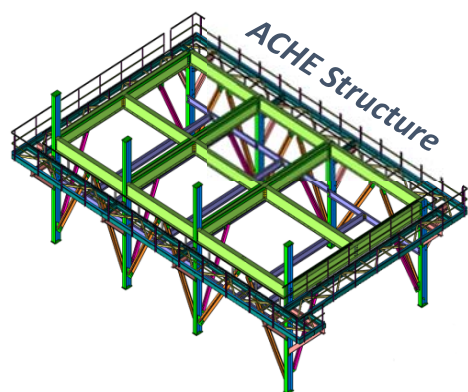
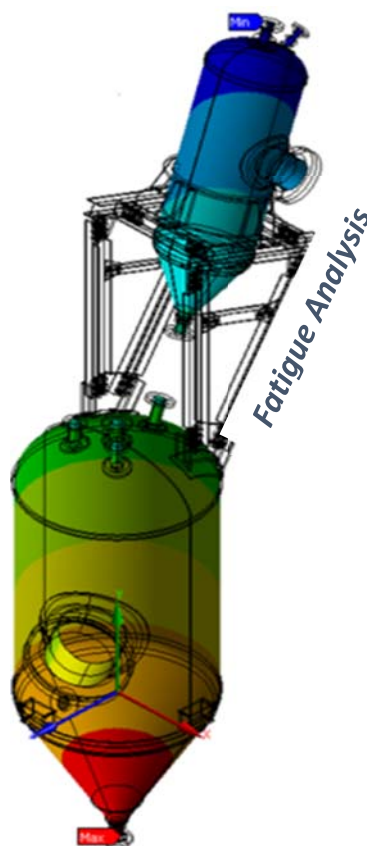


