

JB-23, 24 Type Bellows Expansion Joint

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

For high pressure application Max. 2.0MPa

Double-layer Bellows

Corrosion resistant, durable stainless steel bellows expansion joint, suitable for pressure up to 2.0MPa. The face-to-face dimensions are the same as those of JIS JB-21, 22 Type compliant with JIS standards.



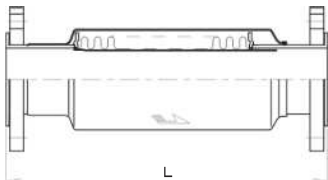
JB-23 Type



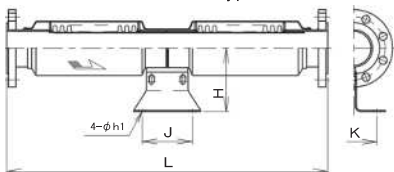
JB-24 Type

CONSTRUCTION

JB-23 Type



JB-24 Type



Note:
1. Depending on size, the structure may vary.
2. Size 350mm or larger is available upon your request
(For details, please contact our local agent).

FEATURES

- Double-layer bellows with improved durability.
- Except for flange, all parts including bellows are made of stainless steel, and the part contacting with fluid is made of stainless steel.
- Loose flange for end connection; preventing shifting in the circumferential direction of bolt hole.
- Double joint allows adjustment (inching adjustment on height and in forward and backward directions) of the position of installation foot and easier installation (JB-24 Type, size up to 150mm).

SPECIFICATIONS

Model name(Type)	JB-23(Single)	JB-24(Double)
Code name	JB23-N	JB24-N
Applicable fluid	Steam, air, inert gases, cold or hot water & oils	
Fluid temperature	Max. 250°C	
Applicable pressure	Max. 2.0MPa	
End connection	Flanged JIS 20K (Loose type)	
Materials	Flange(Carbon steel*), External sleeve(Stainless steel), Internal sleeve & Bellows(Stainless steel)	
Pressure test	Hydraulic 3.0MPa	
Expansion amount	35mm	70mm

* JB-23 and JB-24 Type with stainless steel flange are available upon your request. (Code name: JB23-K, JB24-K Type)

DIMENSIONS JB-23 Type (Single Type)

(mm)

Size	L	Expansion amount		Mass(kg)
		Expansion	Contraction	
20(¾")	365	10	25	3
25(1")	365	10	25	4
32(1¼")	365	10	25	5
40(1½")	365	10	25	5.5
50(2")	365	10	25	6.5
65(2½")	415	10	25	9
80(3")	415	10	25	12.5
100(4")	415	10	25	16
125(5")	440	10	25	24.5
150(6")	440	10	25	28.5
200(8")	440	10	25	43
250(10")	465	10	25	67
300(12")	465	10	25	130

Flange code JIS 20K

DIMENSIONS JB-24 Type (Double Type)

(mm)

Size	L	Expansion amount		H	J	K	h ₁	Mass(kg)
		Expansion	Contraction					
20(¾")	680	20	50	100	100	60	12	4.5
25(1")	680	20	50	100	100	60	12	6
32(1¼")	680	20	50	120	100	70	12	7.5
40(1½")	680	20	50	120	100	70	12	8
50(2")	680	20	50	130	100	80	15	10
65(2½")	780	20	50	140	120	100	15	13.5
80(3")	780	20	50	150	120	110	15	19.5
100(4")	880	20	50	170	120	130	19	25.5
125(5")	880	20	50	200	120	150	19	36.5
150(6")	930	20	50	220	160	180	23	46.5
200(8")	930	20	50	250	160	220	25	70
250(10")	980	20	50	300	180	280	27	102
300(12")	980	20	50	350	200	300	27	200

Flange code JIS 20K

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 set bolt for fixing faces 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(mm ²)	650	830	1440	1770	2990	4460	6840	11930	18610	25790	42940	62640	98000
Spring constant	K(N/mm)	50	52	53	53	80	87	155	185	210	290	490	540	700
Load by max. working pressure at 1.0MPa	Fp(N)	1300	1660	2880	3540	5980	8920	13680	23860	37200	51580	85800	125280	196000
Load by max. contraction at 25mm	Fe(N)	1250	1300	1325	1325	2000	2175	3875	4625	5250	7250	12250	13500	17500
Total load by max. working pressure	Fm=Fp+Fe(N)	2550	2960	4205	4865	7980	11095	17555	28485	42470	58830	98130	138780	213500
Load by hydraulic test pressure at 3.0MPa	(N)	1950	2490	4320	5310	8970	13380	20520	35790	55830	77370	128820	187920	294000

