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1. Basic scope of document

This document defines the basic principles of design for heat exchangers of the plate heat exchanger type. It shall be a basic guide for filling in BCA standard specifications and help to deal with client specifications. It is not mandatory but shall be used as a guideline and deviations from this document may be required on a case to case basis.

2. Basic equations for heat transfer

A heat exchanger follows the equalization principle. With a plate heat exchanger, heat cuts through the surface and separates the hot medium from the cold. Thus, heating and cooling fluids and gases use minimal energy levels.

The theory of heat transfer between mediums and fluids happens when:

- Heat is always transferred from a hot medium to a cold medium.
- There must always be a temperature difference between the mediums.
- The heat lost from the hot medium is equal to the amount of heat gained by the cold medium.

3. Construction of plate heat exchanger

Heat transfer plates are made by pressing thin sheets of corrosion-resistant metal such as stainless steel or titanium, then set them with seal gaskets and hang and pile them on the guide bar. Then, plates are tightened with bolts between the fixed frame and the movable frame. Here, there is a certain gap between the heat transfer plates that allows liquid to flow. The liquid inlets and outlets are in the fixed frame or the movable frame.

3.1 Covers/Frames

Fixed and moveable covers shall be able to withstand the given Design Pressure without added reinforcement or stiffeners. The moveable cover shall be provided with a heavy duty roller bearing assembly for units 3" diameter and greater. The cover plate material shall be a corrosion resistant carbon steel (SA-516-70) cleaned (sandblasted), primed and enamel or epoxy painted.

3.2 Plates

Stainless steel (SA-240, 304SS or 316SS) plates pressed with corrugation to optimize heat transfer shall be provided. Thickness shall not be less than 0.4mm. Plates to be provided with an alignment design, preferably an interlocking mechanism pressed into each plate which interlocks with its adjacent plate providing a precise plate-to-plate alignment to assure proper sealing of the plate pack.

3.3 Gaskets

A one piece molded elastomer gasket compatible with the fluids shown on the plans. The gasket shall have relief grooves in the double gasketed areas to prevent any cross-contamination between the hot and cold fluids. Gaskets to be Nitrile (NBR) rubber (for non-steam applications) where maximum working temperatures are below 250 °F.

3.4 Carrying Bars

Each plate shall be supported and guided by a top & bottom carrying bar, which accurately locates the plates within the frame assembly. The top bar that contacts the stainless steel plates shall be machined stainless steel surface that provides ease of movement of the plates. Upon opening of the unit, the carrying bar design shall permit removal of any one plate within the plate pack without removing adjacent plates.

3.5 Connections

Piping connections 3" diameter and larger shall be studded port design. Piping connections less than 3" diameter shall be externally threaded type MNPT stainless steel.

3.6 Tightening Bolts

High tensile strength carbon steel (SA-193, B7) bolts shall be provided. Both fixed and free nuts shall be heavy duty carbon steel (SA-194, 2H). The bolts, nuts and washers shall be zinc plated.

3.7 Frame Support Pads

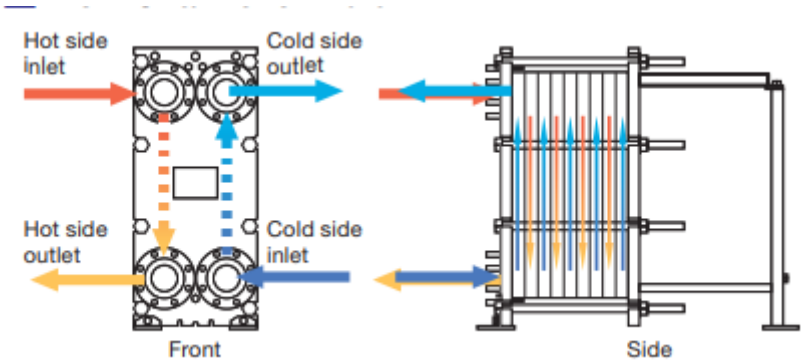
Steel base plates for anchoring to the floor shall be provided. The Frame shall be provided with an end support (outrigger), for units with port sizes 3" and larger.

3.8 Protective Shroud & Insulation

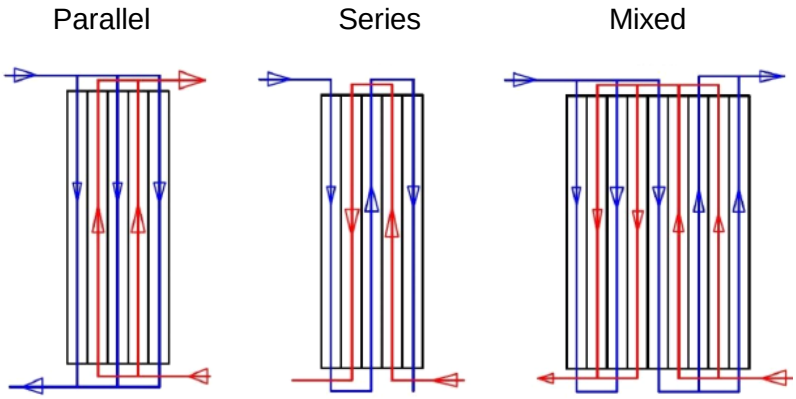
Galvanized Steel protective shroud shall enclose exterior plate bundle. Factory insulation of Plate & Frame unit, if required, shall be shown on plans.

The Plate & Frame Exchanger shall have the capacity for future expansion of at least 20% additional plates.

