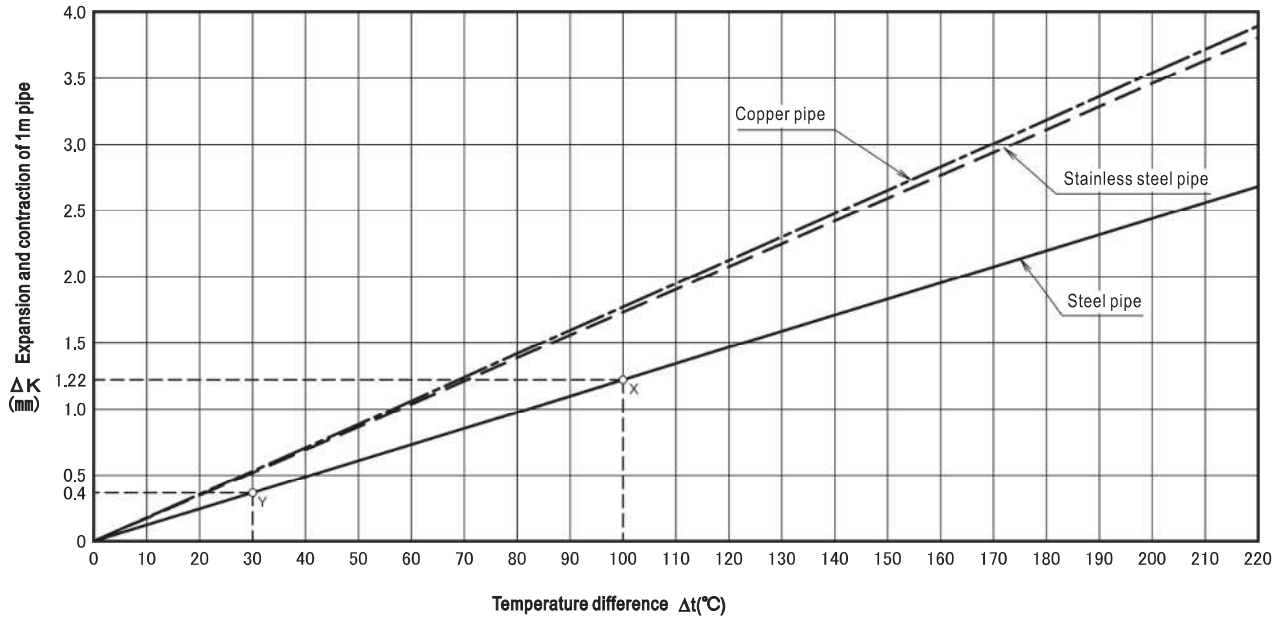
Type	Tensile test			Hardness test		
	Yield Strength N/mm²	Tensile N/mm²	Elongation %	HB	HRB	HV
SUS316L	175 or more	480 or more	40 or more	187 or less	90 or less	200 or less
SUS304L	175 or more	480 or more	40 or more	187 or less	90 or less	200 or less

TABLE3. ANTICORROSION

Type	All surface corrosion	Intercrystalline corrosion	Stress corrosion crack	Porous corrosion	Gap corrosion
SUS316L	○	○	◎	◎	◎
SUS304L	○	○	○	○	○

＊○:Superior ◎:Much superior

■ FIG.1 EXPANSION AND CONTRACTION OF 1m PIPE



■ SELECTING EXPANSION JOINT

Determine the type and number of expansion joints based on the material of pipe and change of temperature, which are factors affecting expansion/ contraction of pipe.

● Calculation $n = \frac{\Delta \ell}{\delta}$

$$\Delta \ell = \beta \times \Delta t \times \ell$$

n : number of joints
δ :max. expansion/contraction of joint (mm)
Δℓ : expansion/contraction of pipe (mm)
β : linear expansion coefficient of pipe (mm/m/℃)
Steel pipe (12.2×10^{-3})
Copper pipe (17.7×10^{-3})
Stainless steel pipe (17.3×10^{-3})

Δt : temperature difference (℃)
ℓ : length of pipe (m)

● Example

Under the following conditions:
Length of pipe (ℓ): 35m
Max. working temperature (t_1): 120℃
Min. ambient temperature (t_2): −10℃
Ambient temperature at the time of installation (t_3): 20℃
Determine the type and number of expansion joints.
The pipe is steel pipe and the joint is to be determined based on standard face-to-face dimensions.