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 consi-

dered 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

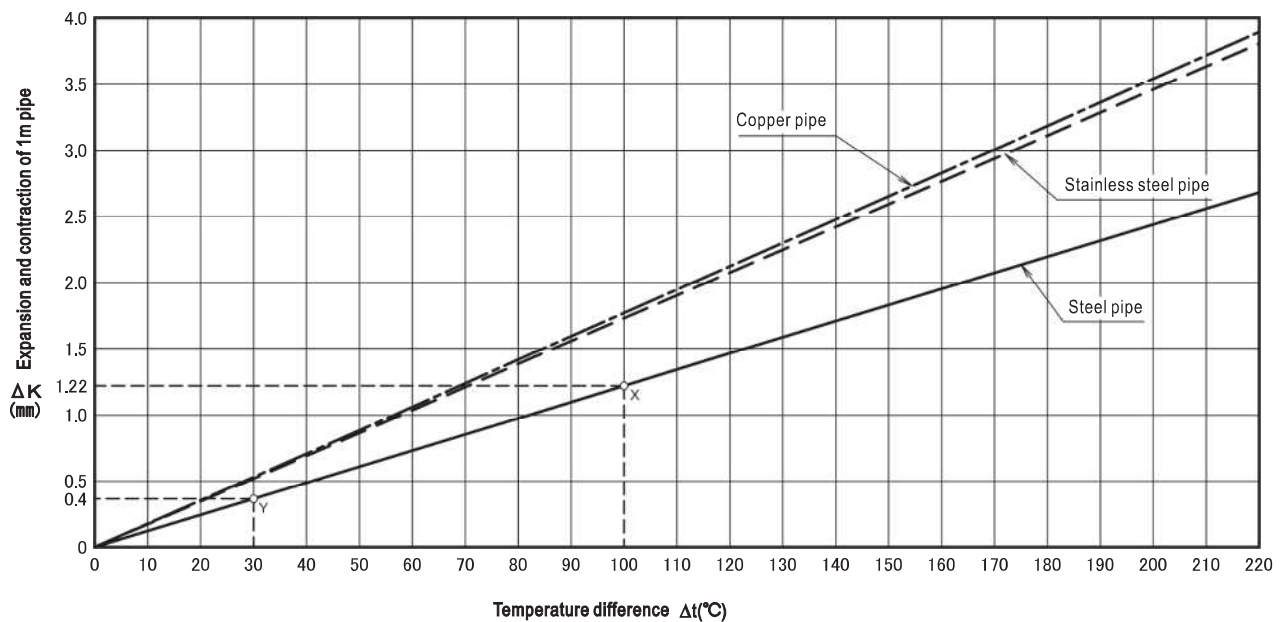
Type	Tensile test			Hardness test		
	Yield Strength N/mm ²	Tensile N/mm ²	Elongation %	HB	HRB	HV
SUS316L	175 or more	480 or more	40 or more	187 or less	90 or less	200 or less
SUS304L	175 or more	480 or more	40 or more	187 or less	90 or less	200 or less

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 $n = \frac{\Delta l}{\delta}$

$\Delta l = \beta \times \Delta t \times l$

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/°C)

Steel pipe (12.2×10⁻³)

Copper pipe (17.7×10⁻³)

Stainless steel pipe (17.3×10⁻³)

Δt : temperature difference (°C)
l : length of pipe (m)

● Example

Under the following conditions:

Length of pipe (l): 35m

Max. working temperature (t₁): 120°C

Min. ambient temperature (t₂): -10°C

Ambient temperature at the time of installation (t₃): 20°C

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:

$$\Delta t_1 = t_1 - t_2 = 120 - 20 = 100^\circ\text{C}$$

Temperature difference at the contraction side of pipe:

$$\Delta t_2 = t_3 - t_2 = 20 - (-10) = 30^\circ\text{C}$$

According to point X in Fig. 1,

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

According to point Y in Fig. 1,

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

Therefore,

The expansion of 35m pipe is:

$$\begin{aligned}\Delta l_1 &= k_1 \times l \\ &= 1.22 \times 35 = 42.7\text{mm}\end{aligned}$$

The contraction is:

$$\begin{aligned}\Delta l_2 &= k_2 \times l \\ &= 0.366 \times 35 = 12.81\text{mm}\end{aligned}$$

Step 2: Determine type and number of joints

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

$$\text{The expansion side of pipe } (\delta = 25\text{mm}): n = \frac{\Delta l_1}{\delta} = \frac{42.7}{25} = 1.71$$

$$\text{The contraction side of pipe } (\delta = 10\text{mm}): n = \frac{\Delta l_2}{\delta} = \frac{12.81}{10} = 1.281$$

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

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

$$\text{The expansion side of pipe } (\delta = 50\text{mm}): n = \frac{\Delta l_1}{\delta} = \frac{42.7}{50} = 0.854$$

$$\text{The contraction side of pipe } (\delta = 20\text{mm}): n = \frac{\Delta l_2}{\delta} = \frac{12.81}{20} = 0.641$$

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 $\pm 2\text{mm}$ for size 125mm or smaller pipes, and $\pm 3\text{mm}$ for size 150mm or larger pipes. The deviation of degree of parallelization of pipe should be within $\pm 2^\circ$.

