

Design of Heat Exchanger (AXS Type - Floating Head with Multiple Passes)

Key Features

Technology:

Intergraph PV Elite

Autodesk AutoCAD

Duration:

The project was completed in 4 weeks

Deliverables:

- General Arrangement & **Fabrication Drawings**
- 2. Major Design Review
- WRC Calculations for process Nozzles/ Lifting Lugs
- Bill of Materials
- Developed Detailed Drawings for various HX components

The Client

A global manufacturer & supplier of heat transfer equipment like shell & tube heat exchangers and pressure vessels. They focus on optimizing heat exchanger designs to match standard codes and specification for ensuring safety and security of equipment.

The Business Need

The client required AXS type HX design as per ASME Sec. VIII Div. 1 Ed. 2010, TEMA Class R (U-stamp) along with General Arrangement (GA) & Fabrication drawings.

Rishabh's Solution

Rishabh Engineering was appointed to design & develop detailed drawings for floating head HX (u-stamp) with 10 passes on tube side and double cross flow on shell side.

We faced two major challenges for considering design, drawing & execution

- ➤ Impact test on shell side (Carbon steel) due to low temperature (minus 40°C MDMT), Impact test evaluation was done in PV Elite as well as in Excel and Shell plates impact tested at minus 46°C as per SA-20 of ASME Sec. II A
- > PFTH and PWHT evaluation was required to be done and incorporated to satisfy code requirements, simulation heat treatment on plate material included in plate material requirements

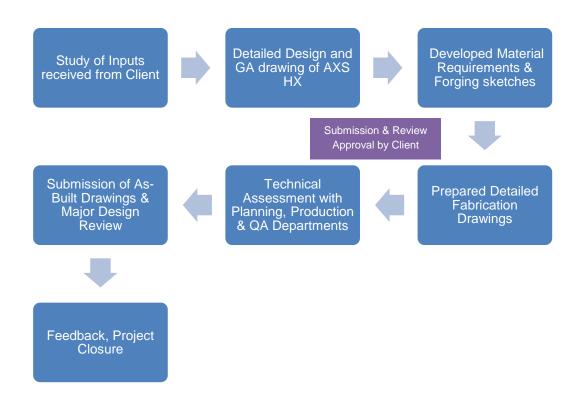


All the design calculations were performed using PV Elite Software. We also prepared material technical requirements & forging sketches for planning to purchase raw materials.

- > Prepared the GA & Fabrication drawings in detail adhering towards the Quality & Production department like main assembly (Elevation/Side View/Plan View) in scale to avoid fouling
- > Developed Nozzle Table/Nozzle loads, Wind Seismic data, Bolt Torque, Weld Joint types/locations, Davit for cover, Insulation Cleats, Tube Bundle with Tube to Tube Sheet Joint, Tube Layout, Baffle Layouts, Spacer/Tie Roads, Bill of Materials, Hold Points, Name Plate, Testing Flange, and others
- > Provided Detailed Drawings for Girth Flanges, Pass Partitions, Gaskets, Bolting, Jack Screw Dowel Pin to avoid mismatch during final assembly
- > Performed WRC for process Nozzles/ Lifting Lugs
- > Delivered all design data necessary during Inspection/Operation/Future Maintenance including weights and prepared Saddle Drawings with Transportation Sketch
- > Poka-yoke was followed to ensure exact match of saddle anchoring during erection at site

We successfully designed and provided detailed drawings for AXS type Heat Exchangers using Intergraph PV Elite which followed the I.E. ASME Sec VIII Div. 1, TEMA standard, wind/seismic standards. The project was completed in 4 weeks with a team of 3 members (1 - Engineer, 1 - Lead Designer & 1 - Designer).

