WELCOME

DESIGN CAPABILITIES - PRESENTATION

TRANSHEAT TECHNOLOGIES EDC
Engineering Design Consultants
About Us

- Engineering organization formed by a group of well experienced professionals.
- Groups’ expertise
  - System engineering
  - Process, thermal and mechanical design
  - Re-rating / Fitness evaluation of process equipments
  - Finite element analysis
  - Pipe flexibility and stress analysis
  - Structural design and detailing
  - Root Cause Failure Analysis
Services Offered

- We provide complete engineering support in the enquiry and order stages for following items.
  - Air cooled (fin fan) heat exchangers
  - Shell and tube heat exchangers
  - Rerating / Performance validation for heat exchangers
  - Pressure vessels, columns, reactors
  - Storage tanks as per API 650 and API 620 standards
  - Finite Element Analysis
  - Piping stress analysis (static and dynamic) and piping fabrication drawings
  - Piping and equipment skids
  - Structural design and fabrication drawings
Experience Of Key Members

- Our key team members have worked in various leading EPC and process equipment manufacturing companies and handled lot of projects in the area of process equipments.
- Due to our team efforts, commitment and sincerity towards work, we have been able to secure work from companies in India, Europe, Gulf within a very short span of time.
- Our team has dealt with many engineering consultants in different regions and have good experience to deliver quality service to our clients.
- Air Cooled HEX

The various type of Air Cooled Heat Exchangers we have handled include:

- Forced draft, Induced draft units and Natural draft units
- Plug, Cover, D type and pipe type headers
- Units with manual fans / AVP fans / fnas driven on VFD motors
- Units with steam coils to take care of winterization / start-up requirements
- Units with manual and / or auto louvers for process control / winterization
- Condensing services with requirement of slope in each pass / last pass
- Materials ranging from carbon steels, alloy steels, stainless steel, duplex and super duplex steels
- Structural design taking into account huge piping loads
- Finite element analysis due to higher nozzle loads on the header boxes

We have good expertise in the optimization of air cooled heat exchanger design based on either:

- Lower overall cost of ownership taking into account the operating costs or
- Lower initial cost of installation

This optimization is done based on the clients’ requirements.
The different type of Shell and Tube Heat Exchangers we handle include:

- Fixed tube sheet heat exchangers
- U-tube heat exchangers
- Floating tube sheet heat exchangers
- Suction heaters
- Stub in type exchangers
- Materials ranging from carbon steels, alloy steels, stainless steel, duplex and super duplex steels, titanium etc.
- Finite element analysis for expansion bellow in fixed tube sheet heat exchangers
- FEA for nozzle load analysis.
- Fatigue analysis for cyclic services

We have good expertise in the optimization of shell and tube heat exchanger design.
- **Storage Tanks**

Design and detailed drawings for fixed roof storage tanks as per

- API 650 standard
- Rectangular tank
- Tanks with
  - Sloped bottom
  - Sloped roof
  - Cone roof
  - Self supported roof
  - Structural roof support
  - Internal heating coils
- Optimized layouts for shell, bottom and roof plates resulting in substantial material savings
- Roof structure design with optimized structural member sizes
- Complete set of fabrication drawings with bill of material lists
Various types of pressure vessels we have handled include:

- Tall columns / towers on skirt supports
- Vertical pressure vessels – leg / lug / skirt supported
- Horizontal pressure vessels on saddles supports
- Reactors
- Detailing of internal and external attachments – vortex breakers, packed bed supports, tray supports, piping support clips, platform support clips, insulation supports, etc.
- Materials ranging from carbon steels, alloy steels, stainless steel, duplex and super duplex steels
- Finite element analysis for local loads
- Fatigue analysis for cyclic services
- Detailed fabrication drawings and bill of materials using 3D modeling tools to eliminate the chance of drafting mistakes.
We have expertise in Finite Element Analysis / Fatigue Analysis for various purposes like:

- Piping loads at nozzle to shell junctions
- Stress evaluation at cone to nozzle junctions
- Stress evaluation at vessel to support junctions
- Stress evaluation for skirt supported vessels with Y type forged pieces at shell – dish – skirt junctions
- Nozzle loads on rectangular header boxes
- Stress evaluation at joins in fabricated miter bends, large Tees’ and other such special fittings
- Fatigue analysis of complete vessels / heat exchangers in cyclic service

This analysis is generally done as per the rules laid down in ASME Sec. VIII Div. 2 Part 5. Analysis as per other standards like PD 5500 can also be taken up.
We regularly undertake piping stress analysis jobs that involve the following activities.

