

Type of Heat Exchanger

<u>Features</u>	<u>Shell and Tube</u>	<u>Gasketed Plate</u>	<u>All-welded Cross-flow Plate</u>	<u>All-welded Plate</u>	<u>All-welded Spiral</u>	<u>All-welded Wide Gap Plate</u>	<u>Fusion-bonded Plate</u>	<u>Brazed Plate</u>
Practical Temp Approach, deg F	10-15	1-2	2-5	1-2	5	5	1-2	1-2
Temp Cross	Difficult/expensive	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Max Temp, deg F	Very high	350	650	650	1,000	450	1,022	752
Max Pressure, psig	>2,000	450	450	600	500	150	435	725
Gaskets	One each bonnet	Yes, interplate	On cover panels	None	On covers	On cover panels	None	None
Modifications Possible	Difficult to add tubes	Yes	Change pass arrangement	No	No	No	No	No
Inspection	Tube side yes, shell side maybe	Yes	Both sides possible	No	Both sides possible	Wide side yes, inside plate no	No	No
Access to Cleaning	Tube side easy, shell side more difficult	Yes	Both sides possible	Clean-in-place	Both sides possible	Wide side yes, inside plate CIP	Clean-in-place	Clean-in-place
Common Materials	Any metallurgy, fluoropolymer, graphite	304/316 SS, Ti, Hastelloy, Nickel, other alloys, graphite	316L SS, Ti, Hastelloy, Incoloy, SMO, other alloys	304/316 SS, Ti, Hastelloy, Nickel, SMO	CS, SS, Ti, Hastelloy, Duplex	CS, 304L, 316 L	316 SS	316 SS with copper brazing
Possible Repairs	Requires tube plugging seat welding of tube joints	Replace plates and gaskets	Limited due to complete welding	Limited	Welding	Limited due to welded plates	Limited	Limited
Max Connection Size, inches	90% of shell ID, decreases with more passes	20	24	8	12, spiral flow; 60, cross flow	12	4	4
Gap Between Plates, inches	Tube diameter dimension	0.12-0.47	0.2	0.12	0.2-1.0	0.2-0.83	0.12	0.12
Max Flow Rate per Unit, gpm	20,000+	15,000	15,000	5,000	3,000	8,000	748	616
Max Heat Transfer Area per Unit, sq ft	10,000+	18,000	3,439	3,000	6,000	3,000	753	753
Typical water/water U-value, BTU/hr-F-sq ft	250	1,000	800-1,000	1,000	400	50-600	1,000	1,000
Price Ratio, based on 1 MM BTU/hr/F	1	0.2	0.6-0.75	0.6-0.75	0.9-1.3	0.8-1.2	0.6-0.75	0.3-0.5
<u>Services</u>								
Liquid-liquid	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gas-liquid	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Condensing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fouling (standard)	Possible, tubes can plug	Yes	Yes, easily cleaned	Yes, with chemical cleaning	Yes	Yes, on wide gap side	Yes, with chemical cleaning	Yes, with chemical cleaning
Fouling (slurries and suspensions)	No, fallout at low velocities	No	No	No	Yes	Yes, on wide gap side	No	No
Fouling (fibrous)	Yes	Yes, wide gap design	No	No	Yes	Yes, on wide gap side	No	No
Viscous	Difficult	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Heat Sensitive	No, uneven temp distribution	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corrosive	Yes	Yes	Yes	Yes	Possible	Possible	Yes, all 316 SS	Yes, compatible with 316 SS & copper