



## Boiler Penetration Seals

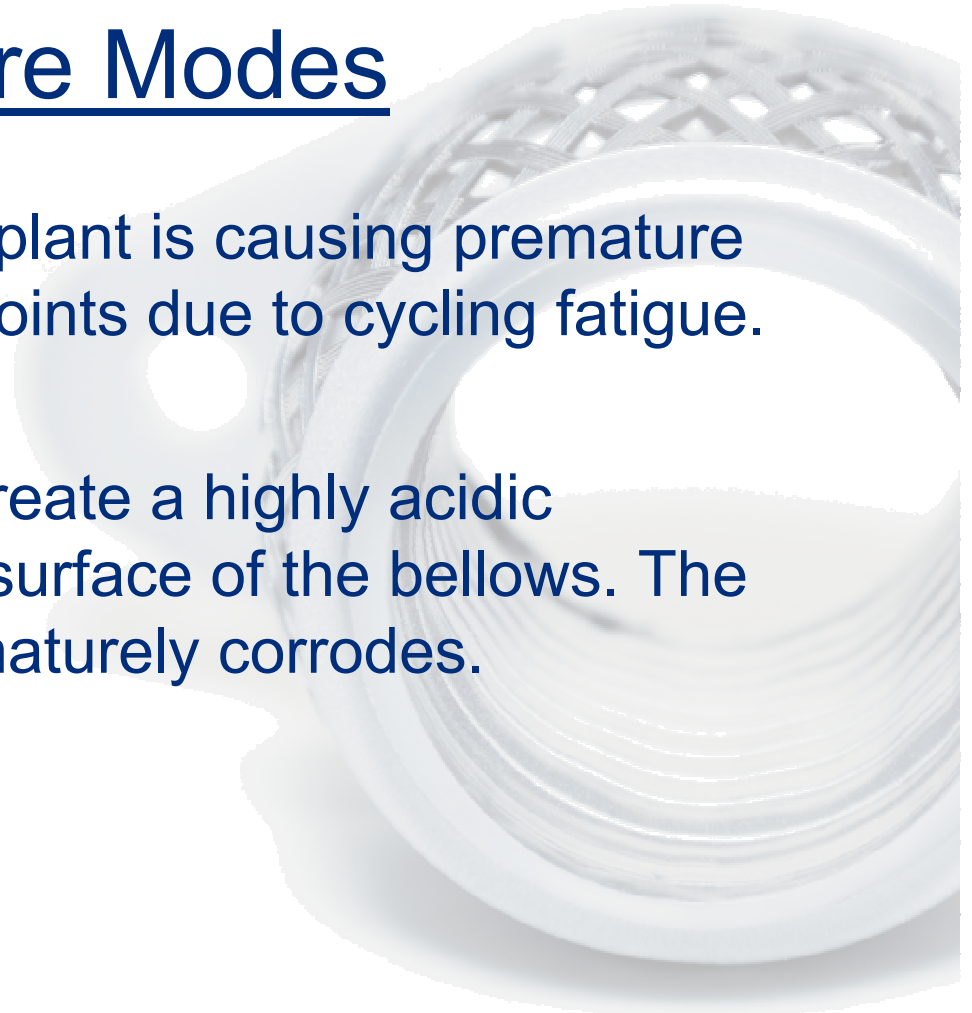
- Current Plants are Designed for 24/7 Operation
- Typical Usage is Actually Only During Peak Hours
- Result is a Plant Designed to Cycle 2 x Per Year is Now Cycling Daily





## Main Failure Modes

- Customer misuse of the plant is causing premature failure of the expansion joints due to cycling fatigue.
- Wash down chemicals create a highly acidic condition on the interior surface of the bellows. The thin gauge material prematurely corrodes.





