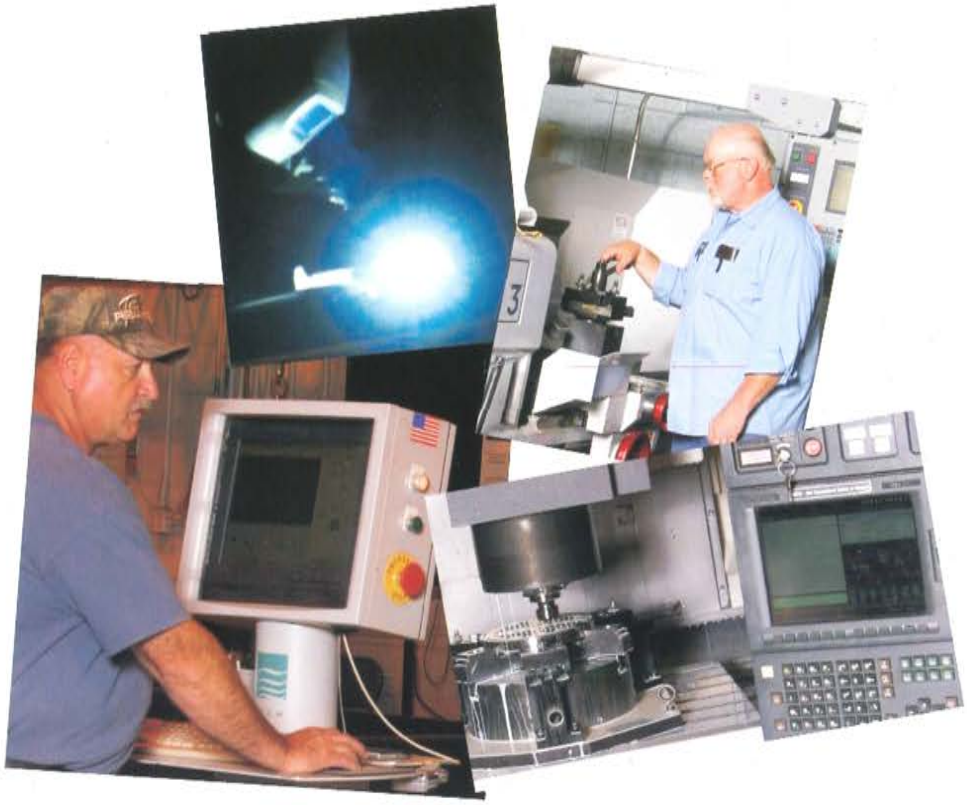
ENERQUIP

Shell & Tube Heat Exchangers



Pharma
Biotech
WFI/USP
Food
Dairy
Chemical

SANITARY EXCELLENCE

ENERQUIP ...innovation, quality and service

Over 125 years of experience in heat transfer

Enerquip traces its beginnings back for over a century. Enerquip has a long history of manufacturing components with unmatched performance in demanding applications.

Through the decades, we have provided heat transfer equipment for a wide range of applications including: nuclear, hydro power (Three Gorges dam), U.S. Navy guided missile destroyers, food, dairy, beverage and pharmaceutical industries.

Located in North Central Wisconsin, Enerquip, Inc. is the premier source for sanitary shell and tube heat exchangers, with excellent lead time, on-time delivery, superb quality, and unmatched customer service.

Here are some typical applications using Enerquip heat exchangers:

- Pharmaceutical and bio-pharmaceutical processes.
- Food, beverage, and dairy processes.
- Guided missile destroyers.
- Evaporation, condensation, heating and cooling.

Enerquip expertise

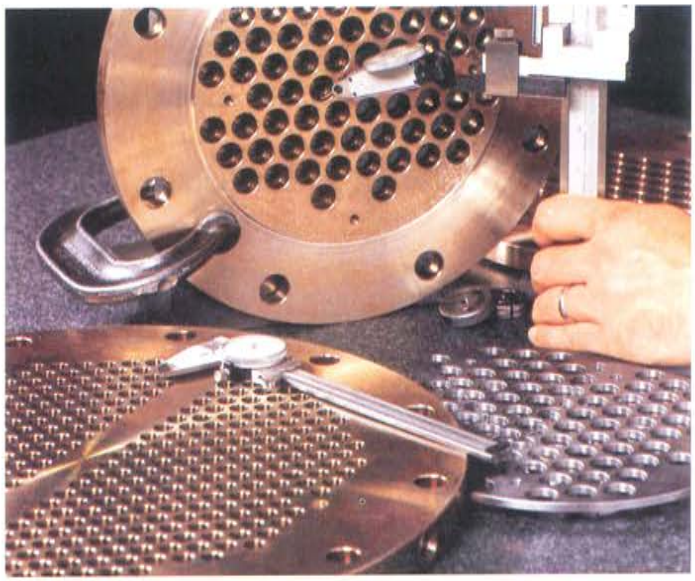
- The engineering team at Enerquip offers its technical knowledge and years of experience to meet your heat transfer needs. With their expertise in mechanical and thermal engineering and the use of computer aided design and modeling, our engineers assure a mechanically and thermally sound design of shell and tube heat exchangers.
- Our certified welders are experts in the art of GMAW, GTAW, flux-core, and submerged-arc welding to military and ASME certifications.
- Enerquip builds heat exchangers that comply with the following codes and standards :
  - ASME Code Section VIII Division 1..
  - TEMA (Tubular Exchanger Manufacturers Association) Standard.
  - 3-A Standards and Practices.
  - BPE (Bioprocessing Equipment) Standard.

  Plus MIL, coastguard, nuclear and many others.

Expanding the tubes into the tubesheet

Seal-welding the tubes to the tubesheet

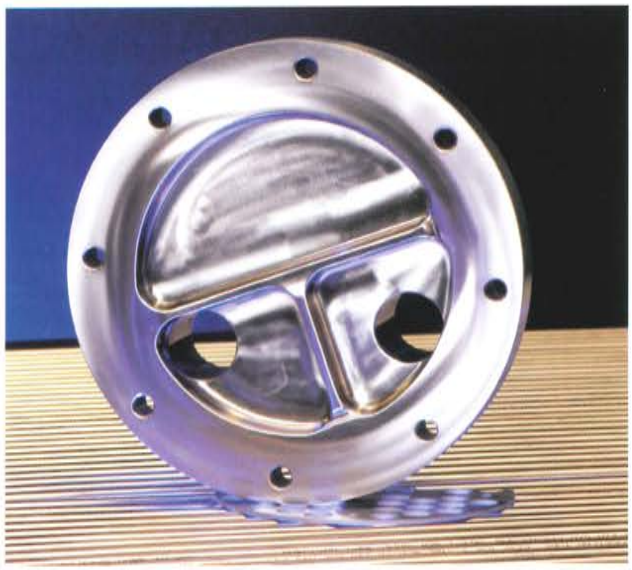
Enerquip quality



- Quality is constantly monitored by in-house inspection at every stage of the manufacturing process. Third party inspection is conducted by an independent agency approved by the *National Board of Boiler and Pressure Vessel Inspectors*.