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 F_m (N)

$$\begin{aligned}F_m &= F_p + F_e \\ F_p &= A_e \times P \\ F_e &= K \times S\end{aligned}$$

Load on main fixing of bending pipe F_b (N)

$$F_b = 2F_m \sin \frac{\theta}{2} + F_c$$

$$F_c = \left(\frac{2ApV^2}{g} \sin \frac{\theta}{2} \right) \times 98.0665$$

Load on intermediate fixing F_i (N)

$$F_i = F_e$$

F_p : Load in axial direction due to internal pressure (N)

F_e : Load due to specified contraction (N)

A_e : 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)

F_c : 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

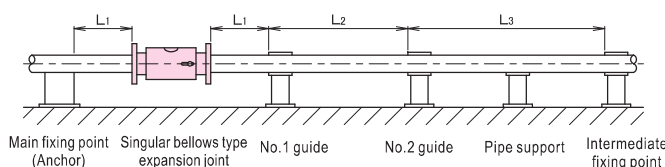
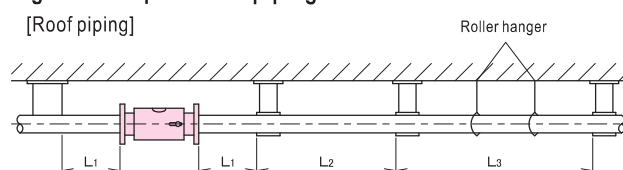


Fig.2-2 Example of roof piping



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.

$$L_1 \leq 4D$$

$$L_2 \leq 14D$$

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

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/mm²)

Steel pipe 200°C: $191 \times 10^3 \text{ N/mm}^2$

Stainless steel pipe 200°C: $183 \times 10^3 \text{ N/mm}^2$

Copper pipe 200°C: $116 \times 10^3 \text{ N/mm}^2$

I: Secondary moment of the cross section of pipe (mm⁴)

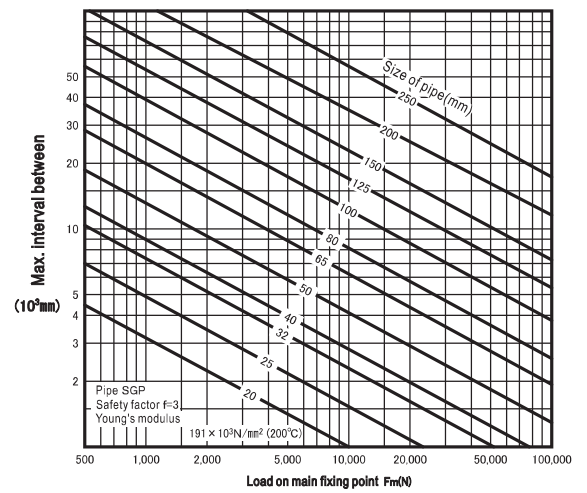
f: Safety factor (3 or larger)

F_m : Load on main fixing point (N)

② Pipe supporting

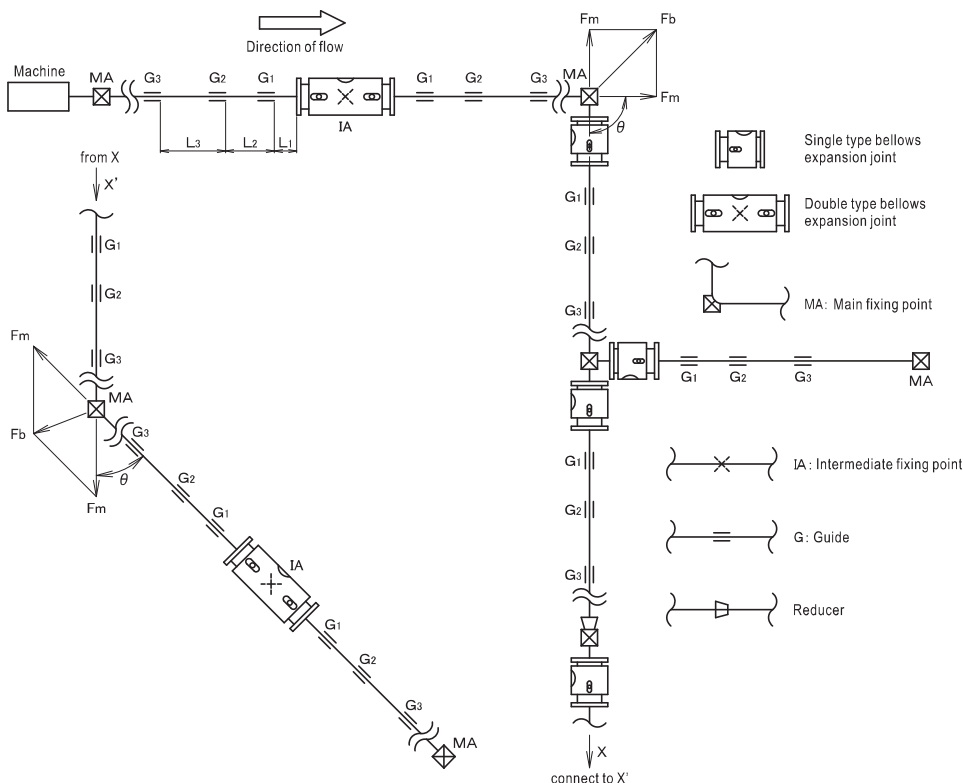
Install roller support or roller hanger guide to prevent pipe from bending due the weight of pipe or fluid.

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)