## Solution To Cycling Failure

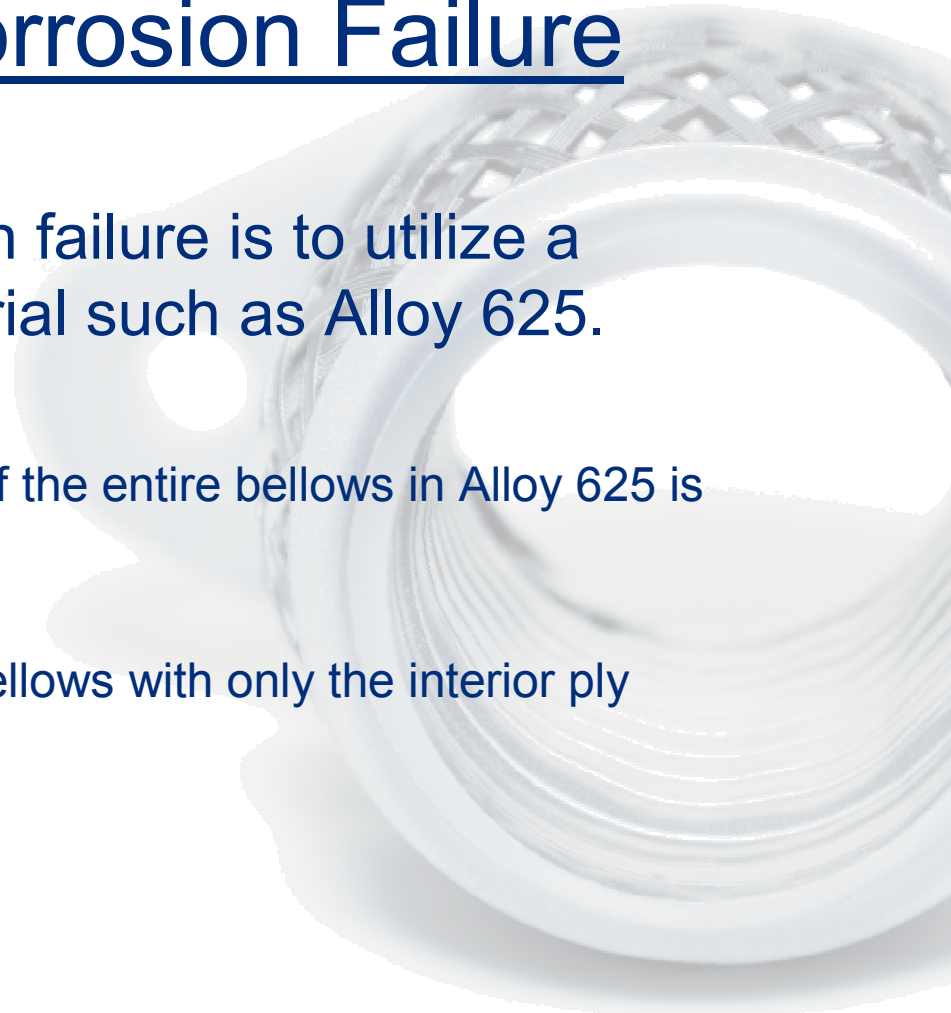
- Best Solution to cycling fatigue failure is to design the expansion joints for a high cycle life.
  - Problem : Not enough room to design high fatigue joint.
  - BOA's Solution: Utilize a multiply expansion joint to increase fatigue life in less space.





## Solution to Corrosion Failure

- Best solution to corrosion failure is to utilize a corrosion resistant material such as Alloy 625.
  - Problem : Construction of the entire bellows in Alloy 625 is expensive.
  - BOA's Solution: Use a bellows with only the interior ply constructed of Alloy 625.





# Boiler Penetration Seal Design Considerations

- Largest cost increases come from large amounts of movement and higher pressures. (End fittings not considered)
- Cost to change from single ply bellows to multiply bellows is less than 20%. Additional cost to use an internal ply of Alloy 625 is less than 15%.
- Standardization of designs over entire units may or may not be economical in the long run. (Don't pay for what you don't need where you don't need it.)
- Allowing space for longer expansion joints will avoid headaches down the road.

Involving us in the iterative design process will reduce the amount of time and money spent changing things towards the end of the design process. It's our job to ensure that you get the information you need to design your system right the first time!