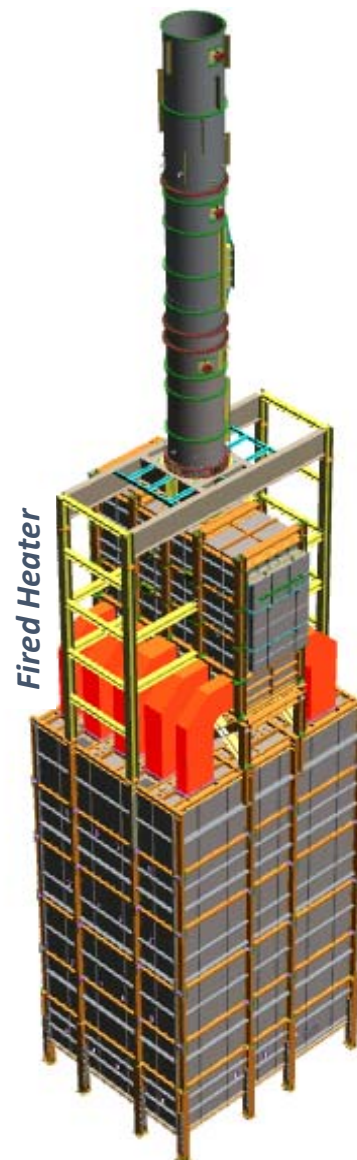
ACHE Tube bundle



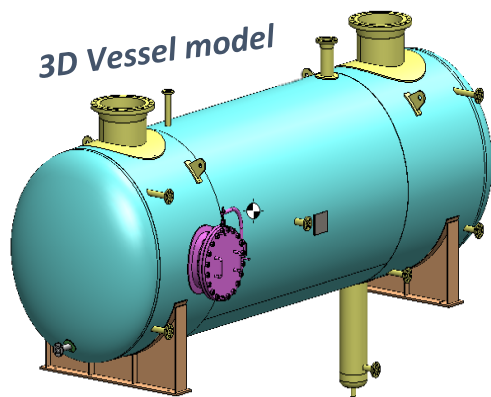
ACHE Structure



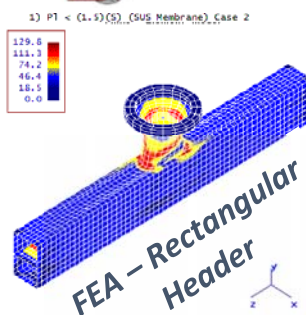
Fatigue Analysis



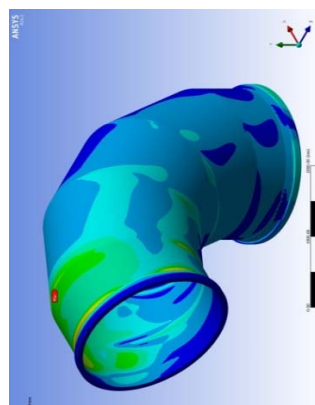
Fired Heater



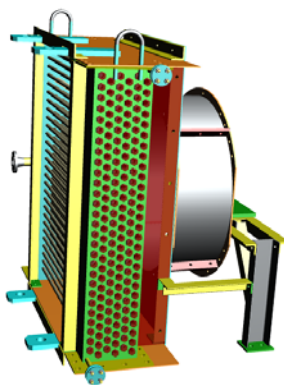
3D Vessel model



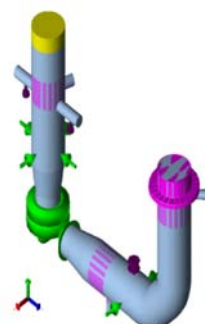
FEA – Rectangular Header



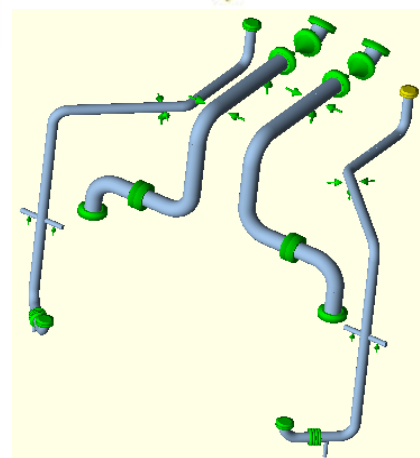
FEA – Miter bend



Skid mounted
Lube oil cooler



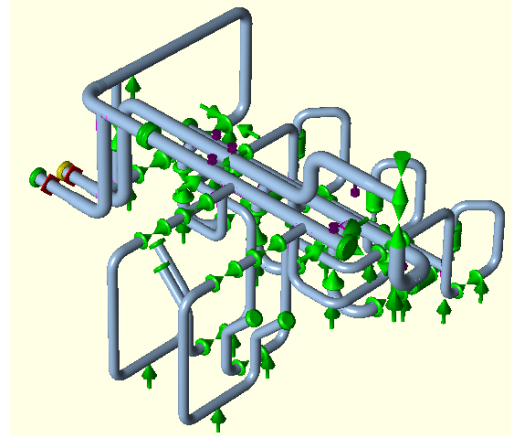
Static & Dynamic Pipe Stress Analysis



Transheat Technologies provides engineering design support during the bid stage and order stage in the following core areas.

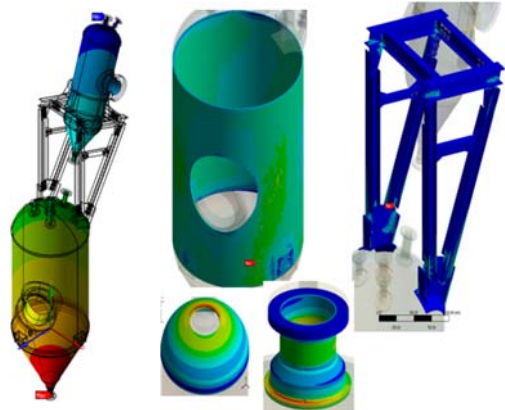
Piping stress analysis

- Tank farm piping systems and process equipment piping
- Static and dynamic stress analysis
- Piping routing modifications to ensure that loads on equipment / pump nozzles are within allowable limits
- NEMA analysis for steam turbine piping
- Specifications for hanger supports
- Design of pipe supports based on loads
- Generation of piping plans and isometric drawings
- Preparation of 3D model of equipment and piping system to ensure valve / instrument accessibility and no fouling between lines



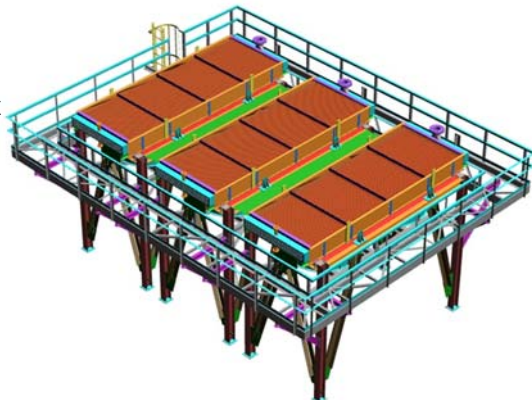
Finite Element Analysis (FEA) / Fatigue Analysis