- Static and dynamic piping stress analysis
- Piping isometrics
- Piping support specifications for spring hangers
- Design of piping supports
- Modal and harmonic analysis to account for rotating equipment connected in the piping system
- Stress analysis of metallic and non-metallic piping, buried piping

Design of piping support structure can also be taken up, if required.
For skid mounted equipment and piping systems, we provide

- Skid layout design
- Skid piping stress analysis with the necessary piping supports design.
- Skid structure design considering equipment loads, pipe support loads, wind and seismic loads, etc.
- 3D modeling of the complete skid assembly.
- Generation of general arrangement and fabrication drawings from 3D model.
We provide complete design solutions for the structural design, structural analysis, detailing with 3D modelling of

- Pipe racks
- Equipment support structures
- Technological structures
- Stack / duct support structures
- Lifting frame / lifting beam design for equipments
- Piping supports

Analysis is done considering the equipment and pipe support loading, wind loads, seismic loads, etc.

Foundation load data for all cases required for doing civil foundation design is provided.
We are equipped with the latest tools and facilities to enhance our productivity and deliver quality service to our clients.

- **Software tools**
  - HTRI
  - AspenONE
  - PVElite and CodeCalc
  - FEPipe (from Pauline Research Group)
  - SolidWorks and SolidEdge
  - Excel calculations sheets for storage tank design
  - CAESAR
  - STAADPro (By arrangement with associates)
  - ANSYS (By arrangement with associates)
  - AutoCAD

- **Other facilities**
  - Dedicated server for data storage / retrieval / backup
  - Static IP address for server
  - Access controls to ensure data confidentiality
MAJOR JOBS HANDLED BY OUR TEAM MEMBERS
- **Major jobs - ACHE**

- Design of 13 ACHE units for a client in Saudi Arabia for Jazan project.
- Design of one induced draft air cooler for a client in Saudi Arabia for Safaniya project.
- Design (including FEA of headers) of four air coolers (3 in combined service) for a client in Saudi Arabia for Sadara project. All units with ASME U-stamp requirements.
- Design (including FEA of headers) of one vertical tube bundle unit for a client in UAE (project in Qatar).
- Design (including FEA of headers) for 4 air coolers (total of 28 tube bundles with 8 bundles in duplex steel) for a client in India (project in Venezuela). All units are with ASME U-stamp requirements.
- Twenty six units for IOCL – Paradeep refinery with various consultants (Toyo, Kazstroy, Essar, UDHE, etc). Total of more than 150 tube bundles. These included large units with duplex steel bundles, extruded fins, pipe support structure tied up to the air cooler support structure.
<table>
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<tr>
<th>Major jobs - ACHE</th>
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<tr>
<td>- Thermal design check of 28 air cooler units for NOCL, Cuddalore, India with UDHE as consultant.</td>
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<td>- 3 units for IOCL – Vadodara Refinery (India) with Code stamping. Hot air recirculation system with auto louvers in one unit.</td>
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<td>- 7 units (15 bundles) for HMEL, Bathinda refinery (India) through Kazstroy. Steam coils &amp; process bundles with slope in each pass.</td>
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<td>- 9 units (42 bundles) for Mangalore Refinery with EIL as consultant.</td>
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<tr>
<td>- 9 units for NOCL, Cuddalore, India with Aker Kaeverner Powergas as consultant.</td>
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<tr>
<td>- One unit for IOCL – Mathura refinery (India) with Technip, India as consultant.</td>
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<tr>
<td>- One unit for IOCL – Paradeep refinery (India) with Toyo, India as consultant.</td>
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Major jobs - STHE

- Design and detailing of natural gas cooler for client in Spain.
- Design and optimization of shell and tube heat exchanger (hair pin type) for a fertilizer plant in India.
- Design of numerous Steam coil air pre heaters for a client in India.
- Design of 8 shell and tube heat exchangers for a power plant project (with materials like titanium, SS, CS etc.)
- Design and detailing of 14 shell and tube heat exchangers for refinery project in India.
- Design check / optimization for 40 Shell and tube heat exchangers for refinery project.
- Design of 9 Shell and tube heat exchangers for a project in UK.
- Major jobs - Tanks