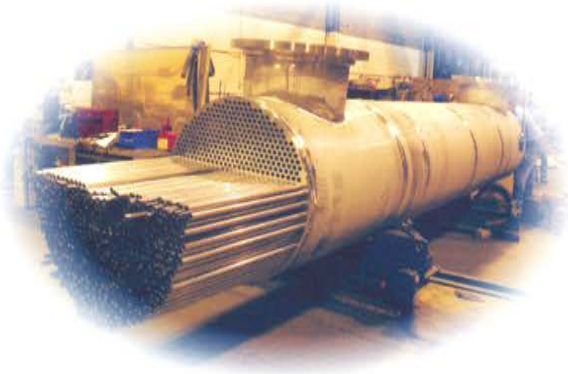
- Enerquip uses state-of-the-art equipment for welding, CNC turning milling, plasma cutting and water jet cutting.

- Engineered designs, highly skilled staff, and excellent equipment enable us to produce superb products that function reliably in the most demanding applications.

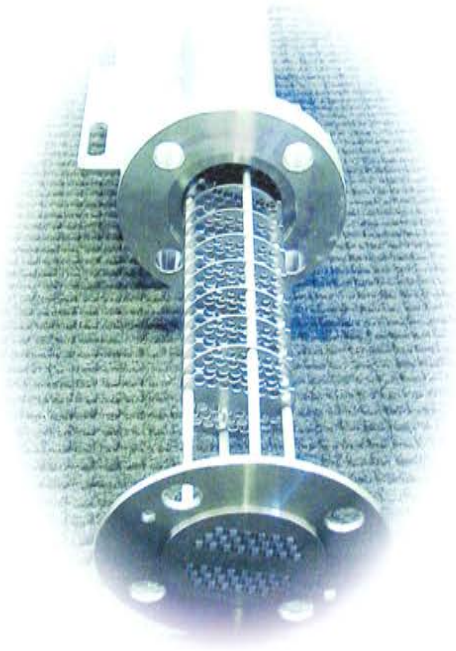


Heat exchanger specifications

- Enerquip designs and manufactures every TEMA type shell and tube heat exchanger, from 2" to 60" in diameter, with straight tubes or U-tubes.
- Each heat exchanger may be built according to the requirements of the following TEMA classes:
  - Class B : chemical process
  - Class C : general process
  - Class R : petroleum process
- We can design ASME heat exchanger for operating pressures as high as 2500 psig. Our standard heat exchangers are designed for 150 psig at 375 °F.
- Enerquip fabricates heat exchangers from a wide range of materials including stainless steel 304L or 316L, duplex stainless steels, or corrosion resistant alloys (Hastelloy, AL-6XN), as well as titanium, copper-nickel alloys, and carbon steel.
- With each heat exchanger, Enerquip offers the following options :
  - Insulation (non-asbestos and chloride free)
  - Horizontal or vertical mounting supports
  - Double tubesheet design
  - Full drainability
  - Passivation
  - Electro-polished surfaces



39" diameter exchanger for fruit processing plant



3" diameter exchanger for chemical service

3-A sanitary heat exchanger design

- Enerquip designs and manufactures heat exchangers that comply with 3-A and BPE standards and practices for heating or cooling WFI, pharmaceuticals, milk products, foods or other comestibles.

- Typical processes include the following :
  - WFI, USP or potable water and clean-in-place (CIP) solutions
  - Condense pure steam to produce WFI.
  - Evaporation such as sugar concentration
  - Juice, sauce, oil, soup, and syrup
  - Brewery processes
  - Chocolate, peanut butter and other viscous products
  - Cheese and whey products
  - Blood, plasma and meat products

- Each 3-A compliant exchanger offers sanitary connections on the process side and food-grade gaskets or O-rings. All product contact surfaces are ground to a 150 grit (#4 3-A sanitary finish) as a standard, but finer finishes including electropolish are available. All internal surfaces are crevice-free in order to minimize corrosion and improve cleanability. Each exchanger is fully drainable to aid in maintaining a sanitary environment inside the tubes and waterboxes.

Fully-drainable waterbox

Waterbox with sanitary connections

Pharmaceutical heat exchanger design

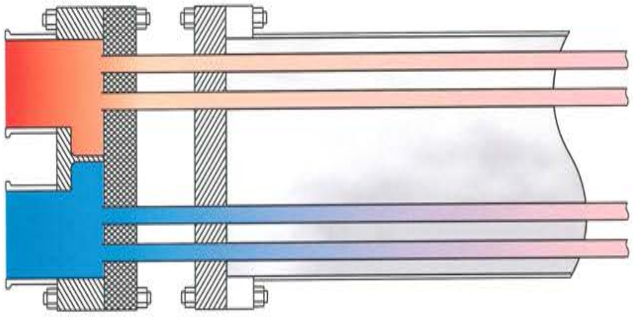
- Enerquip designs and manufactures heat exchangers that comply with the requirements of the hygienic and pharmaceutical industries. These heat exchangers are specially designed for applications where cleanability and surface finish are of utmost importance.
- Typical processes include :
  - WFI, USP, DI, RO or ultra-pure water
  - Pure steam
  - Blood, plasma or growth media
  - API or formulated pharmaceuticals
- Each pharmaceutical grade exchanger offers sanitary connections on the process side and USP Class VI O-rings. Materials for the O-rings are carefully selected in order to be compatible with the process fluids. All product contact surfaces may be electro-polished to as low as a 10 Ra finish to minimize corrosion and enhance sanitary performance. Each exchanger is fully drainable.

Waterbox with pharmaceutical O-ring design

26-pass waterbox for pharmaceutical application

Double tubesheet design

- Double tubesheets are used for applications where the mixing of the tube-side fluid and the shell-side fluid must be avoided. In the event of leaks occurring where the extremities of the tubes are expanded into the tubesheet, the tube-side fluid would leak between the two tubesheets instead of leaking into the shell.