DATA/JB Type Bellows Expansion Joint

Step 1: Calculate expansion/contraction of pipe

Temperature difference at the expansion side of pipe:

$\Delta t_1 = t_1 - t_3 = 120 - 20 = 100℃$

Temperature difference at the contraction side of pipe:

$\Delta t_2 = t_3 - t_2 = 20 - (-10) = 30℃$

According to point X in Fig.1,

Expansion of 1m pipe $\Delta k_1 = 1.22mm$

According to point Y in Fig.1,

Contraction of 1m pipe $\Delta k_2 = 0.366mm$

Therefore,

The expansion of 35m pipe is:

$\Delta \ell_1 = k_1 \times \ell$

$= 1.22 \times 35 = 42.7mm$

The contraction is:

$\Delta \ell_2 = k_2 \times \ell$

$= 0.366 \times 35 = 12.81mm$

Step 2: Determine type and number of joints

For selecting JIS certified JB-13, 21 (single type),

The expansion side of pipe (δ=25mm): $n = \frac{\Delta \ell_1}{\delta} = \frac{42.7}{25} = 1.71$

The contraction side of pipe (δ=10mm): $n = \frac{\Delta \ell_2}{\delta} = \frac{12.81}{10} = 1.281$

The number of joints should be the larger one, i.e., 2.

For selecting compliant with JIS JB-14, 22 (double type),

The expansion side of pipe (δ=50mm): $n = \frac{\Delta \ell_1}{\delta} = \frac{42.7}{50} = 0.854$

The contraction side of pipe (δ=20mm): $n = \frac{\Delta \ell_2}{\delta} = \frac{12.81}{20} = 0.641$

The number of joints should be the larger one, i.e., 1.

To select other types of joints, follow the same steps as above mentioned.

■ POINTS FOR INSTALLATION

- The arrow mark on the main body should match with the flow direction of fluid.
- Make sure no torsional stress is applied on bellows.
- The following parts are for fixing faces and need to be removed after piping is completed.

  JB-13~18: nut and washer

  JB-21~24: set bolt

■ POINTS FOR HANDLING

1. Fixing point

Fixing point with sufficient strength are necessary for installing expansion joint. The position and type of fixing point are the following.

① Main fixing point

- The end of straight pipe where closing plate is installed;
- Bending pipe where the direction of flow changes;
- Between two expansion joints, where reducer is used to change the diameter of pipe;
- Pipe between two expansion joints, where valve is installed;
- The inlet of branch pipe where free expansion joint is installed.

② Intermediate fixing point

- In the middle of two expansion joints between main fixing point;
- Anchor base (installation position) of double type expansion joint.

2. Guide and pipe support

① Guide

To ensure correct expansion and contraction of expansion joint, the axes of expansion joint and pipe must match with each other. In addition, it is necessary to use guides to transmit the force for the movement in axial direction to fixing points. The guides need to be installed according to the following intervals.

The deviation of pipe axes is ±2mm for size 125mm or smaller pipes, and ±3mm for size 150mm or larger pipes. The deviation of degree of parallelization of pipe should be within ±2°.

L_1: The interval between expansion joint and No.1 guide.

L_2: The interval between No.1 guide and No.2 guide.

L_3: The interval between No.2 guide and middle guide.

Load on main fixing point of main straight pipe Fm (N)

$Fm = Fp + Fe$

$Fp = Ae \times P$

$Fe = K \times S$

Load on main fixing of bending pipe Fb (N)

$Fb = 2Fm \sin\frac{\theta}{2} + Fc$

$Fc = \left(\frac{2A\rho V^2}{g} \sin\frac{\theta}{2} \right) \times 98.0665$

Load on intermediate fixing Fi (N)

$Fi = Fe$

Fp: Load in axial direction due to internal pressure	(N)
Fe: Load due to specified contraction	(N)
Ae: Effective area of bellows	(mm^2)
P : Working pressure	(MPa)
K : Bellows spring constant	(N/mm)
S : Expansion/contraction	(mm)
θ : Bending angle of pipe (See Fig.5 Piping example)	
Fc: Load due to centrifugal force of fluid	(N)
A : Cross sectional area of pipe	(cm^2)
ρ : Density of fluid	(g/cm^3)
V : Velocity of flow	(m/s)
g : Acceleration of gravity	($980cm/s^2$)

Fig.2-1 Interval of guides

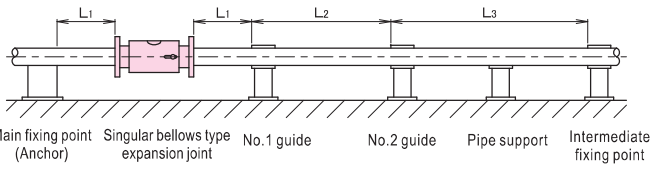
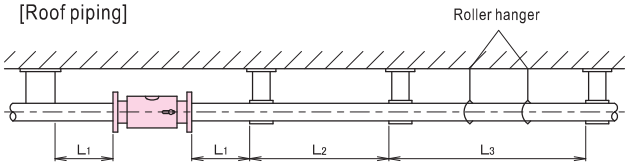


Fig.2-2 Example of roof piping

[Roof piping]



Note: The pipe may buckle if only roller hanger is used. In this case, guides are necessary.

