Senior Operations LLC

PATHWAY

Performance under Pressure

Engineered Solutions: FLUID CATALYTIC CRACKING

Senior Flexonics Pathway recognizes the critical nature of expansion joints in FCCU applications. For more than 40 years, Pathway has built a reputation as the industry leader in design, quality and reliability for expansion joints in the most severe service environments.

CRITICAL COMPONENTS

The FCCU (Fluidized Catalytic Cracking Unit) is the most critical process and the highest revenue producer in a refinery. Many processes in the refinery are dependent upon the availability and output of the FCCU. Expansion joints are critical components used in the FCC process stream.

OVERHEAD LINE

The overhead line exits on top of the regenerator and, if there is a PRT, it enters the top of the third stage separator. This is typically the largest and heaviest expansion joint in the refinery. The design is generally a tied universal cold wall construction with internal refractory and carbon steel shell. The expansion joint accommodates axial growth between the elbows internally and the lateral offset from the relative vertical growth of the regenerator and the next piece of downstream equipment.

POWER RECOVERY TRAIN

The Power Recovery Turbine (PRT) harnesses the energy of the high temperature flue gas generated by the FCC process. Gas exits the regenerator at approximately 50 PSIG and must be reduced in pressure before entering the CO boiler or other downstream components.

Pathway has developed field proven designs that are customized for maximum service life in the PRT operating environment.

A PRT reduces the pressure while converting that pressure into rotary energy. The turbo expander is a close tolerance machine operating at temperatures up to 1,500 F. Because of the high temperature environment, the PRT is very sensitive to loading from attached piping and expansion joints. Expansion joints adjacent to the PRT must be designed for extremely low spring rates and designed to avoid internal insulating materials that could loosen and damage the PRT turbine blades on impact.

Large refractory lined universal style

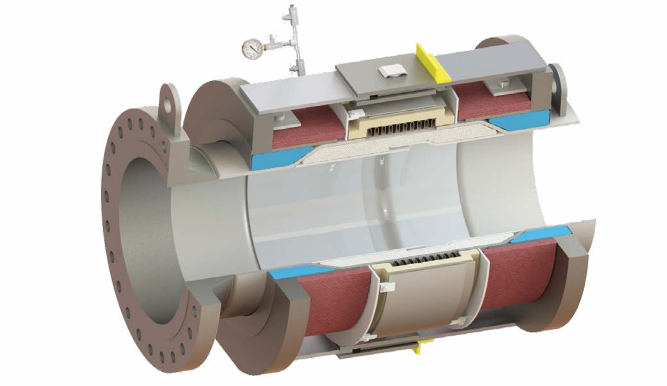
STANDPIPE EXPANSION JOINTS

The standpipe expansion joints in a typical FCC withstand extreme operational conditions - high operating temperatures and pressures as well as flowing catalyst which is extremely abrasive.

These expansion joints must be designed and manufactured to withstand the severe operating environments with 100% reliability between planned outages. Pathway's FCC standpipe expansion joints outlast all others in these severe conditions.

Several design features contribute to achieving this goal. Bellows metallurgy is chosen for maximum cycle life and corrosion protection. Ply testable design is used to insure uninterrupted service.

A pantographic linkage is utilized to balance the movement of standpipe bellows elements. A center spool gimbal is often applied to accommodate out of plane movement. Slotted hinges are used to protect the bellows elements from shear loads and to protect the expansion joint from the effects of high pressure that can result from an upset.



FLOATING RINGS

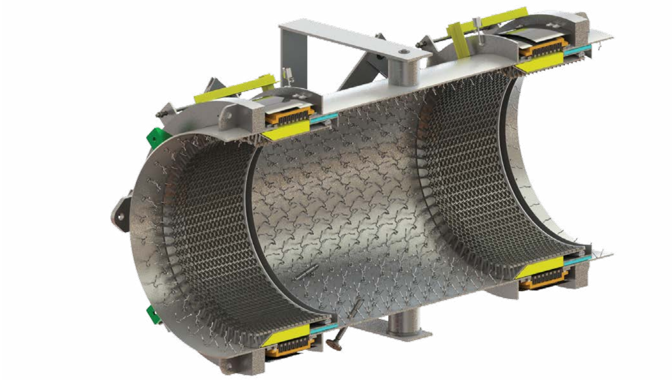
Hot wall design is externally insulated so the pipe wall operates at the media temperature. Expansion joint hardware is outside of the insulation and is relatively cool but it must be connected to the extremely hot shell. The differential growth of the shell and rings results in a significant stress problem.

The solution is floating hardware attached to the shell and designed so there is no constriction on the shell that could result in unacceptably high stress.

COLD WALL DESIGN

Cold wall design provides several advantages. Because the pipe is insulated, it operates at well below the media temperature which results in reduced pipe growth and expansion joint movement.

The number of convolutions can be reduced and the bellows can be designed for lower temperature which minimizes the thickness required for high cost bellows material.



The cold wall design utilizes castable refractory along the pipe wall and hand packed abrasion resistant refractory in hex mesh on the liner.

A liner cavity insulation pillow is included to reduce the temperature and to minimize intrusion of catalyst. External insulation is included to prevent the bellows element from dropping below the acid dew point, the major cause of premature bellows failure in FCC service.

2-PLY TESTABLE BELLOWS

2-Ply testable bellows with monitors are utilized for all critical bellows assemblies. It creates an early warning system that indicates that one bellows ply has failed due to corrosion or fatigue. This allows the user to plan for a replacement during their next shutdown, essentially eliminating the possibility of an unplanned outage.

ROUND THE CLOCK SERVICE

Exceeding expectations on expedited shipments and onsite service is a part of our culture. With a 24 hour client response team, manufacturing processes and engineering tools designed for speed and accuracy, we are committed to being the best solution in the industry.

ISO 14001 certified · UKAS Management Systems 078 · ISO 9001 certified

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