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High Temperature Heat Exchanger – Low Cycle Fatigue Assessment Post Fabrication Design Analysis (Finite Element Analysis, ASME Section VIII Div. 2, ASME FFS-1)

Project Description: A high temperature heat exchanger with an elaborate array of internal refractory, ferrules, and shell-side insulation was evaluated for low cycle fatigue (LCF). Issues with LCF were observed with a sister exchanger and a detailed fatigue assessment had not been conducted during the design stage for either exchangers. Thus, this exchanger was evaluated post-fabrication, placing it into the realm of fitness-for-service (FFS), with the desire to understand the allowable number of cycles. A highly detailed FEA model was created, allowing for proper capture of the distributed temperature profile. Then, these cycles between ambient and steady-state were evaluated using both ASME Section VIII Div. 2 Twice Yield and Cycle-by-Cycle analyses, both elastic-plastic non-linear methods. The end result was the client receiving the allowable number of cycles and the component or components most likely to fail first.

FEA Results: Pertinent images or this fitness-for-service study are shown below:

