

# The Bellows Bottom Line

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## Practical advice on expansion joints

by Greg Perkins

### This month - Pressure Thrust

The good, and dark side of the force

#### The force is always with us

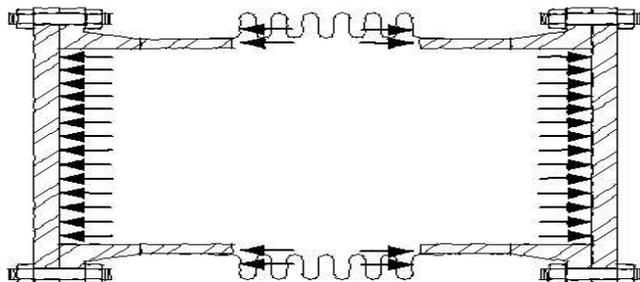
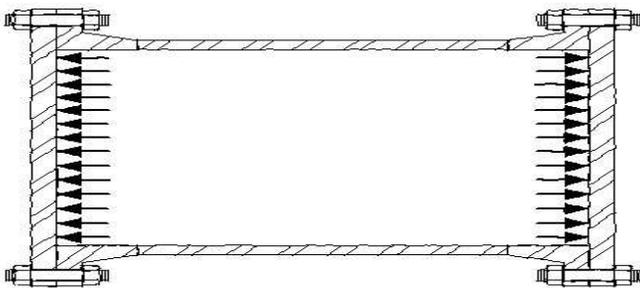
A bellows exerts a longitudinal force when internally pressurized. What's the big deal? So does a pipe. Ahhh, yes, but that force is quietly restrained by the rigidity of the pipe.

When a longitudinally flexible element (AKA a bellows) is inserted, there is no longer a natural restraint. If that force is overlooked in a piping design it can bend pipe and structure, move equipment, and generally ruin an otherwise uneventful day.

#### The source of the force

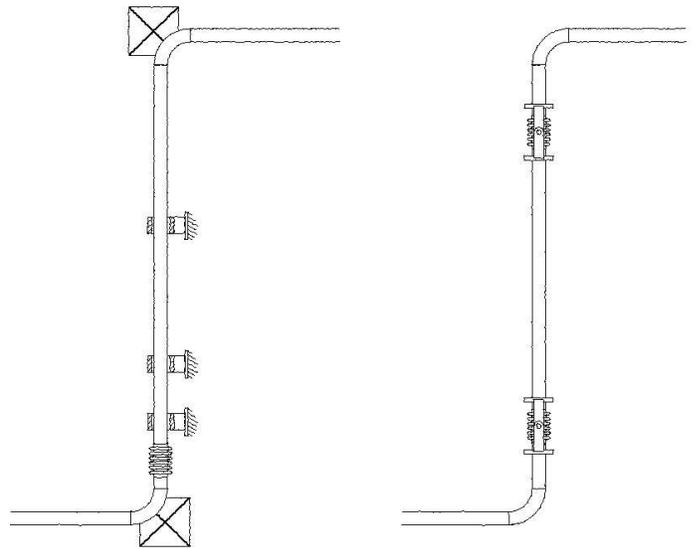
Consider a pressurized pipe blanked off with blind flanges. There is a force on the blind flanges that the bolts have to restrain. That load is transferred through the bolts and onto the cross-sectional area of the pipe. That force is equal to the pipe inside diameter cross-sectional area (in<sup>2</sup>) multiplied by the internal pressure (lb/in<sup>2</sup>).

Now, slip a bellows into that assembly and there is nothing holding that force back; without a restraint somewhere, it will elongate.



#### Becoming one with the force

In many piping systems this load is restrained by anchors located at each change of pipe direction. The piping still has a portion of that pressure thrust acting on the end of the pipe so guides are included to keep the pipe straight and prevent buckling.



Other piping system types have load bearing hardware in the form of rods, or pinned linkages that restrain the pressure thrust within the expansion joint assembly. These devices, by design, usually limit the bellows movement to just lateral or angular directions.

#### Don't underestimate the force

Designers need to determine the right expansion joint system which will either have load bearing anchors on the piping or load bearing hardware on the expansion joint assembly.

Maintenance needs to understand the role of these load bearing parts and not remove any rods, plates, or pins that are critical for operating conditions.

A handwritten signature in black ink, appearing to read "Greg Perkins".

Next Month - Refurbishing Expansion Joints  
Critical tips during an outage