

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:

1. General Arrangement & Fabrication Drawings
2. Major Design Review
3. WRC Calculations for process Nozzles/ Lifting Lugs
4. Bill of Materials
5. 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

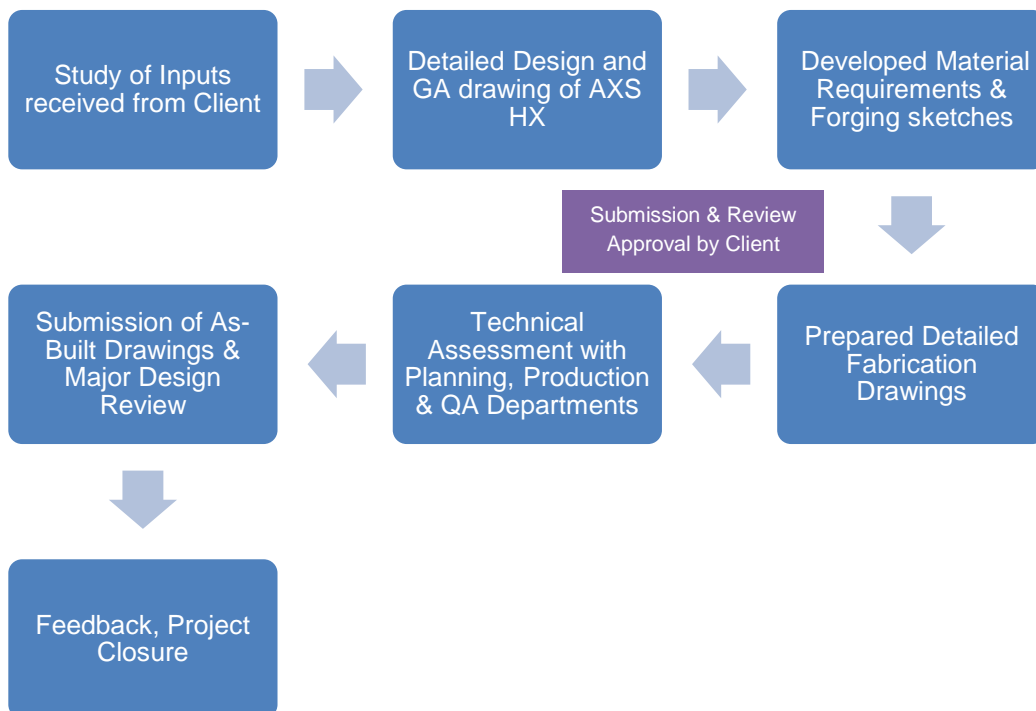
- Impact test on shell side (Carbon steel) due to low temperature (minus 40°C MDMT), Impact test evaluation was done in PV Elite as well as in Excel and Shell plates impact tested at minus 46°C as per SA-20 of ASME Sec. II A
- PFTH and PWHT evaluation was required to be done and incorporated to satisfy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

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

Technology Used

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

Key Deliverables

- General Arrangement & Fabrication Drawings
- Major Design Review
- WRC Calculations for process Nozzles/ Lifting Lugs
- Bill of Materials
- Developed Detailed Drawings for
 - 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

Contact Details

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About Rishabh Engineering

Rishabh Engineering provides multidisciplinary engineering support services to EPC companies in industries like Oil and Gas, Petrochemical, Power and Water treatment. Our parent company, Rishabh Software is a CMMI level-3, ISO9001 and ISO27001 company that provides services in Software Development, Business Process Outsourcing (BPO) and Engineering Services Outsourcing (ESO) to clients globally. Rishabh has offices in USA, UK and India with their main delivery center in Vadodara, India.