- Detail engineering with roof structure design for 2 cone roof storage tanks as per API 650 for a client in Dubai (for Gulf Petrochem project). One tank of 20 m height and 27 m diameter.
- Detail engineering of 7 storage tanks as per API 650 for a client in Dubai (for Hyundai project). Two tanks with internal steam heating coils.
- Detail engineering of 1 dome roof storage tank as per API 620 for a client in Dubai (for Hyundai project).
- Detail engineering of 1 rectangular storage tank for a client in Dubai (for Hyundai project).
- Major jobs – Vessels

- Design and detail engineering for 7 degassing columns for a client in Dubai. Included piping supports and platform supports at multiple elevations in scope.
- Design and detail engineering of 5 pressure vessels for client in Dubai.
- Design and detail engineering of 44 pressure vessels for petrochemical project. Included tall vessels with piping supports and platform supports at multiple elevations.
- Bid stage design support for 17 columns for various clients.
- Design and detail engineering for pressure vessels with jacket arrangement.
- Design and detail engineering for pressure vessels with steam coil arrangement.
- Design and detail drawings for a filter vessel as per PD 5500 standard.
Fatigue analysis of 3 pressure vessels in severe cyclic service. Cyclic service includes pressure and temperature variations.

Finite Element Analysis for reformer pigtail tubes with ovality limits exceeding that specified in the design code.

Finite Element Analysis for a sandwich type pass partition plate assembly in the channel side of a shell and tube heat exchanger for a project of GE, Bangalore, India.

Finite Element Analysis of vessel and heat exchanger nozzles to take care of large piping loads for a project of GE Water, Bangalore, India.

Finite Element Analysis of a 2100 mm diameter miter bend connecting a heat exchanger and a column.

Finite Element Analysis of rectangular header boxes in air cooled heat exchangers for various projects in India, Venezuela and Saudi Arabia.
- Major jobs - Piping

- Piping stress analysis for a spool piece connecting turbine exhaust and surface condenser for a project in India.
- Piping stress analysis and variable hanger specifications for a project of GE Water, Bangalore.
- Piping stress analysis for a hot oil system for a project in UAE.
- Piping stress analysis of a tank farm installation for a client in UAE.
- Piping stress analysis for skid mounted equipment interconnected piping.
- Major jobs - Skid

- Design and detailing of a duplex NG filter skid for client in Dubai.
- Design and detailing of skid for pre-filter and LL Coalescer for client in Dubai.
- The above jobs include piping stress analysis and complete structural design with fabrication drawings.
- Major jobs – Structure Lifting Frames

- Design of lifting and transportation frame assembly for a PSA piping and valve skid – 23 m long x 3 m wide.
- Design of lifting and transportation frame assembly for lifting two harps in one frame – size 15 m long x 3.8 m wide.
- Lifting beam design for a 17 m long x 3.8 m diameter stack segment weighing 90 Ton.
- Lifting beam assemblies for air cooled heat exchangers – tube bundles independently and also complete assembly (tube bundle plus support structure) for numerous air cooler jobs handled by us.
MAJOR ACHIEVEMENTS OF TRANSHEAT
**Job**: Generation of fabrication drawings with 3D models

- **Major advantages**:
  - Drawings generated from 3D model after a thorough review.
  - Drawings are error-free, of very high accuracy.
  - BOM generated from the same model ensuring perfect match with details.
  - Automated weight calculation and clear indication of weld seams.
  - Issues of interferences between different components are eliminated.
  - Client can review a 3D pdf model of the equipment assembly. This review includes all details of internal and external attachments, their orientations and dimensions.

Refer next slides for sample pressure vessel 3D models.
- Major Achievements

Job: Generation of fabrication drawings with 3D models
Sample 3D model and views of a horizontal vessel on saddle supports

Transparent side view showing details of internals (ladder rungs).
Horizontal plane sectional view of vessel with internals
- **Major Achievements**

**Job**: Generation of fabrication drawings with 3D models

Sample 3D model and views of a skirt supported vertical vessel
Job: Fatigue analysis for vessel in cyclic service

- **Criticality:**
  - Vessel in toxic and severe cyclic service. Vertical vessel supported on skirt with a Y-type forging for the shell – head – skirt junction.
  - All self reinforced nozzles with 100% RT requirements.
  - Nozzle loads on all process connections.
  - Effect of internal packing, wind and seismic loads to be considered in fatigue analysis.
  - Cycle - 22 hour cycle with temperature variation of 300°C at constant pressure.

