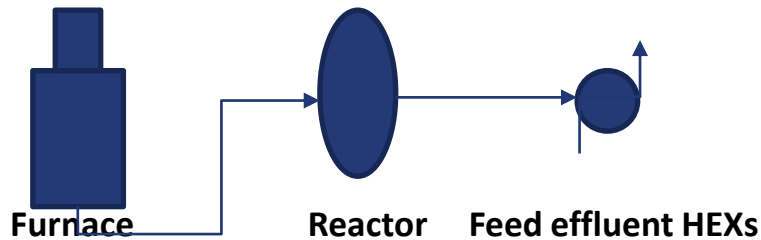


Incident Learning: Fire on Gasoil Hydrodesulphurisation unit

BRIEF DESCRIPTION OF EVENT



1. The girth flange of the feed/effluent exchanger, experienced a seal failure and a flammable mixture of diesel and Hydrogen was released, which ignited.
2. Piping, insulation and instrumentation systems were damaged.
3. The unit was shut down for approximately 3 weeks for repairs.
4. Incident classified as an API Tier 1 event.

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SUMMARY OF FINDINGS

Design

- Fabricator omitted to conduct a finite element analysis, as specified by the Client, in the design of flange. A less stringent level of analysis was done. The Client and appointed Engineering contractor were unaware of this deviation.

Fabrication

- There was misalignment between the gasket manufacturer and exchanger Designer/Fabricator on the acceptable bolt loads for these exchangers resulting in a lower than specified torque being applied on assembly.
- Test gaskets were re-used and utilized in the final assembly of the exchanger.
- The exchanger was not tested to the correct hydro-static pressure by the fabricator, and field test was waived.
- The Client and engineering contractor were unaware of these deviations by the Fabricator.

Operation

- The unit experienced several upsets and trips prior to the flange seal failure.
- The upsets resulted in thermal cycling/shocks to the exchanger which exceeded recommended operating windows.

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LEARNINGS

Design

- Current ASME vessel design code does not offer adequate assurance on leak tightness of flange joints – additional checks should be put in place to ensure good joint seal is achieved, and allowance made for thermal shocks caused by operational upsets.
- Gaskets suppliers/specialists need to be consulted for high temperature, high pressure applications and outcomes aligned with designers and fabricators.
- Bolt tensioning or other techniques are necessary to ensure adherence to proper bolt loading ranges taking into account the type of gasket being used.
- The application of standard bolt tensioning values for special application exchangers is not valid for all gasket types e.g. Spiral wound vs Kammprofile.

Fabrication

- Robust Client quality assurance/control over-sight of fabricator activities is essential to ensure equipment is fabricated and tested to Client expectations.
- Differential pressure heat exchangers require special hydro-testing attention.

Operation

- Thermal cycles and unit upsets can accelerate joint relaxation and lead to allowable joint loads being exceeded.
- Operational controls are necessary to avoid/minimize such cycles.

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CORRECTIVE AND PREVENTATIVE ACTIONS

Design

- Design guideline for special application flanged joints is to be developed and rolled out.
- Project Quality control and handover procedures to be enhanced to incorporate additional assurance steps specifically related to gaskets, bolt tension and joint load verification.

Fabrication

- A Client organization structure to strengthen QA/QC oversight over design and fabrication to be put in place.

Operation

- Operating procedures and systems be strengthened to ensure operating windows are adhered to during start up for HDS units, and recovery from upset conditions.