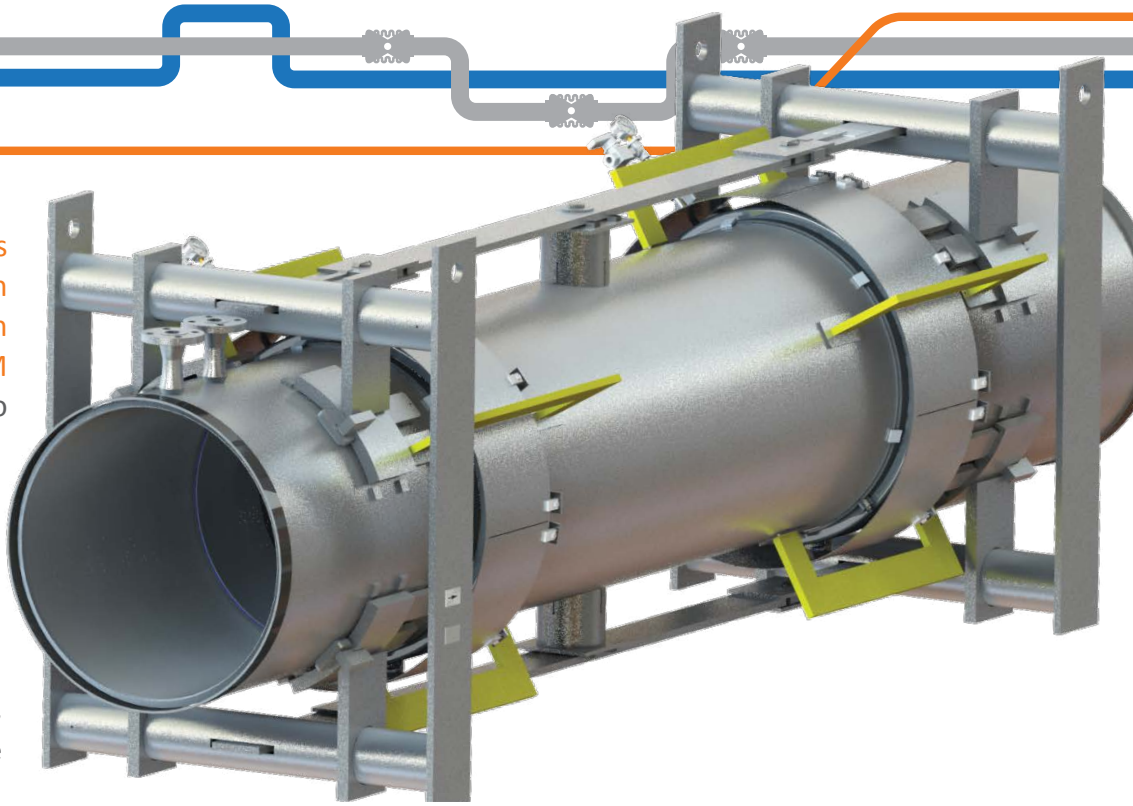
Senior Operations LLC
PATHWAY
Performance under Pressure

Engineered Solutions:
EXPANSION JOINTS IN STYRENE EB/SM SERVICE



Senior Flexonics Pathway is a world leader in the design and fabrication of expansion joints for the Styrene EB/SM processes and will continue to provide solutions to meet our customer's needs.

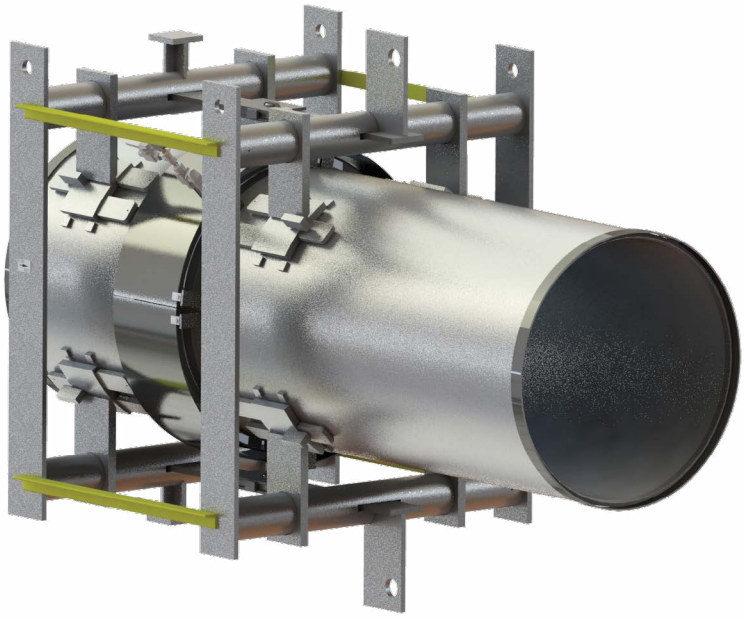
Expansion joints are a critical part of the system and without them the plant could not operate. The service is severe with very high temperatures, extreme flow velocities, and large cyclic movements.

