

Metal Bellows Expansion Joints - Control your Heat, Movement and Pressure

Piping systems are ubiquitous to heavy industrial markets. If there is fluid or gas movement, be it in the petrochemical, electric power supply, paper and pulp or a variety of OEM industries, optimal operation and "up-time" require state-of-the art piping systems to keep your plant competitive, or better, ahead of the curve. You know your business, and you know that in order to be profitable, your system must run at maximum efficiency. Metal Bellows Expansion Joints allow you to control fluid movement and containment in your system under a wide variety of pressures, thermal expansion and contraction, pulsations, vibration, equipment movement and convoluted routing requirements.

Typically, the key component of an expansion joint is the Metal Bellows element. Flexibility is paramount in containing the media and the pressure inherent in the system. Metal Bellows Expansion Joints, thin-walled, corrugated membranes, provide this flexibility.

An excellent solution is the use of punch formed, (expanded mandrel), manufactured Metal Bellows, followed by finish rolling. Rectangular metal sheets are sheared and rolled into a tube, which is then weld-mated using no filler metal. This longitudinal seam weld is then "plannished" to match the parent material thickness. "Bellows," of course, implies convolutions. Once the welding is complete, and testing to tolerance performed, the convolutions are individually punched, drawing material from the top and bottom of the tube, thus creating consistency in the thickness of the Bellows material. Finally, the required "U" shape of the Bellows is implemented through the use of rollers. The Bellows are then trimmed, and ready for installation of attachment ends.

To assure the best performance of Metal Bellows Expansion Joints, the design, quality assurance, and manufacturing practices should be in compliance with EJMA, ASME Section VIII and IX, ANSI B31.1, B31.3 and other major industry standards such as UOP.

The Metal Bellows Expansion Joints may experience one or a combination of axial, angular, lateral, or twisting movement. Depending on system requirements, a variety of unrestrained and/or restrained assemblies, may be utilized. Unrestrained Assemblies include the following:

- * Single Joint Assemblies: a single Metal Bellows welded to either a flange or pipe end.
- * Universal Expansion Joint Assemblies: the connection of two pipe end or flange bellows with a center spool piece. This provides more flexibility with respect to axial, and angular movement.
- * Externally Pressurized Expansion Joints: line pressure acts externally on the bellows component through use of a pressure chamber. More convolutions can be used to control axial movement, and alleviate concerns of bellows instability.

Four extremely effective Restrained Metal Bellows Expansion Joint Assemblies lead the pack:

- * Tied Single Bellows Assemblies: a combination of the Single Bellows Assembly with tie rods, increasing system design flexibility.
- * Tied Universal Assemblies: like Universal Assemblies, these limit lateral offset and angular movement by utilizing tie rods to absorb pressure thrust.
- * Hinged Bellows Assemblies: angular movement is limited to one plane. Two or three Hinged Bellows Assemblies may be employed to handle large amounts of expansion in high pressure piping situations.
- * Gimbal Bellows Assemblies: allow angular movement in all planes, while absorbing pressure thrust and twisting movement. When used in conjunction with a Single Hinged unit, these are particularly suited to maximize absorption in multi-planer piping systems.

While an in-depth discussion is beyond the scope of this article, a variety of options and accessories are available, and often necessary, to complete the installation of Metal Bellows Expansion Joint Assemblies. Briefly, these include the following:

- * Ties rods: attach to an Expansion Joint assembly to mitigate pressure loads, as well as ancillary forces such as dead weight.
- * Limit rods: a "fail-safe" addition which addresses the situation of occasional anchor overload or system malfunction which could cause bellows expansion beyond tolerance.
- * Liners: internal sleeves used to protect the internal surface of the metal bellows from media which may compromise its integrity.
- * Purge Connections: used in tandem with Liners, keep the bellows within high temperature tolerance conditions, such as oil industry applications.
- * Covers: are used to protect the Metal Bellows Expansion Joints from any detrimental external elements.
- * MAIN ANCHORS: resist the effects of all forces acting upon them, including pressure thrust, bellows spring resistance, frictional resistance of pipe guides, and inertial forces at bends and elbows.
- * INTERMEDIATE ANCHORS: used to divide a long pipe run into shorter individual expanding sections.
- * DIRECTIONAL ANCHORS: permit movement in one direction only.

* PIPE ALIGNMENT GUIDES: control thermal expansion in the system so that the movement applied to the bellows assembly is axial only.

As an example, if two expansion joints of different pipe diameters are used in the same section of pipe, such as a line containing a reducer, the pressure thrusts are no longer equal. In this case, the anchor dividing the expansion joints must be a main anchor designed to withstand the difference in pressure thrust generated by the different size Metal Bellows Expansion Joints.

Piping your media to the desired destination is essential to the success of your business; control the heat, movement and pressure on your operation with the appropriate use of Metal Bellows Expansion Joints, and you control the heat, movement and pressure on yourself.

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About the Author

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