AXIAL EXPANSION JOINTS - INSTALLATION INSTRUCTIONS

• At all times protect the bellows element itself from damage, such as dents, or scratches due to falling tools or sharp objects, weld splatter, arc strikes, etc.

• Expansion joints provided with lifting lugs should be lifted only by the designated lifting lugs.

• Remove any protective covering from the ends of the expansion joint.

• Check inside of expansion joint for dessicant bags or other material.

The following steps should be taken prior to installation of the expansion joint

1-Selection of the expansion joint:

Axial expansion joints must be carefully selected according to calculated thermal expansion amount of the connected pipelines. Bellows & connection (weld end, flange etc…) must be decided according to the system temperature, pressure and fluid type.

Springing load features of the expansion joints should be examined before creating fixed points.

Thermal expansion calculation of pipeline & movement capacity of the expansion joints

Expansion amount of the pipeline can easily be calculated with below formula, calculated amount is the key parameter for selecting appopriate expansion joint.

ΔL = α x Δt x L1
ΔL = Expansion amount (mm)

α = Pipe termal expansion coefficient (mm/m°C) (To be selected from the pipe material tables)
L1 = Pipe length between two fixed points (m)
Δt = Temperature difference between fluid and assembly (°C)

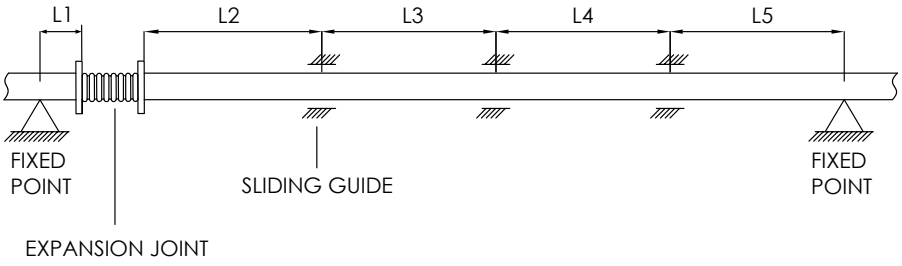
Calculated ΔL value positive (+) means expansion, negative (-) means compression at pipe section.
Expansion joint's movement capacity should be seletected opposite way the pipeline.
(+) If pipeline expands (heating), expansion joint compresses (-)
(-) If pipeline compresses (cooling) expansion joint expands (+)

2- Pipe Sectioning:

Only one expansion joint can be installed between two fixed points.
If the movement amount of the pipeline is to big to be absorbed by one expansion joint, pipeline should be divided in sections by creating additional fixed points.

3-Allocating the Expasion Joints:

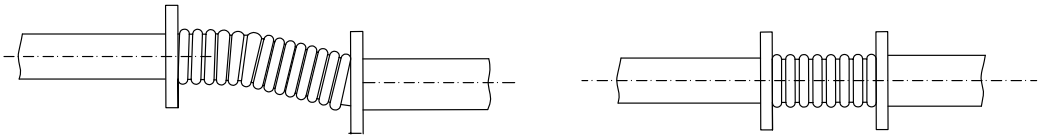
Expansion joints should be located as close as possible to the fixed point in order to risk of buckling.
Sliding guide & fixed point allocations should be completed as shown below.



L4 &L5 values should be selected from the guide tables of EJMA code system. (Table 1)

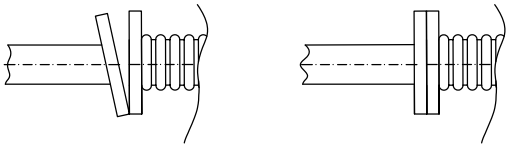
4-Connecting the Expansion Joints

Weld-end expansion joints: The attachment edges of the pipe should be smooth, clean and parallel to each other. Do not use bellows to correct for misalignment of piping unless this has been considered in the design of the expansion joint.