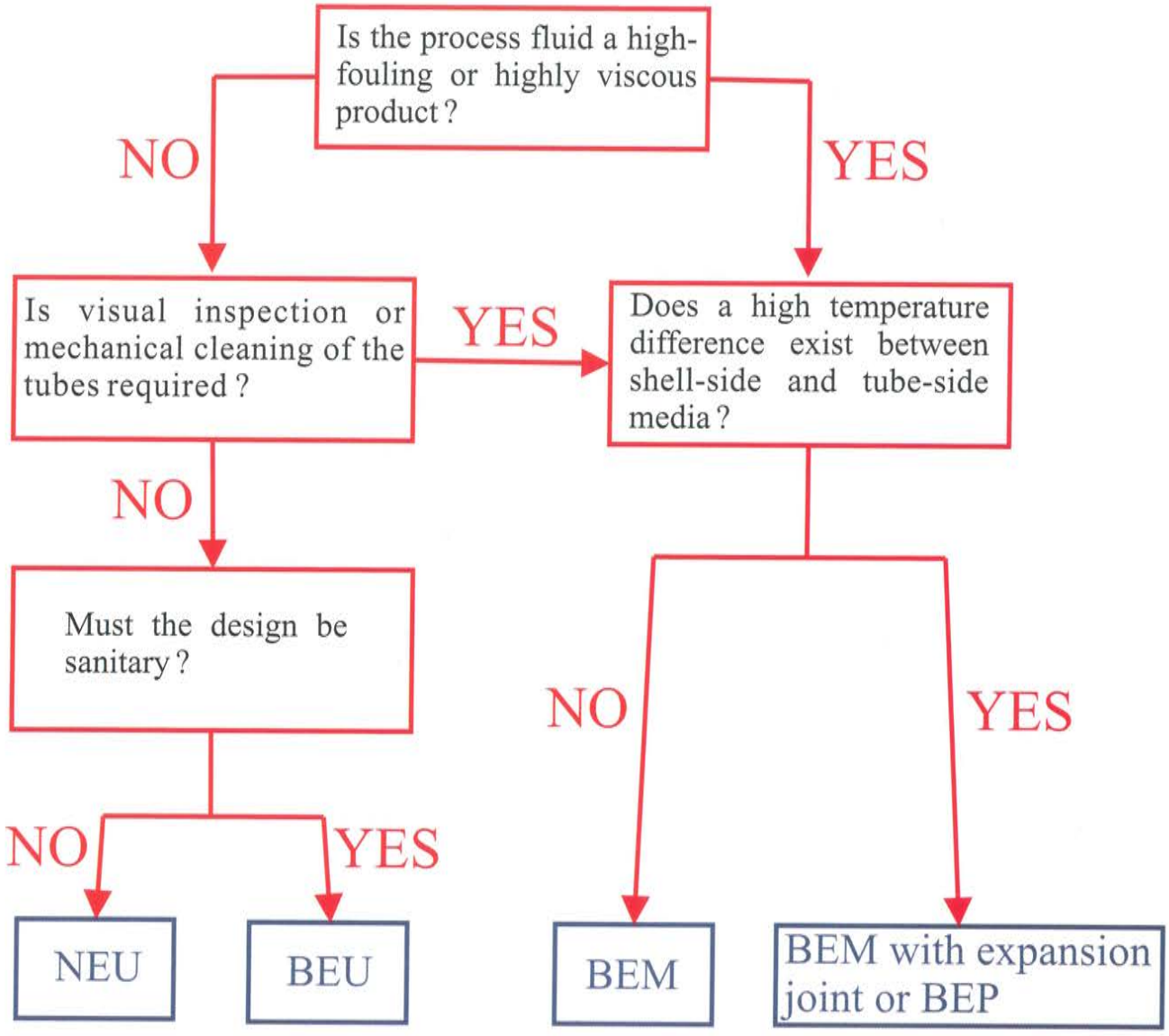


Double tubesheet design

Exchanger with double tubesheet

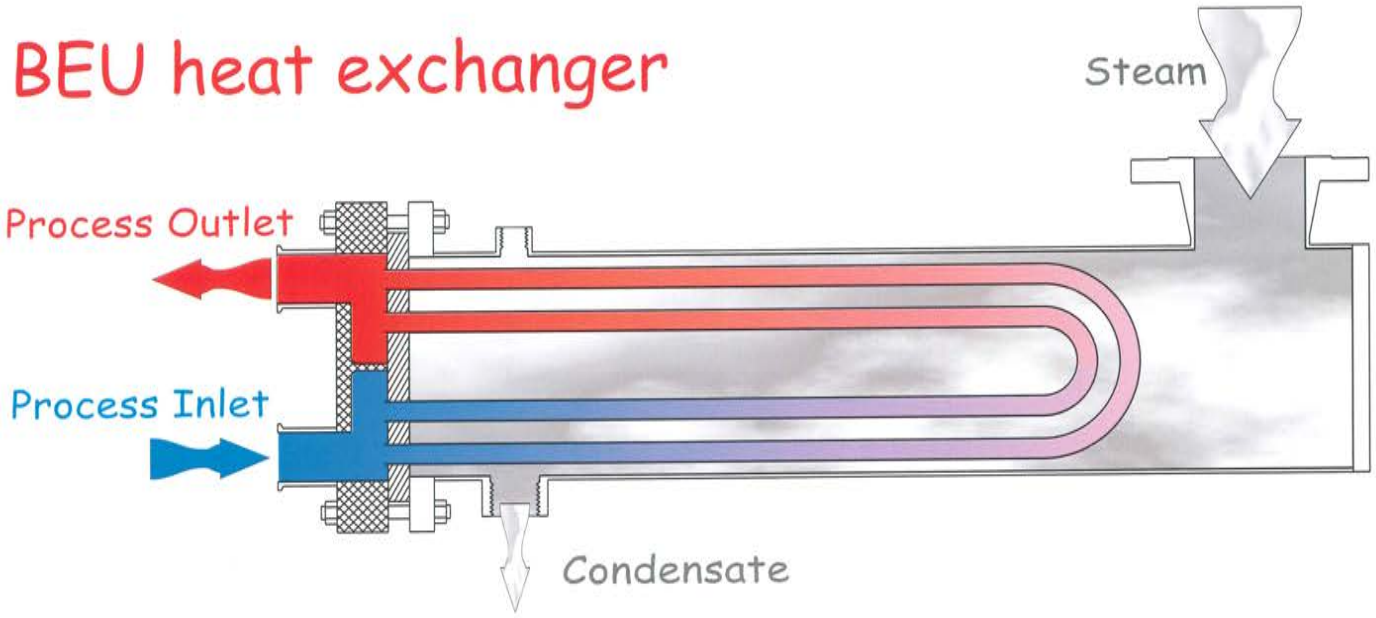
- Enerquip manufactures "separate double tubesheets" : the gap between the two tubesheets is open to the atmosphere so any leakage of either fluid should be visually and quickly detected.
- Double tubesheets are typically a feature of pharmaceutical heat exchangers. However, any shell and tube exchanger may be equipped with a double-tubesheet design.