- Analysis for local nozzle loads
- Analysis of complete vessel for various load conditions
- Analysis of complete vessel for cyclic load conditions
- Inclusion of wind / seismic effects in analysis
- Evaluation of maximum deflections / stress / reactions at support locations
- Analysis of expansion joints / expansion bellows
- Capability to do Computational Fluid Dynamic Analysis



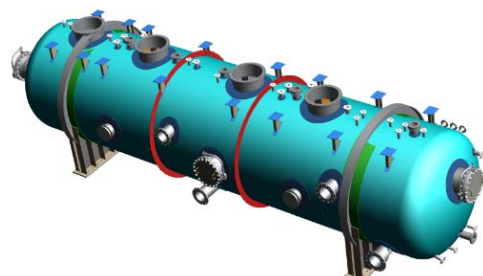
Air Cooled Heat Exchangers (ACHE)

- Thermal, mechanical, structural design, FEA of header box
- Re-rating and performance validation of existing units
- Complete detail engineering and fabrication drawings of complete package
- Fabrication drawings and material lists generated from 3D models
- Support in sourcing of components of air cooler package (like plugs, plug gaskets, drive system, bearing blocks, fans, motors, etc)



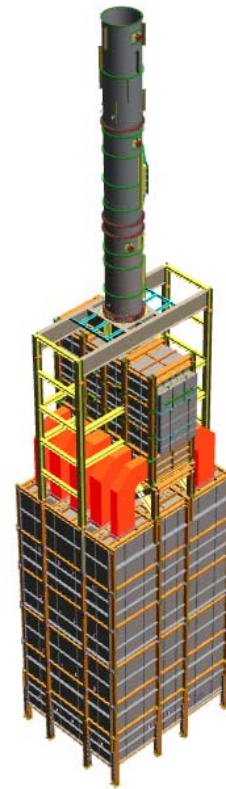
Pressure vessels, columns, reactors and storage tanks

- Complete mechanical design
- Re-rating of existing units for new service conditions
- Evaluation of fitness for service / remaining life based on existing condition
- Complete detail engineering and fabrication drawings
- Fabrication drawings and material lists generated from 3D models



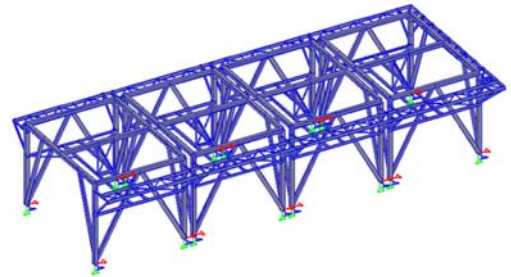
Detail engineering of fired heaters, air pre heaters, ducts and stack / chimney

- a. Heater mechanical design
- b. Mechanical GA drawing
- c. Structural design calculation
- d. Detailing and fabrication drawings for radiant and convection section coils and headers
- e. Structure design of fired heater and APH support structure
- f. Detailing of openings for burners, view ports, coil supports, refractory anchors, etc
- g. Detailing of flue gas / air ducts
- h. Detailing of flue gas stack / chimney
- i. Structure connection detailing
- j. Preparation of 3D model for complete fired heater, air preheater and stack
- k. Generation of 3D model and fabrication drawings for heater coils and headers
- l. Generation of panel-wise fabrication drawings and automated material lists for heater from the 3D model
- m. Generation of detail fabrication drawings for air pre heater support structure and ducting.
- n. Part numbering and bill of material lists are automatically generated from the 3D model
- o. Detailing of platforms and ladders



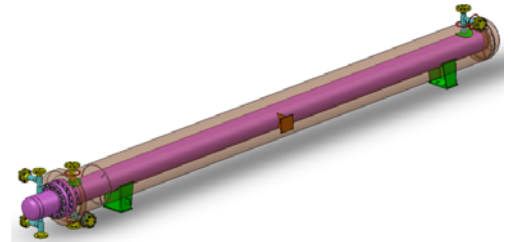
Structure design

- a. Design of pipe racks, equipment support structures / technological structures
- b. Design of skid frames for skid mounted systems
- c. Design of lifting frames / spreader beams