WRONG **RIGHT**

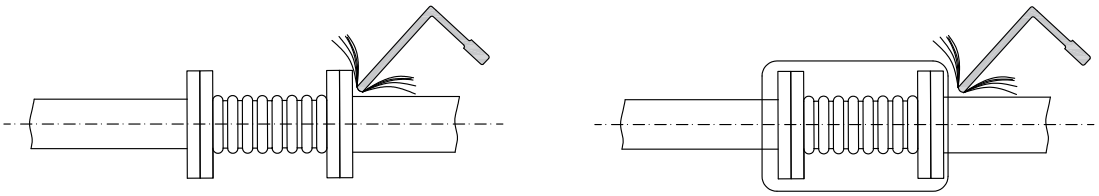
Counter flanges should be placed vertically to the pipe axis.



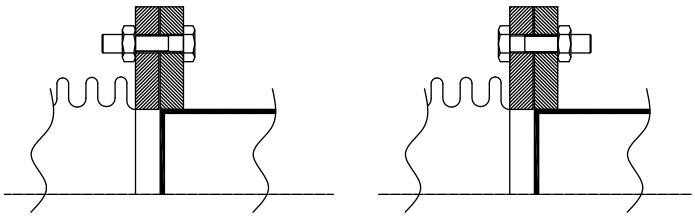
WRONG **RIGHT**

AXIAL EXPANSION JOINTS - INSTALLATION INSTRUCTIONS

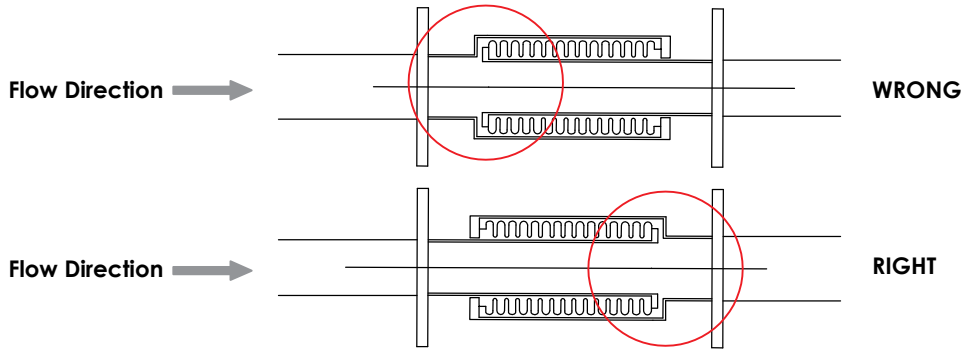
Using the proper electrode, weld the expansion joint to adjacent piping. Damages caused by arc sparks through welding process should be prevented. Bellows must be protected by a wet
towel or cloth during the welding.



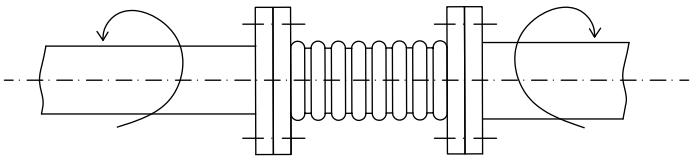
Orient expansion joint flanges so that the bolt holes are aligned with the mating flanges.



When a flow liner is installed in the expansion joint, orient expansion joint with flow arrow pointing in the direction of flow.



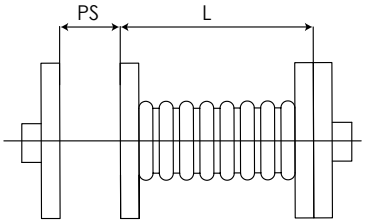
Do not torque the expansion joint to match the bolt holes of the mating flange.
This causes torsion on the bellows and will severely reduce the bellows capability during operation and may lead to premature failure of the expansion joint.



5-Pre-setting the Expansion Joints

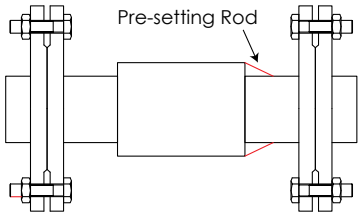
Expansion joints could be pre-stressed. As the expansion joints are often installed in cold pipelines they may be pre-stressed in order to absorb larger movements.

