



METALLIC BELLOWS

Introduction

Metallic expansion joints are used in piping systems, pressure vessels, valves etc. to absorb thermal expansion, vibration and to react at predetermined pressures and forces. They are used successfully not only in comparatively simple applications such as heating and ventilating systems and vehicles exhaust pipes, but also in sophisticated areas of nuclear reactor fuel guide tubes, high technology research into nuclear fusion, and aircraft service ducts.

Bellows designs are based on exhaustive research and testing of the expansion joint element. This includes cyclic fatigue testing and metallurgical examination of the convolution form.

This process is being continually updated using in-house computer programmes. This allows the production of graphical solutions and formulae for any variation in the design.

Bellows are also available to meet the exacting requirements of international standards via a modified design programme to satisfy calculation methods and fatigue analysis.

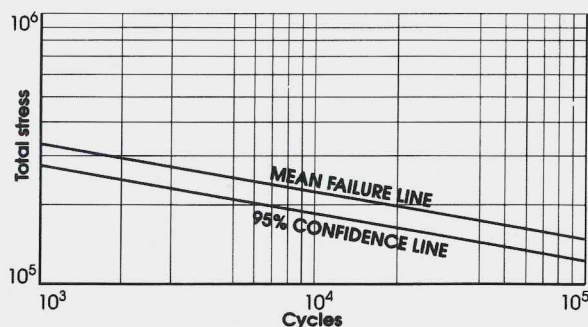
Examples of those standards are:

ASME VIII Appendix 26.

ANSI B 31.3. Appendix X.

Stoomwezen rules.

CODAP-8, French standard.

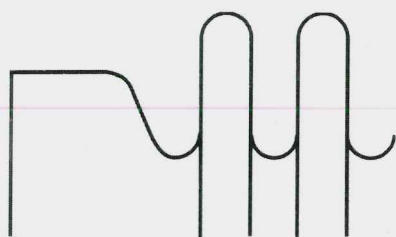


For critical applications such as for nuclear reactors and aircraft, bellows are produced for prototype testing in order to satisfy the exacting reliability required by these applications.

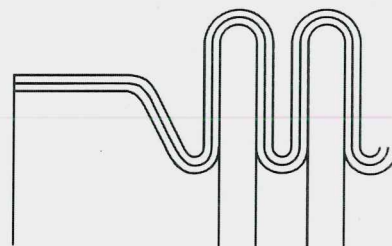
In judging the design of a bellows convolution, consideration has to be given to pressure and temperature requirements together with movement and flexibility, the optimum solution can provide for a convolution of the unreinforced type, single or multi-ply construction for low flexibility and large movement and root ring reinforced type for high pressures.

The versatility of our manufacturing facilities will allow multi-ply bellows to be manufactured for pressures up to 70 bar and beyond.

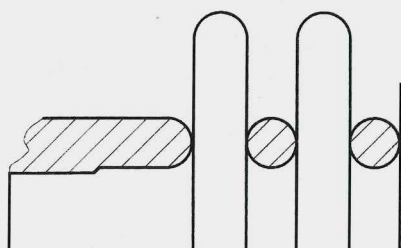
The thickness of material resulting from a design analysis can vary from single and multi-ply 0.1 mm thick for small diameters up to 4 mm thick.



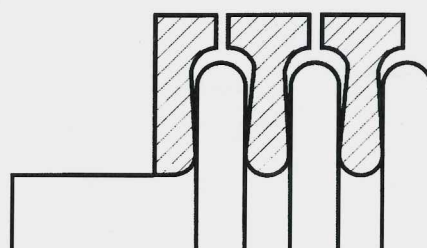
Single ply bellows



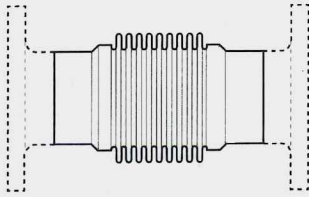
Multiply bellows



Reinforcing rings

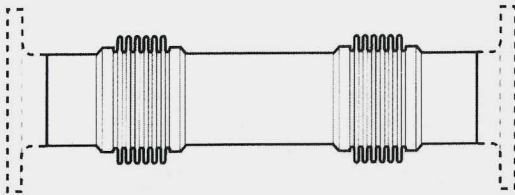


Equalizing rings



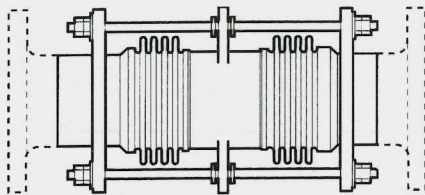
SINGLE EXPANSION JOINT

The simplest form of expansion joint, of single bellows construction, designed to absorb all of the movement of the section in which it is installed. The most common example is that of a single bellows designed to absorb axial movements only. This is often referred to as an axial expansion joint.