Shell and Tube heat exchangers (STHE)

- a. Thermal and mechanical design
- b. Re-rating and performance validation of existing units
- c. Complete detail engineering and fabrication drawings
- d. Fabrication drawings and material lists generated from 3D models



Skid design and detail engineering

- Metering skids
- Skid mounted lube oil coolers
- Layout of equipment and piping on skid
- Pipe stress analysis and structure design for skids
- Generation of 3D models and fabrication drawings for complete skid



Detail engineering of API 650 and API 620 storage tanks

- Complete mechanical and structure design
- Complete detail engineering, plate layouts and fabrication drawings

LIST OF MAJOR PROJECTS HANDLED

Piping stress analysis

- Flash steam overflow piping – for Sembcorp Power plant
- Troubleshooting and modification of hot oil piping system for Indo Amines Limited, Vadodara, India
- Steam generation package – Tecnicas Reunidas, Spain
- Water treatment plant – GE, Bengaluru, India
- Tank farm piping – UAE
- Hot oil recirculation system – UAE

Complete engineering of air cooled heat exchanger package

- Forced & induced draft units for Tecnicas Reunidas – Spain, Petrofac – UAE, Tecnimont, Mustang HDP, Toyo, Thyssenkrupp, DresserRand, Technip, PDVSA – Venezuela, Serck Gulf, Essar, Bechtel, Flour, OSC Dubai, etc for various projects of Saudi Aramco, Indian Oil Corp., Reliance, Essar, Petronas Carigali, etc.
- ASME Sec. VIII Div. 2 – Qualification by FEA – for 2 ACHEs for OSCD Dubai.
- ASME Sec. VIII Div. 1 – Qualification by FEA – for 2 ACHEs for PDVSA, Venezuela / Flash Forge.
- Skid mounted lube oil coolers.

Complete engineering of pressure vessels, columns and reactors

- Numerous pressure vessels under ASME Sec. VIII Div. 1 & 2 with U-designator for Tecnicas Reunidas – Spain, Waterford, Pecofacet, IDOM, INTECSA, Quality International, SPEC Oil & Gas, Petrofac, Ferrofab, VELATH, Clearsep, etc for various projects of Saudi Aramco, SABIC, Sadara, Tatweer, KOC, Balkia, SPEC Oil & Gas FZCO – UAE, etc.

FEA / Fatigue analysis

- Cyclic loading – 2 pressure vessels suspended on spring hanger supports (JGC, Japan / Saudi Aramco)
- Cyclic loading – 1 pressure vessel (JGC, Japan / Saudi Aramco)
- FEA of sandwich partition plate in STHE (GE Water, Bengaluru)
- FEA of 2100 mm diameter miter bend (Saudi Aramco)
- FEA of several ACHE header boxes / custom constructions for clients in Saudi Arabia, Europe and India.

Shell and Tube Heat Exchangers (STHE)

- Thermal design and vibration analysis of numerous units for clients in Saudi Arabia, UAE, Bahrain and India.
- Thermal, mechanical design and drawings for numerous units for clients in India, Europe, UAE and Spain.

Skid Packages and structures

- 2 Equipment and piping skid packages (UAE).
- 5 Technological structures for a client in Bahrain.

Other miscellaneous jobs

- Bid stage technical support and design to various clients.
- Design of lifting frames for heavy equipment
- 3D modelling of equipment / systems
- Assistance during fabrication / assembly / erection

SOFTWARE

- HTRI
 - Aspen
 - PRG – Pauline Research Group
 - PVElite
 - CAESAR 2
 - SolidEdge
 - SolidWorks
 - AutoCAD
 - Advance Steel (Autodesk)
 - ANSYS (*)
 - STADD (*)
 - CADWorx (*)
- (*) – By arrangement

DATA SECURITY

- Dedicated Server
- Access controls
- License software
- Data backup plan
- Power backup

TRANSHEAT MOTTO

We are committed to provide efficient and cost effective solutions to our partners in a transparent and professional manner.

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CASE STUDY – TROUBLE SHOOTING A HOT OIL SYSTEM

Client Indo Amines Limited
Industry Chemicals, Fertilizer and Pesticides
Plant location Vadodara, India

System information

The plant has a closed loop hot oil system (coal fired hot oil heater with hot oil circulation pumps, filters, deaerator, expansion tank, interconnected piping, valves and instruments) which is used for supplying heat to the process.

