

Misalignment + Corrosion = Failure!

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Here's What Happened:

This TFE lined stainless steel expansion joint was part of a piping system containing a high concentration of HCl. The expansion joint was not installed properly and HCl had embrittled the stainless steel bellows. This embrittlement along with fatigue caused by improper alignment and insufficient restraint caused the joint to fail. The catastrophic failure you see in this picture occurred the day after it passed a visual inspection. Fortunately, the system pressure was low, the leak was small, and no one was around when it failed. In this case, there were no injuries. However, if the circumstances had been only slightly different...

What You Can Do



Remember—Expansion joints are usually the weak point in a piping system!

- ✓ Expansion joints are precision engineered equipment and **MUST** be installed correctly!
- ✓ Ensure that all equipment is installed per manufacturer's specifications!!! Use the facility's management of change (MOC) process to review ANY modification or change.
- ✓ When making visual inspections, note every change from previous inspections and notify the inspection department of those changes. *Protect yourself against sudden failure during the inspection.* Sometimes visual inspection while the equipment is in service is not enough. The equipment may have to be disassembled or simply replaced at a defined interval.
- ✓ Know and plan around common causes of failures:
 - 1) Expansion joints are usually weak spots in piping systems.
 - 2) Misalignment may cause stress cracking.
 - 3) HCl embrittles stainless steel.

Inspection and maintenance programs should not overlook common causes and expected failure modes for expansion joints.

PSID members see Free Search—Expansion Joint

How Did this Happen?

- The piping to the vessel where this expansion joint was used was misaligned by approximately $\frac{3}{4}$ inch. This caused stress on the expansion joint.
- The three retaining bolts that limit compression and extension were not installed on the expansion joint because of space limitations. This allowed excessive movement and placed even more stress on the joint.
- The specification for this joint had changed during a retrofit of the process for a new chemical service, but the expansion joint was not replaced with one of proper specification, requiring a higher grade of stainless. This likely contributed to the HCl embrittlement of the stainless steel making it prone to stress cracking and failure.

Expansion Joints have Design Limits—Make Sure they are not Exceeded !

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