An example of pre-stressing amount is given below. Half of the total expansion amount may be practically considered. Expansion joint gap in the pipelines should be as big as L+PS. One side of the expansion joint should be assembled to counter flange, other must be assembled via long bolts to be tighten equally.

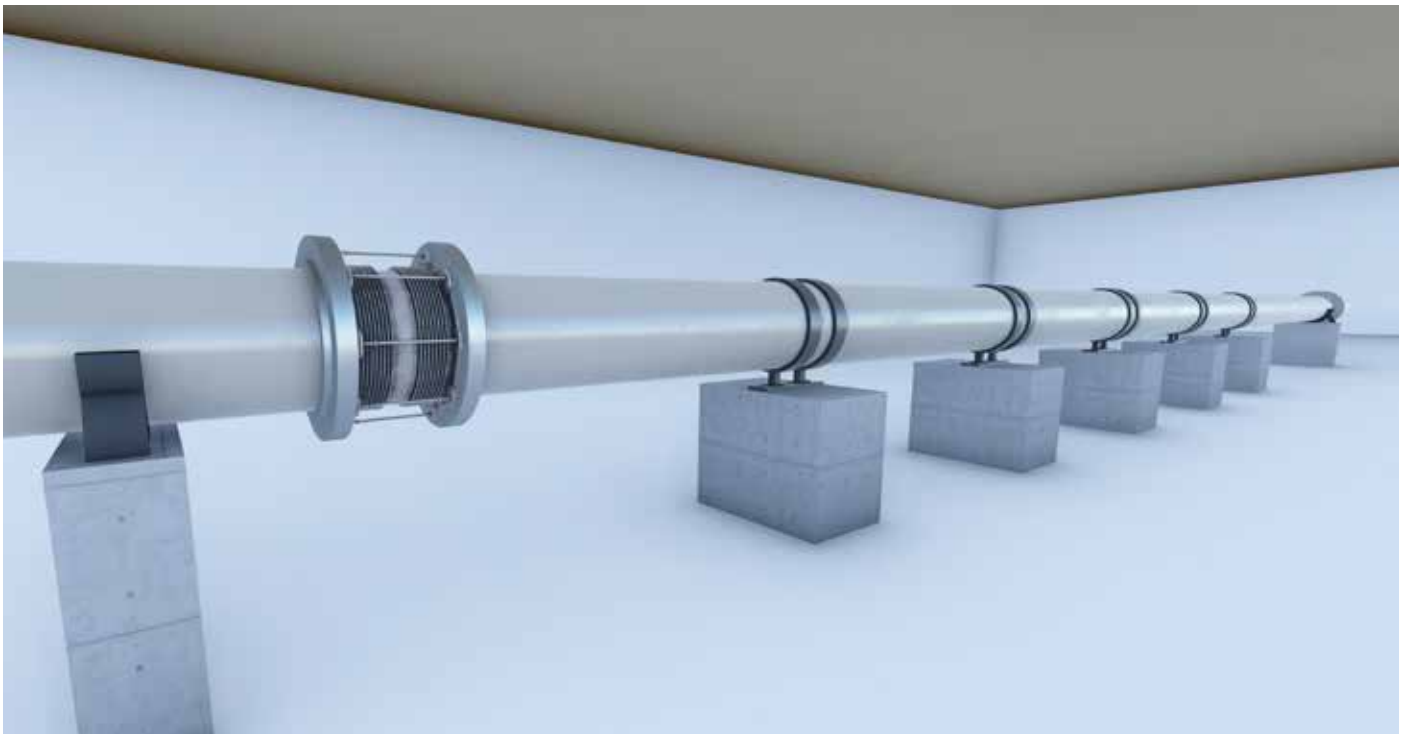


$$PS = \frac{\Delta L}{2} - \Delta L \frac{T_i - T_{min}}{T_{max} - T_{min}}$$

ΔL = Expansion amount
T_i = Ambient temperature
T_{min} = Minimum temperature
T_{max} = Maximum temperature