Shell & tube exchanger selection guidelines



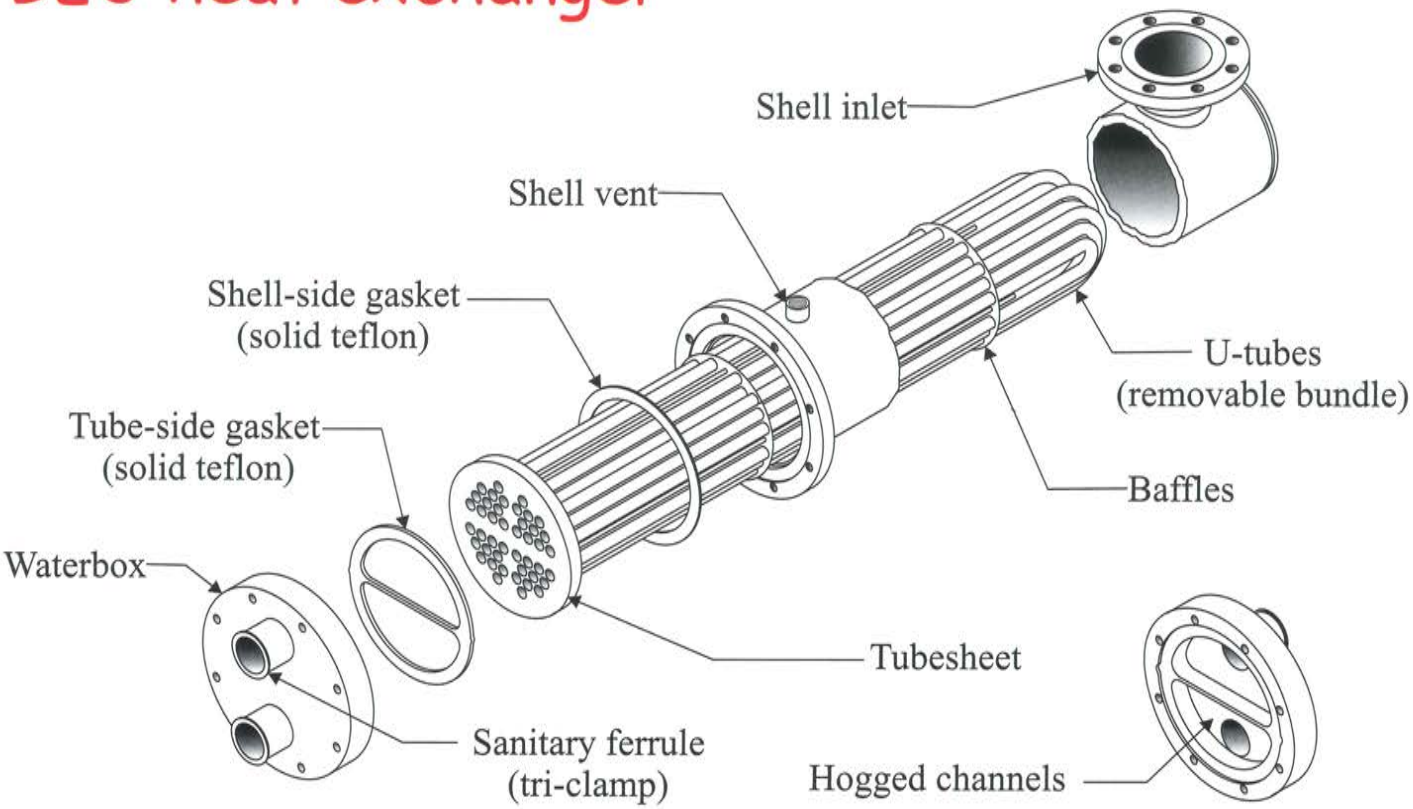
These guidelines are for information only. Other factors may affect the design of shell & tube heat exchangers. Please contact our design team for further information.

BEU heat exchanger

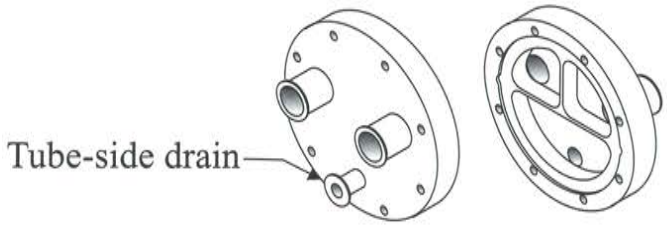


- The BEU heat exchanger is the ideal choice for heating or cooling low-fouling fluids. Typical process fluids include water, CIP solutions, milk and beverages.
- The U-tube bundle is attached to a single tubesheet, allowing the tubes to expand and contract freely under the influence of temperature variations. The BEU exchanger is the preferred design when the temperature difference between tube-side and shell-side fluids is high (for instance when steam is the heating medium).
- The tube bundle is removable and allows cleaning of the outside surfaces of the tubes. In the case of tube failure, Enerquip can supply a replacement bundle that is easily installed into the existing shell assembly.
- The BEU exchanger is generally an economical design as only one tubesheet and waterbox are required.
- Enerquip manufactures a wide range of BEU heat exchangers in standard sizes. Each standard BEU meets the latest 3-A Standard and Practice requirements. Our engineers are also available to design custom BEU heat exchangers meeting your sanitary, pharmaceutical or industrial requirements.

