KETEMA LP

Glossary of Heat Exchanger Terminology

ASME — The American Society of Mechanical Engineers. The ASME Boiler and Pressure Vessel Code comprises a set of manufacturing standards that are meant to define basic construction types while providing safety, reasonable cost and serviceability. The ASME Code allows customers to compare like vessels from different manufacturers and be reasonably assured of similar construction methods, material thickness and manufacturing standards.

Baffle Cut — The baffle cut refers to amount of the baffle that is cut away from the full diameter. The baffle cut can never be greater than around 45% to provide tube support. Baffle cuts are varied between 20% to 35% for API type HT, AHT, HTR vessels while baffle cuts to 45% are used in custom designs to provide adequate fluid velocity across the tube bundle while minimizing pressure drop.

Baffle Spacing — Baffle spacing is the amount of distance between baffles in a tube bundle. As it forces liquid to change direction from one end to the other, the distance between baffles has an effect on fluid velocity, pressure drop and heat transfer rate. A good heat exchanger design uses the available pressure drop in an application by spacing the baffles accordingly to maximize the effective heat transfer rate.

Bonnet — Typically a bonnet refers to the castings that are mounted on the ends of non-TEMA heat exchangers to direct the tube side fluid flow. Bonnets are available in 1, 2, and 4 pass designs, with 6-pass designs available forcertain applications. Bonnets are available in cast iron, cast bronze, cast stainless steel and cast ductile iron. Bonnets contain the pass ribs or partitions to assure adequate fluid velocity through the tubes. Most bonnet designs are interchangable so that a given tube bundle can be converted between pass arrangements. TEMA heat exchangers have an integral fabricated bonnet without a cover plate.

Bundle Assembly — The name of the assembly of tubes, tube supports, baffles, tie rods and tube sheets for a removable design. It can refer to a straight floating head or U-tube design bundle.

Channel Assembly — The channel assembly is similar in function to End Bonnets except the channel is of a fabricated steel construction instead of a casting. The channel assembly contains a removable end plate or channel cover to allow access to the tubes for cleaning.

Core Assembly — Similar to a Bundle Assembly, except the Core Assembly typically refers to the straight, fixed tubesheet designs found in non-removable bundle heat exchangers.

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Cradle Assembly Where a heat exchanger is mounted in addition to the support provided by piping connections, cradles are provided. They can be welded to the shell, or movable where a strap is secured to a fabrication or casting which is secured to a customer provided frame or other support. Some cradles merely support the exchanger by gravity and have no strap around the shell.

Design Pressure The pressure used by engineers to determine the thickness of components. Also referred to as MAWP, or Maximum Allowable Working Pressure. For safety reasons, designers generally specify an maximum working pressure 10% to 25% higher than the actual pressure seen in the vessel.

Dome Refers to the enlarged area of fluid entrance into a shell. A dome is specified to reduce the fluid velocity against the tube bundle. Typically a dome is used in conjunction with an impingement plate installed at the base of the entrance nozzle to provide better fluid distribtuion and reduce the potential for tube damage from high velocity fluid. A dome can be part of the nozzle outside the shell, or can be a fabrication welded to the shell. A dome can be welded to the shell when the tube bundle occupies all of the available space for an impingement plate.

Fixed Tube Sheet The tube sheet on a non-removable core assembly. In steel construction designs, the fixed tube sheet is welded to the shell. In non-ferrous or hubbed designs, the fixed tube sheet is an integral part of the shell forging that is brazed or welded to the shell, depending on materials.

Floating Tube Sheet The tube sheet at one end of a removable bundle designed heat exchanger. The floating end is of a smaller diameter than the stationary end because it is inside the shell. A floating design facilitates removal of straight tube bundles and allows thermal expansion and contraction of the tube bundle independant of the shell.

Gaskets The sealing device between two components. Gaskets are used between the tube sheet and end bonnet of channel assembly, between end cover plates and channels and at times between flanged ports in a customer installation. Gasket materials are typically compressed fiber, neoprene or spiral wound metal for high pressure designs.

Hub A forging or casting that includes the tubesheet, shell connection ports, vent/drain connections and mating surface for brazing or welding to shells. API hubs are available in brass and stainless steel.

Impingement Plate A plate or bar that is welded inside a shell entrance port in a domed design to redude fluid velocity and provide enhanced fluid distribution across the tube bundle. Impingement plates redude the potential for tube surface erosion. They can be welded to the entrance nozzle or directly to bundle supports.