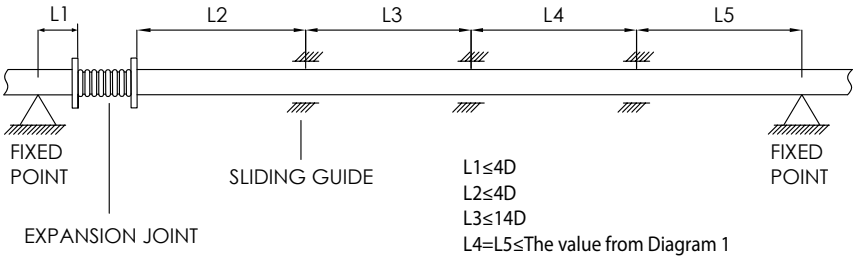


Pre-stressing of externally pressurized expansion joints are done during the production. After the installation of expansion joint, pre-setting rods are taken out and the expansion joint gets ready.



AXIAL EXPANSION JOINTS - INSTALLATION INSTRUCTIONS

CALCULATION OF ANCHOR (FIX POINT) LOADS



MAINTENANCE OF EXPANSION JOINTS and SPARE PARTS

Metal Bellows Expansion Joints are maintenance free items, as long as the product selection and installation are done properly. No additional spare part is needed during the lifetime.

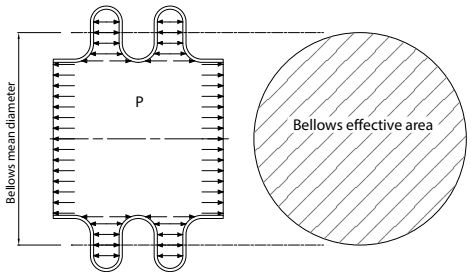
Metal Bellows Expansion Joints have been designed to absorb a specified amount of movement by flexing of the thin-gauge convolutions. If proper care is not taken during installation, it may reduce the cycle life and the pressure capacity of the expansion joints which could result in an early failure of the bellows element or damage the piping system.
The following recommendations are included to avoid the most common errors that occur during installation. When in doubt about an installation procedure, contact the manufacturer for clarification before attempting to install the Expansion Joint.

There are two major loads to be calculated in piping systems where expansion joints installed in order to absorb thermal movements.

1- PRESSURE THRUST:

Pressure thrust is the most important force encountered in pressurised pipe systems and if ignored or incorrectly calculated, it can have a major impact on the pipe systems and the anchors. Pressure thrust can not be eliminated as long as the axial bellows movement exist in the piping and it must be calculated very carefully.

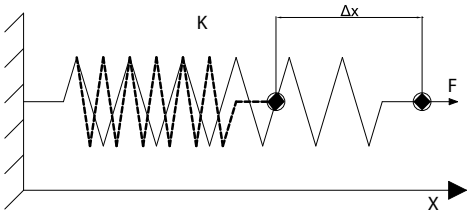
Bellows usually have a cross-sectional area, which is slightly larger than the pipe diameter due to the height of the convolutions. This is very important as it should be taken into consideration when designing the fix points. The effective cross section is given by the sketch below. Pressure thrust force is calculated by bellows mean diameter multiplied by the maximum system pressure as follows:



Fp = P x A
Fp = Pressure thrust force [N]
P = Pressure [bar]
A = Bellows mean diameter area [mm^2]