BEU heat exchanger

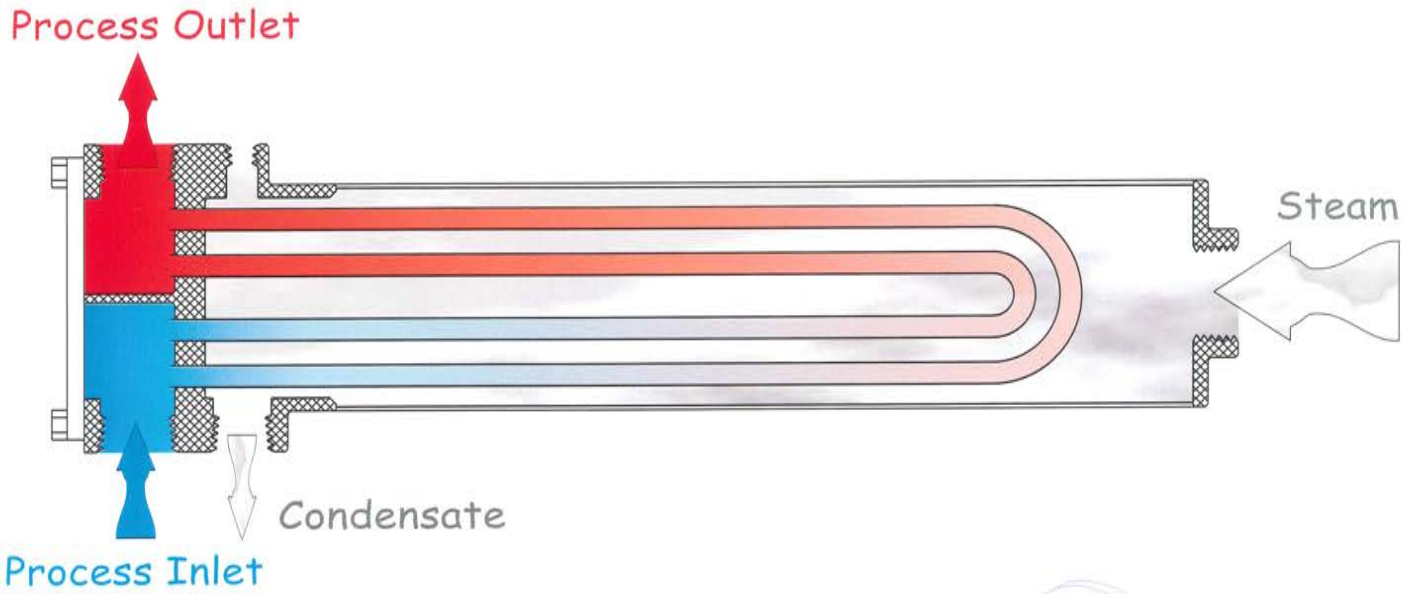


O-ring design



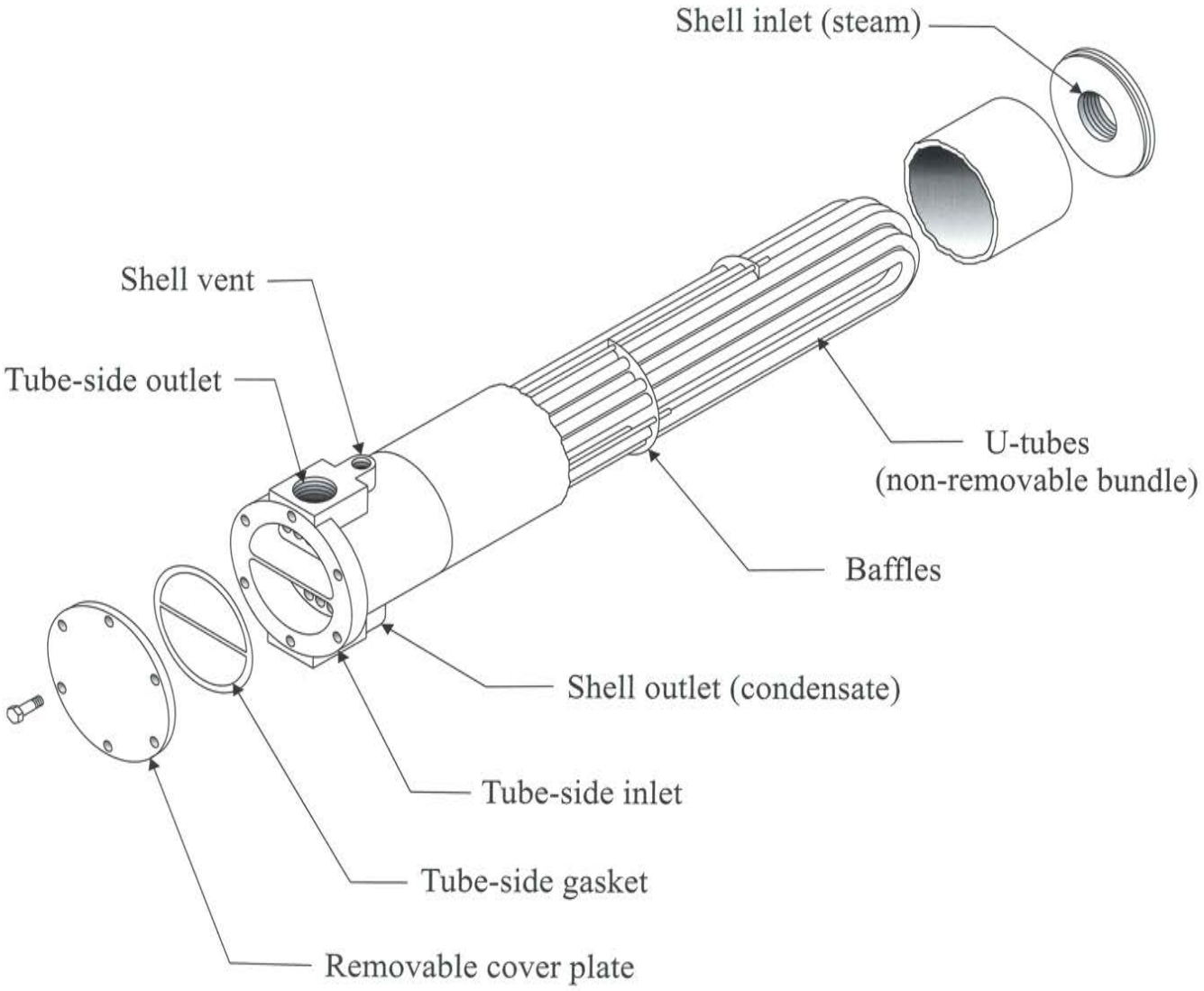
4-pass configuration

NEU heat exchanger

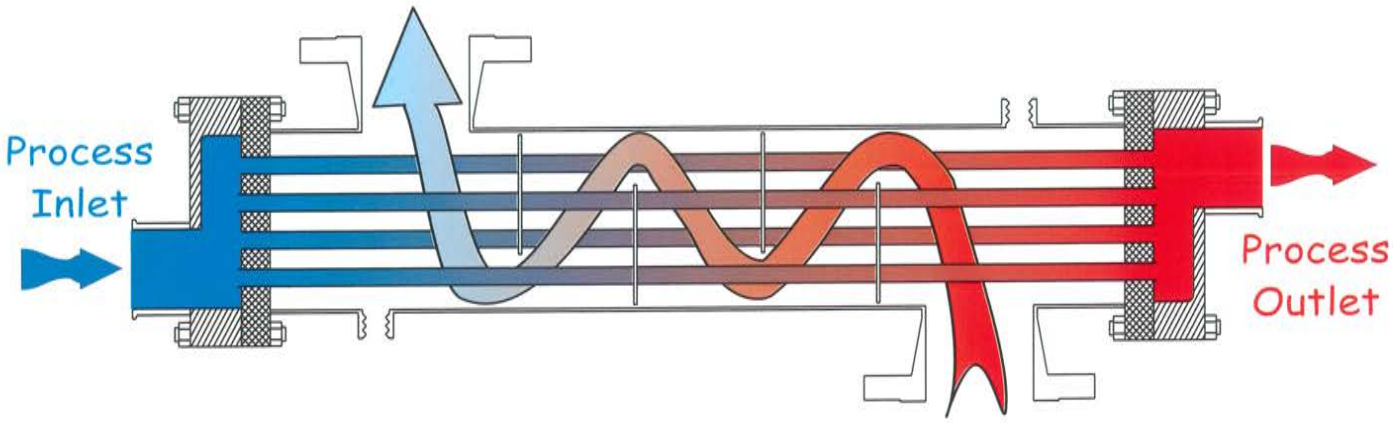


- The NEU heat exchanger is the equivalent of the BEU exchanger for industrial applications that do not need to comply with 3A sanitary requirements. Its threaded connections and unpolished surfaces make it the most economical choice for heating industrial fluids using steam as the heating media.
- The non-removable U-tube bundle is attached to a stainless steel cast waterbox and tubesheet. A removable cover plate allows cleaning of the waterbox channels.
- The U-tubes expand and contract freely under the influence of temperature variations, reducing the risk of failure due to thermal shock.
- Enerquip stocks NEU heat exchangers in several sizes, for quick delivery.