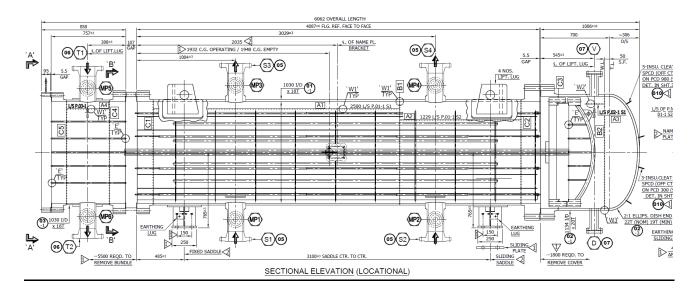
Project Execution Flow Chart



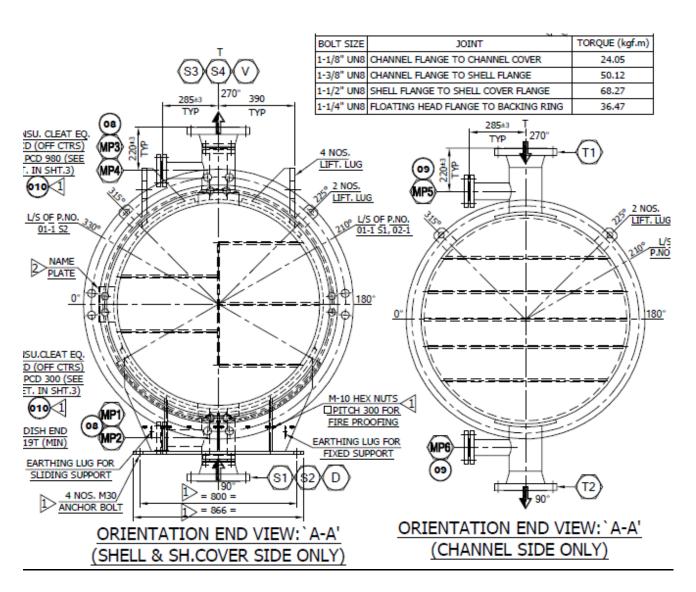


AXS type Heat Exchanger Design Data

1 DESIGN CODE	ASME SECT. VIII DIV-1, ED. 2010, ADD. JULY 2011 + TEMA CLAS 2007 EDITION + API 660 8TH. EDITION.	
TEMA TYPE	AXS (H)	
NO. REQUIRED / POSITION	1 / HORIZONTAL	
	SHELL SIDE	TUBE SIDE
DESIGN PRESSURE (INT./EXT.) kg/cm²(g) 36.8 / - (REF. NOTE: D1)	28.4 / - (REF. NOTE: D1)
3 DESIGN TEMPERATURE (INT./EXT.) °C	145.0 / -	110.0 / -
4 OPERATING PRESSURE (INT./EXT.) kg/cm²(g	9.83 / -	12.50 / -
OPERATING TEMPERATURE (IN/OUT) °C	49.3 / 57.0	76.0 / 62.0
HYDRO TEST PRESS. (SHOP/SITE) (24.5°C <temp<48°c) cm²(g)<="" kg="" td=""><td>51.416 / 47.832</td><td>41.893 / 38.278</td></temp<48°c)>	51.416 / 47.832	41.893 / 38.278
7 MAWP / MAP kg/cm²(g) 36.793 / 39.551	29.445 / 32.225
3 JOINT EFFICIENCY	1.0	0.85
9 RADIOGRAPHY (REF. NOTE-F15) FULL	SPOT
0 CORROSION ALLOWANCE mm	3	3
1 OPERATING FLUID	HP DEPROPANIZER BOTTOM	QUENCH WATER
2 OPERATING FLUID DENSITY kg/m³	588.1	1000
3 POST FORMING HEAT TREATMENT	YES (REF. NOTE- F14)	YES (REF. NOTE- F14)
4 POST WELD HEAT TREATMENT	NO	YES (REF. NOTE- F13)
5 HELIUM LEAK TEST	NO	NO.
6 STEAM OUT CONDITION (@150° C) kg/cm²(g)	0.5	0.5
7 TUBE TO TUBE SHEET JOINT	STRENGTH WELD WITH LIGHT	EXPANSION
8 HEAT EXCHANGED AREA (GROSS/EFF.) m ²	201/181	
9 CAPACITY m ³	2.738	1.472
0 SERVICE	HP DEPROPANIZER REBOILER	
1 SPECIAL SERVICE	(NOTE : D2)	-
2 NO. OF PASSES	CROSS FLOW	10
3 INSULATION (HOT) (BY OTHERS) mm	15/50	15/50
4 FIRE PROOFING mn	n NO	
5 IMPACT TEST REQUIREMENT	YES	NO
6 WIND DESIGN CODE	IS:875, PART-3 - 1987	
7 WIND SPEED m/sec.	50	
8 EARTHQUAKE DESIGN CODE	IS:1893-2005	
9 MIN. DESIGN METAL TEMP. °C	(-)40.0	7.5
0 INSPECTION BY	LLOYD'S	'
1 PAINTING	REF. NOTE: M13	
2 WEIGHT FABRICATED kg	13800~	
BUNDLE kg	5840~ <2	
FULL OF WATER kg	19030~	
EMPTY kg	14352~	



Detail Drawings - AXS Horizontal Floating type Heat Exchanger



Detail Drawings - AXS Horizontal Floating type Heat Exchanger

Technology Used

- > Design Software Intergraph PV Elite
- Drawing Software Autodesk AutoCAD

Key Deliverables

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- > WRC Calculations for process Nozzles/ Lifting Lugs
- Bill of Materials
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 - a. Girth Flanges
 - b. Pass Partitions
 - c. Jack Screw Dowel Pin
 - d. Nozzle Table/Nozzle loads
 - e. Wind Seismic data
 - f. Bolt Torque
 - g. Weld Joint types/locations
 - h. Insulation Cleats
 - i. Tube Bundle with Tube to Tube Sheet Joint
 - j. Tube & Baffle Layouts
 - k. Hold Points

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