ANACONDA EXPANSION JOINTS . . . .

Anaconda has produced flexible metal hose assemblies for over sixty-five years and has developed a vast amount of knowledge in the design, manufacture and application of metal hose and expansion joints.

This experience combined with extensive testing has been used to develop reliable expansion joint assemblies, available as standard units in a broad range of sizes and types. They may also be custom designed for unusual applications.

The design and performance data in this bulletin minimizes and simplifies computations used in selecting the proper standard Anaconda Expansion Joint unit for a given requirement.

High stresses induced in piping and ducting systems due to temperature change have long been a problem. Five basic compensating devices are:

1. **Inherent pipe flexibility . . .** through use of properly proportioned pipe runs and right angle turns. In many instances, related component locations or lack of space render this method impractical.
2. **Pipe loops . . .** generally very cumbersome and require excessive space.
3. **Packed expansion joints . . .** slip joint type, absorb axial movement only . . . need periodic maintenance.
4. **Flexible metal hose . . .** only for lateral movement.
5. **CORRUGATED METALLIC BELLOWS**
   Anaconda type of expansion joint . . . compact . . . absorbs movement in several directions.

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EXPANSION JOINT MANUFACTURERS ASSOCIATION
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ANACONDA Metal Hose is an active member of the Expansion Joint Manufacturers Association

WHY AN EXPANSION JOINT WORKS . . .

Anaconda's Expansion Joint ratings have been established to produce a satisfactory cycle life for the Expansion Joint. Expansion Joint bellows are capable of movement in an axial, angular or lateral direction. These motions are possible because of the ability of the convolution sidewall to deflect under load. The cycle life of any bellows is directly affected by the magnitude of the deflection. This is evidenced in the catalog data covering motion vs. cycles. The greater the motion for a given bellows the lower the anticipated life cycles.

BASIC TERMINOLOGY

- **ANGULAR ROTATION**
The displacement of the longitudinal axis of the Expansion Joint from its initial straight line position into a circular arc. Angular rotation is occasionally referred to as "rotational movement". This is not torsional rotation.

- **AXIAL COMPRESSION**
The dimensional shortening of an Expansion Joint along its longitudinal axis. Axial compression has been referred to as axial movement, traverse, compression, etc.

- **AXIAL EXTENSION**
The dimensional lengthening of an Expansion Joint along its longitudinal axis. Axial extension has been referred to as axial movement, traverse, elongation or extension.

- **BELLOWS**
The flexible element of an Expansion Joint, consisting of one or more convolutions and the end tangents, if any.

- **COLD SPRING OR PRESET**
The pre-aligning of an Expansion Joint assembly such that in the installed or cold position, the joint is offset one half the expected movement so that when the system heats up, the joint will move through its neutral position and end up in an offset position on the opposite side of the centerline.

- **COMBINED MOVEMENTS**
Both axial and lateral movements absorbed by the same Expansion Joint.

- **CYCLE**
One complete movement of an Expansion Joint from initial to extreme position and return.

- **CYCLE LIFE**
Total number of cycles an Expansion Joint will absorb at rated movement.

- **DEFLECTION FORCE**
Amount of force to cause movement in an Expansion Joint.

- **EXTERNAL COVER**
A device used to protect the exterior surface of the bellows of an Expansion Joint from foreign objects or mechanical damage.

- **FITTINGS**
Welding nipples, fixed flanges or floating flanges attached to the ends of the bellows section.

- **INTERNAL SLEEVE**
A device which minimizes contact between the inner surface of the bellows of an Expansion Joint and the fluid flowing through it.

- **LATERAL DEFLECTION**
The relative displacement of the two ends of an Expansion Joint perpendicular to its longitudinal axis. This has been referred to as lateral offset, lateral movement, parallel misalignment, direct shear, transverse movement, etc.

- **MAXIMUM TEST PRESSURE**
Highest permissible pressure which can be exerted on an Expansion Joint without causing objectionable deformation.

- **MAXIMUM WORKING PRESSURE**
Greatest pressure which can be exerted on the Joint during operation.

- **MOVEMENT**
The dimensional changes which the Expansion Joint is required to absorb, such as those resulting from thermal expansion or contraction.

- **PIPE ALIGNMENT GUIDE**
A pipe alignment guide is a form of sleeve or framework fastened to some rigid part of the installation which permits the pipe line to move freely only along the axis of the pipe.

