DHARMA ENGINEERING

AN ISO 9001 CERTIFIED COMPANY

SS REACTORS / MIXING VESSELS
SHELL & TUBE HEAT EXCHANGER
STORAGE & PROCESS VESSELS

SS REACTORS / MIXING VESSELS

Dharma engineering is engaged in design, manufacturing and suppling of high quality process reactors. Reactors, unlike mixing vessels are totally sealed & designed to disperse two or more processed materials together. Reactors on other hand, allows the processed materials inside to go through a reaction phase which ultimately produces new and different product properties

.

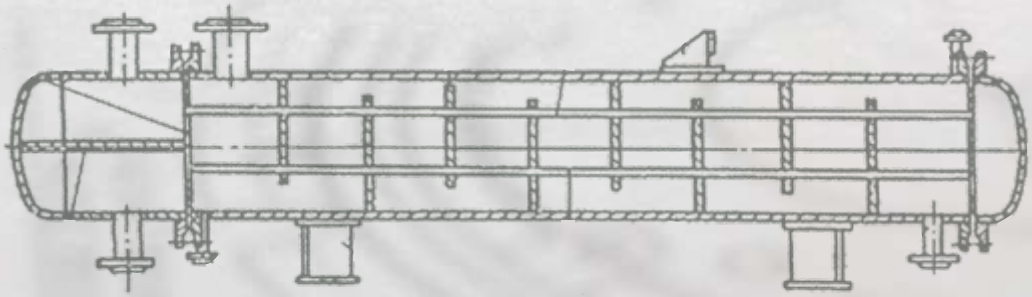
Design of a process reactor deals with multiple aspects of process engineering. Process engineer designs the reactors to maximize net present value for the given reaction. Designer ensures that the reaction proceeds with the highest efficiency towards the desired output products, producing the highest yield of product while requiring the least amount energy to operate.

- Optimum Performance With Longer Servcie Life.
- Designed As Per Different Design Codes And Standard.
- Available In Different Functional Capacities So As To Perfectly Match Up With The Specific Functional Demands Of Different Processes.
- Capacities Ranging From Lab Scale 100 Ltrs To Large Production Scale 20000 Ltrs.
- Diffener Material Of Construction To Suit Process Requirement.
- Ability To Work Under Pressure And Vacuum.
- High Pressure Reactors Are Also Available Upon Demand.
- Different Designs Of Agitator Blades Like Anchor Type, Pbt, Hydro Foil And Propeller Type Etc….
- Available In Gmp / Non Gmp Models With / Without Hot / Cold / Hot& Cold Insulation With Full Argn Arc Welded Covering.
- Agitator / Stirring Mechanism In Accordance With The Application Of The Reactor, Product Viscosity & Density.

HEAT EXCHANGERS (SHELL& TUBE TYPE)

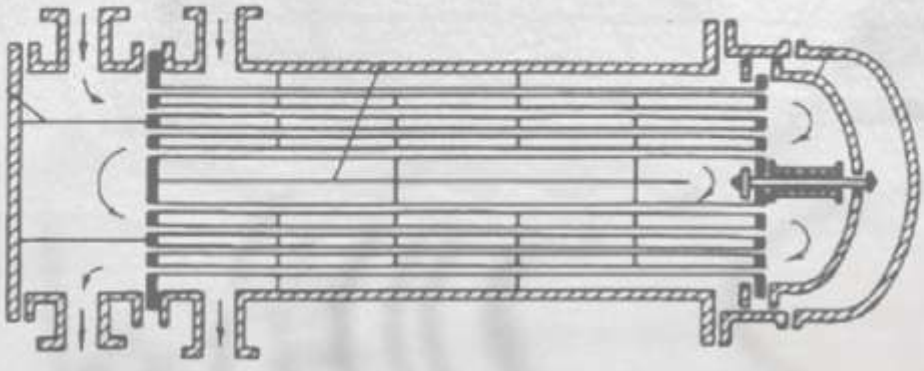
Transfer of heat from one fluid to another is an important operation for most of the processing industries. Heat transfer equipment for transferring heat from one fluid to another fluid are generally called heat exchanger.
Heat exchangers are normally classified depending on the transfer process occurring in them. Amongst of all type of exchangers, shell and tube exchangers are most commonly used heat exchange equipment. The common types of shell and tube exchangers are:

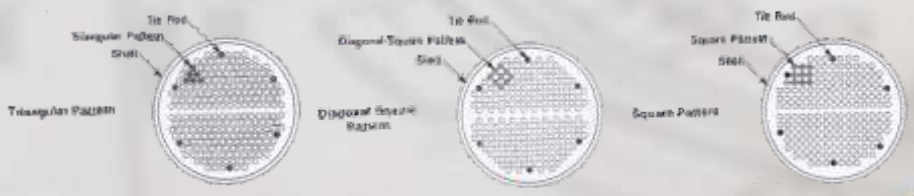
A. Fixed tube-sheet exchanger (non-removable tube bundle): The simplest and cheapest type of shell and tube exchanger is with fixed tube sheet design. In this type of exchangers the tube sheet is welded to the shell and no relative movement between the shell and tube bundle is possible.