NEU heat exchanger

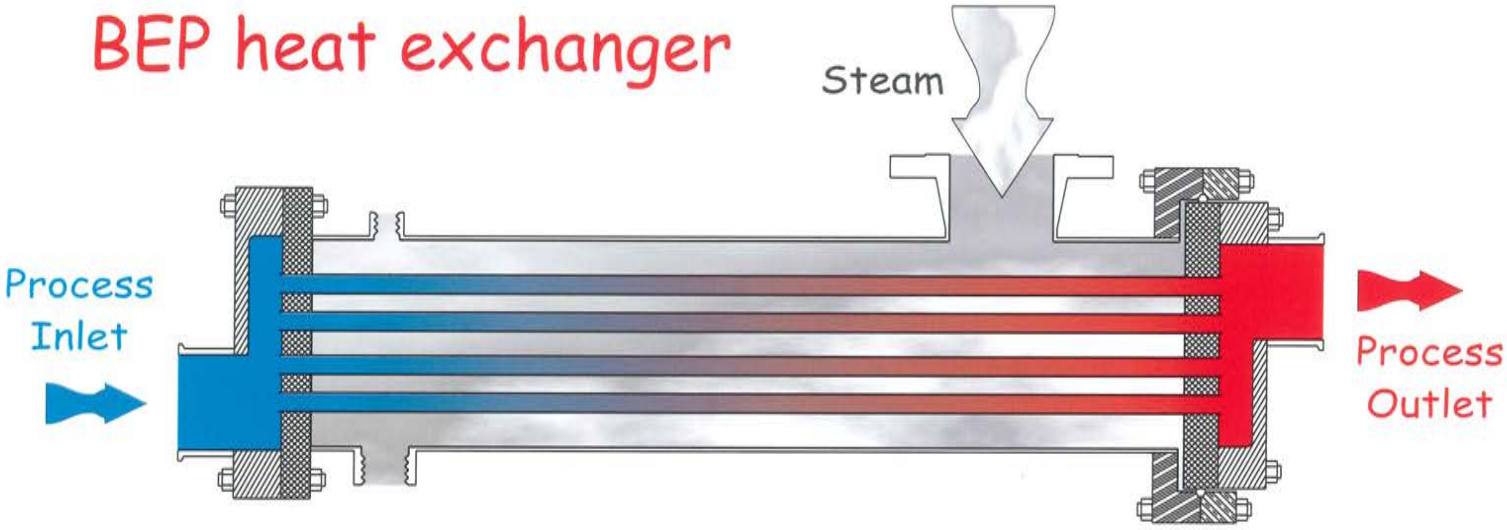


BEM heat exchanger



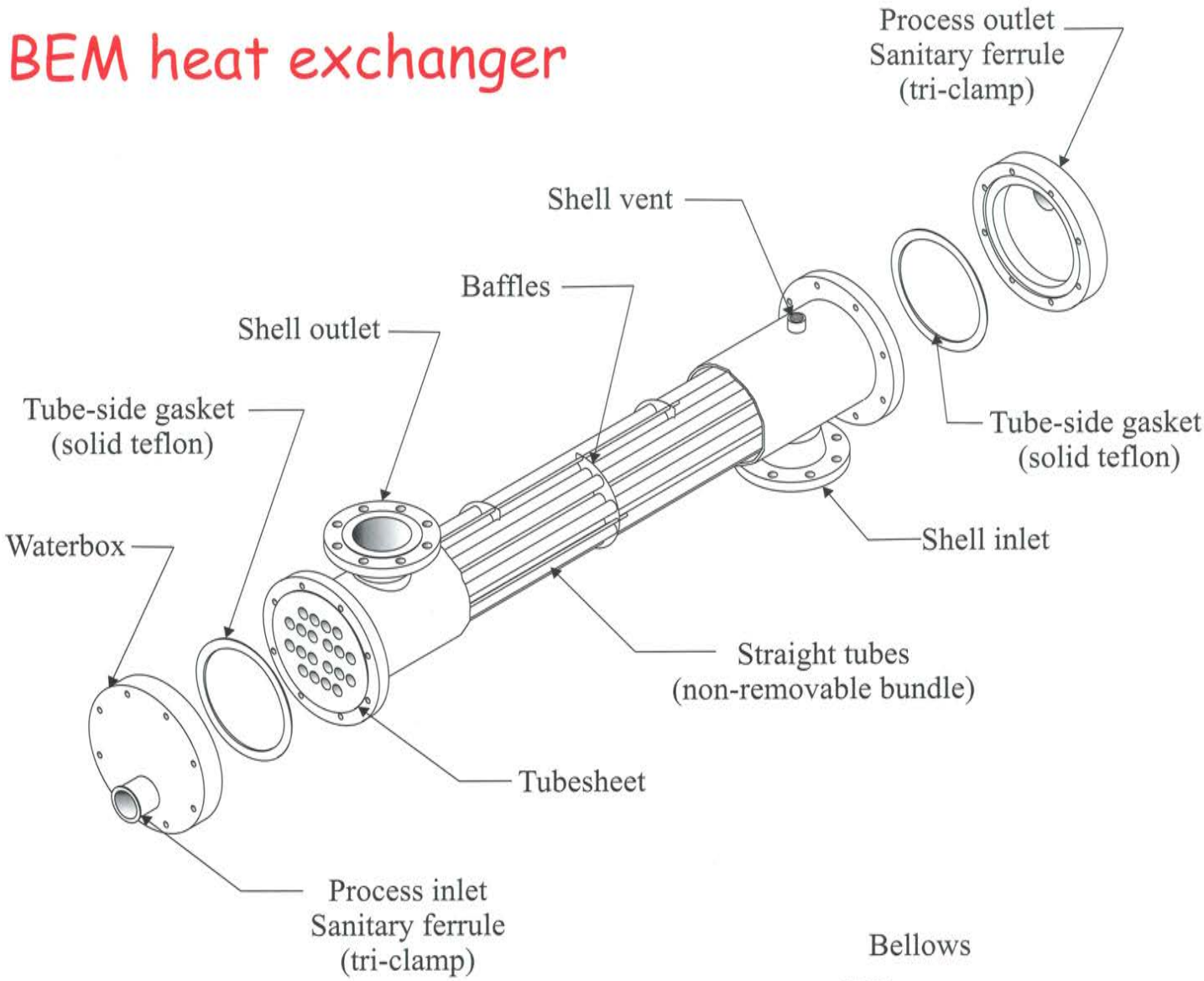
- The BEM heat exchanger has straight tubes and two fixed tubesheets. This design allows the mechanical cleaning and visual inspection of the tubes internal surfaces.
- The BEM design is recommended for applications with high-viscosity and high-fouling fluids or when particulates are present in the process flow. Typical applications include the heating or cooling of cream, whey, sauce, etc.
- In the vertical position, the BEM exchanger is ideal for condensing gas mixtures. Vapors enter the top of the exchanger and, as they are condensing, the condensate drops to the bottom of the unit. The cooling medium runs on the shell-side.
- As the tube bundle of a BEM exchanger is not removable, the shell-side fluid must be non-fouling.
- As the tubes are fixed at both ends, the BEM design is very sensitive to temperature variations. When the temperature difference between tube-side and shell-side fluids is high, an expansion joint may be added in order to reduce the effects of the stresses due to thermal expansion and contraction.
- Enerquip manufactures sanitary as well as industrial BEM heat exchangers. BEM heat exchangers for food applications meet the latest 3-A requirements.