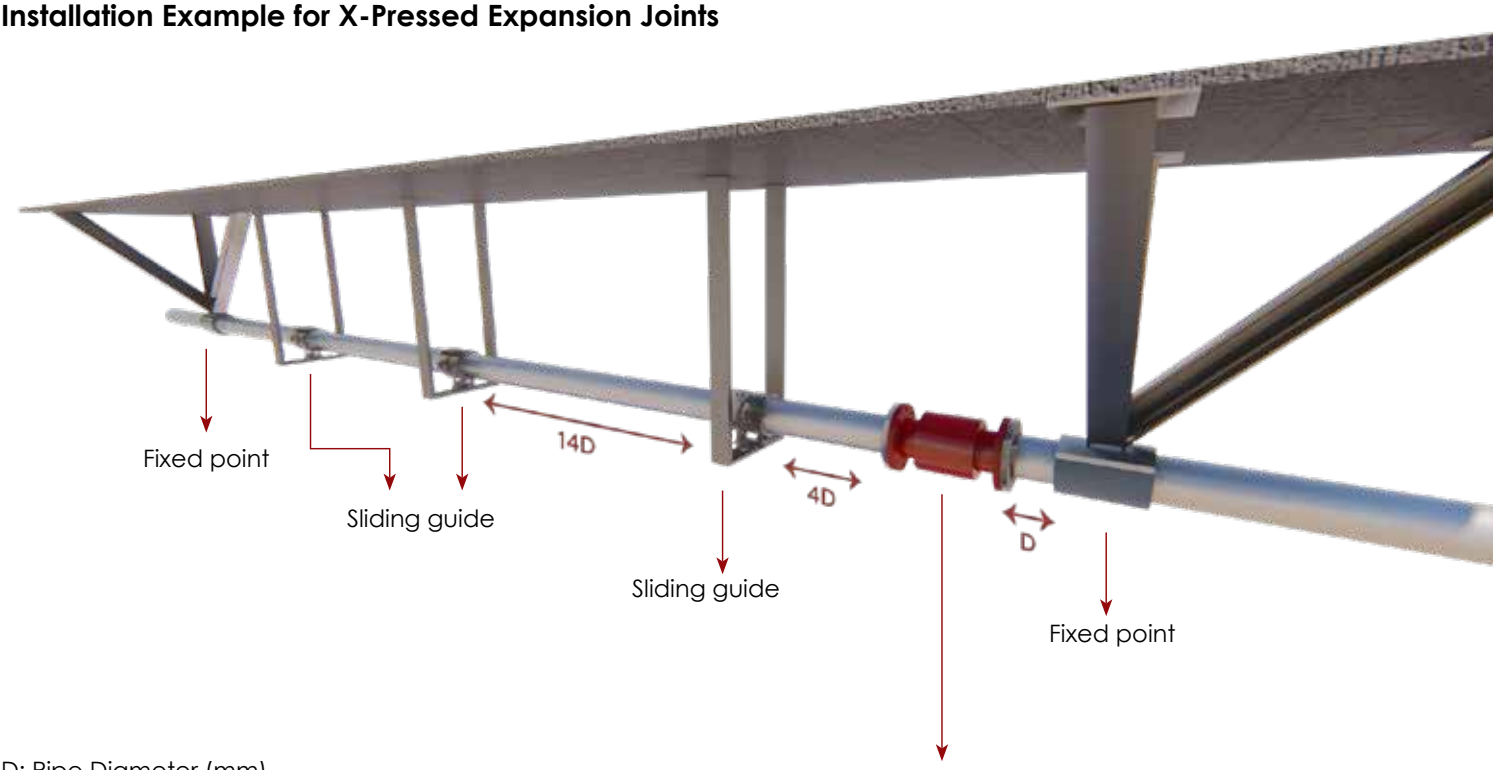
2- SPRINGING FORCE:

Flexible bellows can be compared to a steel spring in its flexible motion. The spring rate is an expression of the force required to compress or extend the bellows, or alternately its resistance to deflect, which is another factor to take into account when calculating loads on fix points. The amount of the spring force is dependent on the bellows spring rate and the amount of the bellows movement, which is calculated as follows:

