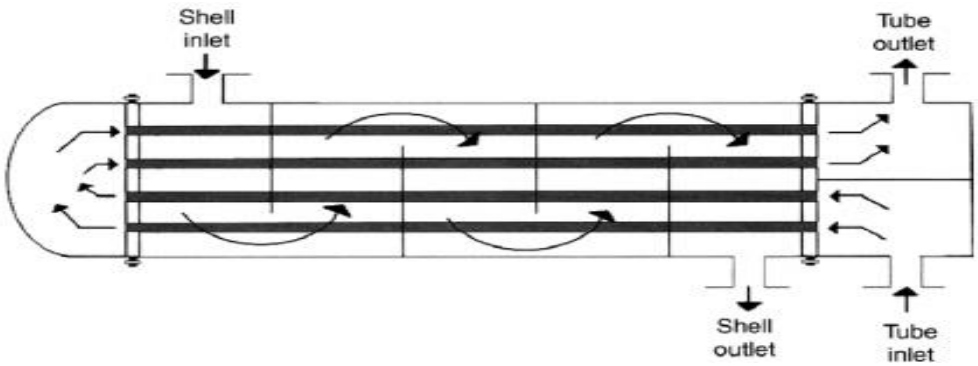
Heat Exchanger manufacturing is closely monitored by various procedures approved by TPI services and AI requirements.



HEAT EXCHANGER (SHELL & TUBE) MANUFACTURING

Heat Exchangers are devices whose primary responsibility is the transfer of heat from one fluid to another. Heat exchangers applications can be seen in oil & gas, chemical, marine and almost all industries and plants.

PURPOSE: -

The basic principle of a heat exchanger (Shell & tube type) is the medium to be cooled (high temp. fluid) pass through the shell and cooling medium (Low temp. fluid) pass through the tubes. The heat is transferred from medium to be cooled to cooling medium. This high temp. fluid enters the shell through inlet nozzle and flows through the baffles according to the design / orientation and meets tubes and at this point the heat transfer occurs. By the time this fluid reaches the outlet nozzle the temp. would have come down to the required level. The cooling medium can be a refrigerant / chilled water or in marine applications - sea water.

SHELL MANUFACTURING DETAILS: -

Inlet / outlet nozzles: The fluid enters the shell through inlet nozzle and exit through the outlet nozzle. In most cases the inlet nozzle will be on the top and outlet nozzle will be on the bottom. So, that the fluid can pass through the outer surface of tubes and between the baffles with ease and flow out through the outlet nozzle. Some exchangers are fitted with drain outlet which will be selected on the bottom most position of shell / nozzle pipe.

Nozzle flanges are either manufactured in a machine shop or we use STD flanges. When manufactured make sure the PCD, Thickness, type of flange face and other dimensions to be exactly same as per sample/drawing/design.

The shell shall be either rolled or we use STD sized pipes of different schedules / thickness. Thickness will be selected as per deign / drawing / sample. The material for shell is selected depending on the applications. There are several methods used to resist corrosion like application of special coatings on the inside surface of shell or by rubber lining. But before coating application it is necessary for a base primer coating to be applied after sand blasting. Coatings can be of several types like hot temperature resistant coating, anti-corrosive coatings (epoxy based) etc.

Additional fittings like support legs, support pads, lifting lugs, air vents etc. are welded on to the shell surface as per the requirement / drawing / design.

Shell flanges are either manufactured in a machine shop or we use STD flanges. When manufactured make sure the PCD, Thickness, type of flange face and other dimensions to be exactly same as per sample/drawing/design. They are welded on to the shell maintaining correct alignment. Enough support to be given as there is chance for the shell flange to bend due to the heat produced during welding.

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Tube sheet – plasma cutting / vertical drilling machines for NBP plates / gas cutting for CS plates for circu
For water jet cutting, arrange for supplier / transportation of plate to supplier workshop and back. Plates w
the lathe and then tube layout will be drilled in CNC as per the Drawing submitted. Tube sheet drilling is d
as per a certain pitch normally triangular or square. And this will be passed on to Vertical drilling machine
on to lathe for final turning process to attain the required OD.
The tubes shall be made ready, cut into required lengths with some tolerance in total length. Tubes are se
heat transfer. Tubes are also selected based on its application.
Baffles - After drilling of tube sheets, baffles will be made ready same as tube sheets. They are then pass
Baffles are mainly for: Supporting the tube, Maintain the tube spacing & Direct the flow of fluid in the desi
Tie rods and spacers are used to: Hold the baffle assembly together & Maintain the selected baffle spacin
The tie rods are secured at one end to the tube sheet and at the other end to the last baffle. They hold th
baffle to maintain the selected baffle pitch. The minimum number of tie rod and spacers depends on the d

After the complete assembly of heat exchanger, they are subjected to a pressure
testing either hydrostatic test or pneumatic test (Air / Nitrogen). The test pressure in
will be as per the design pressure. For high pressures, we normally opt for required
Hydrostatic testing (using Potable water) over pneumatic test.

all thickness & extend of
design and flow required.
he tie rods between each
s.

NDT SERVICES: -

The welding done on the shell are tested by various NDT methods. The welding done on the shell is normally tested either as per client's requirements or by standard company procedures like RT, UT, MPT and PT. Additional to all this we also perform Post / pre-Heat treatment process on the welding joints as per design requirements.

QA/QC INVOLVEMENT: -

The shell manufacturing is closely monitored by various procedures as per QA/QC requirements. Orbit international Survey Services LLC, UAE has various procedures for different types of Heat exchangers that meeting the requirements **of API 660, API 661 and API 650**
The dimensional verification is done at various stages like, fit-up stage & final dimensional verification. Any irregularities are dealt with accordingly as this exchanger during installation will be fitted on to an existing pipe line or other structures. So, any mismatch in dimensions will end up in rejection of heat exchanger manufactured from client side. Welding inspections are also done as per standard procedure and required NDT are performed on the welding.

DEFECTS: -

There are several defects that are associated with heat exchangers. Some of the major defects will be discussed below:

1. Cracks – Tube sheet / shell / end covers / Tube
2. Corrosion – Shell surface / Tube sheet / nozzle / flanges / bolts / end covers
3. Tube leakage / fail.
4. Gasket/O-rings leakage.
5. Tube chocking.

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REFERENCE STANDARDS: -

TEMA Standard	Tubular Exchanger Manufacturers Association
ASME Section VIII Div. 1	Rules for Construction of Pressure Vessels
ASME Section IX	Qualifications Standard for Welding Procedures, Welders and Welding Operators
ASME Section II-A, B, C & D	Materials
ASME Section V	Non-Destructive Examination
ASME B16.5, B16.9, B16.11, B16.20, B16.47 & B36.10M	
API 650	Welded Steel Tanks for Oil Storage
API 661	Air Cooled Heat exchangers for General Refinery Service
API 660	Shell & Tube Heat exchangers for Petroleum, Petrochemical& Natural Gas Industries