BEP heat exchanger

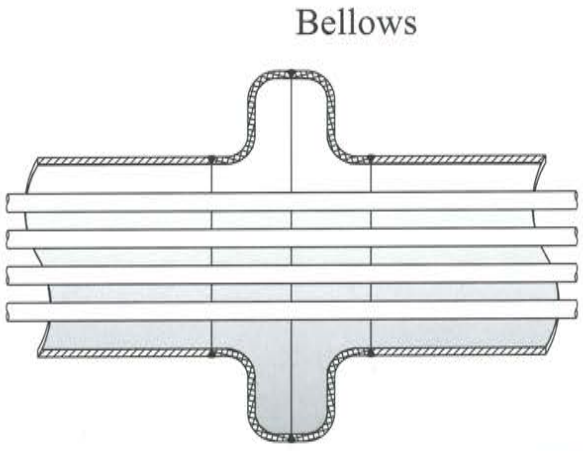


- Like the BEM design, the BEP heat exchanger has straight tubes; however, one of the tubesheets is of the floating type (it is not fixed to the shell but separated from it by an O-ring). This design allows the tube bundle to expand and contract under the influence of severe temperature differentials.
- The BEP design is recommended for applications where the mechanical cleaning of the tubes inner surfaces is required and where a high temperature difference exists between the tube-side and shell-side media.
- With the BEP design, steam may be used as the heating medium.
- Typical applications of the BEP exchanger include the heating or cooling of high-viscosity and high-fouling fluids with particulates.
- As the tube bundle of a BEP exchanger is not removable, the shell-side fluid must be non-fouling.
- Enerquip manufactures sanitary as well as industrial BEP heat exchangers. BEP heat exchangers for food and dairy applications meet the latest 3-A requirements.

BEM heat exchanger



Expansion joint



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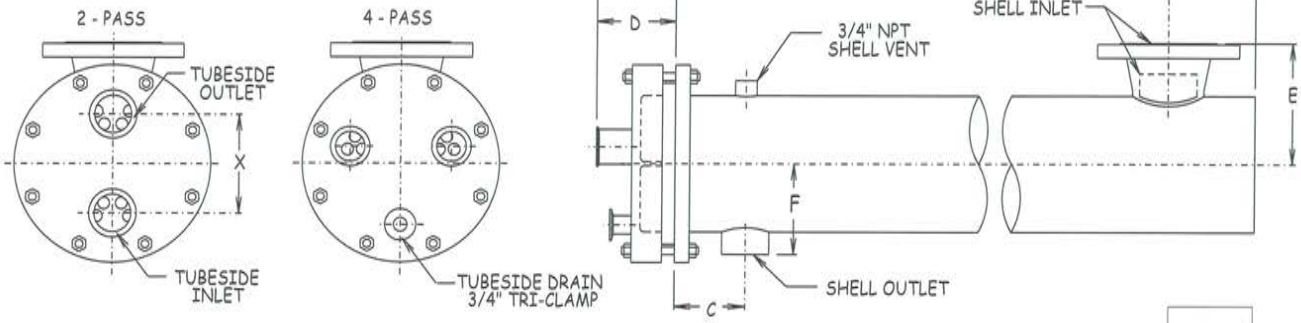
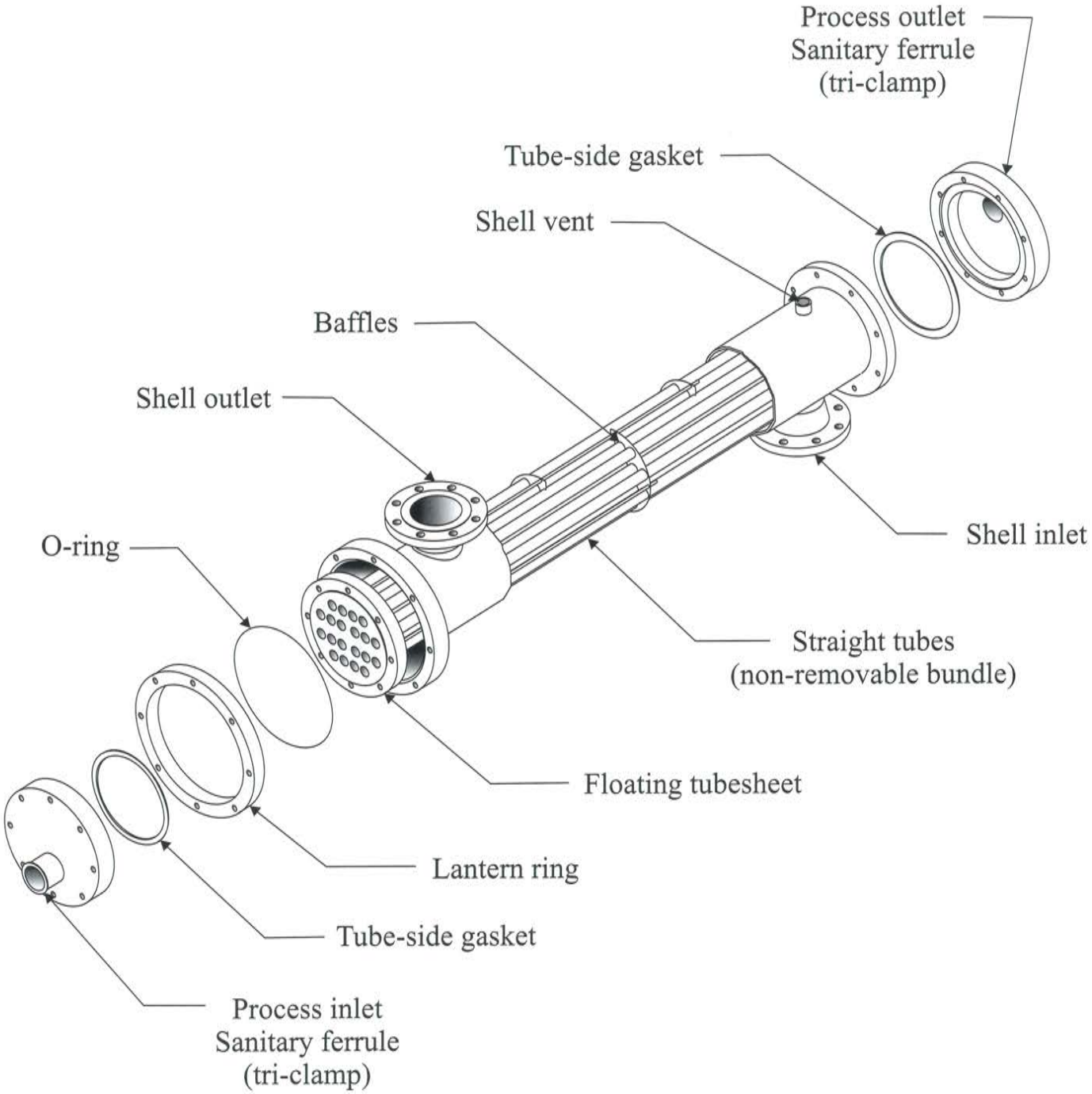
BEU dimensions



