TEXAS TOWER (VCFE) REPLACEMENT

CASE STUDY

CATEGORY

PRODUCTS / HEAT EXCHANGERS

SUMMARY

Project Name : *12E-9 Texas Tower*
Industry : *Refining*
Reference : *LA3250*
Client: *Caltex (Queensland)*
Year : *2015*

Overview

The Caltex Lytton refinery needed a like for like replacement of their Vertical Combined Feed Exchanger (VCFE) commonly known in the refining industry as a Texas Tower, having reached its end of life.

Geometry constraints required the exchanger to be like for like but incorporate kammprofile gaskets to improve operational efficiency. However the design needed to be brought up to current standards; to achieve dimensional compliance under a more conservative design criteria required extensive load analysis for the high temperature operating environment.

Project Timeline

The project was set against a very rigid timeline with specialised cranes on site for the installation during a major shutdown making project planning and monitoring critical to the overall success of the project.

PROJECT DETAILS

Design

- Design Pressure at 400°C
  - Shell Side 855 kPag to Full Vacuum
  - Tube Side 1000 kPag to Full Vacuum
- Design Temperature : 288°C to 540°C
- Dimensions : 2.0m ID x 24m long
- Mass : 124,000 kg
- Standard : AS1210 Class 1, TEMA R

Materials

- Upper Shell ASTM A387 11 CL 2 x 1.3/4" thick
- Channel ASTM A387 11 CL 2 x 1" Thick
- Lower Shell ASTM A387 11 CL 2 x 5/8" Thick
- Bottom end AS1548-PT-460NR x 20mm Thick
- Flanges & nozzles ASTM A182 F11 CL 2
- Tubes ASTM A213 T11

Manufacturing

- NDE 100% Visual, RT, UT, MT
- PWHT 6500C for 1.¼ Cr - ½ Mo Sections only
- Hydro pressure Shell 1310kPa / Tube 1530kPa

Surface Treatment

- Skirt section fireproofing
- Insulated and clad in Zincalume® sheeting

Planning

Initial project planning was highly dependent on confirmation of the design driving final thicknesses of the Cr Mo materials, being long lead items not available in Australia. Once engineering and material delivery was confirmed, planning focused on developing a build sequence to assemble the 80 tonne bundle and test the unit which incorporated a bellows expansion joint on the floating head. The final planning stage was to develop an appropriate fireproofing system, an insulation and cladding methodology, and transport to minimise onsite works after lifting the exchanger into position.

Challenges

Maintaining existing geometry while conforming to the latest design standards presented one of two major challenges for the project. The second was the installation of the bundle and handling the completed exchanger during its finishing operations as the 124 tonne exceeded our workshop lifting capacity. Design challenges were overcome through the application of several FEA intereteration where combined stresses under the high temperature requirements push the limits of the Cr Mo materials. Overcoming handling scenarios were workshopped between the project and fabrication teams to come up with a build sequence and ancillary support arrangements allowing the safe installation of the bundle, hydro testing with the bellows in position and almost entirely insulating the exchanger before loading onto transport for delivery, and lifting into position.

Notes

The 20m long x 80 tonne bundle when fully loaded created a very challenging assembly scenario. This was overcome by partly loading the bundle, installing it in the shell and then finishing the tube loading. This was considered a risky assembly sequence by the workshop team as tube alignment in the baffle holes could not be visually checked during loading, it was something we had never done before.

Find out more at www.la.services

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