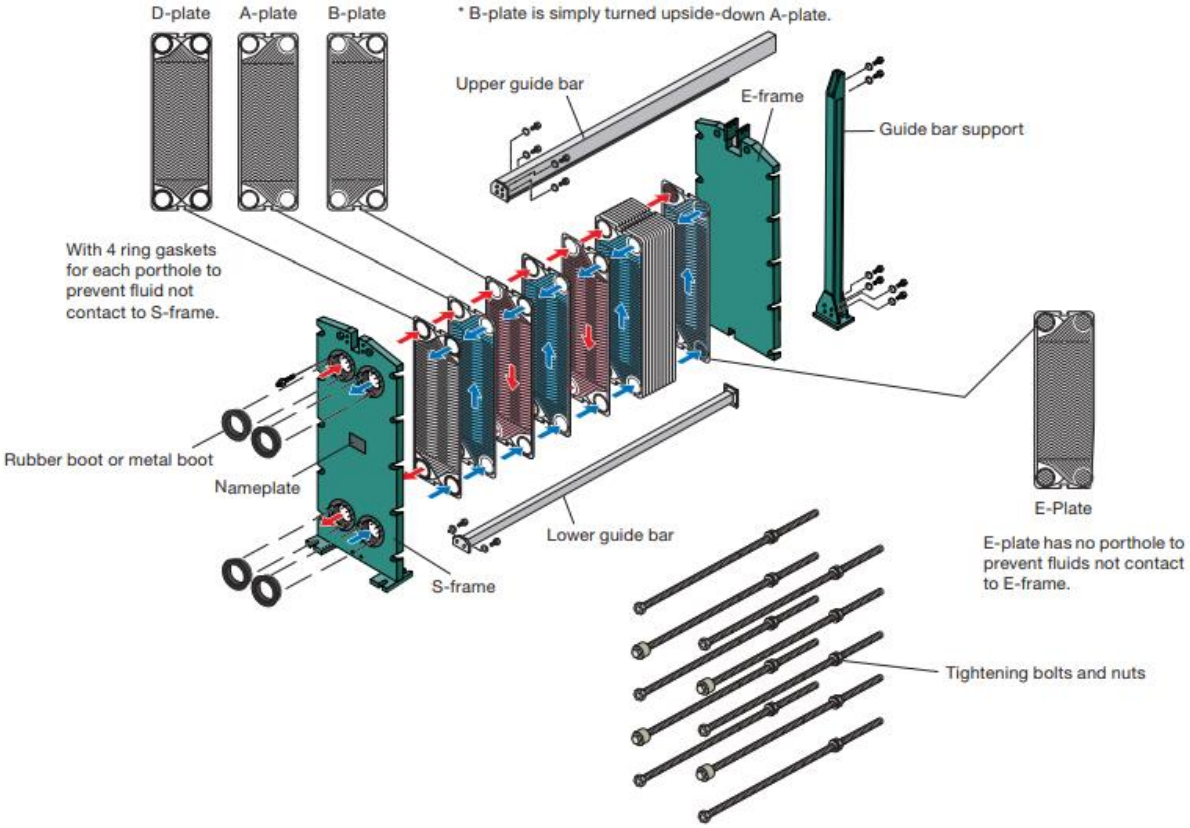
Flow of fluid in PHE:



4. PHE Internals and Arrangements:



A plate exchanger consists of a series of parallel plates that are placed one above the other to allow the formation of a series of channels for fluids to flow between them.



The space between two adjacent plates forms the channel in which the fluid flows.

Inlet and outlet holes at the corners of the plates allow hot and cold fluids through alternating channels in the exchanger so that a plate is always in contact on one side with the hot fluid and the other with the cold.

5. Materials

The most frequently used materials for the plates are stainless steel (AISI 304, 316), titanium and aluminum, Super duplex.

6. Codes and Standards

6.1 API 662

API 662 is an international standard widely used for plate heat exchangers.

1.1.1 This International Standard gives requirements and recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of plate heat exchangers, sometimes referred to as plate-and-frame heat exchangers, for use in petroleum and natural gas industries.

1.2.1This International Standard covers gasketed, semi-welded and welded plate heat exchangers constrained within a frame.

1.3.1 As used in this International Standard, the term heat exchangers, or exchangers, includes coolers, heaters, condensers, evaporators and reboilers.

6.2 ASME Section VII DIV1/2 GA-1420 (HEAT EXCHANGERS)

The manufacturer or supplier must be registered with the National Board. The Plate & Frame Heat Exchanger shall be designed and tested to the latest ASME Code, Sect. VIII, Div. 1 requirements. Design Pressure and maximum working temperatures shall be in accordance with project plans.

7. Selection of Plate heat exchangers:

Plate Heat Exchanger selections shall be verified by the manufacturer to provide the required heat transfer area for the operating conditions and pressure drops.

7.1 Brazed plate heat exchangers (BHE):

Compact design comprised of brazed plates separated by spacer frames to form two independent circuits. Can be circuited for either parallel or counter flow.

7.2 Gasketed plate and frame heat exchangers (GPHE):

A stack of sheet metal plates that have been pressed to give patterns of ridges and grooves that define the coolant flow passages and provide turbulence-promoting surfaces.

7.3 Welded plate heat exchangers (WPHE):

Compact design comprised of welded plates separated by spacer frames to form two independent circuits. Can be circuited for either parallel or counter flow.

8. References / Useful Links

[1] STANDARDS OF THE PLATE HEAT EXCHANGERS

[1] https://standards.globalspec.com/std/342833/api-std-662#:~:text=This%20International%20Standard%20gives%20requirements,petroleum%20and%20natural%20gas%20industries.

[2]http://www.thermopedia.com/de/content/1182/

[3] API STANDARD 662 Plate and Frame Heat Exchangers for General Refinery Services

[4] ASME section VIII Div 1

8.1 Useful links

Design Tips: http://www.hcheattransfer.com/tips.html

Example for HEDS: GlobalCube – Guidance documents

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9. Revision Index

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Chapter	What