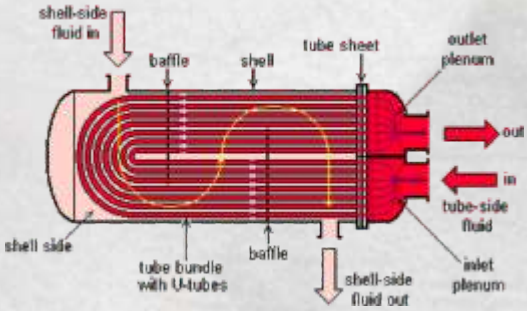
B. Removable tube bundle: Tube bundle may be removed for ease of cleaning and replacement. Removable tube bundle exchanger further can be categorized in floating head and U-tube exchanger.

a. Floating head exchanger: It consists of a stationery tube sheet which is clamped with the shell flange. At the opposite end of the bundle, the tubes may expand into a freely riding floating-head or floating tube sheet. A floating head cover is bolted to the tube sheet and the entire bundle can be removed for cleaning and inspection of the interior.





B. U-tube exchanger: This type of exchanger consists of tubes which are bent in the form of and rolled back into the tube sheet. This means that it will omit some tubes at the center of the tube bundle..



Thermal Design Considerations: The flow rates of both hot and cold streams, their terminal temperatures and fluid properties are the primary inputs of thermal design of heat exchanger. Thermal design of a shell and tube heat exchanger typically includes the determination of heat transfer area, number of tubes, tube length and diameter, tube layout, number of shell and tube passes, type of heat exchanger (fixed tube sheet, removable tube bundle etc), tube pitch, number of baffles, its type and size, shell and tube side pressure drop etc.

Shell: Shell is the container for the shell fluid and the tube bundle is placed inside the shell. Shell diameter should be selected in such a way to give a close fit of the tube bundle. The clearance between the tube bundle and inner shell wall depends on the type of exchanger Shells are usually fabricated from standard steel pipe with satisfactory corrosion allowance.

Tube : Tube OD of ¾ and 1" are very common to design a compact heat exchanger. The most efficient condition for heat transfer is to have the maximum number of tubes in the shell to increase turbulence. The tube thickness should be enough to withstand the internal pressure along with the adequate corrosion allowance. The tube thickness is expressed in terms of BWG (Birmingham Wire Gauge) and true outside diameter (OD). Longer tube reduces shell diameter at the expense of higher shell pressure drop. Finned tubes are also used when fluid with low heat transfer coefficient flows in the shell side. Stainless steel, admiralty brass, copper, bronze and alloys of copper-nickel are the commonly used tube materials.

Tube pitch, tube-layout and tube-count : Tube pitch is the shortest center to center distance between the adjacent tubes. The tubes are generally placed in square or triangular patterns. The number of tubes that can be accommodated in a given shell ID is called tube count. The tube count depends on the factors like shell ID, OD of tube, tube pitch, tube layout, number of tube passes, type of heat exchanger and design pressure.

Tube passes: The number of passes is chosen to get the required tube side fluid velocity to obtain greater heat transfer co-efficient and also to reduce scale formation. The tube passes vary from 1 to 16. The tube passes of 1, 2 and 4 are common in application. The partition built into exchanger head known as partition plate (also called pass partition) is used to direct the tube side flow.

Tube sheet: The tubes are fixed with tube sheet that form the barrier between the tube and shell fluids. The tubes can be fixed with the tube sheet using ferrule and a soft metal packing ring. The tubes are attached to tube sheet with two or more grooves in the tube sheet wall by tube rolling. The tube metal is forced to move into the grooves forming an excellent tight seal. This is the most common type of fixing arrangement in large industrial exchanger. The tube sheet thickness should be greater than the tube outside diameter to make a good seal. The recommended standards (IS:4503 or TEMA) is followed to select the minimum tube sheet thickness.

Selection of fluids for tube and the shell side: The routing of the shell side and tube side fluids has considerable effects on the heat exchanger design.

STORAGE & PROCESS VESSELS

DHARMA ENGINEERING manufactures a wide variety of storage and process vessels for the Pharmaceuticals API, Food & Beverages and Cosmetics Industries including.

- ASME Pressure vessels with Section VIII Division 1 guidelines
- Heat transfer jacketed tanks with ASME Section VIII Division 1 guidelines
- Storage vessels.
- Processing vessels
- Horizontal underground and above ground level vessels.

We fabricate vessels in different configurations. We manufacture large range of storage & process vessels ranging from 50 Ltr To 60,000 Ltr For different applications like

- Water Storage Tanks
- Oil Storage Tanks
- Chemical Storage Tanks
- Bio-diesel Storage Tanks and many more applications.

DHARMA ENGINEERING

AN ISO 9001 CERTIFIED COMPANY

Mfgr's : Equipments and Machines for Pharmaceuticals, Chemicals, Cosmetics and Food Industries.
SPECIALIST IN : RCVD & FBD

Plot No 5133 GIDC, Ankleshwar 393 002 Gujarat, India
: +91 94271 45962 : +91 2646 225133
: dharmaengineering@gmail.com
www.dharmaengg.com