- **PIPE ANCHOR**
Device used to firmly fix the location of a point in the piping system. No movement should occur at the anchor point.

- **PURGE CONNECTIONS**
Purge connections, where required are usually installed at the sealed end of each internal sleeve of an Expansion Joint for the purpose of injecting a liquid or gas between the bellows and the internal sleeve to keep the area clear of errosive and corrosive media and/or solids that could pack the convolutions.

- **RATED MOVEMENT**
Rated movement is the maximum amount of movement (axial compression, lateral deflection, angular rotation, or any combination thereof) which an Expansion Joint is capable of absorbing.

- **SHIPPING RODS**
Temporary supporting members attached to the fittings of an Expansion Joint to prevent movement of the joint and retain dimensional stability during shipping, handling and installation.

- **SPRING RATE**
The force required to compress or extend the Expansion Joint, usually expressed in pounds per inch.

- **THRUST AREA**
Area over which the effects of pressure in an Expansion Joint will produce a longitudinal force in the piping system.

- **TIE RODS**
Rods or bar devices for the purpose of restraining the Expansion Joint from the thrust due to internal pressure acting on the thrust area of the Expansion Joint, plus other specified forces.

- **TORSIONAL ROTATION**
The twisting of one end of the Expansion Joint with respect to the other end about its longitudinal axis. This twisting produces extremely high membrane stresses in the bellows. For this reason, Expansion Joints must not be used to absorb tortional rotation.

- **VELOCITY**
The speed at which the medium flows through the Expansion Joint, usually specified in feet per second.

LINERS AND COVERS

LINERS (Internal Sleeve) AND EXTERNAL COVERS

A liner should be CONSIDERED AND USED where service conditions warrant. The purpose of a liner is to minimize contact, smooth flow, control erosion and eliminate resonance caused by the medium passing through the bellows.

An external cover should be considered if the unit is to be located where damage may occur. Expansion Joint performance is materially affected by dented or otherwise damaged bellows. In vertical installations, the sleeve should be attached at the upper end to prevent trapping of water, dirt or other foreign materials between it and the bellows.

Where an Expansion Joint is furnished with internal sleeves, external covers, or tie devices spanning the bellows, these components must be designed with adequate clearances to accommodate the lateral deflection or angular rotation of the Expansion Joint. The amount of clearance required is directly proportional to the displacement and, if the Expansion Joint is cold sprung 50%, these clearances can be reduced to a minimum. By this means, internal sleeves of maximum diameter can be furnished, the overall diameter of an Expansion Joint incorporating external covers or tie devices minimized, and the design of external structures simplified.

Internal sleeves should be specified for all Expansion Joints, regardless of the metal of the bellows, in the following cases:

a. Where it is necessary to hold friction losses to a minimum and smooth flow is desired.

b. Where flow velocities are high and could produce resonant vibration of the bellows. (This is dependent on the diameter and media being conveyed).

c. When turbulent flow is generated upstream of the expansion joint by changes in flow direction, valves, tee or elbow sections, cyclonic devices, etc. When sleeves are long or large in diameter and turbulence is high, heavy gauge sleeves may be required.

d. Where there is a possibility of erosion, such as in lines carrying catalyst or other abrasive media, heavy gauge sleeves should be used. At no time should the relatively thin bellows be directly exposed to erosion.

e. Where there is reverse flow, heavy gauge sleeves may be required to prevent buckling of the sleeve and possible damage to the bellows.

f. For high temperature applications to decrease the temperature of the bellows and enable the bellows metal to retain its higher physical properties. (To obtain a maximum effect, the Expansion Joint should not be externally insulated.)

Internal sleeves should not be used where high viscosity fluids such as tars, etc., are being transmitted, since these fluids may cause "packing up", "coking" and "caking" which, in turn, may cause premature Expansion Joint failure. Where the fluid is such that purging will effectively prevent the "packing up", internal sleeves may be used in conjunction with purge connections.

Where lateral deflection or rotation is present, the sleeve must be sufficiently smaller in diameter to provide clearance between the O.D. of the sleeve and the I.D. of the bellows or pipe nipple. If this reduction of inside diameter is objectionable, an oversize bellows or an alternate Expansion Joint design must be used, or the Expansion Joint may be cold sprung.

Drain holes should be provided for sleeves in Expansion Joints for steam or liquid service when the flow direction is vertically upward.