MODEL	A	B	C	D	SHELL INLET	E	SHELL OUTLET	F	TUBESIDE TRI-CLAMPS*	X	SURFACE AREA SQFT*
4 x 24	34.25	26.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	5
4 x 36	46.25	38.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	8
4 x 54	64.25	56.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	13
4 x 72	82.25	74.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	17
4 x 84	94.25	86.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	20
4 x 96	106.25	98.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	23
4 x 108	118.25	110.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	26
4 x 114	124.25	116.25	4.50	3.75	1.5" NPT	3.43	1" NPT	3.26	1.5"	3.13	27
6 x 24	38.75	29.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	11
6 x 36	50.75	41.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	16
6 x 54	68.75	59.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	25
6 x 72	86.75	77.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	33
6 x 84	98.75	89.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	39
6 x 96	110.75	101.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	44
6 x 108	122.75	113.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	50
6 x 114	128.75	119.00	4.50	4.75	2.5" NPT	4.70	1" NPT	4.38	2" or 2.5"	4.38 - 3.88	53
8 x 24	40.00	30.00	5.00	5.00	2.5" NPT	5.73	1" NPT	5.41	2", 2.5" or 3"	6.76 - 6.26 - 5.76	17
8 x 36	52.00	42.00	5.00	5.00	2.5" NPT	5.73	1" NPT	5.41	2", 2.5" or 3"	6.76 - 6.26 - 5.76	25
8 x 54	70.00	60.00	5.00	5.00	4" NPS	7.66	1.5" NPT	5.69	2", 2.5" or 3"	6.76 - 6.26 - 5.76	38
8 x 72	88.00	78.00	5.00	5.00	4" NPS	7.66	2" NPT	5.73	2", 2.5" or 3"	6.76 - 6.26 - 5.76	51
8 x 84	100.00	90.00	5.00	5.00	4" NPS	7.66	2" NPT	5.73	2", 2.5" or 3"	6.76 - 6.26 - 5.76	59
8 x 96	112.00	102.00	5.00	5.00	4" NPS	7.66	2" NPT	5.73	2", 2.5" or 3"	6.76 - 6.26 - 5.76	68
8 x 108	124.00	114.00	5.00	5.00	4" NPS	7.66	2" NPT	5.73	2", 2.5" or 3"	6.76 - 6.26 - 5.76	76
8 x 114	130.00	120.00	5.00	5.00	4" NPS	7.66	2" NPT	5.73	2", 2.5" or 3"	6.76 - 6.26 - 5.76	81
10 x 24	43.19	32.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	31
10 x 36	55.19	44.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	47
10 x 54	73.19	62.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	71
10 x 72	91.19	80.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	95
10 x 84	103.19	92.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	111
10 x 96	115.19	104.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	127
10 x 108	127.19	116.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	143
10 x 114	133.19	122.00	6.00	5.19	4" or 6" NPS	8.97 - 9.51	2" NPT	6.85	3" or 4"	7.57 - 6.60	151

All dimensions are in inches. We reserve the right to make reasonable design changes without notice.
*Figures are for 2-pass only. Contact Enerquip for 4-pass specifications.

BEP heat exchanger



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Shell & tube heat exchanger RFQ form

Company Name	
Company Address	
Email Address	
Phone	
Fax	
Project Name / Reference No.	

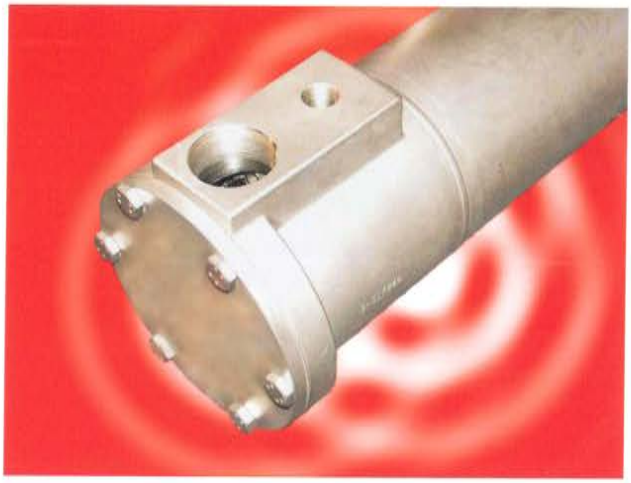
		Shell Side	Tube Side
Fluid Name			
Liquid or Vapor	L or V		
Flow Rate	GPM or lb/h		
Temperature In / Out	°F or °C	/	/
Heat Exchanged	Btu/h		
Density	lb/ft^3		
Viscosity	cp		
Thermal Conductivity	Btu/ft/h/°F		
Specific Heat	Btu/lb/°F		
Operating Pressure	psig		
Allowable Pressure Drop	psi		
Material of Construction	304L, 316L, other		
ASME Code	Yes or No		
TEMA Construction	B, C or R		
Sanitary Design	Yes or No		
Surface Finish	Ra or Grit #		
Horizontal or Vertical Mounting	Hor or Ver		
Dimensional Restrictions	in or ft		

Please fax this completed form to 715 748 6484.
If you need assistance to complete this form, call our design team at 715 748 5888.

Think ENERQUIP for the following applications

Pharmaceutical

Dairy, Food & Beverage



Industrial

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Shell & Tube Heat Exchangers

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