**Analysis done using ANSYS Workbench.**
Refer next slide for figures
- Major Achievements

Job: Fatigue analysis for vessel in cyclic service
- Major Achievements

Job: Fatigue analysis for vessel in cyclic service
- Major Achievements

Job: Fatigue analysis for interconnected vessels in cyclic service

- Criticality:
  - Two vertical lug supported vessels – one supported on top of another with mounting structure in-between.
  - Vessels in severe cyclic service.
  - All self reinforced nozzles with 100% RT requirements.
  - Nozzle loads on all process connections.
  - Effect of internal catalyst, wind and seismic loads to be considered in fatigue analysis.
  - Cycle - 1 hour cycle with pressure variation at constant temperature.
  - FEA study done for the complete two-vessel assembly including intermediate support structure at various load cases.
  - Mesh independence study to prove accuracy of analysis results.

Analysis done using ANSYS Workbench.
Refer next slide for figures.
- Major Achievements

Job: Fatigue analysis for interconnected vessels in cyclic service
Major Achievements

Job: Fatigue analysis for interconnected vessels in cyclic service
- Major Achievements

Job: Fatigue analysis for interconnected vessels in cyclic service
Job: Finite Element Analysis of sandwich type PP plate.

**Criticality:**
- Pass partition plate on channel side of a fixed tube sheet heat exchanger – made up of three plates – varying thickness and different materials – with plug welding at intermittent locations.
- Process fluid is a thick slurry with tendency to form deposits.
- High nozzle loads on the channel side inlet and outlet nozzles.

FEA study done for the complete assembly at various load cases including differential pressure across the pass partition plate while accounting for the varying thermal expansion of the sandwich plates. Suggested additional stiffener arrangements to ensure that the system is safe at all expected operating conditions.

Analysis done using ANSYS Workbench.

Refer next slide for figures.
- **Major Achievements**

**Job**: Finite Element Analysis of sandwich type PP plate.

- 3 Partition Plates with plug welds
- Von mises stress in stiffeners
Job: Finite element analysis of mitre bend

- Size: 2100 mm ID, made in five segments.
- Body flanges at both ends of miter bend. One end connected to tube sheet of a 10 meter vertical heat exchanger supported on spring hangers. Other end connected to a column.
- Huge loads specified by client.
- MOC: SS 304 / 304L
- Analysis performed using ANSYS.
- Refer next slide for figures.
- Major Achievements

Job: Finite element analysis of mitre bend
- Major Achievements

Job: Finite element analysis of rectangular headers

- Equipment type: Rectangular plug header box in air cooled heat exchanger tube bundle.
- Need for analysis: Due to large piping loads on the header box.
- Material of header box: CS / SS / Duplex steel
- Analysis performed using – either FePipe / ANSYS.

Refer next slide for figures.
- Major Achievements

Job: Finite Element Analysis of rectangular header box

1) $P < 1.5 \text{ (SUS Membrane) Case 2}$

- Inlet header

7) Bending $< \text{ User (OPE Bending) Case 3}$

- Outlet header
Job: Stress analysis for 32 inch AL6XN piping.

- Criticality:
  - 132 KW pump and motor assembly (weight 2500 kg.) suspended on piping flanges.
  - Piping system supported on spring hangers.
  - Static and dynamic pipe stress analysis performed.
  - Short pipe routing leading to high loads on equipment nozzles.
  - FEA of connected equipment for the high nozzle loads.

The system is installed in a water treatment facility in India and is functioning as designed.
Refer next slide for figures.
- **Major Achievements**

Job: Stress analysis for 32 inch AL6XN piping.

![AL6XN Piping](image1)

![CS Piping](image2)
Job: Optimization of hairpin heat exchanger

- **MOC**: SS 304 tubes
- **Original design**: 4 hairpins in series, total area of 2553 m².
- **Optimized design**: 4 hairpins in series, total area of 1820 m².
- **Benefit**: A net reduction of 29% in heat transfer area.
- **Cost saving**: More than USD 100,000

The heat exchanger is installed in one of the fertilizer projects in India and is functioning as designed.
Contact…….

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The Transheat Motto.....

Transheat is committed to provide efficient engineering solutions and support its partners at all times.

Transheat welcomes you for a long and mutually beneficial association.

Thank you.