

How Not to Use a Rubber Expansion Joint

Pay careful attention to these 9 issues.

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Rubber expansion joints are likely the least understood and most abused component in a piping system. They are flexible, stretchy and easily forced into lots of places despite what the installation instructions say. Most of the time, rubber joints are merely an afterthought in multimillion-dollar piping systems—until things go awry.

The rubber joint is unmatched for vibration isolation. If properly installed, a rubber joint can greatly reduce equipment nozzle loads. Its resilience allows it to be installed in many different systems under a range of temperatures, pressures and media. What could possibly go wrong?

Blame Mr. Murphy if you want, the fates or the alignment of the planets. The reality of most failures is more straightforward. Most of the time, it is installation. More specifically, not following the manufacturer's instructions. See Images 1 to 7 illustrating the ugly aftermath of ignored installation instructions and unforeseen operating conditions.

Learn these lessons well so your piping system does not become the subject of another article.

Respect the Dimensions

Sometimes flexibility is a disadvantage. Why? Because it is easy to compress a joint into a space that is too small, which is exactly the problem in this example. The bead was damaged as the joint was forced into a gap between flanges, resulting in a seal failure. Spherical expansion joints rely on this bead to form a seal between flanges. If the bead is damaged, the building engineer will curse your name for eternity. Do not violate the face-to-face dimensions of an expansion joint.

Alignment Is Still Necessary

Pipes misaligned? Think a bendy, stretchy rubber joint will fix the situation? Think again. This joint was installed between two misaligned flanges. A typical scenario may look like this:

1. Joint installed between two misaligned flanges
2. Joint begins leaking at the flange-to-flange seal in a week (or month, or several months)
3. Bolts tightened, leak stops. In the meantime, the rubber bead takes a compression set, becoming less resilient.
4. Repeat steps 2 and 3 several times
5. Bead is compressed to about 1/16th inch, rips apart from the body, pump room is now a water park

Do not turn your pump room into a water park or, even worse, a sewage tank. Align those flanges before installing expansion joints.



IMAGE 1: What's wrong with this picture? (Images courtesy of the author)



IMAGE 2: Joint compressed into space too small



IMAGE 3: Joint installed between two misaligned flanges.



IMAGE 4: Failed expansion joint



IMAGE 5: Hard-boiled expansion joint



IMAGE 6: Over-extended spherical joint



IMAGE 7: Media reacts with rubber

Consider Steam Generation

Did you know water pumps can generate steam? This operator did not. In this unfortunate scenario (Image 4), the operator closed the pump isolation valves with the pump operating, dead-heading the pump. This situation is fine for a short duration, but eventually all that mechanical energy added to the water has to go somewhere. It went into heat. The water contained in the pump and pipe up to the isolation valves had so much energy added that it flashed to steam. The expansion joint was the first component to fail, which was fortunate for the pump. The temperatures and pressures exceeded the rubber performance limits and the joint failed, nobly sacrificing itself for the greater good of the pump and piping.

Pay Attention to Temperature Limits

The previous example showed both temperatures and pressures out of limits. If only the temperature exceeds the rubber

rating, the joint will still fail but it will not be quite as spectacular. Image 5 illustrates a hard-boiled expansion joint. Rubber turns hard and brittle when exposed to temperatures exceeding the published limits. It will not be immediate, but over time the rubber will essentially transform into something resembling plastic and no longer move.

Vacuum Conditions

A vacuum is any point in the pipe where the pressure drops below atmospheric pressure (14.7 pounds per square inch absolute [psia]/29.92 inches of mercury [Hg]). Some expansion joints can deal with a partial vacuum, and some cannot. This poor spherical joint in Image 6 was subjected to a vacuum and over-extended itself. In building systems, expansion joints can be exposed to unintentional vacuum conditions when a riser is drained and not vented, or if a pump inlet pressure is below atmospheric pressure.

Always check the operating conditions, then follow the manufacturer's directions for installing joints for the conditions.

Material Considerations

Material compatibility issue? When an expansion joint turns to goo, that is a good first guess. Image 7 shows the most unfortunate aftermath of the media reacting with the rubber. This situation could have been avoided by selecting a different elastomer.

Control Rods

Absent from these photos is the expansion joint's trusty sidekick: the control rods. Control rods are not necessarily required for every installation, but they are always a good idea. Consider control rods as inexpensive insurance, preventing expansion joints from overextending or over-compressing. A control rod assembly will avoid problems related to excessive movement.



IMAGE 8: Control rods

Loose Bolts

One more problem where a rubber joint failed is loose bolts. This is no exaggeration: every failure site had expansion joints with bolts that could be removed without tools (even on joints that were not involved in the failure). Although manufacturers have different bolt tightening requirements, the one common thread (bad pun intended) is that bolts must be re-tightened after the initial installation.

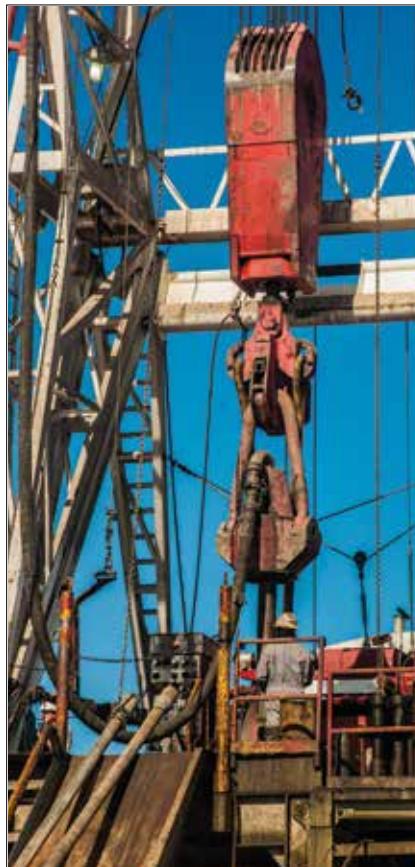
What do these failures have in common? They all boil down to human error. Each incident could have been avoided by following the manufacturer's instructions and effectively communicating the application requirements prior to ordering the expansion joint. Convincing people to follow instructions can be a futile effort. Communicating application requirements, by contrast, is easy. Appendix L, page 49, of the "Expansion Joints Piping Technical Handbook" has one single information sheet that can eliminate many of the problems shown in this article. ■



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