Operating conditions

Operating temperature	300°C
Operating pressure	12 bar(g)
Number of hot oil pumps	2 (one working plus one stand-by)
Pump motor rating	50 kW

Problem reported

Client reported repeated failures in the form

- Leakages at mechanical seal of the hot oil circulation pumps
- Breaking of pump shaft

Failures were so repetitive and resulted in a huge loss of production every month.

Transheat team visited the installation site and found that

- Hot oil supply and return pipe routing was done without due consideration of the pipe behaviour at elevated temperatures
- Supports located in the hot oil piping system were not selected properly.
- Proper stress analysis of the hot oil piping network was not carried out.
- These deficiencies lead to huge piping reactions at the hot oil pump suction and discharge nozzles and consequently failure in the hot oil pumps.

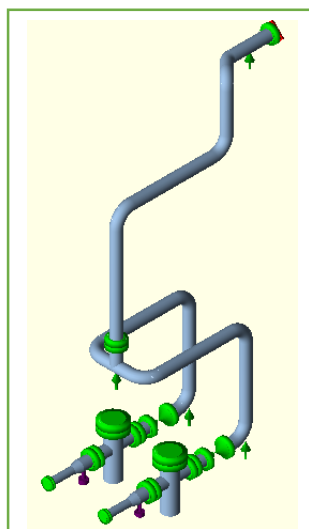
Solution implemented

Transheat analyzed the complete piping system and

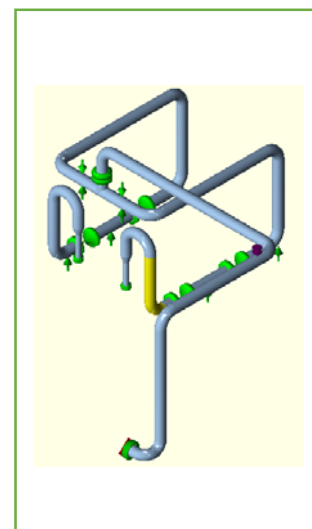
- Suggested changes in pipe routing keeping many site constraints in view of the existing plant layout
- Designed proper pipe supports at the required locations
- Provided spring hanger supports in the hot oil pump suction piping

The modifications suggested by Transheat maintained adequate flexibility in the piping system and ensured that the piping reactions at the hot oil pump suction and discharge nozzles were well within the limits recommended by the pump supplier.

The suggested modifications were implemented by client (under Transheat supervision) and the system is now operating continuously.