DATA/JB Type Bellows Expansion Joint

The maximum interval between guides can be calculated using the following formula.
The interval (max.) between intermediate guides (L_3) can also be determined using Fig.3.

$L_1 \leqq 4D$

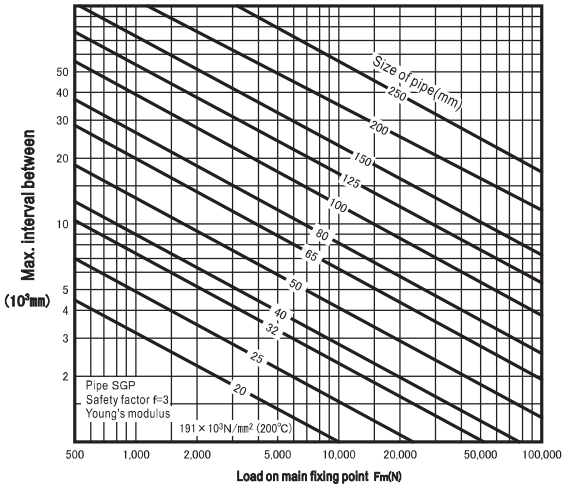
$L_2 \leqq 14D$

$L_3 \leqq \sqrt{\frac{\pi^2 EI}{fFm}}$ $\quad I = \frac{\pi}{64}(D^4 - d^4)$

L_1, L_2, L_3: Interval between guides (max.)	(mm)
D: External diameter of pipe	(mm)
d: Internal diameter of pipe	(mm)
E:Young's modulus at the designed temperature of pipe material	(N/mm^2)
Steel pipe 200℃:	$191\times10^3 N/mm^2$
Stainless steel pipe 200℃:	$183\times10^3 N/mm^2$
Copper pipe 200℃:	$116\times10^3 N/mm^2$
I: Secondary moment of the cross section of pipe	(mm^4)
f: Safety factor	(3 or larger)
Fm: Load on main fixing point	(N)

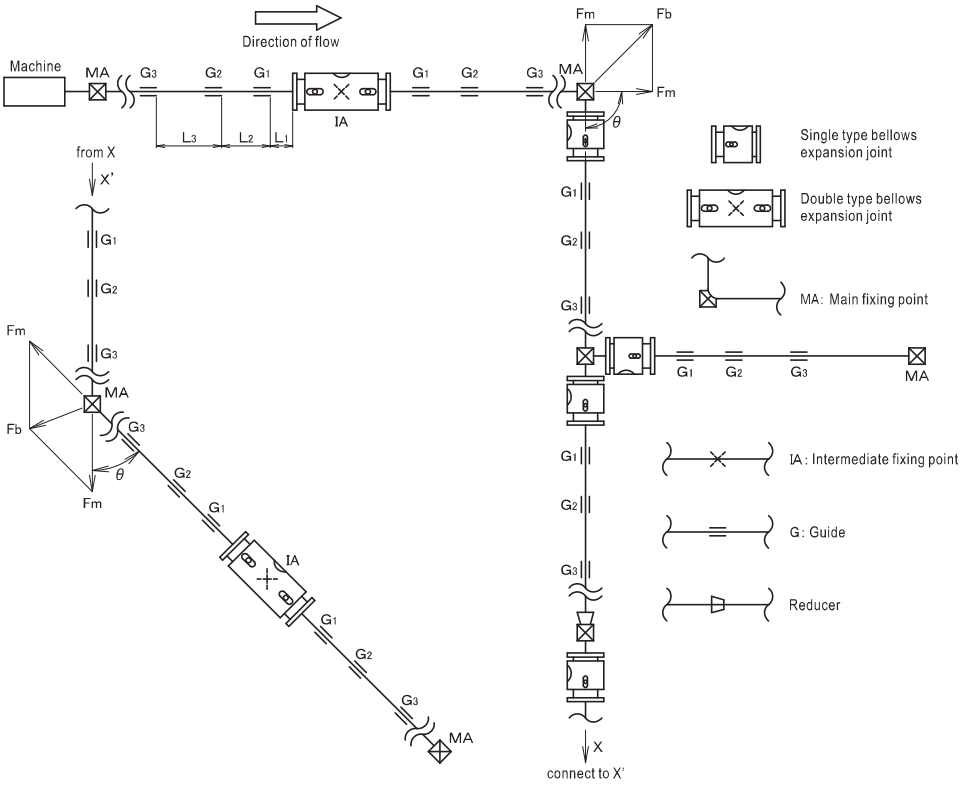
② Pipe supporting
Install roller support or roller hanger guide to prevent pipe from bending due the weight of pipe or fluid.

Fig.3 Max. interval between intermediate guides



Note: See Page 185 for STPG (carbon steel)pipe.

Fig. 5 Piping example



Note: Carry out axes matching before installing expansion joint.

Fig.4 Fixing point and guide (example)