As such, expansion joints in styrene service require special consideration for design, installation, and maintenance. The design must address pressure capacity, thermal stress, vibration, and weight support. For security, the bellows must have redundancy and advance warning capability. Correct installation and subsequent monitoring is imperative for long life expectancy.

Because the conditions are so severe, the design and manufacturing must be executed with the upmost attention to detail. There is very little margin for error. Users must make sure that the licensor's specification is being followed and that important features are present on the expansion joint. This will insure that the expansion joints will have a long life.

Pathway has been a pioneer in the design and testing of expansion joints for styrene EB/SM service and has more experience with this process than any other expansion joint company. We have worked very closely with the licensor for many years to develop the designs and implement improvements to prolong the life of the expansion joints in this very severe service.

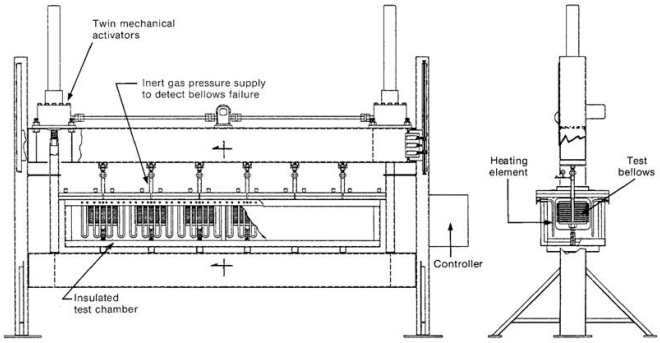
This is the reason that many styrene EB/SM plants continue to place their trust in Pathway with expansion joint design and fabrication in this service.



EXPANSION JOINTS IN STYRENE EB/SM SERVICE

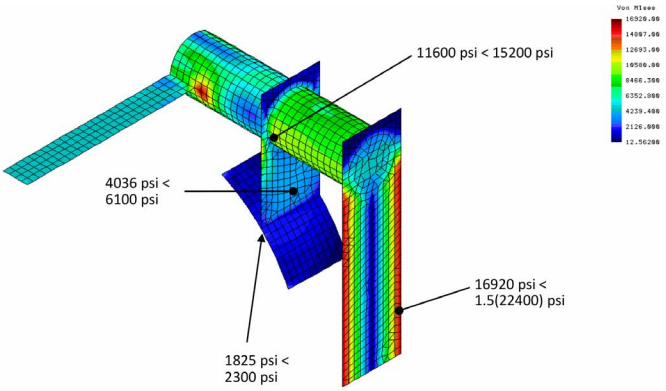
- 2-Ply testable bellows
- 800H Special Chemistry Bellows (annealed after forming)
- 800H and 304H Piping
- Internal insulation reduce the bellows operating temperature
- External covers to protect bellows against weather
- Specially designed floating torsion pipes and attachments for pressure thrust restraint
- Movement indicators
- Shipping bars secure length during shipping

EXTENSIVE TESTING



Pathway has performed extensive high temperature cycle testing which has resulted in the development of proprietary design and manufacturing processes. Above is a test fixture which was developed for a major Engineering firm to perform analysis on 800H bellows operating at high temperatures.

FINITE ELEMENT ANALYSIS

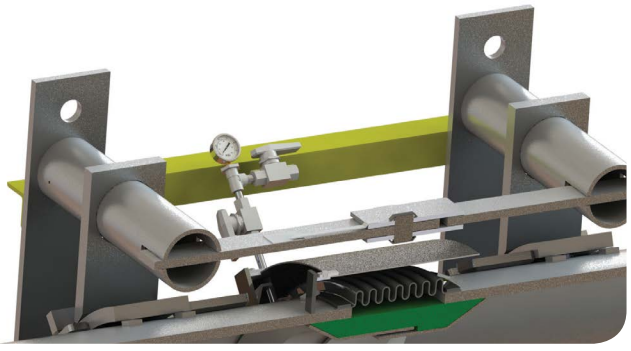


Shown here is an FEA model for the floating torsion pipe design. The floating torsion pipe is not directly welded to the outside of the line pipe to prevent the very high thermal stresses that would result from such an attachment. The torsion pipe and hinge/gimbal hardware is positioned outside of the insulation so that it operates well below the material creep range.

Expansion joints are insulated internally to reduce the bellows operating temperature and increase the cycle life of the bellows.

ROUND THE CLOCK SERVICE

For over 40 years Senior Flexonics Pathway's reputation has been built on the ability to exceed client expectation on Emergency requirements. Pathway's culture is based on our ability to deliver expedited shipments. Manufacturing redundancies, 24 hour staffing and a client response team, engineering and production personnel on-call 24 hours a day 365 days a year will continue to be an Pathway exclusive.



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