Pump suction piping



Pump discharge piping

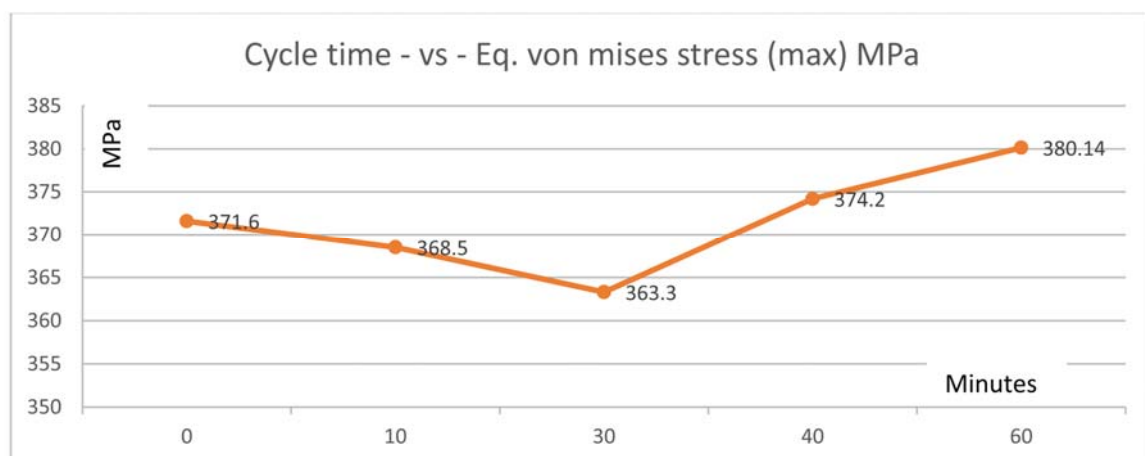
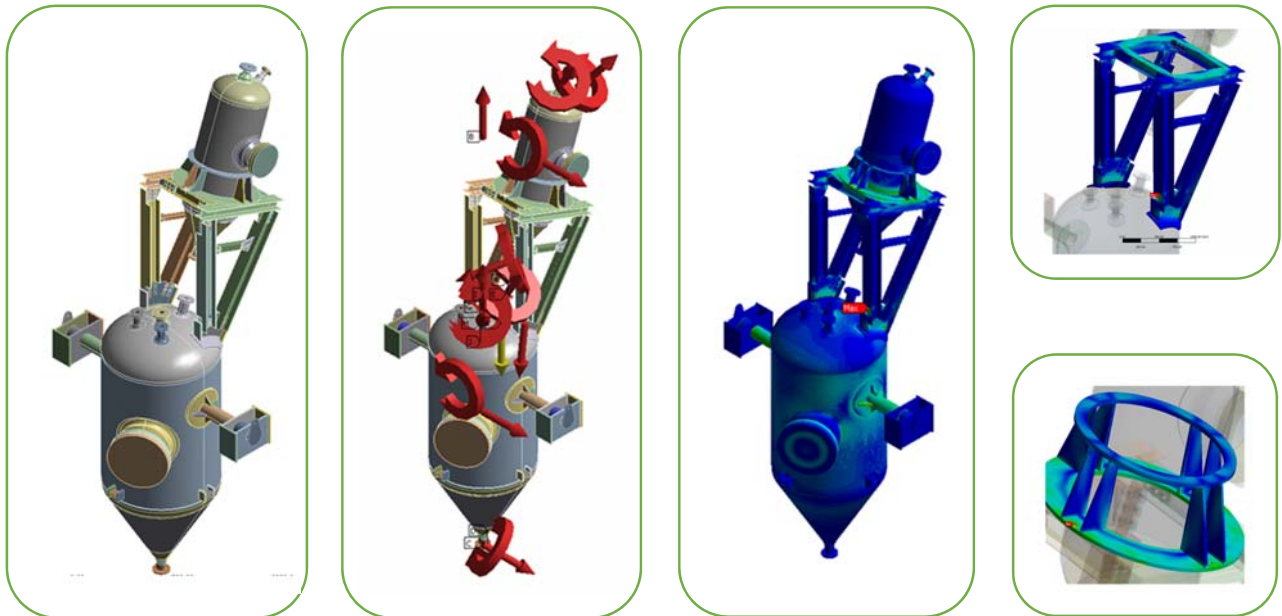
CASE STUDY – FATIGUE ANALYSIS OF VESSEL SUSPENDED ON HANGERS

End User Saudi Aramco
Consultant JGC
Project Jazan Refinery and Marine Terminal
Plant location Jazan, Kingdom of Saudi Arabia

System information

The system includes two pressure vessels - with one vessel being supported on a structure frame from the top dish of the bottom vessel. The bottom vessel is suspended on lifting hangers and does not rest on any rigid foundation. Both vessels are under cyclic service requirements. ASME Sec. VIII Div. 1 is the specified code of design and construction for these vessels. Stress linearization and fatigue analysis calculations are done as per the rules of Part 5 of ASME Sec. VIII Div. 2 to ensure that stresses in the vessels are within the code allowable limits for all load combinations (thermal, wind, seismic, pressure, nozzle loads, etc).

Transheat suggested modifications in the vessel support arrangements to ensure that the calculated number of cycles to failure was much more than the number of cycles specified for the operating life of the equipment.