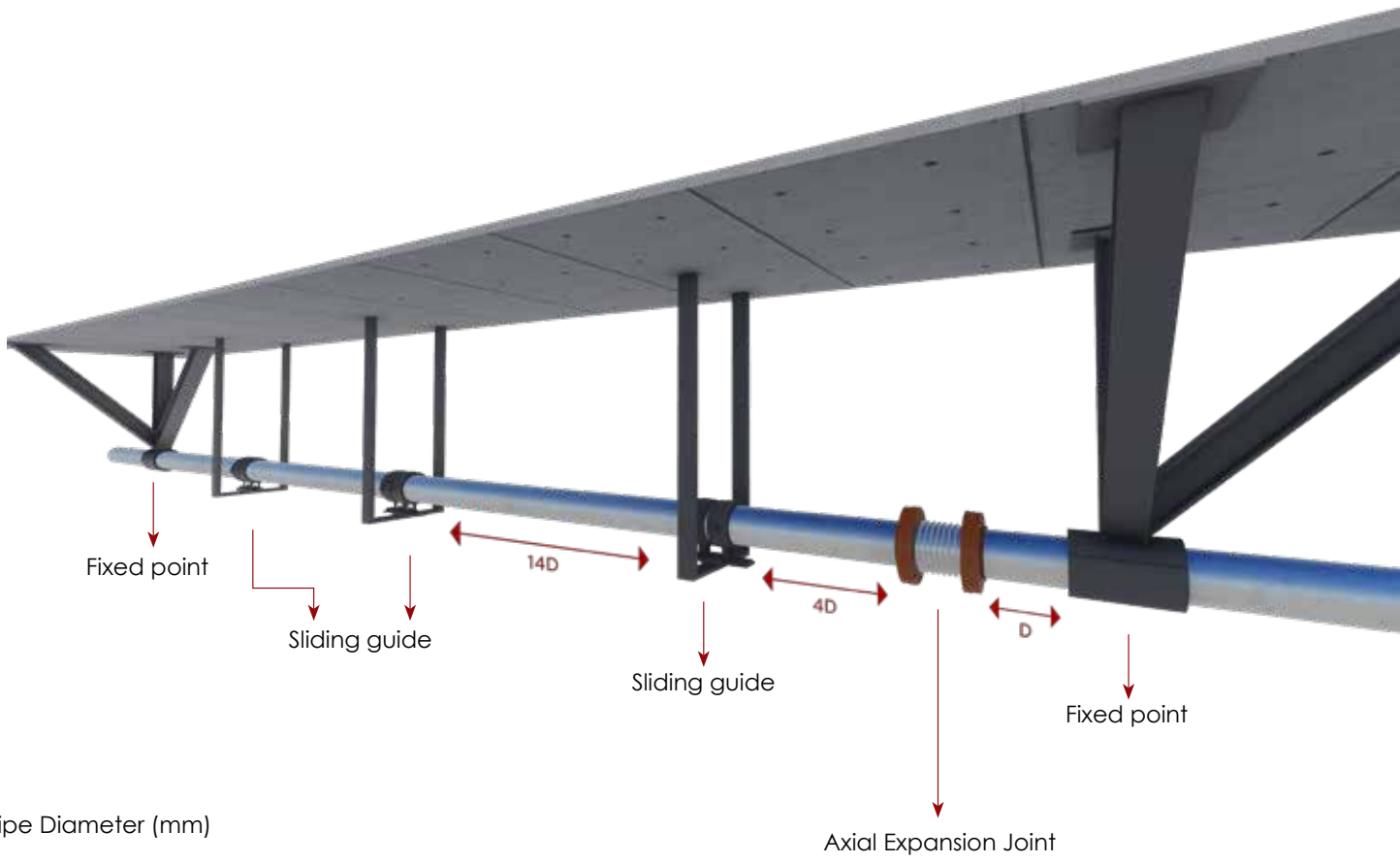


F = K x X
F = Force [N]
K = Spring rate [N/mm]
X = Movement [mm]

Installation Example for X-Pressed Expansion Joints



D: Pipe Diameter (mm)



D: Pipe Diameter (mm)

AXIAL EXPANSION JOINTS - INSTALLATION INSTRUCTIONS