Lantern Ring	A nylon or metal ring on certain packed joint designs. Also referred to as gland rings or retaining rings, they are installed over the outside of diameter of rear floating tubesheets to hold the packing in place. They are typically designed with small “weep” holes to indicate fluid leakage from the shell circuit without the potential for fluid mixing.
Lap Joint Flange	A flange arrangement where an inexpensive metal such as carbon steel is used in conjunction with a more exensive metal for direct fluid contact. The lower cost metal contains the bolt ring while the more expensive metal meets the design intent for the metals in contact with the process fluid.
Packed Head	The end of the tube bundle that contains the floating head design and packed rings. See Floating Head.
Packing Ring	A fairly soft non-metalic ring which is used to seal the floating head. In typical constructions, the packing ring slips over the floating tubesheet on either side of the Lantern Ring. It also fits into a groove in the shell and bonnet flange, or is held in place by a retaining ring.
Pass Lane	The area of the tube bundle where there are no tubes caused by a straight pass rib against the tubesheet to direct tubeside fluid flow. Pass ribs on custom ring and cover designs can also be made in a serpentine pattern instead of a straight rib pattern to allow a full tube count.
Pass Rib	The cast or fabricated rib that directs tube side flow patterns through the tubes in the front and rear head assemblies or castings. Pass ribs are placed to force tube side fluids only through sections of the tube bundle at a time, thus effecting fluid velocity, pressure drop and heat transfer rates.
Protector Rod	Also known as Zinc Anodes, they are usually placed in the tube side fluid stream as a sacrificial metal to help prevent corossion of tubes, tube sheets and bonnets. An optional device, they should be specified with heat exchangers containing Admiralty tubes and for heat exchangers with sea water or brackish water in the tube circuit.
Reversing Head	The end bonnet or fabrication that does not contain the tube side fluid inlet or outlet ports, but contains pass ribs that reverses the flow of fluid in multi-pass heat exchangers.
Shell Head	A formed plate which is welded to the shell pipe. It can be in a dished, elliptical, or hemispherical shape and have axial or tangential ports or have no ports. On small diameter vessels, a flat end plate cover is more economical.
Slip On Flange	A flange design that features a flange ring fitted over and welded onto a pipe section, or nozzle pipe.

Spacer	A piece of tubing that slides over the tie rod or tie tube between baffle plates to secure the baffle position in a tube bundle or core assembly.
Stacked Set	A set of heat exchangers, usually with interconnecting piping that function either as units in series service, or as a prepiped standly unit for continuous service while one heat exchanger is being serviced. Stacked sets can include switchover valves for both shell ports and tube ports.
Stud/Stud Bolt	A stud bolt is a threaded rod that extends through holes in two mating flanges and is secured with hex nuts on each end. A stud is a threaded rod that is attached to a tapped hole in one of the mating flanges. The other end is secured with a hex nut assembly.
Stuffing Box Flange	A flange used at a packed floating head assembly. When a packed joint is tightened, the packing ring is forced against this flange by the lantern ring or gland seal.
TEMA	Tubular Exchanger Manufacturers Association. TEMA specifications cover manufacturing, installation, operation and maintenance of shell and tube heat exchangers. See section on Selecting TEMA Heat Exchangers.
Test Pressure	The pressure used during hydrostatic testing of a heat exchanger to detect any tube to tubesheet leaks, mechanical joints and materials. Generally the test pressure is 1.5 times the operating pressure. Compressed air at 50 to 75 PSI are generally used for tube joint leak tests.
Tie Rod	A small diameter rod which threads into the stationary end tubesheet and secures the baffles and spacers together.
Tube Layout	Refers to the tube pitch and pattern of tubes within a tube bundle or core assembly. The tube layout generally shows the position of tie rods as well as tubes.
Tube Sheet	The plate that secures the tubes and separates the tube side and shell side fluid. Both fluids contact the tube sheet. Tube sheets have holes that correspond with the tubes. Tubes can be secured by brazing, welding or expansion rolling. Certain designs utilize seal welding before expansion rolling. Tube sheets can contain grooves inside the tube holes to provide greater adhesion.
Weld Neck Flange	Used as a nozzle or body flange, it is used whenever a butt weld is required. The end of the flange has a beveled edge butts up against a piece of pipe, also with a beveled edge. There is no overlapping of parts. In some cases, welding is more efficient by using a backing ring behind the two mating beveled edges, however ASME does allow backing rings, but with varying joint efficiencies, so that welding inside and outside must be done to meet certain requirements.