CASE STUDY: FEA OF EXPANSION JOINT OF HEAT EXCHANGER

INTRODUCTION

Expansion Joints are provided on the shell side of heat exchanger. It allows the free expansion of shell relieving tubesheet & tube to tubesheet weld junction. Thus preventing its failure.

Process equipment manufacturer from India & Abroad approached ANALYZER to seek assistance in evaluating the design of their newly developed heat exchangers for their expansion joint & provide the solution in case of any observed failure.

FEA WORKFLOW

- Design parameters & material properties extraction for Expansion Joint of the heat exchanger
- Preparing FEA Models for 4 different conditions of expansion joint i.e. Nominal Thickness including/excluding corrosion allowance & minimum thickness including/excluding corrosion allowance.
- Solving all four FEA Models for stiffness calculations
- Providing the expansion joint stiffness to client in order to get the shell axial membrane stress summary for two different thicknesses of expansion joint (Nominal & Minimum).
- Solving two extreme geometrical conditions of expansion joint (Nominal excluding corrosion allowance & minimum including corrosion allowance) for different loading conditions
- Preparing an easy to understand report for the performed FEA.

CHALLENGES

- Studying the stiffness calculations by different methods (FEA & Design Software) & using the most appropriate method capturing the actual behavior of the structure i.e. FEA method of stiffness calculation

THE SOLUTION

The expansion joint was analyzed for different loading conditions as per TEMA standards using Finite Element Analysis in ANSYS APDL Solver. Stress Linearization has been carried out at various locations as per the guidelines. The results showed that the induced stresses were well within the acceptable limits. Hence, the structure's design was predicted to behave safe during operation without premature failure.

BENEFITS

- Actual behavior of expansion joint of a heat exchanger is studied.
- Reduced manufacturing time
- Application of an expansion joint for multiple heat exchanger designs can also be studied.