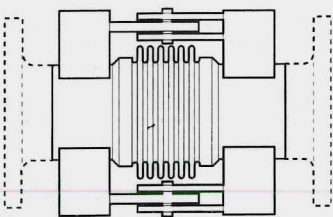
UNITED DOUBLE EXPANSION JOINT

An untied double expansion joint consists of two bellows separated by a short connecting tube and is capable of absorbing combinations of axial, lateral and angular movement. For this reason it is sometimes referred to as a universal expansion joint.



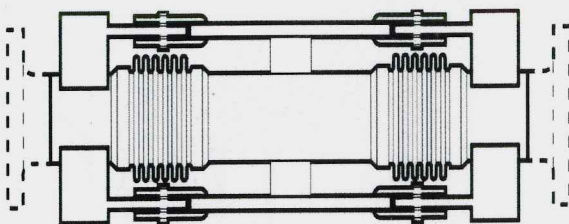
TIED DOUBLE EXPANSION JOINTS

A tied double expansion joints differs from an untied double unit in that the pressure thrust is carried by external or internal ties across the bellows. This type of unit accommodates movement in the lateral direction in any plane. Provided there are no more than two tie bars it can accommodate angular movement of the end flange at ninety degrees to the plane of the tie bars.



HINGED SINGLE EXPANSION JOINT

A single hinged expansion joint contains one bellows and is designed to permit angular rotation in one plane only by the use of a pair of pins through hinge plates attached to the expansion joint ends. The hinges and hinge pins must be designed to restrain the thrust of the expansion joint due to internal pressure and extraneous forces, where applicable.



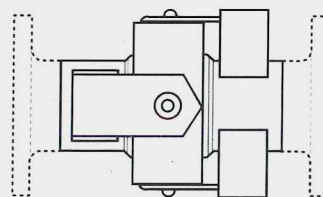
HINGED DOUBLE EXPANSION JOINT

A double hinged expansion joint is similar to a double tied unit in performance except that lateral movement can only be in one plane at ninety degrees to the hinge straps. An exception to this is when the unit is fitted with P.T.F.E. lined spherical bearings at the hinge points for transmittal of low forces due to friction, in this case a small degree of lateral movement can take place in line with the hinge straps.



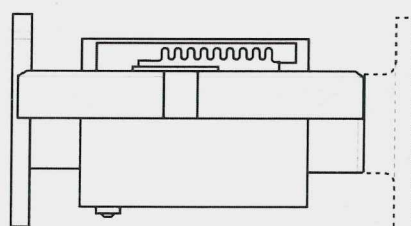
GIMBAL SINGLE EXPANSION JOINT

A single gimbal expansion joint contains one bellows and is designed to permit angular rotation in any plane by the use of two pairs of hinges affixed to a common floating gimbal rings. The gimbal ring, hinges and pins must be designed to restrain the thrust of the expansion joint due to internal pressures.



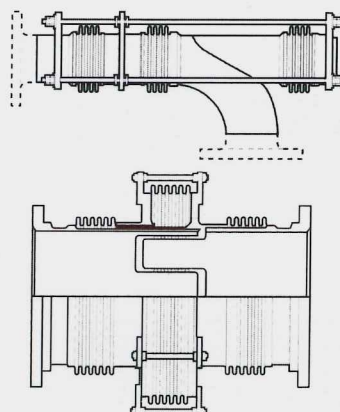
EXTERNALLY PRESSURISED EXPANSION JOINT

In piping systems an externally pressurized expansion joint is designed so that at the pressure within the pipe acts on the outer surface of the bellows. This form of construction is often used where it is periodically necessary to completely drain the fluid within the system and where large axial movements are required.



PRESSURE BALANCED EXPANSION JOINTS

A pressure balanced expansion joint is designed to absorb axial movement and/or lateral deflection while restraining the pressure thrust by means of tie rods. These interconnect the flow bellows with an opposed bellows also being subjected to line pressure. A pressure balanced expansion joint sometimes contains two bellows in the flow section separated by a common connector to permit greater lateral movement.



BELLOWS FOR HEAT EXCHANGERS

Axial type bellows are used to absorb the differential expansion between shell and tubes in fixed head and floating heat exchangers. For fixed head heat exchangers, the bellows is installed in the shell and is only designed for shell side conditions.

The construction of the assembly usually consists of a thin wall bellows, single or multi-ply, manufactured in a material suitable for resisting the corrosion effects of the shell side media. This is then welded to stub pipe ends compatible with the shell material and size. The assembly can be fitted with installation or guide bars.

For floating head type heat exchangers, the same principles as above apply except that the bellows should be designed for shell and tube side conditions.