CASE STUDY – PIPING STRESS ANALYSIS – PUMP WITH NO FOUNDATION

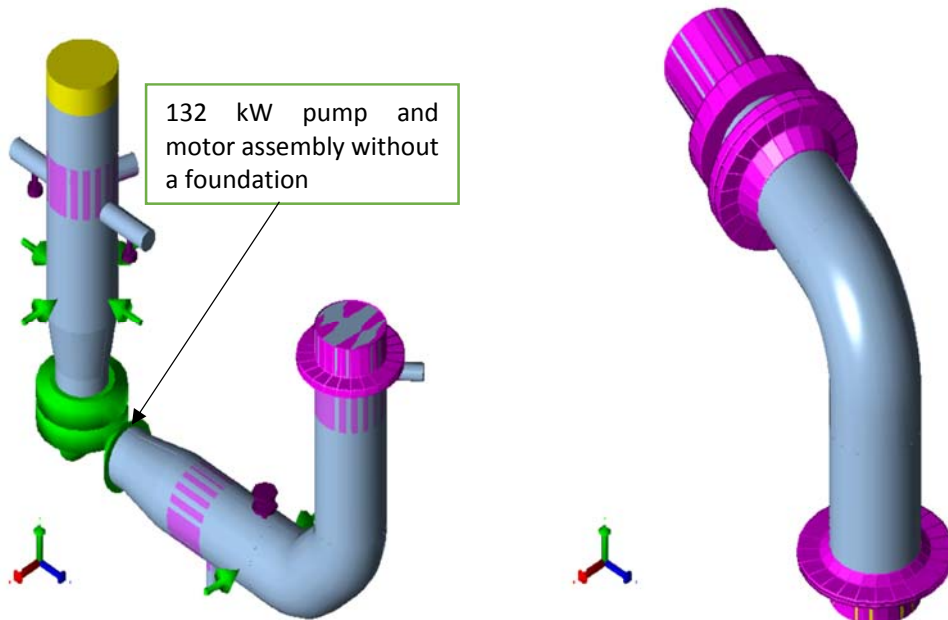
Client Anup Engineering / GE Water
Project Lanxess
Plant location India

Criticality of the system

The compact plant layout and large diameter piping involved the following major challenges for Transheat.

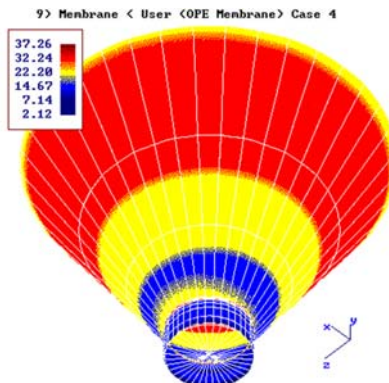
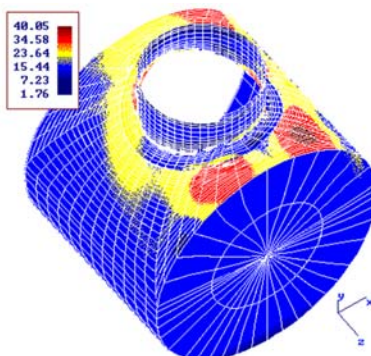
- 132 KW pump and motor assembly (weight 2500 kg.) suspended only on piping flanges. No rigid foundation for the pump and motor assembly.
- Piping system supported on spring hangers.
- Static and dynamic pipe stress analysis.
- Short pipe routing leading to high loads on equipment nozzles.
- FEA of connected equipment due to the high loads from piping.

Transheat scope of work included pipe stress analysis for 32 inch AL6XN piping and suggestion of proper supporting arrangement.



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CASE STUDY – OPTIMIZATION OF HAIR PIN HEAT EXCHANGER

Client Anup Engineering, India / PDIL, India
 Project Fertilizer plant in India
 Type of unit Hair pin type heat exchanger

Material SS 304 tubes

Original design 4 hairpins in series, total area of 2553 m².

Optimized design 4 hair pins in series, total area of 1820 m².

Benefit A reduction of 29 % in heat transfer area with a cost saving of more than USD 0.1 M.

CASE STUDY – DESIGN BY FEA – ASME Sec. VIII Div.2 AIR COOLER

Type of air cooler Forced draft unit
 Design conditions 280 barg, 130 C, material Carbon steel
 Hydrotest pressure 400.4 barg
 Header box size 2620 mm long x 515 mm high x 343 mm deep outside dimensions
 Nozzles Class 2500 LWNRF

Qualification by Design by analysis using FEA as per ASME Sec. VIII Div. 2 Part 5
Analysis review by Registered Professional Engineer (RPE)

Analysis checks done include the following – comparison of peak stress values, generation of stress classification lines and linearized stress data, check for elastic collapse as per CI.5.3.2, check for meridional stress as per CI.5.2.2.2b, mesh sensitivity analysis, comparison of reaction forces with applied loads to ensure model equilibrium.

